Partnership consensus in triple helix pathways: a challenge for sustainable higher education

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Abstract. The study's purposes are (i) to determine the gender role in the relationship between partnership consensus with the lecturer's attributes and (ii) to test Etzkowitz's partnership pathways in determining the role of consensus in mediating the influence of an institution's sustainable entrepreneurial culture (ISEC) on innovation. This study confirmed that the partnership consensus has no relationship with the education level of male lecturers, while the functional position has one. In contrast, a partnership consensus for female lecturers has no significant relationship with the educational level and functional position. The partnership consensus was able to mediate ISEC's influence in the Etzkowitz partnership path towards the emergence of innovation to 53% from 30% directly. The quadruple helix in Indonesia was decomposed into a triple helix with a university-government-community and university-industry-community partnership pattern. The conclusions are lecturers' partnership consensus has no relationship with internal factors, such as education level or functional position, but rather because of the institutional culture that supports increasing innovation capability, namely ISEC. Internal and external partnership consensus triggers innovation significantly. These findings are helpful for higher education (HE) policymakers, where gender equality is crucial to formulate in partnership. Furthermore, HE must build an ISEC to trigger the innovations as a manifestation of HE's contribution to sustainable regional socio-economic development.

1 Introduction

A regional socio-economic development model that has been conducive to being developed in the last two decades is: transforming from resource-based to knowledge-based; moving from state-led to university-led; and changing single or multiple innovation systems to interactions based on the triple helix innovation model between higher education, government, and industry [1-3]. The triple helix can occur through the partnership pathways model (Figure 1), known as the three partnership spaces: knowledge, consensus, and innovation [1]. Knowledge space is where sources of innovation for socio-economic development are born, such as research institutes, higher education institutions, laboratories and testing centers, and others.

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Consensus space means a place where partnership actors gather to make innovation collaboration agreements through brainstorming, problem analysis, and formulating innovation plans to be carried out.

Fig. 1. Triple helix partnership pathways [1].

Innovation space means the creation of a new organizational mechanism to initiate knowledge-based regional development as the realization of innovation plans and goals agreed upon in the consensus space. This innovation can be formed from research results from the knowledge space, which is then decided to be used for community needs. Conversely, it can move from community requests to research and development, which is then agreed to be used as a solution. Various innovations that can be adopted, among others, are providing business incubators, realizing the establishment of startup businesses, providing initial funding assistance from venture capital for new businesses from innovation spaces, establishing science parks, and others [1].

Furthermore, the quadruple helix expands the triple helix by adding interactions between higher education-government-industry with the community through media-based and culture-based [4]. This expansion complements the limitations of the triple helix that focuses more on commercial missions, namely commercialization and technology transfer [5], so that this expansion can foster and empower society [6] and trigger the emergence of social innovation in higher education [7]. This challenge is facilitated through higher education collaboration with government and industry [1] and expanded to the partnership with the community in quadruple helix interactions [4, 8]. A recent study states that quadruple helix, even n-helix, can be formed through triple helix decomposition in various synergistic combinations [9].

As an illustration, quadruple helix interactions between University (U), Government (G), Industry (I), and Community (C) can occur through UGI, UGC, or UIC interactions [9]. The helix decomposition will return to the primary form of a triple helix, where this interaction is formed through three partnership spaces: knowledge, consensus, and innovation space. Higher education is one of the resources in the "knowledge space" partnership in generating innovative ideas for regional socio-economic development [1].

Socio-economic development then moves to the issue of sustainable socio-economic development. Sustainable socio-economic development challenges higher education to direct all internal environmental entities to start improving themselves to prepare all resources and capabilities in responding to this sustainability issue [10]. Regarding fulfilling this issue, previous researchers confirm that higher education is crucial in implementing sustainability principles through curriculum development and a culture of sustainability [10]. This finding aligns with other researchers who state that principles and outlooks on life prioritizing equal rights and obligations and responsibility for the environment encourage the emergence of sustainable knowledge, inventions, and innovations [11] that give rise to sustainable entrepreneurial activity.

Sustainable entrepreneurship consists of two syllables, namely sustainable and entrepreneurship. The concept of sustainability is not only related to environmentally friendly products, global warming, or environmental issues but also concerns 3P: people-

planet-profit, otherwise known as the triple bottom line [12, 13]. Entrepreneurship is more than just creating a business. Entrepreneurship includes broader activities, from looking for opportunities to taking risks and even providing tenacity to push ideas into reality [14]. The findings of previous researchers confirm that not all entrepreneurial activities have a positive impact. Some products from entrepreneurship activities cause market failure, further impacting environmental degradation [15]. Of course, this kind of entrepreneurial activity does not generate sustainable benefits. It gives rise to sustainable entrepreneurship as part of entrepreneurship [15]. It reinforces that business people prioritize economic benefits and broadly cover social aspects and environmental innovation to move towards real sustainability benefits [16]. Other researchers state that sustainable entrepreneurship focuses on nature conservation, life support, and communities in pursuit of perceived opportunities to realize future products, processes, and services to gain economic and non-economic benefits for individuals, economies, and society [17].

Many studies have started to examine the readiness of higher education institutions to respond to sustainability issues, including the willingness of human capital, which is an asset for institutions, both men and women. In the last five years, many researchers have begun examining the relationship between sustainable socio-economic development and gender equality [18–23]. Other findings state that gender equality is a fundamental goal because its implementation can drive a positive effect on the development of achieving the SDGs and is directly connected to the continuing education linkage [22]. Regarding the role of Gender in higher education in achieving sustainable development goals, gender policies emerge. However, a gender policy does not necessarily translate into gender balance in all universities [18]. In Saudi Arabia, awareness of knowledge-based social-economy development raises a determination to empower women and place them at the center of the country's educational and economic transformation plans, even though a study finds Saudi women's labor market participation is unsatisfactory [23]. Studies in Pakistan also confirm that in developing countries, education cannot affect gender equality, and there is an urgent need to address religious issues in developing countries to promote gender equality [19].

Furthermore, a study on sustainability in higher institutions through the perspective of female managers found a positive and significant relationship to the knowledge management process in HE through the view of female managers [20]. Previous studies state that government and industry can easily accept and support higher education that will carry out partnerships in creating innovation for regional socio-economic development through commercialization and technology transfer, but this is not the case for certain academic circles [1], [24]. Certain academicians believe that higher education institutions should focus more on educational and research activities and not need to carry out commercial activities. Furthermore, the sustainability challenges and partnership consensus issue lead the author to conduct empirical evidence to test the role of consensus in Etzkowitz's partnership pathway model and explore the triggers for consensus emergence.

The synthesis of the triple helix partnership model, sustainable entrepreneurial culture, Gender, and higher education leads the author to draw hypotheses 1-5 (H1-5), namely:

H1: Gender influences the relationship between the lecturer's attributes and the consensus.
H2: Institutional sustainable entrepreneurial culture (ISEC) directly affects consensus.
H3: Consensus directly affects innovation.
H4: ISEC directly affects innovation.
H5: Consensus can mediate the relationship between ISEC and innovation.

Therefore, several research questions (RQs) in this study are formulated as follows:

RQ1-What is the role of Gender in the relationship between the lecturer's attributes and the consensus's emergence?

RQ2-Can consensus mediates the relationship between an institution's sustainable entrepreneurial culture and innovation in Etzkowitz's partnership pathways model?

Several literature reviews referred to this study led the author to formulate a conceptual model, as shown in Figure 2.

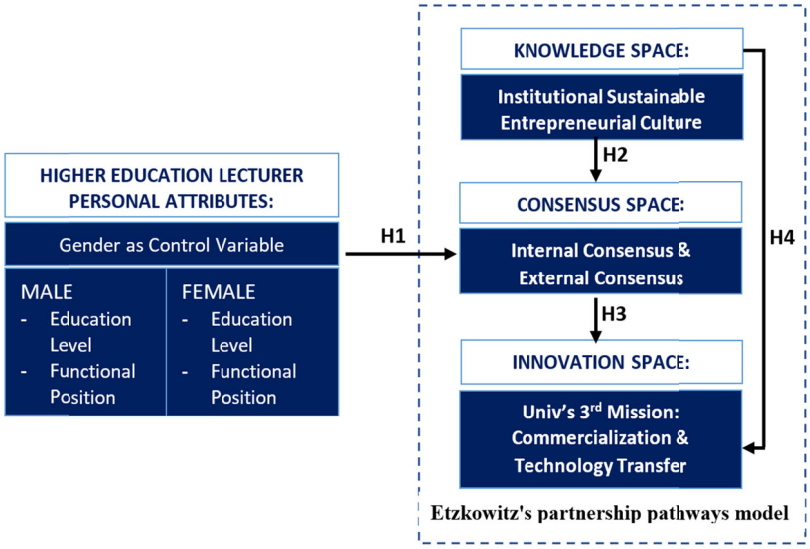

Fig. 2. Conceptual Model.

2 Method

This study used a quantitative method with research objects: the lecturer's functional position, educational level, partnership consensus, ISEC, and innovation. The universities in Indonesia under The Ministry of Education, Culture, Research, and Technology are spread over five large islands (Java, Sumatra, Kalimantan, Sulawesi, and Papua) and spread across 34 provinces. 62% of public universities are spread over Java and Sumatra, with the rest over Kalimantan, Sulawesi, and Papua; 72% of private universities are spread over Java and Sumatra, and the rest are spread over the three other islands [25]. Considering this, the author determined that the target population to be sampled was public and private universities, most spread over Java and Sumatra islands.

Data analysis used descriptive statistics to analyze demographic data on respondent profiles and the normality of research data; contingency analysis using SPSS25 software to perform empirical evidence on H1; and structural equation modeling analysis using SmartPLS4 to run empirical evidence on H2, H3, H4, and H5. The sampling technique used purposive sampling with faculty members (FM) as the unit of analysis. A cross-sectional survey was conducted from June to September 2022 at 101 campuses, with 311 FM voluntarily contributing as respondents. The online questionnaire was distributed by sending URL links through the institution's e-mail.

The observed variables: consensus, SEC, and innovation, have been operationalized and presented in Table 1.

Table 1. Operationalization variables.

Variables	Item	Scale
Partnership Consensus (PC)	EEEM-IC: I agree that the goals of entrepreneurship education include developing entrepreneurial skills, integrating entrepreneurship with other disciplines, establishing relationships between the academic, business, and community, and triggering the growth of startups [26].	5-point Likert Scale.
	RTTO-IC: I agree that the research and technology transfer office (RTTO) was established to commercialize research findings, generate independent institutional income, commercialize startups that form civitas academic, and RTTO as university integrators [26].	
	UGC-IC : I agree with the institution's commitment to partner with the government and communities by managing an incubator business, mentoring business, dialogue business, developing products/services, or other social innovation programs [27, 28].	
	UGI-IC : I agree with the institution's commitment to partner with the government and industry in joint research, joint projects, technology transfer, commercialization of research results, formation and coaching of startups, and others [3].	
	UIC-IC : I agree with the institution's commitment to partnering with industry and communities by managing an incubator business, mentoring business, dialogue business, product/service development, or other social innovation programs [11].	
	UGC-EC : I have made consensuses with the government and the community, one of which includes: business incubators management, business assistance, business dialogue, product development, and social innovation programs [27], [28].	
	UGI-EC : I have made consensuses with the government and industry, one of which includes: joint research, joint projects, technology transfer, commercialization of research results, and the formation and coaching of startups [3].	
	UIC-EC : I have made consensuses with industry and community, one of which includes: business incubators management, business mentoring, business dialogue, product development, and other social innovation programs [11].	
Institutional sustainable entrepreneurial culture (ISEC)	SECSO: My Tri dharma activities (teaching, research, community service) and student mobility are mostly related to sustainable social issues, such as gender equality, education, healthy living, prosperity, and others [17, 24, 29, 30].	5-point Likert Scale.
	SECEC: My Tri dharma activities (teaching, research, community service) and student mobility mainly relate to sustainable economic issues, such as innovation, responsible consumption and production, economic growth, and others [17, 24, 29, 30].	
	SECEN: My Tri dharma activities (teaching, research, community service) and student mobility are related to sustainable environmental issues, such as sustainable cities and settlements, proper water and sanitation, climate change, and others [17, 24, 29, 30].	
Innovation (Inn)	InnCTT: Through RTTO, I can commercialize or technology transfer my research findings [1].	5-point Likert Scale.
	InnBI: Through an institutional business incubator, I can be involved in commercializing student startups [1].	
	InnVC: Through an institutional business incubator, I can be involved in efforts to raise initial funding for student startups [1].	
	InnUSO: I have been involved in a university-spin off program, namely research with community/company ideas; or utilizing the results of the institutional study for solutions in society/companies [1].	

U=University; G=Government; C=Community; EC=External Consensus; IC=Internal Consensus; SECSO=Social Sustainable Entrepreneurial Culture; SECEC=Economic Sustainable Entrepreneurial Culture; SECEN=Environment Sustainable Entrepreneurial Culture; InnCTT=Innovation in commercialization and transfer technology; InnBI=Innovattion in Business Incubator; InnVC=Innovation in startup fundraising; InnUSO=Innovation in university-spin off.

3 Results and Discussion

3.1 Demographic Data

Demographic data are presented in Figure 3, among others, Gender on a nominal scale, age on an ordinal scale, lecturer's education level on an ordinal scale, and lecturer's functional position on an ordinal scale. The total number of respondents who participated in this survey was 311; after filtering, the author got 300 data to be analyzed. The proportion of Gender is relatively even, 46% female and 54% male, so there's no response bias in Gender. By age, most of those participating were lecturers <55 years old, 86%, and those at retirement age 14%, so most respondents were productive-age lecturers.

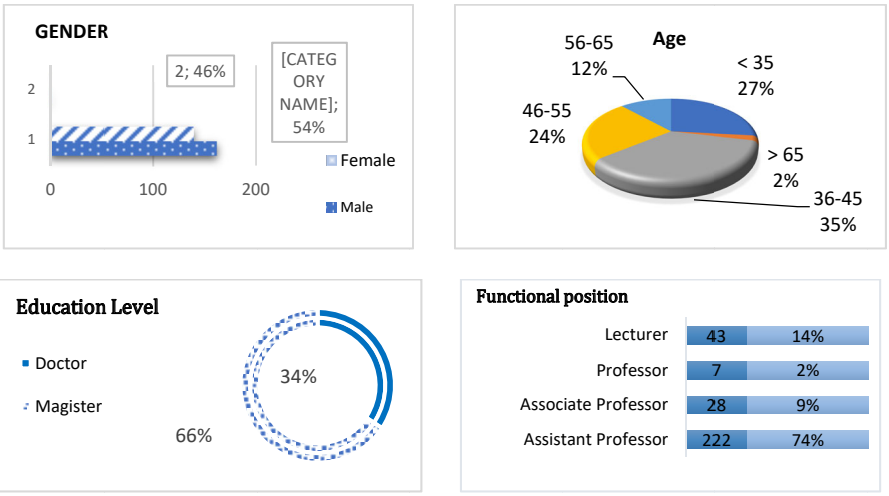

Fig. 3. Demographic Data.

While on the education level, although mostly at masters levels, did not show a non-response bias because the highest education level in the population of Indonesian lecturers was a master, as much as 70.44% [31], also functional positions did not show a non-response bias because the most Indonesian lecturer is an assistant professor at 65.02% [31].

3.2 Relationship partnership consensus with lecturer's attribute using Gender as control variable.

Contingency tables can present (i) information about the relationship between two or more variables so that specific amounts can be read easily [32]. (ii) the chi-square (χ^2) testing results which are processed in the crosstab menu in the SPSS software. It can provide information about how likely the two variables are to be independent or related to each other through independence testing [32]. The author formulates hypothesis 1 to test Gender as a control variable in the relationship between lecturers' attributes (functional position and education level) and internal consensus within an institution and external consensus with the government, industry, and community. To get an accurate measurement, the author formulates 16 sub-hypotheses from hypothesis 1 (H1), as follows:

H1-1: Gender influences the relationship between the functional position and the internal consensus about eclectic entrepreneurial education mission (EEEM-IC).

H1-2: Gender influences the relationship between the functional position and the internal consensus about research and technology transfer mission (RTTO-IC).

H1-3: Gender influences the relationship between the functional position and the internal consensus toward partnership with government and community (UGC-IC).

H1-4: Gender influences the relationship between the functional position and the internal consensus toward partnership with government and industry (UGI-IC).

H1-5: Gender influences the relationship between the functional position and the internal consensus toward partnership with industry and community (UIC-IC).

H1-6: Gender influences the relationship between the education level and the internal consensus about eclectic entrepreneurial education mission (EEEM-IC).

H1-7: Gender influences the relationship between the education level and the internal consensus about research and technology transfer mission (RTTO-IC).

H1-8: Gender influences the relationship between the education level and the internal consensus toward partnership with the government and community (UGC-IC).

H1-9: Gender influences the relationship between the education level and the internal consensus toward partnership with government and industry (UGI-IC).

H1-10: Gender influences the relationship between the education level and the internal consensus toward partnership with industry and community (UIC-IC).

H1-11: Gender influences the relationship between the functional position and the external consensus with the government and community (UGC-EC).

H1-12: Gender influences the relationship between the functional position and the external consensus with government and industry (UGI-EC).

H1-13: Gender influences the relationship between the functional position and the external consensus with industry and community (UIC-EC).

H1-14: Gender influences the relationship between the education level and the external consensus with the government and community (UGC-EC).

H1-15: Gender influences the relationship between the education level and the external consensus with the government and industry (UGI-EC).

H1-16: Gender influences the relationship between the education level and the external consensus with industry and community (UIC-EC).

Decision-making in contingency testing in Table 2 used two rejection rules: (1) the p-value approach; reject H0 if p-value $\leq \alpha$ with the level of significance (α) = 0.05; (2) the critical value approach [33]: reject H0 if χ^2 count $\geq \chi^2$ table.

Table 2. Recapitulation of independence testing results.

Chi-Square Test	Asympt. Sig. (2-sided)		Contingency Coefficient		Conclusion	
	M	F	M	F	M	F
H1-1: functional * EEEM_IC * gender	0.066	0.470	0.333	0.242	ns.a	ns.a
H1-2: functional * RTTO_IC * gender	0.000	0.530	0.479	0.234	sig.b	ns.a
H1-3: functional * UGC_IC * gender	0.022	0.193	0.328	0.321	sig.b	ns.a
H1-4: functional * UGI_IC * gender	0.033	0.288	0.350	0.269	sig.b	ns.a
H1-5: functional * UIC_IC * gender	0.063	0.755	0.334	0.155	ns.a	ns.a
H1-6: education * EEEM_IC * gender	0.733	0.088	0.111	0.212	ns.a	ns.a
H1-7: education * RTTO_IC * gender	0.435	0.338	0.152	0.154	ns.a	ns.a
H1-8: education * UGC_IC * gender	0.454	0.334	0.127	0.178	ns.a	ns.a
H1-9: education * UGI_IC * gender	0.262	0.252	0.178	0.169	ns.a	ns.a
H1-10: education * UIC_IC * gender	0.396	0.681	0.157	0.074	ns.a	ns.a
H1-11: functional * UGC_EC * gender	0.045	0.676	0.338	0.251	sig.b	ns.a
H1-12: functional * UGI_EC * gender	0.508	0.243	0.256	0.312	ns.a	ns.a
H1-13: functional * UIC_EC * gender	0.016	0.338	0.365	0.297	sig.b	ns.a
H1-14: education * UGC_EC * gender	0.862	0.837	0.089	0.101	ns.a	ns.a
H1-15: education * UGI_EC * gender	0.088	0.356	0.219	0.175	ns.a	ns.a
H1-16: education * UIC_EC * gender	0.248	0.696	0.180	0.125	ns.a	ns.a

ns.a : not significant; sig.b: significant; M=Male; F=Female.

Table 2 presents the contingency testing for H1 with 16 sub-hypotheses. Contingency Testing for H1-2, H1-3, H1-4, H3-11, H3-13 presented on Table 3-Table8. From the 16 sub-hypotheses of H1, only male lecturers on H1-2, H1-3, H1-4, H1-11, and H1-13 showed a significant relationship between the variables tested.

(1) H1-2 Gender influences the relationship between the functional position and the internal consensus about the RTTO mission.

Table 3. Independence testing: functional * RTTO-IC * gender.

	Functional	functional * RTTO-IC * gender									
		1.00	2.00	3.00	4.00	5.00	Total				
Male	Lecturer	0	0	2	12	11	25		Value	df	Sig.
	Assistant Prof.	0	1	12	61	45	119	CS.	47.917	12	0.000
	Associate Prof.	1	3	0	8	0	12	CC.	0.479		
	Full Professor	0	0	1	1	3	5				
	Total	1	4	15	82	59	161				
Female	Lecturer		0	4	4	10	18	CS.	8.040	9	0.530
	Assistant Prof.		1	11	44	47	103	CC.	0.234		
	Associate Prof.		1	2	8	5	16				
	Full Professor		0	0	1	1	2				
	Total		2	17	57	63	139				

CS: Chi-Square; CC: Contingency Coefficient; Prof.: Professor

Table 3 shows χ^2count=47.917 ≥ χ^2critical $_{(0.05;12)}$ =21.026 and p-value=0.000. It means H1-2 was supported significantly. Consensus related to the commercialization and technology transfer missions that institutions will carry out through research and technology transfer offices (RTTO). The male lecturers agreed that the establishment of RTTO, among others, aims a) to commercialize research findings, b) to generate independent institutional income through commercialization and technology transfer, c) to commercialize startups formed by the academic community, such as students, lecturers, staff, and alumni, and d) RTTO's role as a university integrator in partnership. The agreement regarding this mission facilitates the next steps for male lecturers to coordinate and take further action in partnerships that the institution will carry out with the government, industry, and the community. The finding aligns with previous studies, which stated that technology transfer managers facilitated transferring university research findings to business firms and other research users [34].

(2) H1-3 Gender influences the relationship between the functional position and UGC-IC.

Table 4. Independence testing: functional * UGC-IC * gender.

	Functional	functional * UGC-IC * gender									
		1.00	2.00	3.00	4.00	5.00	Total				
Male	Lecturer		1	2	9	13	25		Value	df	Sig.
	Assistant Prof.		2	6	37	74	119	CS	19.355	9	0.022
	Associate Prof.		0	4	5	3	12	CC	0.328		
	Full Professor		0	0	0	5	5				
	Total		3	12	51	95	161				
Female	Lecturer	1	0	1	6	10	18	CS	15.954	12	0.193
	Assistant Prof.	0	0	5	36	62	103	CC.	0.321		
	Associate Prof.	0	1	1	5	9	16				
	Full Professor	0	0	0	0	2	2				
	Total	1	1	7	47	83	139				

CS: Chi-Square; CC: Contingency Coefficient; Prof.: Professor

Table 4 shows χ^2count=19.355 ≥ χ^2critical $_{(0.05;9)}$ =16.919 and p-value=0.02, so H1-3 was supported significantly.

The consensus of male lecturers with the institution's commitment to partner with the government and communities (UGC-IC), including business incubators management, business mentoring, business dialogue, product/service development, or other social innovation programs.

(3) H1-4 Gender influences the relationship between the functional position and UGI-IC.

Table 5. Independence testing: functional * UGI-IC * gender.

	Functional	functional * UGI-IC * gender									
		1.00	2.00	3.00	4.00	5.00	Total				
Male	Lecturer	0	0	3	7	15	25		Value	df	Sig.
	Assistant Prof.	0	1	9	38	71	119	CS	22.430	12	0.033
	Associate Prof.	1	1	1	4	5	12	CC	0.350		
	Full Professor	0	0	0	0	5	5				
	Total	1	2	13	49	96	161				
Female	Lecturer		0	1	5	12	18	CS	10.820	9	0.288
	Assistant Prof.		0	4	34	65	103	CC	0.269		
	Associate Prof.		1	0	7	8	16	.			
	Full Professor		0	0	0	2	2				
	Total		1	5	46	87	139				

CS: Chi-Square; CC: Contingency Coefficient; Prof.: Professor

Table 5 shows χ^2count=22.430≥ χ^2critical $_{(0.05;12)}$ =21.026 and p-value=0.033, so H1-4 was supported significantly. The consensus of male lecturers with the institution's commitment to partner with the government and industry (UGI-IC) in the form of joint research, joint projects, transfer of technology, commercialization of research results, formation and coaching of startups, and others. It is in line with previous studies, which stated that the commercialization mission of universities must be recognized and respected. Regional stakeholders and university management need to recognize that this mission needs support from internal and external colleagues and financial support [35]. The consensus for conducting partnerships is only significant in the relationship between male lecturers' functional position and education level towards UGC and UGI. It proves that consensus will be quickly agreed upon, especially for partnerships involving the government as a regulator. It will create a sense of security in partnerships between UGC and UGI actors.

(4) H1-11 Gender influences the relationship between the functional position and UGC.

Table 6. Independence testing: functional * UGC-EC * gender.

	Functional	functional * UGC-EC * gender									
		1.00	2.00	3.00	4.00	5.00	Total				
Male	Lecturer	2	1	3	12	7	25		Value	df	Sig.
	Assistant Prof.	9	15	27	41	27	119	CS	21.698	12	0.045
	Associate Prof.	1	1	3	4	3	12	CC.	0.338		
	Full Professor	0	0	5	0	0	5				
	Total	12	17	38	57	37	161				
Female	Lecturer	1	3	7	5	2	18	CS	9.315	12	0.676
	Assistant Prof.	8	10	29	30	26	103	CC.	0.251		
	Associate Prof.	1	0	5	8	2	16				
	Full Professor	0	0	1	0	1	2				
	Total	10	13	42	43	31	139				

CS: Chi-Square; CC: Contingency Coefficient; Prof.: Professor

Table 6 shows χ^2count=21.698 ≥ χ^2critical $_{(\alpha=0.05;\ df=12)}$ =21.026 and p-value=0.045. It means H1-11 was supported significantly.

The external consensus that Indonesian male lecturers have carried out empirically shows a significant relationship between the government and the community (UGC) in business incubator management, business mentoring, business dialogue, product development, or social innovation programs.

(5) H1-13 Gender influences the relationship between the functional position and UIC.

Table 7. Independence testing: functional * UIC-EC * gender.

	Functional	functional * UIC-EC * gender									
		1.00	2.00	3.00	4.00	5.00	Total				
Male	Lecturer	2	0	5	10	8	25		Value	df	Sig.
	Assistant Prof.	14	17	32	29	27	119	CS	24.798	12	0.016
	Associate Prof.	0	3	2	5	2	12	CC	0.365		
	Full Professor	0	0	5	0	0	5				
	Total	16	20	44	44	37	161				
Female	Lecturer	5	2	7	0	4	18	CS	13.444	12	0.338
	Assistant Prof.	15	15	27	26	20	103	CC	0.297		
	Associate Prof.	3	0	6	5	2	16				
	Full Professor	0	0	0	1	1	2				
	Total	23	17	40	32	27	139				

CS: Chi-Square; CC: Contingency Coefficient; Prof.: Professor

Table 7 shows χ^2count=24.798 ≥ χ^2critical $_{(0.05;12)}$ =21.026 and p-value=0.016, so H1-13 was supported significantly. Other external partnerships consensus by Indonesian male lecturers empirically shows a significant relationship between industry and community in business incubator management, business mentoring, business dialogue, product/service development, or other social innovation programs (UIC). The partnerships in higher education in Indonesia were decomposed into partnerships between UGC and UIC. It indicates that many HE partnership practices include managing business incubators, business mentoring, business dialogue, product/service development, and other social innovation programs. It means the practice of social innovation [7] is mainly carried out by higher education in Indonesia to foster and empower communities [6]. This empirical evidence is in line with previous studies stating that the quadruple helix can be decomposed into a triple helix relationship in various synergies, such as UGI, UGC, or UIC [9].

Furthermore, empirical evidence confirmed that female lecturers had no significant relationship between functional position and education level for all consensus toward HE, government, industry, and community partnerships. Even if several female lecturers agree on the partnership, it is not because of the lecturer's attributes that influence it, but other things that are not included in this test. It also underlies the author in formulating H2, H3, H4, and H5 to determine the role of sustainable entrepreneurial culture in influencing the emergence of a lecturer partnership consensus and the implication to the innovation.

3.3 Relationship between the sustainable entrepreneurial culture, partnership consensus, and innovation

To answer RQ2, the author conducted a variance-based structural equation modeling using SmartPLS4 through the measurement and structural model assessments. The results show all outer loadings values of >0.7 and AVE >0.5. Table 8 presents the measurement model assessment of the three observed variables. It indicates the SEC and Innovation indicators have good convergent validity and internal consistency [36]. The formative indicators on consensus showed a VIF <5. It confirmed no collinearity in the four indicators measured [36]. According to Table 8, the SEC variable's most significant outer loading value is in the economic sustainable entrepreneurial culture (SECEC) indicator, 0.914.

It shows that most of the processes of education, research, publication, and community service activities, as well as student mobility, are related to the sustainable economic pillar, such as responsible consumption and production, economic growth, and innovation [17, 24, 29, 30]. It is the main characteristic of a sustainable entrepreneurial culture at universities in Indonesia. Furthermore, the "Innovation" variable's most significant outer loading value is innovation in venture capital for student startups (InnVC), 0.909.

Table 8. Valid and reliable measurement model.

Variable	Reflective	Outer Load.	Cr. Alpha	rho_a	rho_c	AVE
ISEC	SECEC	0.914	0.865	0.869	0.918	0.788
	SECEN	0.868				
	SECSO	0.881				
Inn	InnCTT	0.870	0.910	0.911	0.937	0.787
	InnBI	0.885				
	InnUSO	0.884				
	InnVC	0.909				
	Formative	VIF	Outer weight	t-value	p-value	
PC	UGC-EC	1.457	0.309	3.224	0.001	
	UIC-EC	1.473	0.672	8.220	0.000	
	UGI-IC	1.324	0.259	2.906	0.004	
	UIC-IC	1.317	0.171	2.153	0.031	

Cr.= Cronbach; AVE: Average Variance Extracted; VIF: Variance Inflation Factor.
ISEC=Institutional sustainable entrepreneurial culture; Inn=Innovation; PC=Partnership Consensus.

The question posed to the sampled lecturers was, "I have been involved in efforts to raise initial funding for student startups." This effort is the primary concern of the institution in realizing the results of student entrepreneurship learning at the campus business incubator, as well as the results of research by lecturers with students so that it can support the student startups until the early startup fundraising. It is the main characteristic of innovation at universities in Indonesia. After confirming convergent validity and internal consistency, the author tested the discriminant validity of the two variables by measuring HTMT (Table 9). The HTMT < 0.85 indicates no collinearity between innovation and SEC [37]. It shows good discriminant validity results.

Table 9. Heterotrait-Monotrait assessment.

	Inn	ISEC
Innovation (Inn)		
Sustainable Entrepreneurial Culture (ISEC)	0.594	

$HTMT_{0.85}$; SEC=Sustainable Entrepreneurial Culture; Inn=Innovation

Next, to figure out the answer to H2-H5, the author carried out a structural measurement.

Table 10. Structural model assessment.

Original sample		St. Dev	t- stat	p-values	Decision	R^2-Adjusted
Total direct effect						
H2: ISEC → PC	0.484	0.053	9.172	0.000	Supported	0.443
H3: PC → Inn	0.468	0.053	8.869	0.000	Supported	
H4: ISEC → Inn	0.301	0.057	5.309	0.000	Supported	
Total indirect effect						
ISEC → Inn	0.227	0.036	6.263	0.000		
Total effect						
H2: ISEC → PC	0.484	0.053	9.172	0.000		
H3: PC → Inn	0.468	0.053	8.869	0.000		
H4: ISEC → Inn	0.528	0.047	11.202	0.000		

ISEC=Institutional sustainable entrepreneurial culture; Inn=Innovation; PC=Partnership Consensus.

Based on the results of Table 10 it can be drawn a prediction equation for higher education innovation, namely:

$$Innovation = 0.301\ ISEC + 0.468\ PC \quad (1)$$

ISEC → Inn, t-stat = 5.309; p-value = 0.000; $f^2 = 0.125$.
PC → Inn, t-stat = 8.869; p-value = 0,000; $f^2 = 0.303$. $R^2 = 0.443$.

Table 10 empirically shows that the sustainable entrepreneurial culture influences the emergence of various innovations in higher education directly, about 30.1%, but indirectly through consensus, could increase the innovation become 52.8% significantly. It increases the influence of the sustainable entrepreneurial culture that has occurred in a university in triggering innovation among the academic community. The academic community must wholeheartedly understand, support, and be fully committed to these innovations, even to the institution's commitments and consensus with other partnership actors in the quadruple helix (government, industry, and community), to arrive at the creation of these innovations. Furthermore, the author assesses the strength of the predictive model using PLS predicts menu in SmartPLS4 software. This assessment indicates the power of the model to predict the data out-of-sample [36]. If the PLS path model shows high predictive relevance, then the model can accurately predict the data outside the sample tested.

Table 11. PLS predict results.

	Q^2predict	PLS-SEM_RMSE	LM_RMSE	Conclusion
InnCTT	0.287	0.953	1.011	
InnBI	0.297	0.948	0.969	High predictive
InnUSO	0.438	0.816	0.888	power
InnVC	0.442	0.890	0.928	

InnCTT=Innovation in commercialization and transfer technology; InnBI=Innovattion in Business Incubator

Table 11 shows that all indicators of the innovation variable have PLS-SEM RMSE < LM-RMSE values. It proves that the institutional innovation model, which is influenced by sustainable entrepreneurial culture and partnership consensus from academia civitas, is confirmed to have high predictive power [36].

4 Conclusion, limitations, and recommendations

The results of empirical evidence conclude that for female lecturers in Indonesia, the consensus to carry out partnerships with government, industry, and the community has nothing to do with the lecturer's attributes, such as level of education and functional position. Meanwhile, for male lecturers in Indonesia, it is proven that functional position has a significant relationship with partnership consensus but not with the level of education. It implies that gender equality in the partnership policy needs to be formulated. Confirmed that it is not the personal attributes such as functional positions or educational levels that make lecturers agree to conduct partnership, but other things are more supportive and related.

What are the other things? One of them is a culture of sustainable entrepreneurship which can influence the emergence of consensus significantly by 48.4%. It means that academics easier to agree on partnerships in a working environment under sustainable entrepreneurship culture, among others: tri dharma activities and student mobility that are oriented towards sustainable entrepreneurship; infrastructure that supports academics to innovate together with the government, industry, or society, and management support and institutional leadership with sustainable entrepreneurial vision.

Consensus formed internally and externally is proven to increase innovation results in institutions with a sustainable entrepreneurial culture, from 30% to 53%. It means that civitas academia's understanding, support, and agreements related to partnerships carried out by institutions with government, industry, and the community will significantly stimulate the academic community to be more productive in innovation. It is a good precedent for sustainable regional socio-economic development from the perspective of higher education institutions as one of the partnership actors. Various innovations have been successfully carried out by institutions that have a sustainable entrepreneurial culture, among others commercializing research findings and technology transfer, innovation in the establishment or development of startups, innovation in fundraising for newly established startups, as well as innovation in creating problem-solving of community problems, or research findings used in providing solutions to problems in the community.

The limitations and recommendations of the research are this study was only conducted at Universities in Java and Sumatra Islands, Indonesia. Future researchers should expand the scope of study to the islands of Kalimantan, Sulawesi, and Papua to obtain more comprehensive results so that the model can generalize the further higher education innovation model.

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