

FACTOR ANALYSIS OF ACADEMIC RESEARCH IMPACT ACROSS SOCIO-ECONOMIC DIMENSIONS: A CROSS-SECTIONAL STUDY OF STATE ISLAMIC UNIVERSITIES IN SUMATRA

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ABSTRACT

University research principally generates outputs, outcomes, and impacts that enhance academic performance and socio-economic contributions. The Indonesian Ministry of Religious Affairs assesses these aspects through the ARKAN Program with a focus on outputs and outcomes. However, the study of the impact of academic research on socio-economic sectors remains very limited. Therefore, this research aims to map the academic research impact based on socio-economic factors and their underlying dimensions, especially among lecturers at State Islamic Universities, using a factor analysis approach. The data gathering was collected through interviews and questionnaires with lecturers from UIN Ar-Raniry Banda Aceh, UIN Suska Riau, UIN Imam Bonjol Padang, and UIN Sunan Gunung Djati Bandung, respectively. The results revealed that researchers have identified four key social dimensions, namely equality, knowledge exchange, employability and opportunities, and quality of life, each with distinct indicators. In the economic domain, the main influential dimensions include business development, job opportunities, public facilities, productivity, and income growth. From a socio-economic perspective, researchers emphasize equality, knowledge exchange, quality of life, business development, job opportunities, public facilities, productivity, and income growth, while notably excluding employability and opportunities as distinct dimensions.

Keywords: academic research impact; socio-economic dimensions; factor analysis; researcher's perspective

1. Introduction

A persistent issue that continually resurfaces is the lack of an effective evaluation system for measuring the socioeconomic impact of university-based research. Existing assessment practices remain heavily oriented toward research outputs and outcomes. These practices demonstrate limited consideration of how research findings enhance community well-being, expand employment opportunities, or stimulate local economic development (Dotti & Walczyk 2022). This gap has resulted in inadequate documentation of the extent to which academic research contributes to addressing social problems and informing public policy (Zheng *et al.* 2021). In principle, the more progressed systematic research and community engagement activities, the greater their potential to contribute to the advancement of the surrounding environment. In many developed countries, higher education institutions have long functioned as a central pillar of national human capital development. Accordingly, university academics, as key components of this human capital, play a vital role in strengthening the quality, relevance, and societal impact of higher education (Nguyen *et al.* 2021).

In Indonesia, the performance of university academics is evaluated through the Three Pillars of Higher Education: teaching, research, and community service, as mandated in the Directorate General of Higher Education Regulation No. 21/E/KTP/2021 on the Operational Guidelines for Academic Workload. Consequently, research functions act as a key performance indicator in academic career advancement. Through the research component, academics conduct investigations, generate scientific findings, and disseminate them through journals or conference proceedings, thereby enhancing the performance of individual scholars, study programs, and higher education

institutions. However, current realities indicate a misalignment between these expectations and actual performance (Lesmana & Nasution 2020; Wahyudi *et al.* 2021; Winarno & Hermana 2019). Data released by the Directorate General of Higher Education in 2019 reveal that out of approximately 177,000 academics across 4,607 universities in Indonesia, only 34,007 research outputs were successfully published. Similarly, performance in the teaching and community service components also remains at a relatively low level (Wahyudi *et al.* 2021).

State Islamic Universities (PTKIN) also position research as one of the Three Pillars of Higher Education and regard it as an important indicator in assessing academic staff performance. The government, through the Directorate General of Islamic Education and various programs such as ARKAN, has supported improvements in research output in scientific publications and intellectual property rights (HaKI). Although the quantity of publications has increased significantly (Truong *et al.* 2021), the actual societal impact of these research findings remains insufficiently examined (Boshoff & Jong 2019). In the PTKIN context, this issue is particularly challenging because most research topics focus on fields that theoretically hold substantial potential to generate socio-economic impact, like religion, social humanities, and education. Yet, there is still no valid and structured measurement framework to assess impact from two essential perspectives: the researcher and the community as the end-users of research outcomes. In fact, community-based research approaches have been proven to enhance the applicability and relevance of research findings to local needs, suggesting the urgent need for a more robust impact assessment system (Susilawaty *et al.* 2016; Prasajo 2019).

This study aims to identify and map the success factors that influence the socio-economic impact of research conducted by State Islamic Universities (UNIS). The instrument used for measurement was developed based on a review of relevant literature and guidelines from the Ministry of Religious Affairs, by breaking down aspects into measurable dimensions and indicators using a four-point Likert scale. The population included all lecturers from State Islamic Universities (UIN) across Sumatra, with the target sample consisting of lecturers from UIN Ar-Raniry (Aceh), UIN Imam Bonjol (Padang), and UIN Suska Riau (Pekanbaru), with UIN Sunan Gunung Djati Bandung as a comparison institution. Data analysis began with a descriptive approach followed by factor analysis. The main advantage of using factor analysis is its ability to manage datasets filled with many aspects or variables while simplifying the interpretation process. These findings can provide data-driven recommendations for improving research policies within PTKIN environments to produce impactful and sustainable results for society.

2. Fundamental Concept

2.1. Concept of Innovation Research and Strategy

Previously, a study highlighted the importance of adopting a systems-thinking approach to better understand how research generates impacts within society (Althaus *et al.* 2021). The actual impact of research is not an isolated outcome but rather a phenomenon that emerges from interactions within a broader systemic context. A systems-thinking approach can reveal the dependencies, responsibilities, and relationships among various research stakeholders (Morrow *et al.* 2017). This perspective clarifies how research findings truly produce public benefit. While research has significant potential to generate societal impact, it is often assessed as offering a relatively low contribution. Therefore, research conducted within universities is anticipated to deliver meaningful societal impact through the production of relevant and applicable research outputs.

Innovation in research outputs can generate meaningful public impact, particularly within the social sector. Several studies have developed a typology of twelve forms of impact produced by research in the social sciences and humanities (Muhonen *et al.* 2020). These impact pathways were

identified through an analysis of 60 case studies and categorized based on the types of outcomes generated. The typology serves to enhance understanding and support the creation of research impact, especially for the purpose of research evaluation. Accordingly, the societal impact of university research provides a conceptual framework for expanding the relevance and application of academic inquiry. Social impact research is highly important for policymakers in both the university and government sectors. However, research on science policy, particularly regarding research impact, remains relatively underdeveloped.

A case study of collaborative projects between universities and local communities illustrates how such partnerships can accommodate a broader range of research outcomes, including more nuanced social impacts at the local level (Woolcott *et al.* 2020). The findings help address limitations within existing impact assessment frameworks and provide insights into how collaborative research networks function and contribute to innovation. Moreover, the study highlights the shortcomings of current approaches to measuring societal impact and proposes alternative perspectives capable of capturing a wider spectrum of research outcomes. Accordingly, the research recommends establishing collaborative interaction patterns between universities and external stakeholders to enhance the societal relevance and impact of academic research.

2.2. Concept of Academic Research in the University

Various studies have reviewed the literature on the concepts, methods, and contributing factors related to successful research impact in higher education. This body of research discusses the degree to which higher education institutions generate research relevant and beneficial to society (Paunescu *et al.* 2022). These studies successfully demonstrate the role of universities in producing research that contributes to economic competitiveness and societal well-being. Furthermore, such research enhances the capacity of institutions to transform academic findings and applied research outputs into meaningful knowledge for key stakeholders, including businesses, industries, the economic sector, and the wider community.

Additionally, a journal article reviewing 135 academic publications has examined the conceptualization, monitoring methods, and success factors related to societal impact (Dotti & Walczyk 2022). The study generated three key findings. First, there is widespread dissatisfaction with the narrow use of bibliometric indicators, highlighting the need for broader perspectives that capture long-term societal impact. Second, the literature emphasizes alternative approaches, such as altmetrics, that track engagement activities and productive interactions between researchers and stakeholders. Third, the review reveals a shift from viewing impact merely as an attribute of research outputs toward recognizing researchers' active contributions in addressing societal challenges.

A study analyzing research impact cases reported to impact assessment institutions in Australia and England identified the types of research impacts that occur in professional practice outside academia (Zheng *et al.* 2021). The cases demonstrate that research can generate meaningful benefits for stakeholders beyond the academic environment. From this analysis, the article identifies three types of impact: the recognition of new opportunities among potential users, the continued or long-term use of research outputs, and the enhancement of user experience. Thus, the article provides a more representative description of the various forms of research impact on practice.

The Indonesian government has allocated research funding through various ministries. This effort designates research institutions as extensions of government efforts and ensures that research activities generate tangible benefits for society. However, the measurement of societal impact resulting from these research activities remains limited, and current performance indicators have yet to fully capture the breadth of outcomes experienced by communities. This limitation underscores the need for studies that enhance understanding of how university research influences society, particularly in identifying and organizing the various types of impacts that arise from

interactions between researchers and non-academic stakeholders, including individuals, organizations, communities, industries, and economic sectors, within the Indonesian governmental context.

2.3. Concept of Research Outcomes, Outputs and Impact

A study examines how research impact is conceptualized in Africa by exploring the use of the logic model commonly adopted in program evaluation (Boshoff & Jong 2019). The logic model categorizes research results into three elements: outputs, outcomes, and impacts. A web survey was administered to 485 researchers across African countries to gather their views on these three elements in relation to the societal impact of the research. The findings indicate that impact is perceived as the strongest element, referring to the tangible benefits of research for society. However, 23% to 43% of respondents consider the three elements to be equally important. Another key finding highlights that the relationship between university research and societal impact lies in how African researchers conceptualize research impact itself. By understanding the perspectives and definitions of impact held by researchers, the article implicitly demonstrates that university research is regarded as contributing positively to society.

Furthermore, a study explores the diverse landscape of research publications undertaken by various organizations beyond commercial academic publishers (Lawrence 2021). The article aims to provide a holistic understanding of the research publication system and proposes a system-oriented approach that recognizes the wide range of actors, institutions, and practices involved. The goal is to ensure that the research communication system functions effectively for the benefit of the broader society. By acknowledging the diversity of stakeholders and practices in research publishing, the article contributes to understanding the wider social impacts of university research. It emphasizes the need for a more holistic and system-oriented perspective in research publishing that aligns with the goal of maximizing the benefits of the research publication system and promoting diversity in research outputs.

In a different context, a study examined the use of diverse research publications for public policy and practice in Australia (Lawrence 2022). The researchers conducted a large-scale online survey and structured interviews with research users across various sectors to identify the types of materials they accessed and utilized in policy development and practical decision-making. The findings revealed that active research users rely on a wide range of information sources and require diverse forms of research publications, including reports and papers produced by organizations and made available online. The authors argued that maximizing the public value of research requires greater recognition of the diversity of publication types and information sources needed for policy-oriented research, as well as improvements in standards, skills, and public knowledge infrastructures. Outputs and outcomes are typically measurable at the time of project reporting to funders. In contrast, research impact assessment is more challenging because it depends on feedback and evidence from the end users.

3. Methodology

3.1. Development of a Research Instrument

The measurement of the social and economic impacts of university members' research was operationalized through the development of questionnaire items. These items were derived from the social and economic aspects identified based on researchers' perspectives. Each aspect was then delineated into specific dimensions and indicators, selected from relevant literature obtained through online sources and refined to ensure alignment with the study's thematic focus and the

guidelines set by the Ministry of Religious Affairs. Both instruments employed a four-point Likert scale comprising “Strongly Disagree”, “Disagree”, “Agree”, and “Strongly Agree” to minimize potential response bias (Budiaji 2013). Table 1 presents the selected dimensions and indicators associated with the social and economic aspects.

Table 1: Developed instrument for research impact measurement

Aspect (Level 1)	Dimension (Level 2)	Indicator (Level 3)	Author
Social	Equality	Research and Policy	A
		Education and Employment	A
		Community Engagement	A
		Innovation Ecosystems	A
		Interdisciplinary Research	A
	Knowledge Exchange	Public Engagement	A, B, C
		Collaboration with Stakeholders	A, B, C
		Tailored Guidance	A, B, C
		Impact Plans	A, B, C
		Repository of Best Practices	A, B, C
	Employability and Opportunities	Research-Based Training	A, D, E, F, G
		Network Learning	A, D, E, F, G
		Impact on Employment Quality	A, D, E, F, G
		Social Entrepreneurship Interventions	A, D, E, F, G
		Innovation Ecosystems	A, D, E, F, G
	Quality of Life	Public Health Interventions	H
		Environmental Sustainability	H
		Cultural Understanding	H
		Public Policy Influence	H
		Social Infrastructure	H
Economy	Business Development	Economic Output and Employment Generation	I
		Human Capital Development	J
		Knowledge Spillovers and Innovation	K
		Regional Economic Growth	L
		Job Creation from University Research	K
	Job Opportunities	Human Capital Development	M
		Knowledge Spillovers	K
		Increased Investment in R&D	K
		Economic Impact on Local Communities	M
		Link Between Research Funding and Economic Growth	N
	Public Facilities	Investment in Public Facilities	P
		Knowledge Transfer and Innovation	J
		Long-term Economic Impact	O
		Research Output and Innovation	J
		Start-ups and Spin-offs	P
	Productivity	Collaborative Research and Industry Partnerships	J, O
		Employment and Economic Growth	J
		Knowledge Transfer and Skill Development	Q, R
		Increased R&D Expenditures	Q
		Job Creation and Employment Opportunities	J, P
	Income Growth	Commercialization of Research	M
		Partnerships and Collaborations	P, S
		Long-term Economic Impact	O, Q

Note: A= (Paunescu et al. 2022); B= (Reed et al. 2014); C= (Roberts 2009); D= (Baturina 2022); E= (Chism et al. 2012); F= (Shiyuan et al. 2022); G= (Chen 2017); H= (McDonnell-Naughton & Păunescu 2022); I= (Spowage et al. 2023); J= (Cheah & Yu 2016); K= (Parilla & Haskins 2023); L= (Valero & Van Reenen 2019); M= (Arizona State University 2025); N= (American Academy of Arts & Sciences 2016); O= (Kotosz et al. 2015); P= (Yusuf & Nabeshima 2007); Q= (El-Ansary 2013); R= (Kern 2011); S= (Mahmud et al. 2022).

The questionnaire contains 43 statements that represent and measure researchers' perceptions of the impact of lecturers' research in various socio-economic dimensions, such as attention to gender and social justice, which represent the equality dimension; the knowledge exchange dimension, which is assessed through collaboration with the community, government, and the use of technology; the employability and opportunities dimension, which is represented by statements related to improving graduates' skills, networks, and careers; the quality of life dimension, which is related to research contributions to health, the environment, culture, and public policy. Then, in the economic aspect, the business development dimension is assessed by encouraging the local economy and industrial innovation; the job opportunities dimension through job creation and strengthening human resources; the public facilities dimension, which assesses the impact of research on development and welfare; the productivity dimension through statements about publications, patents, and research collaborations; and the income growth dimension, which is represented by statements related to research contributions to improving the community's economy through commercialization and industrial partnerships. The complete questionnaire table is shown in the appendix page.

3.2. Population and Sample

In this study, the population includes all lecturers from State Islamic Universities (UIN) across Sumatra. The target samples (respondents) consist of lecturers from UIN Ar-Raniry (Aceh), UIN Imam Bonjol (Padang), and UIN Suska Riau (Pekanbaru), with UIN Sunan Gunung Djati Bandung included as a comparative institution. Data and information were primarily collected from 127 respondents using two developed instruments as well as interviews.

3.3. Data Analysis

The data analysis process consists of instrument development and instrument validation. Indicators for monitoring and evaluation were formulated through the instrument, which included items on respondent demographics, research clusters, research funding received, research outputs, and research contributions to society. The instrument was designed by aligning these components with the relevant research clusters and funding schemes. Subsequently, the instrument underwent expert validation. Following the validation stage, a pilot study was conducted to assess the reliability of the instrument. This study specifically developed an instrument to measure the perceived effectiveness of university. The detailed data analysis procedure is presented in Figure 1.

4. Results and Discussion

4.1. Descriptive Statistics for Respondents' Demographic and Socio-Economic Aspects

In this cross-sectional study, the respondents' demographic and socio-economic aspects are clearly described in Tables 2, respectively.

Based on Table 2, the majority of respondents fall within the age range of 45–48 years (22.05%). In terms of educational qualifications, 51.97% of respondents hold a Master's degree (S2), while 48.03% hold a Doctoral degree (S3). Overall, the respondents represent various State Islamic Universities across Sumatra, including UIN Suska Riau (48.82%), UIN Imam Bonjol Padang (15.75%), and UIN Ar-Raniry (14.17%). The respondents' fields of expertise include Science and Technology (39.37%), Social Sciences (29.13%), and Religious Studies (14.96%). In the past five years, the largest proportion of respondents reported having conducted two research projects (37.80%). The most frequently conducted types of research were Interdisciplinary Basic Research (27.59%) and Study Program-Based Basic Research (24.14%).

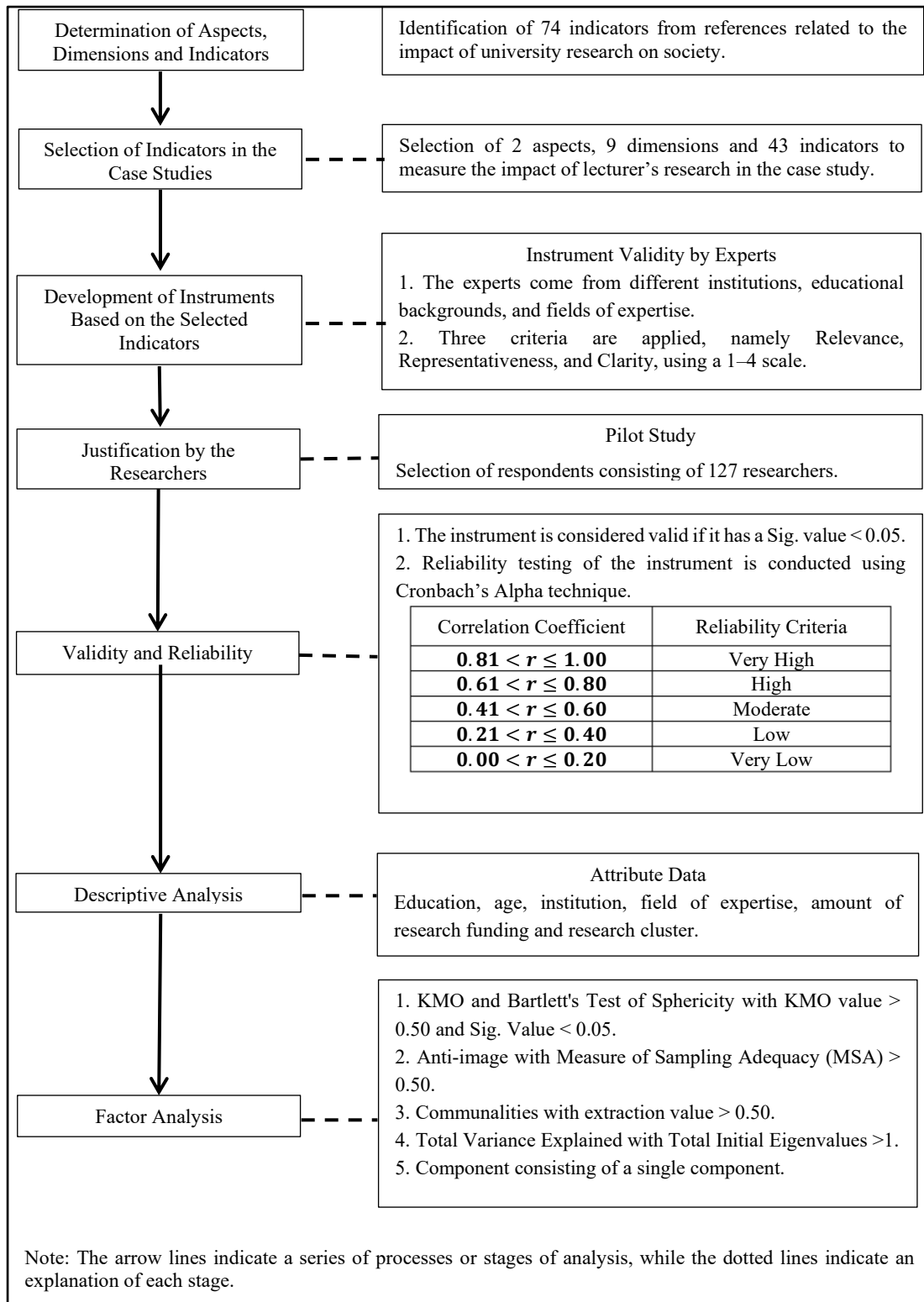


Figure 1: Flow of data analysis

Table 2: Respondents' demography (university's researchers)

	Researchers	
	%	N
Total Respondents	100	127
Age		
a. 29 - 32	4.72	6
b. 33 - 36	12.60	16
c. 37 - 40	19.69	25
d. 41 - 44	11.02	14
e. 45 - 48	22.05	28
f. 49 - 52	16.54	21
g. 53 - 56	6.30	8
h. 57 - 60	7.09	9
Last Education		
a. S2	51.97	66
b. S3	48.03	61
Institution		
a. UIN Imam Bonjol Padang	15.75	20
b. UIN Ar-Raniry	14.17	18
c. UIN Suska Riau	48.82	62
d. UIN Mahmud Yunus Batusangkar	3.94	5
e. Universitas Dharma Andalas	0.79	1
f. Universitas Andalas	3.15	4
g. IAIN Langsa	0.79	1
h. Litapdimas Kemenag Pusat	0.79	1
i. Universitas Negeri Padang	0.79	1
j. Universitas Riau	0.79	1
k. UIN Sunan Gunung Djati Bandung	6.30	8
l. UIN Sunan Kalijaga	0.79	1
m. UIN	1.57	2
n. Big Academy	0.79	1
o. Perguruan Tinggi	0.79	1
Areas of Expertise		
a. Science and Technology	39.37	50
b. Medical	1.57	2
c. Social Sciences	29.13	37
d. Religious	14.96	19
e. Others	14.96	19
Research Funding Amount (Last 5 Years)		
a. 1	25.98	33
b. 2	37.80	48
c. 3	22.83	29
d. 4	5.51	7
e. 5	7.87	10
Research Cluster		
a. Capacity Building/Development Research	18.72	38
b. Study Program Basic Research	24.14	49
c. Interdisciplinary Basic Research	27.59	56
d. Applied for National Strategic Studies Research	11.33	23
e. Applied Correlated with the Business and Industry World Research (DUDI)	0.00	0
f. Collaborative Development Research Between Universities and/or Ministries/Institutions	7.88	16
g. International Collaborative Development Research	5.42	11
h. National Strategic Studies Survey Development Research	2.96	6
i. Others	1.97	4

4.2. Confirmatory Factor Analysis (CFA) for the Dimension and its Items

The factor analysis procedure was conducted in two stages: confirmatory factor analysis (CFA) and exploratory factor analysis (EFA). CFA was employed to examine the extent to which the measurement indicators represented the underlying factors of the social and economic aspects. Each indicator within each dimension was analyzed individually to determine its validity. This study

employed first-order confirmatory factor analysis. A second-order approach was not applied because all dimensions studied yielded a single component matrix. This indicates that each dimension can be measured directly by the indicators used, eliminating the need for second-order constructs (Kaloeti & Dewi 2020). Subsequently, to further explore the dimensions underlying the social and economic aspects from the researchers' perspectives, EFA was utilized. All validated indicators representing specific dimensions were analyzed based on the total scores of each indicator. This procedure was applied to each aspect individually as well as to the combined aspects. The selection of indicators and determination of final results followed standard factor analysis criteria. The analytical steps for the equality dimension (researcher perspective) are outlined as follows:

Step 1: Conducting the Kaiser–Meyer–Olkin (KMO) Test

The Kaiser–Meyer–Olkin (KMO) test was performed to assess whether the indicators and data met the requirements for factor analysis. The eligibility criteria stipulate that the KMO value must exceed 0.50, and the significance value (Sig.) must be less than 0.05. The results of the KMO test are presented in Table 4.

Table 3: First test of KMO dimension of equality from the researchers' perspective

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.715
Bartlett's Test of Sphericity	Approx. Chi-Square	295.153
	df	10
	Sig.	0.000

Based on Table 3, the KMO value obtained was 0.715 with a significance level of 0.000. These results indicate that the data meet the required criteria, and therefore, the factor analysis can proceed accordingly.

Step 2: Determining the Anti-Image Matrix

The anti-image matrix was examined to evaluate and determine the adequacy of each indicator for inclusion in the factor analysis. One of the required criteria is that the Measure of Sampling Adequacy (MSA) for each indicator must be greater than 0.50. The results of the anti-image analysis are presented in Table 4.

Table 4: First test of the anti-image dimension of equality researcher's perspective

		Anti-image Matrices				
		Research and Policy	Education and Employment	Community Engagement	Innovation Ecosystems	Interdisciplinary Research
Anti-image Covariance	Research and Policy	0.233	-0.179	0.046	0.021	-0.011
	Education and Employment	-0.179	0.198	-0.040	-0.073	-0.058
	Community Engagement	0.046	-0.040	0.680	-0.210	-0.154
	Innovation Ecosystems	0.021	-0.073	-0.210	0.585	-0.129
	Interdisciplinary Research	-0.011	-0.058	-0.154	-0.129	0.614

Table 4 (Continued)

Anti-image Correlation	Research and Policy	0.622 ^a	-0.833	0.115	0.057	-0.030
	Education and Employment	-0.833	0.644 ^a	-0.109	-0.215	-0.165
	Community Engagement	0.115	-0.109	0.767 ^a	-0.334	-0.238
	Innovation Ecosystems	0.057	-0.215	-0.334	0.818 ^a	-0.215
	Interdisciplinary Research	-0.030	-0.165	-0.238	-0.215	0.876 ^a

a. Measures of Sampling Adequacy (MSA)

In Table 4, the MSA values are shown in the anti-image correlation column, marked with the code (a). All indicators have MSA values above 0.50, indicating that the anti-image criteria are fully met.

Step 3: Determining Communalities

Communalities represent the extent to which each indicator contributes to the factors formed; thus, a higher communality value indicates a greater influence of that indicator on the extracted factors. Each indicator is required to have an extraction value greater than 0.50. The results of the communalities analysis are presented in Table 5.

Table 5: First test of the communalities dimension of equality from researchers' perspective

Communalities		
	Initial	Extraction
Research and Policy	1.000	0.636
Education and Employment	1.000	0.762
Community Engagement	1.000	0.393
Innovation Ecosystems	1.000	0.570
Interdisciplinary Research	1.000	0.576

Extraction Method: Principal Component Analysis.

As shown in Table 5, the extraction values for all dimensions are greater than 0.50, with the exception of the community engagement indicator, which has an extraction value of 0.393. Therefore, this indicator cannot be used to explain the underlying factors. Consequently, the community engagement indicator must be removed, and the analysis should be repeated until all indicators meet the required criteria.

Step 4: Reconducting the Kaiser–Meyer–Olkin (KMO) Test

A reanalysis was performed after removing the community engagement indicator. The results of the updated KMO test are presented in Table 6.

Table 6: Second test of KMO dimension of equality from researchers' perspective

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.675
Bartlett's Test of Sphericity	Approx. Chi-Square	251.312
	df	6
	Sig.	0.000

Based on Table 6, the second test produced a KMO value of 0.675 (which exceeds the threshold of 0.50) and a significance value below 0.05. These results indicate that the data meet the required criteria, and the analysis can therefore proceed.

Step 5: Reconducting the Anti-Image Test

The results of the repeated anti-image analysis are presented in Table 7.

Table 7: Second test of anti-image dimension of equality from researchers' perspective

		Anti-image Matrices			
		Research and Policy	Education and Employment	Innovation Ecosystems	Interdisciplinary Research
Anti-image Covariance	Research and Policy	0.236	-0.181	0.040	-0.001
	Education and Employment	-0.181	0.200	-0.097	-0.071
	Innovation Ecosystems	0.040	-0.097	0.658	-0.210
	Interdisciplinary Research	-0.001	-0.071	-0.210	0.651
Anti-image Correlation	Research and Policy	0.614 ^a	-0.831	0.101	-0.002
	Education and Employment	-0.831	0.617 ^a	-0.268	-0.198
	Innovation Ecosystems	0.101	-0.268	0.783 ^a	-0.322
	Interdisciplinary Research	-0.002	-0.198	-0.322	0.835 ^a
a. Measures of Sampling Adequacy(MSA)					

In Table 7, all indicators show MSA values greater than 0.50, indicating that the factor analysis can proceed accordingly.

Step 6: Reconducting the Communalities Test

The results of the repeated communalities analysis are presented in Table 8.

Table 8: Testing the second communalities dimension of equality from researchers' perspective

Communalities		
	Initial	Extraction
Research and Policy	1.000	0.739
Education and Employment	1.000	0.837
Innovation Ecosystems	1.000	0.516
Interdisciplinary Research	1.000	0.551
Extraction Method: Principal Component Analysis.		

Referring to Table 8, all indicators show extraction values greater than 0.50. Therefore, all indicators can be retained to explain the underlying factors, and the analysis process can be continued.

Step 7: Total Variance Explained

The next step in the factor analysis is to determine the Total Variance Explained, which reflects the amount of variance accounted for by the extracted factors based on respondents' perceptions. This determination was made using the Initial Eigenvalues, where only components with eigenvalues greater than 1.0 were retained. The factor-forming components are presented in Table 9.

Table 9: Components forming the equality dimension factors from researchers' perspective

Component	Total Variance Explained					
	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	Variance (%)	Cumulative (%)	Total	Variance (%)	Cumulative (%)
1	2.643	66.069	66.069	2.643	66.069	66.069
2	0.744	18.606	84.675			
3	0.496	12.397	97.072			
4	0.117	2.928	100.000			
Extraction Method: Principal Component Analysis						

Based on the analysis presented in Table 9, there is only one component with an initial Eigenvalue greater than 1.0. Since only a single factor is generated, it can be concluded that the equality dimension consists of one underlying factor.

Step 8: Component Matrix

The expected outcome in the component matrix is the extraction of a single component, indicating that the indicators used are valid in representing the underlying factor. The results of the Component Matrix analysis for the equality dimension are presented in Table 10.

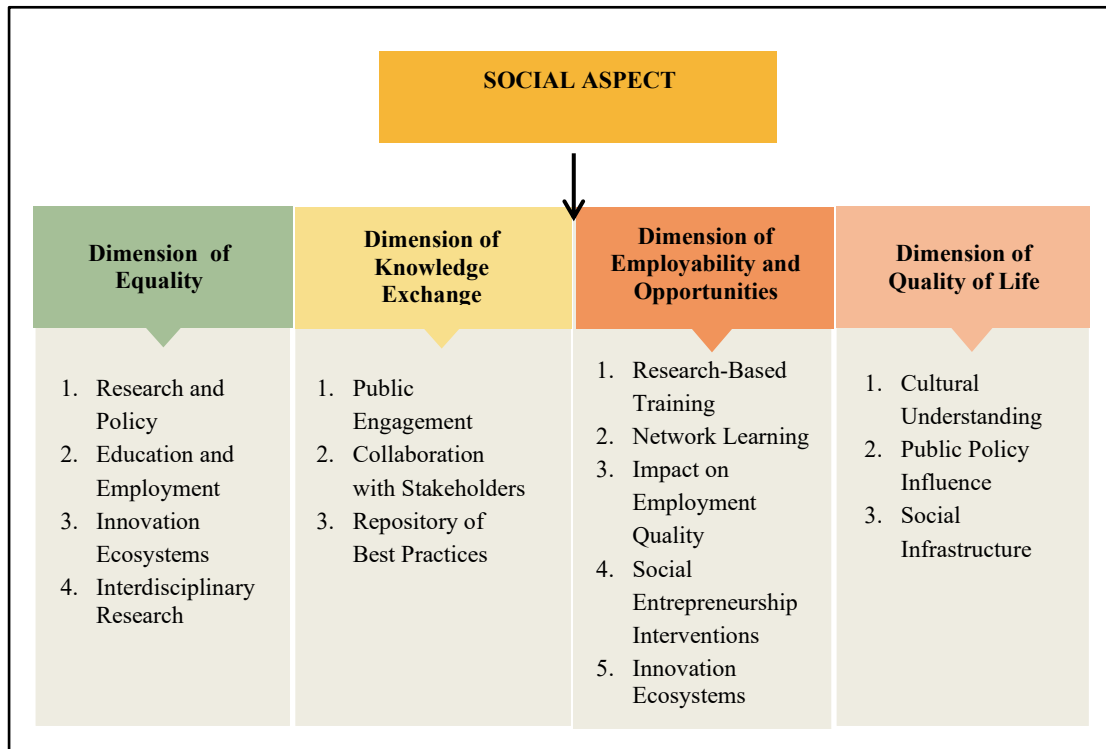
Table 10: Component matrix of equality dimensions from researchers' perspective

Component Matrix ^a	
	Component 1
Research and Policy	0.860
Education and Employment	0.915
Innovation Ecosystems	0.718
Interdisciplinary Research	0.742
Extraction Method: Principal Component Analysis.	
a. 1 components extracted.	

Based on Table 10, a single component was extracted, indicating that the indicators research and policy, education and employment, innovation ecosystems, and interdisciplinary research are valid and collectively represent the underlying factor of the equality dimension.

All dimensions of the social and the researcher-perspective economic aspects were analyzed using the same sequence of procedures. For the social aspect, from the researchers' perspective, the analysis was conducted three times for the knowledge exchange and quality of life dimensions, whereas the employability and opportunities dimension required only one round of analysis. For the economic aspect, from the researchers' perspective, the analysis was carried out once for the business development, job opportunities, and income growth dimensions, and twice for the public facilities and productivity dimensions. The valid indicators for each dimension within both the social and economic aspects, according to the researchers' perspective, are illustrated in Figures 2 and 3.

The indicator filtering process employed factor analysis across all previously examined aspects, resulting in a set of valid indicators for each dimension. Based on these results, a subsequent round of factor analysis was conducted to obtain the outcomes. This follow-up analysis adhered to the same procedures used in the earlier stages, involving only valid and eligible dimensions for inclusion. The final results of the factor analysis are presented as in Table 11.



.Figure 2: Valid indicators for social aspects based on researchers' perspective

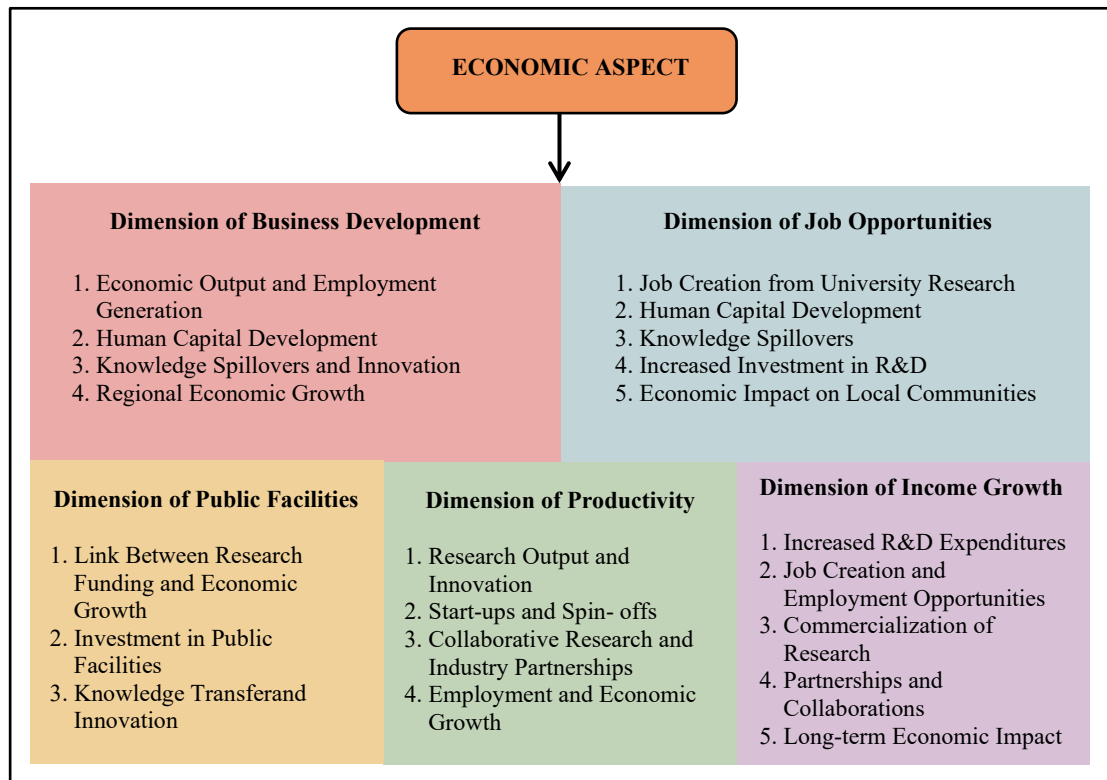


Figure 3: Valid indicators for economic aspects based on researchers' perspective

Table 11: Component matrix of social aspects of researchers' perspective

Component Matrix^a	
	Component 1
Equality	0.780
Knowledge Exchange	0.880
Employability and Opportunities	0.825
Quality of Life	0.809
Extraction Method: Principal Component Analysis	
a. 1 components extracted	

Based on Table 11, one component was extracted, indicating that the dimensions of equality, knowledge exchange, employability and opportunities, and quality of life collectively constitute the underlying factor representing the social aspect from the researcher's perspective.

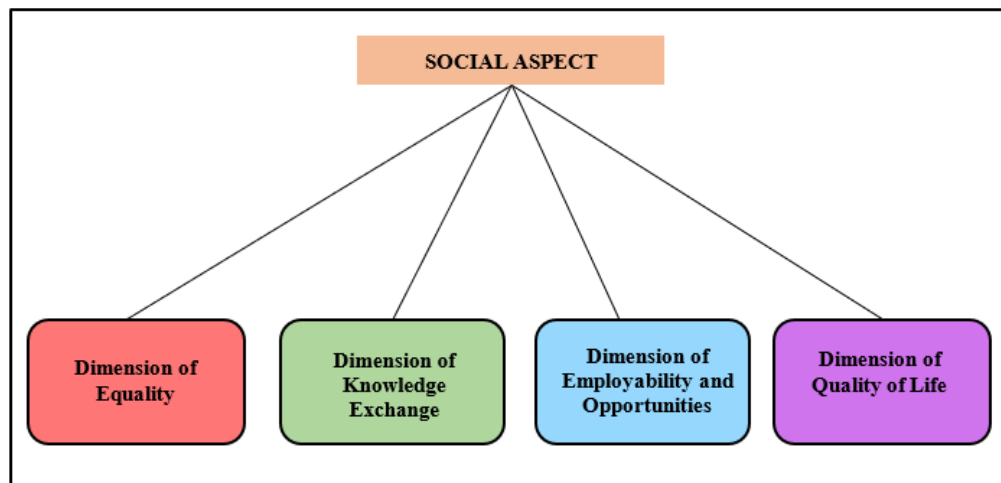


Figure 4: Final results of factor analysis for social aspects based on the researchers' perspective

Table 12: Component matrix of economic aspects from researchers' perspective

Component Matrix^a	
	Component 1
Business Development	0.905
Job Opportunities	0.912
Public Facilities	0.903
Productivity	0.895
Income Growth	0.869
Extraction Method: Principal Component Analysis.	
a. 1 components extracted.	

As shown in Table 12, a single component was formed, indicating that the dimensions of Business Development, Job Opportunities, Public Facilities, Productivity, and Income Growth collectively explain the economic aspect from the researchers' perspective.

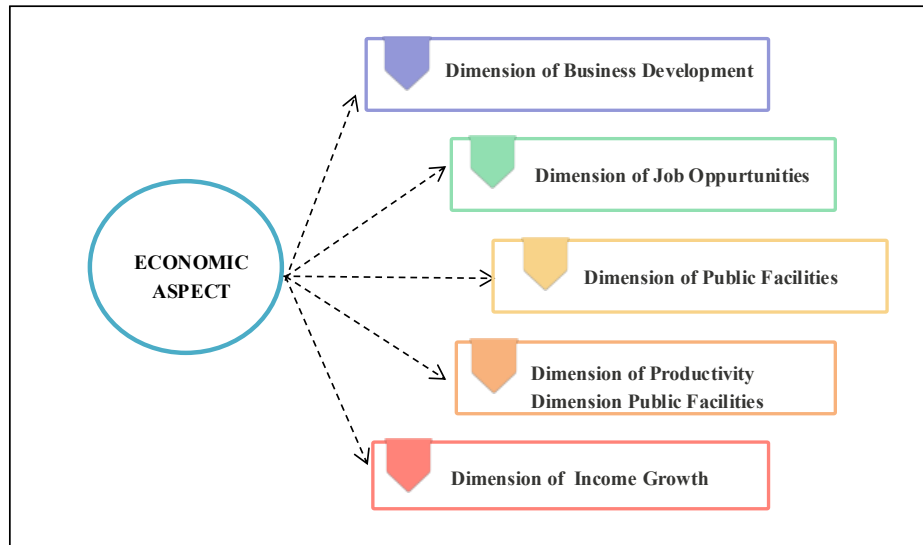


Figure 5: Final Results of Factor Analysis for Economic Aspects Based on Researchers' Perspective

Table 13: Component matrix of socio-economic aspects of researchers' perspective

Component Matrix ^a	
	Component 1
Equality	0.715
Knowledge Exchange	0.723
Quality of Life	0.758
Business Development	0.894
Job Opportunities	0.877
Public Facilities	0.867
Productivity	0.878
Income Growth	0.840
Extraction Method: Principal Component Analysis.	
a. 1 components extracted.	

The socio-economic factor from the researchers' perspective, as presented in Table 13, yields a single component comprising the dimensions of equality, knowledge exchange, quality of life, business development, job opportunities, public facilities, productivity, and income growth. Then, this aspect is described in Figure 6.

5. Conclusion

The analysis of respondents' answers using factor analysis identified the indicators and dimensions underlying perceptions of the socio-economic relevance of PTKIN lecturers' research for the community. From the perspectives of both researchers and community members, nine dimensions were identified in relation to the socio-economic relevance of PTKIN research in Sumatra. The dimensions of equality, knowledge exchange, employability and opportunities, and quality of life represent the social aspect. These dimensions reflect aspects considered important in assessing the social relevance of lecturers' research, particularly in relation to equality, knowledge transfer, employment opportunities, and quality of life in society. This interpretation is supported by previous studies highlighting these dimensions as important considerations in evaluating the societal relevance of academic research, since research outcomes are expected to generate new knowledge

and respond to social challenges such as inequality, employment, and quality of life (Paunescu *et al.* 2022). The economic aspect is represented by the dimensions of business development, job opportunities, public facilities, productivity, and income growth. These dimensions reflect areas considered relevant in assessing the economic relevance of lecturers' research, including its possible relation to local business activity, employment, public infrastructure, productivity, and income improvement. This is in line with previous studies suggesting that university research should play an important role in supporting innovations related to economic development (Cheah & Yu 2016).

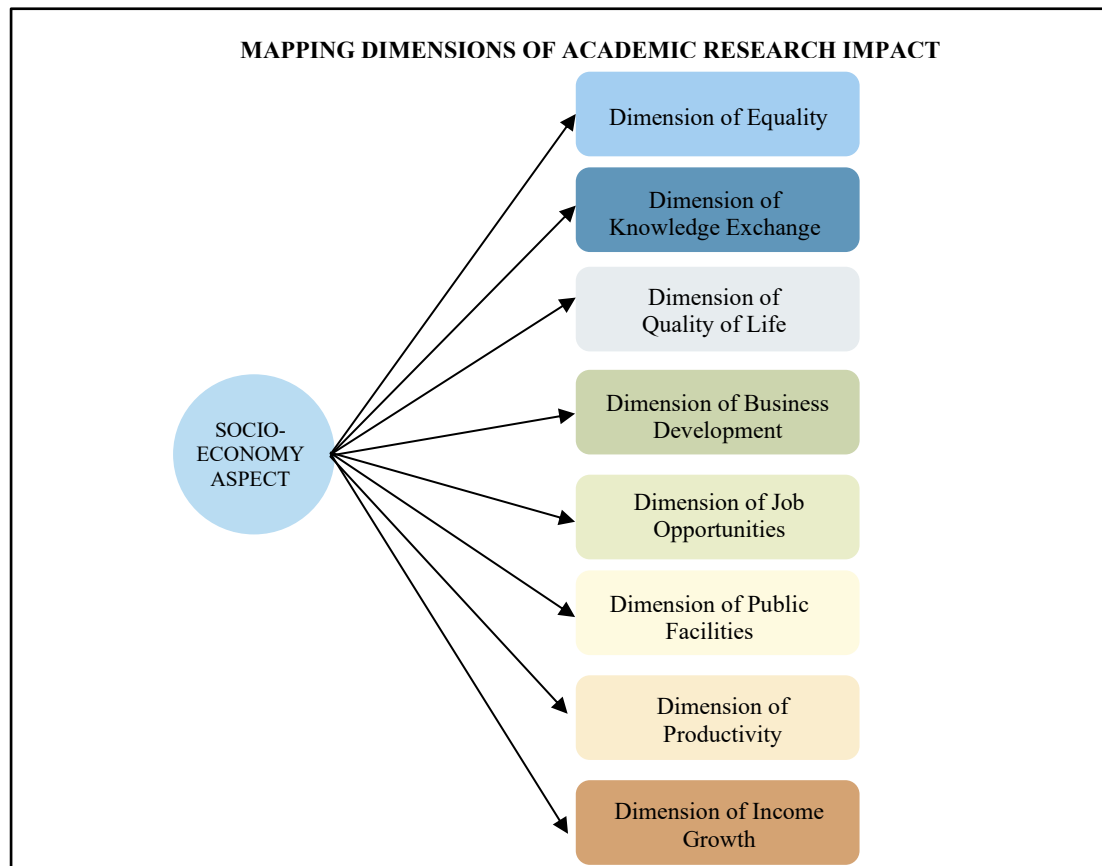


Figure 6: Proposed dimensions for socio-economy aspects based on researchers' perspective

In general, evaluations of lecturers' research outcomes tend to focus primarily on publications and intellectual property rights (HKI), with limited attention to dimensions that may be used to assess the socio-economic relevance of research for the community. Using factor analysis, this study identifies several dimensions and associated items that can inform the development of a broader framework for evaluating research conducted by PTKIN lecturers. These findings provide a basis for assessing completed and future research by highlighting dimensions considered relevant from the perspectives of researchers and the community. However, this study does not examine the actual influence or direct impact of research on the socio-economic conditions of society; rather, it maps the dimensions perceived to be relevant to such assessment. Since university research is expected to provide benefits to society, research agendas should remain attentive to community needs in order to maintain relevance and continuity. Previous studies suggest that research sustainability can be strengthened when users or beneficiaries of innovation receive clear feedback and tangible benefits.

As this study is limited to identifying the dimensions associated with the socio-economic relevance of lecturers' research, future studies are encouraged to test improvement strategies and examine how these dimensions may relate to measurable community outcomes. Such efforts may contribute to more effective approaches for strengthening the socio-economic relevance of PTKIN lecturers' research for the broader community.

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References

- Althaus C., Carson L., Sullivan H. & Wanrooy B.V. 2021. Research and education in public sector practice: a systems approach to understanding policy impact. *Policy Design and Practice* 4(3): 309–322.
- American Academy of Arts & Sciences. 2016. *Public research universities: serving the public good*. Cambridge: American Academy of Arts & Sciences
- Arizona State University. 2025. Traditional economic impact analysis of universities. https://economist.asu.edu/universities-knowledge/traditional_economic-impact-universities (29 July 2026).
- Baturina, D. (2022). Pathways towards Enhancing HEI's Role in the Local Social Innovation Ecosystem. *Social Innovation in Higher Education, Innovation, Technology, and Knowledge Management*, 37–59. https://doi.org/10.1007/978-3-030-84044-0_3
- Boshoff N. & Jong S.P.L. 2019. Conceptualizing the societal impact of research in terms of elements of logic models: a survey of researchers in Sub-Saharan Africa. *Research Evaluation* 29(1): 1–18.
- Budiaji W. 2013. Skala pengukuran dan jumlah respon skala likert. *Jurnal Ilmu Pertanian dan Perikanan* 2(2): 125–131.
- Cheah S. & Yu C. 2016. Assessing economic impact of research and innovation originating from public research institutions and universities—case of Singapore PRIs. *Triple Helix* 3(6): 1–36.
- Chen Y. 2017. Graduate employability: the perspective of social network learning. *EURASIA Journal of Mathematics, Science and Technology Education* 13(6): 2567–2580.
- Chism N.V.N., Holley M. & Harris C.J. 2012. Researching the impact of educational development. *To Improve the Academy: A Journal of Educational Developmen* 787: 129–145.
- Dotti N.F. & Walczyk J. 2022. What is the societal impact of university research? A policy-oriented review to map approaches, identify monitoring methods and success factors. *Evaluation and Program Planning* 95: 1–12.
- El-Ansary A. 2013. How to increase scientific publishing in the scientific and health department at King Saud University. https://dsrs.ksu.edu.sa/sites/dsrs.ksu.edu.sa/files/imce_images/d_ff_Insry.pdf (29 July 2026).
- Kaloeti P.P. & Dewi S.P. 2020. Analisis faktor konfirmatori konsep water sensitive city pada kawasan permukiman di kecamatan Banyumanik. *Jurnal Permukiman* 15(2): 84–94.
- Kern S. 2011. Analytic model for academic research productivity having factors, interactions and implications. *Cancer Biology and Therapy* 12(11): 949–956.
- Kotosz B., Lukovics M., Molnar G. & Zuti B. 2015. How to measure the local economic impact of universities? Methodological overview. *Regional Statistics* 5(2): 3–19.
- Lawrence A. 2021. Beyond the grey zone: organization research publishing and bibliodiversity in the research communication system. *Pop! Public. Open. Participatory* (3).
- Lawrence A. 2022. Research use and publishing diversity: the role of organisation research publishing for policy and practice. *Australian Journal of Public Administration* 82(1): 46–68.
- Lesmana M.T. & Nasution A.E. 2020. Analysis of factors affecting the performance of lecturers in conducting research: a case study on private universities in Medan. *Asia Pacific Journal of Management and Education* 3(2): 33–44.
- Mahmud A., Nuryatin A. & Susilowati N. 2022. Income generating activity in higher education: a case study of a public university in Indonesia. *International Journal of Evaluation and Research in Education* 11(1): 303–312.
- McDonnell-Naughton, M., & Păunescu, C. (2022). Facets of Social Innovation in Higher Education. *Social Innovation in Higher Education. Innovation, Technology, and Knowledge Management*, 9–35. https://doi.org/10.1007/978-3-030-84044-0_2
- Morrow E.M., Goreham H. & Ross F. 2017. Exploring research impact in the assessment of leadership, governance and management research. *Evaluation* 23(4): 407–431.
- Muhonen R., Benneworth P. & Olmos-Peñuela J. 2020. From productive interactions to impact pathways: understanding the key dimensions in developing ssh research societal impact. *Research Evaluation* 29(1): 34–47.
- Nguyen T.D., Bui T.H.V., Nguyen T.L.T., Tran M.D. & Tran T.K.N. 2021. Perception of organizational support to

- lecturers' research motivation: the case of Vietnam. *Journal of Asian Finance, Economics, and Business* **8**(2): 657–666.
- Parilla J. & Haskins G. 2023. How research universities are evolving to strengthen regional economies. <https://www.brookings.edu/articles/how-research-universities-are-evolving-to-strengthen-regional-economies/> (29 July 2026).
- Paunescu C., Lepik K.L. & Spencer N. (eds.). 2022. *Social innovation in higher education: Landscape, practices, and opportunities*. Switzerland: Springer Nature.
- Paunescu C., Nikina Ruohonen A. & Stukalina Y. 2022. Fostering research with societal impact in higher education institutions: a review and conceptualization. In Păunescu C., Lepik K-L & Spencer N. (eds.), *Social Innovation in Higher Education, Innovation, Technology, and Knowledge Management*: 153–178. Switzerland: Springer.
- Prasojo E. 2019. Hilirisasi penelitian dan pengabdian masyarakat di PT. <https://www.kompas.id/artikel/hilirisasi-penelitian-dan-pengabdian-masyarakat-di-pt> (29 July 2026).
- Reed, M. S., Stringer, L. C., Fazey, I., Evely, A. C., & Kruijsen, J. H. J. (2014). Five principles for the practice of knowledge exchange in environmental management. *Journal of Environmental Management*, **146**, 337–345. <https://doi.org/10.1016/j.jenvman.2014.07.021>
- Roberts M.R. 2009. Realizing societal benefit from academic research: analysis of the national science foundation's broader impacts criterion. *Social Epistemology* **23**(3–4): 199–219.
- Shiyuan Y., Jinxiu Y., Jingfei X., Yuling Z., Longhua Y., Houjian L., Wei L., Hao C., Guorong H. & Juan C. 2022. Impact of human capital and social capital on employability of chinese college students under covid-19 epidemic—joint moderating effects of perception reduction of employment opportunities and future career clarity. *Frontiers in Psychology* **13**: 1–15.
- Spowage M., Randolph H.L., Gillan B., Dzhonov S. & Milne K. 2023. *The economic impact of university research funding in Scotland*. Glasgow: Fraser of Allander Institute.
- Susilawaty A., Tasruddin R., Ahmad D. & Salenda K. 2016. *Panduan Riset Berbasis Komunitas (Community Based Research)*. Mahfudz M. (ed.). Makassar: Nur Khairunnisa.
- Truong H.T., Le H.M., Do D.A., Le D.A., Nguyen H.T. & Nguyen T.K. 2021. Impact of governance factors over lecturers' scientific research output: an empirical evidence. *Education Sciences* **11**(9): 1–21.
- Valero A. & Van R.J. 2019. The economic impact of universities: evidence from across the globe. *Economics of Education Review* **68**: 53–67.
- Wahyudi, Sutoro M. & Mukrodi. 2021. Reality of lecturers' performance, what's next?. *Proceedings of the 1st International Conference on Research in Social Sciences and Humanities*, pp. 320–324.
- Winarno A. & Hermana D. 2019. Commitment, work engagement, and research performance of lecturers, in indonesia private universities. *Malaysian Online Journal of Educational Management* **7**(4): 45–63.
- Woolcott G., Keast R. & Pickernell D. 2020. Deep impact: re-conceptualising university research impact using human cultural accumulation theory. *Studies in Higher Education* **45**(6): 1–45.
- Yusuf S. & Nabeshima K. (eds.). 2007. *How universities promote economic growth*. Washington: The World Bank.
- Zheng H., Pee L.G. & Zhang D. 2021. Societal impact of research: a text mining study of impact types. *Scientometrics* **126**(9): 7397–7417.

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