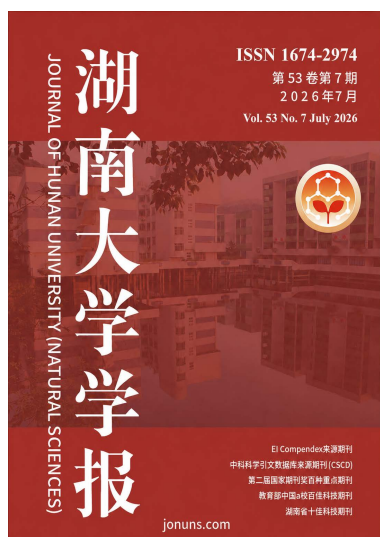




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Modeling Fishermen's Welfare: The Role of Sekee Institutions in Buleleng Regency, Bali, Indonesia

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Abstract: Fishermen in Buleleng Regency continue to face constraints in improving their productivity and welfare. These constraints arise from the suboptimal utilization of production factors, the ineffective functioning of fishermen's institutions, and insufficient government support, including limited attention to local fishermen's organizations. This study aims to analyze the determinants of fishermen's productivity and welfare in Buleleng Regency by examining local institutions rooted in fishermen's traditional wisdom. The direct, indirect, moderating, and mediating effects were tested using partial least squares structural equation modeling (PLS-SEM) based on 171 questionnaires collected through the pick-up survey method. The results indicate that fishermen's institutions are the main determinant of productivity, whereas the role of government is the main determinant of fishermen's welfare. Technology does not significantly moderate the relationship between human resource quality and fishermen's productivity, while the role of government does not significantly moderate the relationship between fishermen's institutions and productivity. Productivity mediates the relationships between the study variables and fishermen's welfare. Furthermore, local institutions such as sekee and Fisheries Business Groups (KUB) that apply the sekee mechanism can optimize production factors and promote a more equitable distribution of income, thereby improving fishermen's welfare. This study emphasizes the importance of strengthening local institutions and increasing productivity to achieve sustainable fishermen's welfare within the framework of the blue economy.



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Keywords: fishermen's productivity; fishermen's welfare; fishermen's institutions; sekee; Fisheries Business Groups (KUB); blue economy.

渔民福利建模：印度尼西亚巴厘省布勒伦县Sekee组织的作用

摘要：布勒伦县渔民在提高生产率和改善福利方面仍面临诸多制约。这些制约主要源于生产要素利用不充分、渔民组织运行效率不高以及政府支持不足，包括对地方渔民组织关注有限。本研究旨在通过考察植根于渔民传统智慧的地方制度，分析布勒伦县渔民生产率与福利的决定因素。研究基于通过问卷回收调查法收集的171份问卷，采用偏最小二乘结构方程模型（PLS-SEM）检验直接效应、间接效应、调节效应和中介效应。研究结果表明，渔民组织是影响生产率的主要因素，而政府作用是影响渔民福利的主要因素。技术对人力资源质量与渔民生生产率之间的关系不具有显著调节作用，政府作用对渔民组织与生产率之间的关系也不具有显著调节作用。生产率在各研究变量与渔民福利之间发挥中介作用。此外，Sekee等地方组织以及采用Sekee机制的渔业经营小组（KUB）能够优化生产要素配置，促进收入更加公平地分配，从而改善渔民福利。本研究强调，应在蓝色经济框架下加强地方组织建设并提高生产率，以实现渔民福利的可持续改善。

关键词： 民生生产率；渔民福利；渔民组织；Sekee；渔业经营小组（KUB）；蓝色经济。

1. Introduction

Indonesia is an archipelagic nation in which approximately two-thirds of its territory consists of oceans, enormous potential for marine resources and fishery resources. Within the framework of Nawacita Concept, the government aspires to position Indonesia as a global maritime axis. Buleleng Regency, as one of the regencies in Bali Province, Indonesia, possesses significant fisheries potential estimated at approximately 20,119 tons. This is attributed to its longest coastline in Bali, measuring 157.05 km, a water area spanning 1,166.75 km², and its strategic location bordered by the Bali Strait and Lombok Strait, which supports abundant marine biodiversity [1]. However, over the past five years, the fisheries production in Buleleng Regency has consistently been lower than that of Denpasar, Jembrana, Badung, and Karangasem within Bali Province, with an actual production of only 16,674.70 tons, or approximately 83 percent of its potential [2].

Fishermen's production is related to their productivity, which is influenced by the quality of human resources, capital, institutional strengthening, optimal utilization of technology, and government policy aspects [3 and 4]. If productivity is optimized, then the welfare of the fishermen can be achieved [5 and 6]. The low productivity is due to the low quality of the fishermen's human resources, who tend to rely more on traditional experience and customs rather than being supported by technological innovation or the

implementation of new methods [7 and 8]. Additionally, fisherman also hampered by capital because they difficult to access financing from formal financial institutions due to the lack of collateral or complete business documentation. This makes it challenging to acquire modern fishing gear, or to repair and upgrade existing equipment [9]. The Buleleng Regency government has made efforts to boost productivity through programs such as providing assistance with boats, fishing equipment, training, and the development of fisheries infrastructure, but this has not been sustainable [1].

The welfare theory presented by [10] and [11] states that welfare is achieved when there is a system or service to assist individuals or groups meet their basic needs, improving the quality of life and achieve overall welfare. This organized system exists within fishermen's institutions in the form of fishermen's groups to optimize production factors, including their relationship with the government [12]. However, in Buleleng Regency, these institutions often do not function effectively, they are active during government assistance programs and lack sustainability [8 and 13]. As a result, fishermen utilize production factors individually without the support of an organized system, which ultimately reduces overall productivity [14].

The primary issue faced by fishermen in Buleleng Regency is the suboptimal utilization of production factors, as they rely more on experience and age, often surpassing their productive years, and

encounter difficulties in adopting new technology [1, 8 and 15]. The fishermen's institutions that manage production factors have not yet played an effective role, as their utilization does not align with the fishermen's needs. This affects productivity, resulting in minimal income and consequently impacting their welfare [14]

The second issue is the suboptimal support from the Buleleng Regency government in providing assistance, due to a lack of coordination between fishermen's institutions and the actual needs of the fishermen [1]. Until now, government assistance to fishermen has been channeled only through the Fisheries Business Groups (KUB), which are official institutions under the Food Security and Fisheries Service of the Buleleng Regency Government. However, these groups are only active during periods of aid distribution, and their roles have not fully met the needs of the fishermen. Fishermen in Buleleng Regency actually have local fishermen's institutions that understand their traditional wisdom, but the government has not fostered these local institutions. As a result, government assistance often does not align with the actual needs of the fishermen.

Therefore, research on fishermen's institutions in Buleleng Regency is important, as most studies have primarily focused on the KUB [8, 13, and 16]. If only using KUB, the research results will not be able to show how institutions can solve the problems faced by fishermen in Buleleng Regency because the existing KUB does not yet have a working mechanism in managing the quality of human resources, capital, and technology, which affects the productivity and welfare of fishermen. However, this research still uses KUB as an object of analysis because KUB is a group recognized by the government, and only through KUB can the government's role in the productivity and welfare of fishermen be observed.

However, previous research results that used KUB as the object of analysis were not complemented by local fishermen's institutions, which are formed by fishermen members and understand the needs of the fishermen themselves [17]. Fishermen in Buleleng Regency have formed a local fishermen's institution called Sekee. They naturally emerged from the social, cultural, and economic needs of the fishermen and aligns closely with their requirements. Sekee demonstrates effectiveness, efficiency, and flexibility in managing production factors. Sekee already has a mechanism for work distribution and management of human resources, capital, and technology that meets the needs of fishermen, thereby increasing their productivity. Sekee has a transparent and fair income distribution system, ensuring that fishermen have income certainty that impacts their welfare. Additionally, Sekee aligns with the Blue Economy concept and they can ensure the sustainability of the

fisheries sector in Buleleng Regency, thereby increasing productivity and realizing the fishermen welfare.

Sekee is rarely explored in research on fisher institutions because previous studies have focused more on formal government institutions, whereas Sekee is a local institution not recognized by the government. Sekee has unique characteristics, especially in the mechanisms of labor division and result distribution, which can only be revealed through an in-depth approach to the fishermen. Previous research on fisher institutions focused more on the existence of fisher institutions rather than the actual institutional mechanisms. It is these mechanisms that constitute a system capable of enhancing productivity and achieving the welfare of fishermen.

2. Method and Materials

This research uses an explanatory sequential mixed-methods design. This design was chosen because statistical analysis can show the relationship between variables, but it has not fully explained the underlying reasons for that relationship in the context of fisher institutions in Buleleng Regency [18]. In the initial stage, this research uses a quantitative approach to test the relationships between variables, test hypotheses, and obtain an overview of the determinants of productivity and the well-being of fishermen in Buleleng Regency.

The method used in the quantitative approach is a survey, with data collected using questionnaires distributed through the pick-up survey technique to fishermen in the KUB in Buleleng Regency because the researcher can interact with the fishermen, the fishermen feel more valued, and the researcher can provide direct explanations if there are questions that the fishermen do not understand. The researcher also explained the purpose of the study to the fishermen as potential respondents, so that they would voluntarily participate in filling out the questionnaire. During the filling process, the researcher accompanied the respondents to provide explanations if there were questions that were not well understood, without influencing the answers given by the respondents.

Based on data from DKPP, population of fishermen in Buleleng Regency amounts to 4,292 fishermen who are grouped into 139 KUB. The KUB and fishermen are spread across nine sub-districts. Based on the Proportionate Stratified Random Sampling technique and the Slovin formula using a margin of error of 7.5 percent, the sample in this study consists of 171 fishermen from 27 KUB that can be visited. Fishers who are members of KUB were selected as respondents because they are the primary actors directly involved in fishing activities and actively participate in various group programs and decision-making processes. Their direct involvement enables them to provide reliable

information regarding the functioning of KUB, institutional support, technology adoption, and other factors influencing fishing productivity and welfare

Data obtained through questionnaires were analyzed using Partial Least Squares. The results of the quantitative analysis then serve as the basis for conducting interviews to explain and interpret the statistical findings in accordance with the explanatory sequential mixed-methods design.

Strengthening information before the interview, the researcher asked for initial information from the Fisheries Extension Officer of Buleleng Regency (DKPP) because this officer, who often conducts outreach, knows best the conditions of fishermen and their institutions in Buleleng Regency.

The researcher then conducted semi-structured interviews with nine Head of KUB who have the largest number of members, have been operating for a long time, and have frequently received extension services from DKPP. The Head of KUB was chosen as an informant because he has a comprehensive understanding of the function and management of KUB institutions and their involvement in the implementation of government programs. Information obtained from the Head of the KUB was used to explain the quantitative findings regarding the role of fishermen's institutions in improving fishermen's productivity and welfare. This interview aimed to explain the results of the PLS-SEM analysis, specifically regarding the role of fishermen's institutions in supporting fishermen's productivity and welfare, as well as to provide a contextual understanding of institutional management, operational mechanisms, and the relationship between fishermen's institutions and government programs.

To strengthen information before in-depth interview, the researcher requested initial information from the Fisheries Extension Officer of DKPP Buleleng Regency because this officer frequently conducts outreach and is most knowledgeable about the conditions of fishermen and their institutions in Buleleng Regency. Based on the results of interviews with the Head of the KUB and suggestions from the DKPP Extension Officer regarding the deepening of the relationship between KUB and local fishermen's institutions (Sekee), the researcher conducted in-depth interviews. The KUB selected was KUB Dharma Putra Braban in Kubutambahan District. This KUB is a pilot KUB and has always been a reference for the management of other KUBs in Buleleng Regency. Kubutambahan District is a fisheries center in Buleleng Regency.

The Head of KUB Dharma Putra Braban has implemented the Sekee mechanism, thus having a good understanding of the practice of the Sekee mechanism in KUB. From the Head of KUB Dharma Putra Braban, information was obtained from the local fishermen's

institutions, namely the Head of Sekee Gede Robot and the Head of Sekee Kadek Moleh, who were previously members of other KUBs, but now choose to pursue their fishing profession through the local fishermen's institution (Sekee). Sekee in its operations already has a definite work mechanism and revenue sharing mechanism. The Head of KUB Dharma Putra Braban then adopted the work mechanism and revenue sharing in Sekee so that KUB Dharma Putra Braban became a pilot KUB in Buleleng Regency.

3. Results and Discussion

3.1 Results

Table. 1 showed the respondents were predominantly aged 41–50 years (40.93%), followed by those aged 51–60 years (26.90%), indicating that most respondents were in their productive working years. Regarding educational attainment, the largest proportion had completed senior high school (40.93%), followed by junior high school (32.16%), while only 0.58% held a diploma or bachelor's degree. In terms of family dependents, most respondents had four dependents (32.16%), followed by five dependents (26.31%). Overall, these findings indicate that the majority of respondents were middle-aged, had secondary-level education, and supported relatively large households.

Table 1. Respondent Profile

Characteristics	Category	Frequency	(%)
Age	20-30	9	5,26
	31-40	22	12,86
	41-50	70	40,93
	51-60	46	26,90
	>61	24	14,03
Education	Not	10	5,84
	Primary School	35	20,46
	Junior High School	55	32,16
	Senior High School	70	40,93
	Diploma/Bachelor's Degree	1	0,58
Number of Family Dependents	3	25	14,61
	4	55	32,16
	5	45	26,31
	6	35	20,46
	>6	11	6,43

Before data analysis, validity and reliability tests were conducted. The model evaluation was conducted through assessments of both the outer and inner models. The outer model evaluation by examining convergent validity and discriminant validity for each construct. Based on the Table 2, all outer loading values exceed 0.70, thereby satisfying the recommended rule of thumb. Although several indicators have outer loading values below 0.70, they still exceed the minimum threshold for convergent

validity (approximately 0.30). Therefore, these indicators are considered to have acceptable convergent validity and are retained in the measurement model.

Table 2. Outer Loading

Variables	Indicators	Outer Loading
Human Resource Quality (X1)	X1.1	0.837
	X1.2	0.846
	X1.3	0.823
	X1.4	0.777
	X1.5	0.852
	X1.6	0.801
	X1.7	0.652
Capital (X2)	X2.1	0.845
	X2.2	0.918
	X2.3	0.808
	X2.4	0.802
Fisherman Institutions (X3)	X3.1	0.868
	X3.2	0.898
	X3.3	0.951
	X3.4	0.746
	X3.5	0.712
Technology (X4)	X4.1	0.874
	X4.2	0.869
	X4.3	0.903
	X4.4	0.860
	X4.5	0.791
Government Role (X5)	X5.1	0.795
	X5.2	0.767
	X5.3	0.718
	X5.4	0.795
	X5.5	0.751
Fisherman Productivity (Y1)	Y1.1	0.791
	Y1.2	0.857
	Y1.3	0.799
	Y1.4	0.868
	Y1.5	0.800
	Y1.6	0.734
	Y1.7	0.733
	Y1.8	0.743
Fisherman Welfare (Y2)	Y2.1	0.818
	Y2.2	0.776
	Y2.3	0.794
	Y2.4	0.761
	Y2.5	0.867
	Y2.6	0.631
	Y2.7	0.756
	Y2.8	0.662
	Y2.9	0.689
	Y2.10	0.682

Additionally, the reliability test in Table 3 showed Cronbach's Alpha values greater than 0.60 for each variable, confirming that the questionnaire items across all variables were reliable. Average Variance Extracted (AVE) values above 0.50, thereby satisfying the criteria for convergent validity. Furthermore, the discriminant validity assessment demonstrated that all

constructs met the required criteria, as evidenced by the square root of the AVE for each construct being greater than the correlations between constructs. This result is in accordance with the criteria of the rule of thumb [19] and [20].

Table 3. Output Quality Criteria Overview
Algoritma

Variables	Cronbach's Alpha	Composite Reliability	AVE
Human Resource Quality (X1)	0.906	0.926	0.641
Capital (X2)	0.866	0.909	0.713
Fisherman Institutions (X3)	0.893	0.922	0.706
Technology (X4)	0.913	0.934	0.740
Government Role (X5)	0.824	0.876	0.587
Fisherman Productivity (Y1)	0.914	0.931	0.627
Fisherman Welfare (Y2)	0.911	0.926	0.558

Table 4 showed that the inner model evaluation in was conducted by assessing the model fit using Standardized Root Mean Square Residual (SRMR) with a value of 0.066, which is below the commonly accepted threshold of 0.08, indicating a good model fit. Additionally, the Normed Fit Index (NFI) was calculated at 0.699, above minimum acceptable value of 0.50. Therefore, the model can be considered to a good fit.

Table 4. Model Fit Test Results

Index	Statistic	Good Fit Threshold	Poor Fit Threshold
SRMR	0,066	Less than 0.08	Greater than 0.10
NFI	0,699	Greater than 0.50	Less than 0.50

Furthermore, Table 5 showed model was evaluated using the coefficient of determination (R^2) for the endogenous variables showed R^2 values obtained were 0.407 for the first dependent variable (Y1) and 0.678 for the second dependent variable (Y2). These results are adequate as predictors of changes in the value of the dependent variable in the research model.

Table 5. R-square

Variables	R Square
Fisherman Productivity (Y1)	0,407
Fisherman Welfare (Y2)	0,678

Based on Table 6, Hypothesis test indicate that, variables of Human Resource Quality, Capital, Fishermen's Institution, Technology, and Government Role have a positive significant effect on Fishermen's Productivity in Buleleng Regency (Y1). This conclusion is supported by the t-values all of five variables on Fishermen's Productivity (Y1), above the critical t-value threshold of 1.65, and p-values less than 0.05 ($p=0.000 < 0.05$). The path coefficients for the impact on Fishermen's Productivity were significant for all five variables: Human Resource Quality ($\beta=0.227$; $p=0.012$), Capital ($\beta=0.179$; $p=0.006$), Fishermen's Institution ($\beta=0.239$; $p=0.001$),

Technology ($\beta=0.128$; $p=0.026$), and Government Role ($\beta=0.137$; $p=0.030$). These results confirm that hypothesis H1 is supported.

Table 6 also showed that the hypothesis testing results indicate that the variables Human Resource Quality, Fishermen's Institution, Government Role, and Fishermen's Productivity have a significant positive direct effect on Fishermen's Welfare in Buleleng Regency (Y2). This is evidenced by the t-values for Human Resource Quality, Fishermen's Institution, Government Role, and Fishermen's Productivity on Fishermen's Welfare (Y2) all exceeding the critical t-value threshold of 1.65, with p-values less than 0.05 ($p=0.000 < 0.05$). Conversely, the variables Capital and Technology did not exhibit a significant direct effect on Fishermen's Welfare, as their t-values were below the critical threshold (< 1.65) and their p-values exceeded 0.05 ($p > 0.05$).

According to [21], a hypothesis is considered unsupported if all six path coefficients are found to be insignificant. Conversely, if at least one of the six coefficients is statistically significant, the hypothesis is deemed supported. In this study, four path coefficients were found to have a significant effect on Fishermen's Welfare: Human Resource Quality ($\beta=0.166$; $p=0.019$), Fishermen's Institution ($\beta=0.172$; $p=0.001$), Government Role ($\beta=0.209$; $p=0.000$), and Fishermen's Productivity ($\beta=0.501$; $p=0.000$). Meanwhile, two path coefficients were not statistically significant predictors of Fishermen's Welfare: Capital ($\beta=-0.083$; $p=0.062$) and Technology ($\beta=0.052$; $p=0.177$). Overall, these results confirm that hypothesis H2 is supported, as a majority of the tested variables exert a significant positive influence on fishermen's welfare.

Furthermore, Table 6 also shows that moderation analysis was conducted to examine the moderating effects between variables. The results indicate that the moderating effect of Technology on the relationship between Human Resource Quality and Fishermen's Productivity was not statistically significant, with an interaction coefficient of $\beta=0.025$ and $p=0.410$. However, technology significantly moderated the effect of Human Resource Quality on Fishermen's Welfare, with a positive interaction coefficient of $\beta = 0.106$ and $p=0.029$. Therefore, hypothesis H3 is supported.

The study also found that the moderating effect of Government Role on the relationship between Fishermen's Institution and Fishermen's Productivity was not statistically significant, with an interaction coefficient of $\beta= -0.018$ and $p=0.386$. However, the moderation of Government Role on the effect of Fishermen's Institution on Fishermen's Welfare was significant, indicated by an interaction coefficient of $\beta=0.064$ and $p=0.04$. Therefore, these results collectively confirm that hypothesis H4 is supported.

Table 6. Direct Effect and Moderation Effect

	<i>Original Sample</i>	<i>Standard Deviation</i>	<i>t- Statistics</i>	<i>P Values</i>
Fisherman Productivity (Y1)				
X1 $\rightarrow$ Y1	0.227	0.100	2.274	0.012
X2 $\rightarrow$ Y1	0.179	0.072	2.501	0.006
X3 $\rightarrow$ Y1	0.239	0.074	3.203	0.001
X4 $\rightarrow$ Y1	0.128	0.066	1.952	0.026
X5 $\rightarrow$ Y1	0.137	0.073	1.879	0.030
Fisherman Welfare (Y2)				
X1 $\rightarrow$ Y2	0.166	0.079	2.086	0.019
X2 $\rightarrow$ Y2	-0.083	0.054	1.541	0.062
X3 $\rightarrow$ Y2	0.172	0.053	3.236	0.001
X4 $\rightarrow$ Y2	0.052	0.056	0.926	0.177
X5 $\rightarrow$ Y2	0.209	0.063	3.343	0.000
Y1 $\rightarrow$ Y2	0.501	0.065	7.658	0.000
Technology Moderation				
X1 $\rightarrow$ Y1	0.025	0.109	0.227	0.410
X1 $\rightarrow$ Y2	0.106	0.056	1.893	0.029
Government Role Moderation				
X3 $\rightarrow$ Y1	-0.018	0.062	0.290	0.386
X3 $\rightarrow$ Y2	0.064	0.038	1.692	0.045

Based on Table 7 results in this study also demonstrate that Fishermen's Productivity mediates the influence of Human Resource Quality, Capital, Fishermen's Institution, Technology, and Government Role on Fishermen's Welfare in Buleleng Regency. The indirect effects of these variables on Fishermen's Welfare through Fishermen's Productivity were all statistically significant: Human Resource Quality ($\beta=0.114$; $p=0.018$), Capital ($\beta=0.090$; $p=0.006$), Fishermen's Institution ($\beta=0.119$; $p=0.003$), Technology ($\beta=0.064$; $p=0.031$), and Government Role ($\beta=0.069$; $p=0.029$). Therefore, these findings collectively support hypothesis H5.

Table 7. Indirect Effect

	<i>Original Sample</i>	<i>Standard Deviation</i>	<i>t- Statistics</i>	<i>P Values</i>
X1 $\rightarrow$ Y1 $\rightarrow$ Y2	0.114	0.054	2.100	0.018
X2 $\rightarrow$ Y1 $\rightarrow$ Y2	0.090	0.035	2.539	0.006
X3 $\rightarrow$ Y1 $\rightarrow$ Y2	0.119	0.043	2.794	0.003
X4 $\rightarrow$ Y1 $\rightarrow$ Y2	0.064	0.034	1.868	0.031
X5 $\rightarrow$ Y1 $\rightarrow$ Y2	0.069	0.036	1.892	0.029

3.2. Discussion

3.2.1. Human Resource Quality, Capital, Fishermen's Institution, Technology, and Government Role Effect on Fishermen's Productivity in Buleleng Regency

The test results show that H1 is supported. This means that human resources quality as reflected by factors such as productive age, experience, skills, knowledge, adaptability, competitiveness, and resilience effectively motivates fishermen in Buleleng Regency to work more efficiently. Similarly, the availability of quality equipment, adequate financial resources, harmonious relationships among fishermen, and a well-maintained environment contribute to

optimizing fishing activities. The strong fishermen's institutional in Buleleng also plays a crucial role in enhancing efficient and effective work management, as fishermen within the group continuously engage in learning, collaboration, production, and marketing improvements. Furthermore, the technology employed by fishermen in Buleleng improves operational efficiency and catch yields through the use of user-friendly and appropriate tools. In addition, the role of the Buleleng Regency government through policies, assistance programs, training, and facilitation further strengthens the capacity of fishermen [22 and 23].

Strengthened results from interview tests show that the fishermen's KUB in Buleleng Regency also influences the optimization of fish catches. However, the role of KUB has not been optimal because it acts more as an administrative and aid distribution group. Without a mechanism to manage production factors and productive work, the assistance and training provided do not achieve optimal productivity.

Corroborated by depth interview findings, indicate that local wisdom in the form of Sekee and the management of KUB adhering to Sekee (KUB Dharma Putra Braban) principles can enhance fishermen's productivity. Because all production factors are effectively used to increase fish catches while maintaining marine sustainability, in line with blue economy concept, due to the certainty of production sustainability, efficiency and effectiveness in the use of production factors, and the strengthening of social communities [24]. Through this management approach, KUB become more active and are able to serve as intermediaries between fishermen and the DKPP (local government) of Buleleng Regency. Consequently, fishermen in Buleleng receive greater access to assistance, training, and support tailored to their specific needs. This demonstrates that local wisdom drives fishermen's institutions to enhance fishermen's productivity [25].

This study shows that fishermen's institutions are the main determinant of fishermen's productivity in Buleleng Regency. It is evident that sekee and KUB based on sekee have proven effective in enhancing and sustaining fisher productivity within a sustainability framework. This aligns with the principles of the blue economy, which emphasize a balance among economic, social, and environmental goals as the main objectives [26]. Because fishing activities only in their fishing ground and are not permitted on others' it. These fishing ground serve as fish habitats that consistently attract fish, ensuring a steady catch as long as the surrounding environment is well maintained.

3.2.2. Human Resource Quality, Capital, Fishermen's Institutions, Government Role, Technology, and Productivity on Fishermen's Welfare in Buleleng Regency

The results of the study indicate that hypothesis H2 is supported. This implies that the human resources quality of enables fishermen in Buleleng Regency to work more effectively, thereby increasing their income. Fishermen's institution, also plays a significant role in expanding access to resources, information, and markets, while strengthening the bargaining position of fishermen, which contributes to higher income levels. Moreover, the government's role ultimately fostering improvements in their welfare [27].

However, the test results indicate that capital does not significantly affect fishermen's welfare when they are unable to fish due to high waves or lean seasons, which carry substantial risks. Interviews with fishermen involved in KUB and Sekee revealed that physical capital cannot be utilized during such periods. The only feasible action is to maintain equipment, which requires financial capital. Consequently, this capital cannot be deployed for fishing activities, thereby negatively impacting fishermen's welfare, including when fishermen mismanage their financial capital. Similarly, the use of inappropriate technology imposes additional costs on fishermen either through technology maintenance or the costs associated with the catch. These expenses ultimately reduce net income, adversely affecting fishermen's earnings and welfare [28]

Interviews with Sekee and KUB Dharma Putra Braban reveal that fisher institutions play a crucial role in improving the welfare of their members by generating income through institutional systems. The one-day fishing system employed by Sekee and KUB Dharma Putra Braban provides daily income based on the fish caught, sold, and deducted by the day's operational costs. Income distribution within Sekee and KUB Dharma Putra Braban follows a specific scheme fishing ground owners receive one share, equipment owners (including boats, nets, and engines) receive one and a half shares, and the remaining one and a half shares are divided among the crew members. This system guarantees a stable income for fishers, positively impacting their welfare. Interviews with KUB Dharma Putra Braban this system effectively promotes fisher welfare. In addition to the income-sharing system similar to Sekee, KUB Dharma Putra Braban allocates a portion of earnings to a communal fund, as KUB owns the equipment. During lean seasons, this fund is distributed to KUB Dharma Putra Braban members, compensation is provided to the management for overseeing operations, and financial support is given to the families of deceased members.

The findings of this study indicate that fishermen institutions also play a significant role in realizing fisher welfare, which can be achieved more effectively through between KUB and Sekee, synergize with government role. Consequently, the role of the government becomes a key determinant of fishermen

welfare, aligned with the sustainability of marine resources within the framework of blue economy. This study supports [10] welfare theory, as the institutional systems of Sekee and KUB Dharma Putra Braban whose mechanisms follow the Sekee model represent an organized system capable of achieving fishermen welfare while incorporating environmental considerations as part of blue economy implementation and demonstrate social inclusivity that ensures the improvement of welfare.

3.2.3. *Technology Moderates the Effect of Human Resource Quality on Fishermen's Productivity and Welfare in Buleleng Regency*

Based on the test results, technology does not moderate the effect of human resource quality on fishermen's productivity. The increase in fisher productivity in Buleleng Regency is primarily determined by the fishers' own abilities, skills, experience, knowledge, and perseverance rather than the technological support used. Fishers in Buleleng perceive indicate that technology functions primarily as a supporting tool, therefore, the catch results using such technology depend largely on the quality of the fishers who utilize it. This implies that the technology provided will not significantly impact catch outcomes unless accompanied by adequate fisher competence [29].

The technology used by fishers in Buleleng Regency faces several limitations, including restricted access, lack of appropriateness, insufficient integration with local practices, difficulty in adoption, and misalignment with the actual needs of fishers during fishing activities. These factors create significant obstacles for fishers in their fishing operations [30]. Within the Sekee system, knowledge transfer and adaptation have not been effective because Sekee is inaccessible to officers from the Department of Marine and Fisheries (DKPP) and KUB only active at the time of assistance. Moreover, technology provided is not supported through sustainable development, resulting in its inability to strengthen the human resources quality to enhance catch productivity.

The study also shows that technology moderates the effect of human resource quality on fisher welfare [31]. This means that better, more efficient fishing gear that meets the needs of fishers, combined with the ability to use such equipment in accordance with their experience, knowledge, and skills, results in lower operational costs, thereby contributing to improved welfare. Furthermore, interview with Sekee and KUB Dharma Putra Braban, technology based applications such as GPS and Windy used by fishers can extend the lifespan of equipment, enhance occupational safety, and provide certainty in fishing activities. These factors contribute to the sustainability of fishing operations, ultimately supporting the welfare of fishers in Buleleng

Regency. This represents an implementation of the blue economy aimed at sustaining fishermen activities. Such practices can be carried out within Sekee and KUB that operate using the sekee mechanism.

3.2.4. *The Role of Government in Moderating the Effect of Fishermen's Institutions on Fishermen's Productivity and Welfare in Buleleng Regency*

The test results indicate that the effect of fishermen institutions on fishermen productivity is not strengthened by role of government [32]. Because the limited engagement of the Buleleng Regency government in strengthening the role of fishermen institutions to increase productivity. Interview with KUB, government programs in Buleleng Regency are often top-down, lacking integration and alignment with the real needs of fishers and fisherman institutions in Buleleng Regency. This situation may be caused by several factors, such as the lack of accurate mapping of fishermen institutions' conditions, limited government resources for intensive assistance, or program designs that are too general and insufficiently contextualized to the local characteristics of Buleleng Regency. Furthermore, coordination between fishermen institutions and government agencies has not been effective, resulting in fishers in Buleleng Regency having limited understanding of the benefits of institutions, as they do not perceive tangible advantages. The study results indicate that the benefits of institutions in the form of Sekee are more strongly perceived.

The study findings that the role of government moderates the effect of fisherman institutions on fishermen welfare [33]. This means that the role of government strengthens institutions in achieving welfare, so that these institutions not only function as organizational entities but also serve as effective channels to realize their welfare [34]. This is because, through institutions recognized by government such as KUB, the government can formulate policies and programs that optimize the outcomes of institutional activities, ultimately leading to improved fishermen welfare.

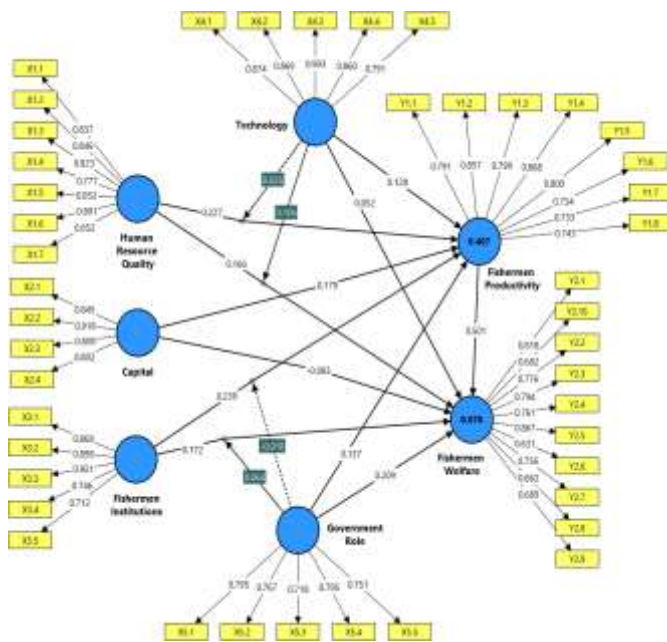


Figure 1. Full PLS Model

3.2.5 Fishermen's Productivity Mediates the Effects of Human Resource Quality, Capital, Fishermen's Institutions, Technology, and Government Role on Fishermen's Welfare in Buleleng Regency

Based on the test results, productivity mediates the effects of human resource quality, capital, fishermen institutions, technology, and government role on fishermen welfare [35]. This means that the quality and capacity of human resources, adequate capital, strong institutions whether in the form of Sekee or KUB implementing the Sekee mechanism technology utilization, and government support significantly impact fishermen welfare. These outcomes can be realized if fishers in Buleleng Regency are able to enhance their productivity.

Fishermen productivity reflects the ability to generate optimal output from available inputs, both in terms of catch volume and operational efficiency. Productivity improves when human resource quality increases, capital utilization becomes more effective, institutions function optimally, technology is appropriately leveraged, and supportive government policies are in place. These factors contribute to higher income, economic stability, and fishers' capacity to meet their livelihood needs, thereby realizing fisher welfare in Buleleng Regency. Therefore, efforts to enhance fishermen welfare should not only focus on providing inputs but also on improving productivity, as it represents the capability to produce greater output through efficient and effective use of resources within an organized system aimed at achieving welfare [5, 6, 36 and 37]. This is in line with the concept of the blue economy.

4. Conclusion

The conclusions of this study are as follows, first, the higher the quality of human resources, the adequacy of capital availability, the active role of fishermen institutions, the appropriate use of technology, and the optimal role of government, the greater the level of fisher productivity, where fishermen institutions serving as the primary determinant. Similarly, role of government is the key determinant of fisherman welfare. However, fisherman welfare is not directly influenced by capital and technology, their effects on welfare are indirect, mediated through increased productivity.

Second, the inappropriate use of technology limits its additional contribution to fishermen productivity. However, the fishing gear currently in use aligns with the needs of fishers, leading to lower operational costs and thereby contributing to improved fishermen welfare. Furthermore, although fisher institutions have been established and government presence is evident, there remains insufficient synergy to effectively support fishers' catch outcomes, with supporting programs being limited and unsustainable. Nevertheless, the role of government has been proven to strengthen the influence of institutions on fishermen welfare, particularly through its function as a facilitator.

Third, productivity as a key factor mediating the effect of production factors, fishermen institutions, and role of government on fishermen welfare. Because production factors, institutional strengthening, and government involvement do not directly impact fishermen welfare without being accompanied by increased productivity. Fourth, fishermen institutions in the form of Sekee represent groups that align with the needs and preferences of capture fishers in Buleleng Regency, enabling the optimization of all production factors and income distribution that meets fishers' expected earnings. Furthermore, if the management of KUB follows the Sekee mechanism, fisher participation will increase due to shared fishing efforts, equitable income distribution, and the existence of a KUB fund that provides income support to members during lean seasons. Therefore, there is a need to strengthen fishermen's institutions by integrating KUB as a formal institution with sekee as a local institution. This integration should address institutional governance, social capital, technological innovation, and the government's role in adapting to fishermen's needs, to enhance productivity and achieve sustainable welfare for fishermen within the framework of the blue economy.

Declarations

Author Contributions

Conceptualization, I.G.A.P.Y, N.N.Y and M.K.S.B.; methodology, N.N.Y and M.K.S.B.;

software, I.G.A.P.Y.; validation, N.N.Y and P.A.P.P.; formal analysis, I.G.A.P.Y and P.A.P.P.; investigation, I.G.A.P.Y.; resources, I.G.A.P.Y and N.N.Y.; data curation, I.G.A.P.Y writing—original draft preparation, I.G.A.P.Y and N.N.Y.; writing—review and editing, N.N.Y and M.K.S.B; visualization, I.G.A.P.Y and P.A.P.P; supervision, N.N.Y and P.A.P.P; project administration, I.G.A.P.Y.; funding acquisition, I.G.A.P.Y. All authors have read and agreed to the published version of the manuscript.

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Institutional Review Board Statement

The study was conducted in accordance with the Declaration of Helsinki and approved by Faculty Economics And Business, Udayana University.

Conflicts of Interest

The author declares that there is no conflict of interests regarding the publication of this manuscript. In addition, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancies have been completely observed by the authors.

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