Research article

Predicting Women's Involvement for Sustainable Tourism in the Local Economy: A Bayesian Network Approach

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Abstract: This study aims to explore the main factors influencing women's involvement and analyze the interaction between variables to develop policy recommendations that enhance women's involvement in tourism sustainability in Penglipuran Village. This research will use prospective analysis methods, specifically MICMAC Analysis and Bayesian Belief Network (BBN). The study's results identified several potential variables affecting women's involvement, such as awig-awig, gender equality, women empowerment, infrastructure, customary institutions, skills, and culture. Additionally, the study discusses how managing five key nodes with a 100% probability led to a 20% increase in women's engagement and a 5% increase in tourism sustainability. The findings of this study emphasize the crucial role of handling infrastructure and customary institutions supporting women's tourism involvement. Women are expected to have equal access to resources and opportunities, alongside promoting women's empowerment.

Keywords: women's involvement, tourism sustainability, Bayesian belief network

JEL Classification: A13, C11, J16, L38

Abstrak: Studi ini bertujuan untuk mengekplorasi faktor-faktor utama yang mempengaruhi keterlibatan perempuan dan menganalisis interaksi antar variabel untuk mengembangkan rekomendasi kebijakan guna meningkatkan keterlibatan perempuan dalam keberlanjutan pariwisata di Desa Penglipuran. Penelitian ini akan menggunakan metode analisis prospektif, yaitu Analisis MICMAC dan *Bayesian Belief Network* (BBN). Hasil penelitian ini menemukan bahwa terdapat beberapa variabel potensial yang mempengaruhi keterlibatan perempuan, seperti awig-awig, kesetaraan gender, pemberdayaan perempuan, infrastruktur, lembaga adat, keterampilan, dan budaya. Selain itu, penelitian ini juga membahas bagaimana lima node utama dengan probabilitas 100% berhasil meningkatkan keterlibatan perempuan sebesar 20% dan meningkatkan keberlanjutan pariwisata sebesar 5%. Temuan penelitian ini menekankan pentingnya penanganan infrastruktur dan lembaga adat yang mendukung keterlibatan perempuan dalam pariwisata. Perempuan diharapkan memiliki akses yang setara terhadap sumber daya dan kesempatan, serta mendorong pemberdayaan perempuan.

Kata kunci: keterlibatan perempuan, keberlanjutan pariwisata, desa penglipuran, bayesian belief network

1. INTRODUCTION

Bali has many tourist village developments that are known worldwide, one of which is Penglipuran Village. Located in Bangli Regency, Penglipuran Village is renowned for its unique architectural style. The buildings are uniformly structured and meticulously organized, with identical entrance gates (angkul-angkul). This distinct layout and architectural uniformity contribute to

Penglipuran Village's status as a special tourism destination. Penglipuran Village has received numerous accolades, including being named the cleanest village in the world in 2016. It also won the Indonesia Sustainable Tourism Award (ISTA) in 2017 and was listed among the Sustainable Destinations Top 100 by the Green Destinations Foundation (Suartika, 2018). In 2023, it was ranked among the best tourist villages in the world.

Women are provided access to economic activities to support the development of tourism potential in Penglipuran Village, driving the local economy. Women in Penglipuran Tourism Village actively participate in tourism, both directly and indirectly. Direct participation includes roles such as managing homestays, operating food stalls, and involvement in tourism events. Indirect participation involves maintaining environmental sustainability and community harmony to support tourism. Tourism development in Penglipuran Village is closely linked to the active role of the community, particularly women. This effort aims to empower local communities, improve welfare, and preserve art and culture (Andriyani et al., 2017). Tourism provides a pathway for woman to engage in economic and social life, serving as a means to enhance independence and empowerment, particularly for those who live in rural areas with limited employment opportunities (Ertac & Tanova, 2020). Increasing women's involvement in tourism is also crucial for achieving gender equality, as outlined in Sustainable Development Goals (SDGs) number five. Both men and women should have equal opportunities and rights for careers in tourism (Khadijah, 2022). According to (Boley & McGehee, 2014), enhancing women's involvement in tourism development requires a multidimensional approach that includes psychological, political, and social aspects.

Women's involvement in tourism sustainability is crucial for the overall development of rural tourism destinations (Dong & Khan, 2023). Studies emphasize the significance of women's entrepreneurship, education, social capital, and human capital in driving sustainable tourism growth (Candra et al., 2023). Women's empowerment acts as a mediator between these factors and the sustainable development of rural tourism, positively impacting community, economic, environmental, and cultural aspects (Kutlu & Ngoasong, 2024). Furthermore, woman's involvement in tourism activities is influenced by societal factors such as patriarchal cultures, stereotypes, and self-esteem issues, highlighting the need for comprehensive empowerment programs and community support (Samad & Alharthi, 2022). Additionally, studies show that women's self-efficacy, perceptions of women's work, empowering leadership, and psychological empowerment significantly influence women entrepreneurs' involvement in tourism, subsequently impacting sustainable tourism development (Gerged et al., 2023). These findings underscore the importance of women's involvement in tourism to ensure the long-term sustainability and growth of tourism destination.

Social capital theory plays a crucial role in understanding women's involvement in various aspects of society. Women's social capital practices, such as maintaining loyalty, strong family support, and cooperation, significantly contribute to the resilience of small industrial enterprises (Kimbal et al., 2022). Social capital has been linked to the proactive participation of women in urban planning and environmental management, underscoring the importance of togetherness and trust in community activities (Asteria et al., 2018). Social capital theory examines how people form connections and networks that can benefit them in various aspects of life. Women leverage social capital to address daily challenges, empower themselves, and advocate for women's rights both locally and globally. There is a direct relationship between social capital and women's involvement in community activities, highlighting the need to strengthen values of togetherness and trust for effective community empowerment and environmental management (Ikhar et al., 2022).

Despite the rapid development in woman's involvement in tourism activities in Penglipuran Village, obstacles still hinder their participation. Common challenges include language barriers, technology utilization, and economic uncertainty. Rasanjali et al. (2021) found that language skills, problem-solving abilities, and childcare responsibilities significantly affect women's involvement in the tourism industry. Women play a crucial role in establishing and maintaining tourist villages, contributing significantly to various aspects of tourism activities. Research highlights that women's participation in tourist villages is voluntary, and democratic, and involves them in planning and decision-making processes. They often contribute through labor, expertise, and financial means

(Kusumadewi et al., 2023). Therefore, it is important to analyze strategies that can ensure women's continued involvement in the tourism sector of Penglipuran Village. This analysis is very important to understand how women can maintain their bargaining position amidst the rise of modern markets around Penglipuran Village.

Once comprehensive information about these influential variables is gathered, the study will further investigate the impact of these selected variables on women's involvement and the sustainability of tourism in Penglipuran Village. Additionally, this research will conduct a scenario analysis to evaluate the critical variables affecting woman's involvement in tourism sustainability. This analysis is essential for formulating policy recommendations to sustain and enhance the role of women in the development of sustainable tourism in Penglipuran Village. This study aims to analyze and explore key variables that contribute to the sustainability of women's participation in the tourism sector. These variables will be derived from various aspects, including economic, social, environmental, and tourism aspects.

The novelty of this study lies in examining key variables using the Matrix of Cross Impact Multiplications Applied to a Classification (MICMAC) analysis and the Bayesian Belief Network (BBN) approach for scenario analysis. This perspective is important because MICMAC is a valuable method for predicting the strength of influence and dependence among supporting factors and barriers (Singh et al., 2023). Additionally, the BBN approach effectively describes how changes in input variables can affect output levels, a technique often referred to as scenario analysis or "what-if" analysis (Giffoni et al., 2022). The structure of the paper is as follows: Part II presents the empirical data and methods addressing the study's objectives Part III discusses the data and results. The final part provides the conclusion.

2. RESEARCH METHODS

This research was conducted in Penglipuran Village, one of the World Cultural Heritage Villages. The data in this study are categorized into primary and secondary data. Primary data were obtained directly from respondents using questionnaires, interviews, and Focus Group Discussion (FGD) techniques. Meanwhile, secondary data is obtained from related agencies, such as the Tourism Office or government agencies. This study involved 20 respondents from institutional aspects representing the hexahelix elements: communities, government, business, academia, regulators, and the media. The data collected from the questionnaires will serve as references in the FGD to explore and discuss various information factors affecting the sustainability of women's tourism activities.

This FGD will be attended by 19 stakeholders representing the hexahelix elements. These 19 respondents include women in tourism businesses, government officials from the provincial to village level, village financial institutions, and members of Tourism Awareness Group (Kelompok Sadar Wisata/POKDARWIS) representing the tourism community, media, tourists, and travel agents. To achieve the research objectives, this research will utilize two data analysis techniques: the Matrix of Cross-Impact Multiplications Applied to a Classification (MICMAC) and Bayesian Belief Network (BBN) analysis techniques.

2.1. Matrix of Cross-Impact Multiplications Applied to a Classification

MICMAC was employed to identify key variables influencing women's involvement in tourism sustainability in Penglipuran Village. A major advantage of the MICMAC analysis is its utility in predicting the strength of influence and dependence among supporting factors and barriers (Singh et al., 2023). MICMAC analysis evaluates system variables based on direct classification, where relationships between variables are directly identified by experts and stakeholders (Wijaya et al., 2020). The first step in MICMAC analysis is identifying relevant variables. Based on the results of the FGD, the variables used in this research include community income, village financial institutions, social capital, culture, women empowerment, gender equality, employment, traditional institutions, awig-awig, skills, education, regional government, natural resources and environment, tourist visits, and infrastructure.
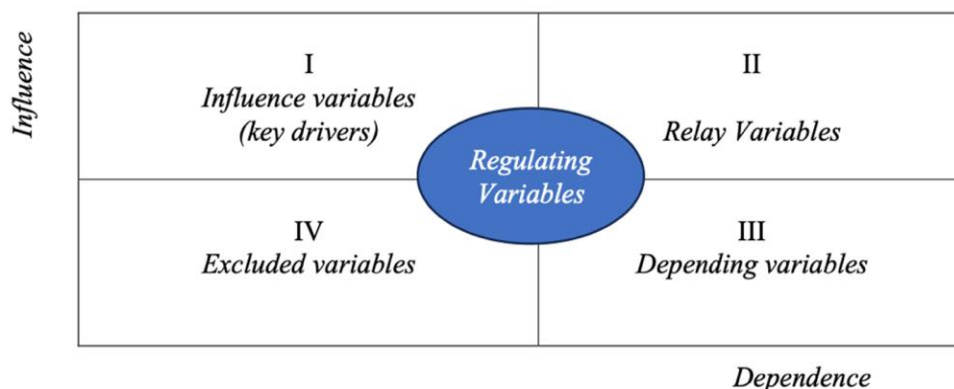
Figure 1. Variable Mapping in MICMAC Analysis
Source: Fauzi, 2019

Based on Figure 1, the MICMAC analysis method determines the relationship between development variables by grouping them based on their levels of dependence and influence. This analysis categorizes variables into four groups: (1). Quadrant I (Influence Variables) is a variable with significant influence but low dependence. (2). Quadrant II (Relay Variables) is a variable with significant influence and high dependence. (3). Quadrant III (Depending Variables) are variables with low influence but high dependence. (4). Quadrant IV (Excluded Variables) is a variable that has no influence or dependence on other variables.

2.2. Bayesian Belief Network

Bayesian Belief Network (BBN) is a graphical model used to represent interactions between variables, incorporating arrows and nodes (Isfahani, et al., 2023). BBN combines two critical aspects of decision-making: qualitative and quantitative. The qualitative aspect of the BBN is represented by a Directed Acyclic Graph (DAG), where each node in the graph represents a variable, and the arcs between nodes describe causal relationships or dependencies among variables. The BBN quantitative aspect is expressed through a Conditional Probability Table (CPT) for each node in the network (Chakraborty et al., 2016). The CPT quantifies the probability of a variable based on the values of other variables in the network (Fauzi & Ariyani, 2024). As illustrated in Figure 2, variable X and variable Y are the parent nodes of variable Z, while variable Z is a child node of variable X and variable Y.
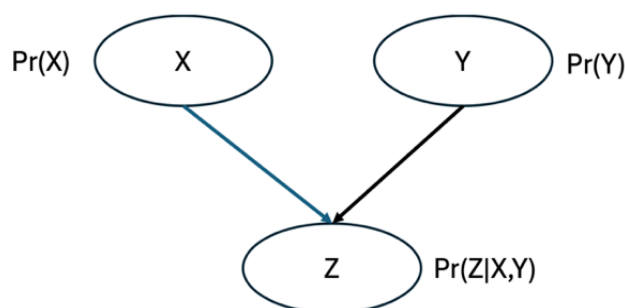
Figure 2. Simple Structure of DAG
Source: Fauzi & Ariyani, 2024

The BBN's approach was chosen to consider the factors influencing women's involvement in tourism sustainability. Based on the results of the FGD, variables influencing women's involvement in tourism sustainability include community income, village financial institutions, social capital, culture, women empowerment, gender equality, employment, traditional institutions, Awig-awig, skills, education, regional government, natural resources and environment, tourist visits, and Infrastructure.

A major advantage of the BBN is its ability to describe how changes in input variables can affect output levels, often referred to as scenario analysis or "what-if" analysis (Giffoni et al., 2022). For example, policymakers can easily test the impact of policy interventions by adjusting inputs and observing their impact on network structures. Furthermore, the cause-and-effect relationships in BBN are easy to understand, and additional variables can be incorporated as needed (Nguyen, 2016). Its network structure is intuitive, making it easy to illustrate intervention theories and evaluate them against real-world data. Besides these advantages, the BBN can rigorously handle uncertainty in the form of probabilities, making it suitable for analysis in a management context and particularly when dealing with incomplete data (Marre et al., 2020).

All results from the FGD will first be processed using the MICMAC application to identify the relevant key variables. This study will focus on variables located in quadrant I, which indicates variables with significant influence, and quadrant III, which indicates variables with a high dependence but relatively low influence. Subsequently, these variables will be analyzed using the Baynesian Belief Network (BBN) approach with GeNIe software.

3. RESULTS AND DISCUSSION

3.1. Existing Conditions of Penglipuran Tourism Village

Penglipuran is a traditional village located in Bangli Regency, Bali, Indonesia, renowned as a tourist destination due to its resident's adherence to traditional Balinese culture. The village community maintains harmony between God, humans, and the environment through their building architecture and land management practices, which are based on the Tri Hita Karana concept. Each house in the village features a uniform gate known as angkul-angkul and must include three specific buildings: the angkul-angkul, a kitchen, and bale saka enam. From 1991 to 1992, several tourists visited Penglipuran Village. In 1993, this village was officially designated as Tourism Village by Regent Decree No. 115, dated April 29, 1993. In 1995, Penglipuran Village was awarded the Kalpataru award by the Government of Indonesia for its efforts in preserving the Bamboo Forest within their local environment. In 2016, Penglipuran Village was recognized as the Cleanest Tourism Village in the World. In 2023, the Village was ranked among the best tourism villages in the world given by The World Tourism Organization (UNWTO). After the presence of the tourism village, the people of Penglipuran Village began to engage in other professions related to tourism, such as craftsmen, souvenir traders, homestay managers, tour guides, and other tourism-related roles.

Figure 3. Conditions of Penglipuran Village
Source: Researcher Documentation, 2023

3.2. Women's Involvement in Penglipuran Tourism Village Development

The involvement of women in the development of Penglipuran Village is a phenomenon that illustrates women's active participation and contribution to increasing tourism potential and achieving sustainable tourism development Women are involved in traditional roles such as household management and participate in decision-making, planning, promotion, marketing, and financial management within the tourism sector. Their roles in development are equivalent to those of men, allowing women to partake in various economic and social activities. Women are involved

in various activities, including homestay management, the handicraft industry, running stalls, traditional food and beverage businesses, and promoting local culture. Their involvement in these diverse activities shows their contribution to enriching and expanding the scope of village development. The following is a photo of women's involvement in tourism in Penglipuran Village, Bangli Regency, Bali.

Figure 4. Penglipuran Village Women Selling at Pelipur Lara Market
Source: Researcher Documentation, 2023

3.3. Identification of Variables Considered in Women's Involvement in Tourism Sustainability in Penglipuran Village (Using MICMAC Analysis)

The main purpose of MICMAC Analysis is to determine dependency and identify factors that have the highest driving force (Kaur et al., 2023). Research on women's involvement in tourism sustainability in Penglipuran Village utilizes MICMAC analysis to determine variables that significantly and dominantly influence women's involvement. Fifteen key variables were selected based on the findings of the FGD. The long and short labels for each element inserted into the MICMAC software are shown in Table 1.

Table 1. Identify Key Variables

No	Long Label	Short Label
1	Social Capital	Social
2	Local Culture	Culture
3	Tourist Visits	Tourist
4	Infrastructure	Infrastruc
5	Women Empowerment	Empower
6	Gender Equality	Gender
7	Natural Resources and Environment	Natural
8	Employment	Employment
9	Income	Income
10	Customary Institutions	Adat
11	Village Financial Institution	LKD
12	Local Government	Government
13	Education	Education
14	Awig-Awig	Awig
15	Skill	Skill

Source: Author's estimation using MICMAC, 2024

Table 1 shows the direct relationships among fifteen variables are analyzed to determine the factors influencing women's involvement in tourism sustainability. The relationship between vertical and horizontal variables is assessed as follows: a value of 0 indicates no influence, 1 indicates weak influence, 2 indicates moderate influence, 3 indicates strong influence, and P indicates potential influence. Based on the matrix in Table 1, results were obtained in the form of mapping based on the level of influence and dependence displayed in 4 quadrants.

The Matrix of Direct Influence (MDI) evaluates 15 main variable components. Experts or stakeholders directly involved in the research can provide assessments or judgments by completing the evaluation matrix with values ranging from 0-3, as well as P.

Table 2. Matrix of Direct Influence (MDI) Relationship Scale

Scale	Relation
0	There is no relationship
1	There is a weak relationship
2	There is an average relationship
3	There is a strong relationship
P	Potential relationship

Source: Fauzi, 2019

The Direct influence/dependent map derived from MICMAC data processing is presented. The results of the MICMAC analysis, shown in Figure 5, reveal that the variables of Women Empowerment (Empower), Local Culture (Culture), Gender Equality (Gender), Skill, Awig-Awig (Awig), Infrastructure (Infrastruc), and Customary Institutions (Adat) significantly influence women's involvement in tourism sustainability. The influence of women's empowerment in Penglipuran Village became evident when the village was developed as a tourist destination. Women have actively participated in developing local tourism through various entrepreneurial activities, such as stalls, handicraft businesses, food, and other culinary. This indeed triggers women's involvement in Penglipuran Village tourism activities.

Penglipuran village is known as a traditional village that continue to preserve its cultural heritage amid modernization. The uniform architecture of the buildings, particularly the angkul-angkul is a major attraction of this destination. Penglipuran Village maintains its local tradition and culture by implementing various ceremonies, such as the *ngusaba bantal* ceremony (Hidayat & Saskara, 2024). Gender equality is evidenced in the balanced roles of men and women in economic and social activities. Penglipuran Village also has Karang Memadu as a customary sanction for villagers who practice polygamy. Karang Memadu serves as proof of Penglipuran Village ongoing dedication to upholding gender equality. Women have several skills that support tourism activities, including handicraft skills and strong communication and serviceability. Awig-awig, the customary law in Penglipuran Village, serves as the fundamental guideline for regulations. For instance, awig-awing prohibit of villagers from practicing polygamy, and violators face customary sanctions, such as exile to Karang Memadu and deprivation of their social rights and obligations.

Good infrastructure, such as adequate accessibility, can increase women's participation in tourism activities. Adequate infrastructure creates significant employment and entrepreneurship opportunities for women, either directly through employment opportunities in the tourism sector or indirectly by supporting local businesses. The successful operation of tourism in Penglipuran Village is closely linked to the involvement of customary institutions from both economic and social perspectives. These institutions have the authority to make a policy and regulation that becomes the basis for women's involvement in tourism.

The variables of Social Capital (Social) and Tourist Visits (Tourist) are positioned in quadrant II, indicating that they have significant influence but also a high dependence on other variables. These variables are volatile because any intervention affecting them will impact women's overall involvement in tourism. The influence of social capital is substantial, as evidenced by the close-knit relationships within the community. Resident help and complement each other in various activities, and there are no partitions between the yards of neighboring houses (Hidayat & Saskara, 2024). Tourist visits are increasing yearly, creating economic and social opportunities for women. Increased tourist visits lead to higher demand for local products and crafts, thus enhancing women's involvement in production. When women are involved in the tourism business, they have opportunities to expand their social networks, acquire new skills, and increase self-confidence and autonomy in making economic and social decisions. In quadrant III at the bottom right, there are three variables, namely Employment, Local Government (Government), and Income, which have

high dependence but low influence on women's involvement in tourism sustainability. Women have a significant contribution to the tourism workforce. Various types of jobs in the tourism sector, such as sewing traditional clothes, running food stalls, or being a tour guide, often directly involve women. Their involvement in tourism can increase family income and positively impact society's overall well-being. Moreover, women 's participation in tourism can influence development patterns prioritized by local governments by emphasizing and strengthening aspects of environmental conservation, culture, and sustainable economy.

Figure 5. Direct Influence/Dependent Map Results
Source: Author's estimation using MICMAC, 2024

Education, Natural Resources and Environment (Natural), and Village Financial Institutions (LKD) are variables in quadrant IV at the bottom left, namely variables that have low influence and dependence. These results align with previous research conducted by (Hidayat & Saskara, 2024). Developing and maintaining tourism in a region does not degrade or alter the environment and contributes to maintaining the sustainability of the region in the long term (Desbiolles, 2018).

Figure 6. Direct Influence Relationship Between Variables
Source: Author's estimation using MICMAC, 2024

As shown in Figure 6, some variables exhibit strong mutual influences on each other. The red arrow line (outward arrow) shows the powerful influence of one variable on other variables, illustrated by variables such as Infrastructure, Women Empowerment, Skill, Gender Equality, and Customary Institutions. Meanwhile, Income, Local Government, and Social Capital are strongly influenced by other variables (arrows to these variables). The number three, located above the red arrow line, indicates the strong influence exerted or received by the variable.

3.4. Relationship between Variables of Women's Involvement in Sustainable Tourism

The BBN model is constructed based on the results of the MICMAC analysis, specifically utilizing the influence variables located in quadrant I and dependent variables located in quadrant III. Researchers used the GeNIe software tool in this research to build a BBN model. The influence variables used are Women Empowerment, Culture, Gender Equality, Skill, Awig-Awig, Infrastructure, and Customary Institutions. The dependent variables used are Income, Local Government, and Employment. Concerning tourism, sustainability also has three indicators: Socio-Cultural, Economic, and Environmental. The structure of the BNN, which illustrates the determinants of women's involvement in tourism sustainability can be seen in Figure 7.

As shown in Figure 7, the Conditional Probability Table (CPT) value of women's involvement is derived from various variables: Local Culture variables with 80:20 chances, awig-awig variables with 90:10 opportunities, Skill variables with 90:10 opportunities, Women Empowerment variables with 60:30:10 opportunities, Gender Equality with 80:20 opportunities, Infrastructure with 50:40:10 opportunities, and Customary Institutions with 80:20 opportunities. These variables collectively contribute to a women's involvement level of approximately 70%.
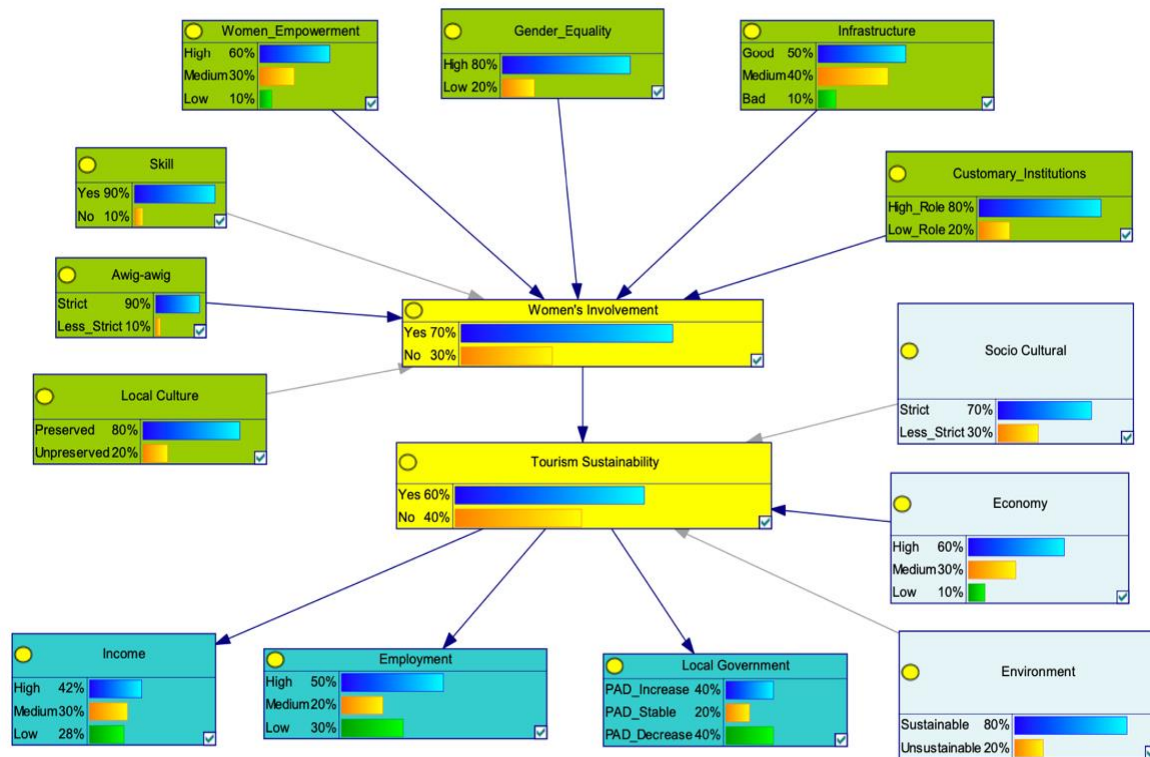

Figure 7. BBN Model of Women's Involvement in Tourism Sustainability in Penglipuran Village
Source: Author's estimation using GeNIe, 2024

The CPT value of tourism sustainability is obtained from the involvement of women with 70:30 opportunities, Socio-Culture with 70:30 opportunities, Economy with 60:30:10 opportunities, and the Environment with 80:20 opportunities. Thus, the predicted level of tourism sustainability is around 60%. Based on this sustainability level with tourism sustainability opportunities of around 60%, the Income level is predicted to be around 42:30:28, the Employment rate is predicted to be around 50:20:30, and the Local Government PAD level is around 40:20:40.

In BBN analysis, the next step involves identifying relationships between variables in the network structure. Strength analysis provides insights into potential cause-and-effect relationship between variables, where the width of the arc represents the strength of each connection between parent and child nodes (Ali et al., 2024). The influence diagram of strength analysis is presented in Figure 8.
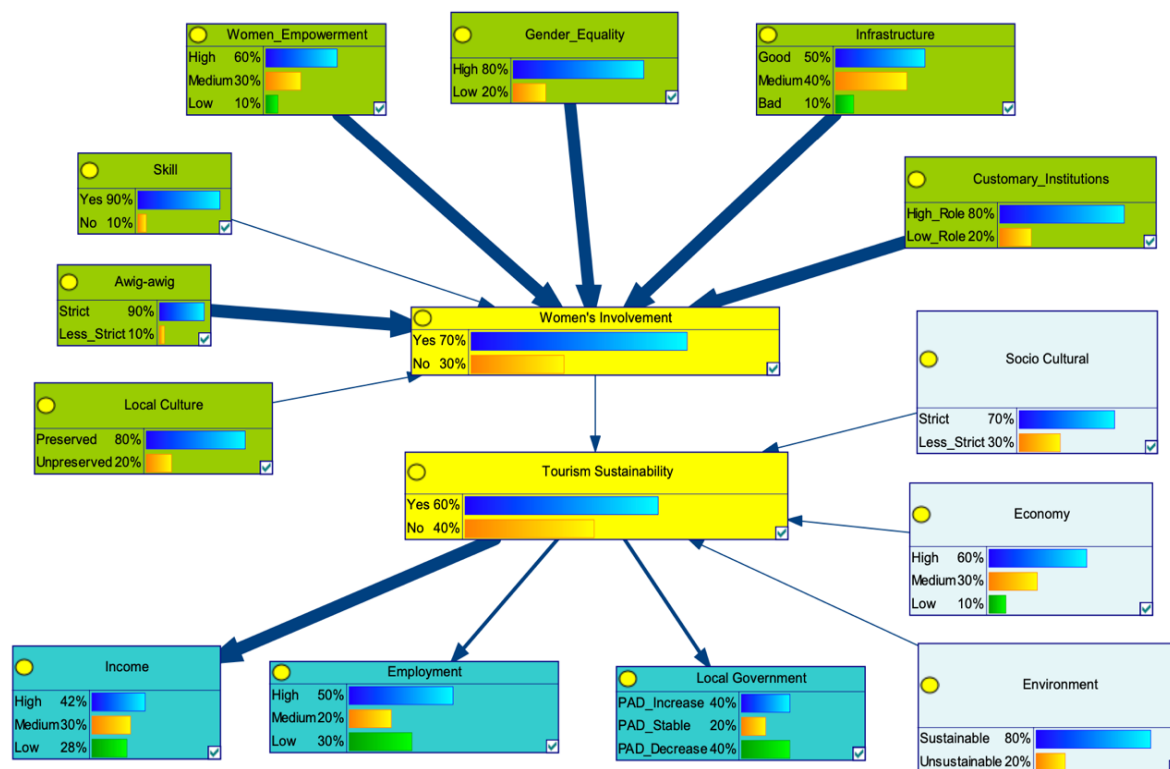

Figure 8. Strength Analysis Influence Diagram
Source: Author's estimation using GeNIe 4.1, 2024

Based on Figure 8, the variables Awig-Awig, Women's Empowerment, Gender Equality, Infrastructure, and Customary Institutions strongly influence women's involvement. The sustainability of tourism in Penglipuran Village will also strongly influence the income of the surrounding community. If we were to present the influence strengths from the analysis in tabular form, the influence scores could be organized as follows in Table 3.

Table 3. Intervariable Strength Influence Score

Parent	Child	Average	Maximum
Environment	Tourism Sustainability	0	0
Local Culture	Women's Involvement	0	0
Skill	Women's Involvement	0	0
Socio-Cultural	Tourism Sustainability	0	0
Economy	Tourism Sustainability	0.016	0.039
Women's Involvement	Tourism Sustainability	0.058	0.088
Tourism Sustainability	Employment	0.331	0.331
Tourism Sustainability	Local Government	0.347	0.347
Women Empowerment	Women's Involvement	0.049	1
Gender Equality	Women's Involvement	0.059	1
Awig-awig	Women's Involvement	0.063	1
Infrastructure	Women's Involvement	0.072	1
Customary Institutions	Women's Involvement	0.108	1
Tourism Sustainability	Income	1	1

Source: Author's estimation using GeNIe, 2024

Table 3 reports the most significant impact can be seen from the influence of tourism sustainability on the Income of the people in Penglipuran Village, with an average score of 1 and a maximum score of 1. Followed by the influence of Customary Institutions on women's involvement, with an average score of 0.108 and a maximum of 1. In addition, there is an influence from Infrastructure to the women's involvement, with an average score of 0.072, influence from Awig-Awig to the women's involvement, with an average score 0.063, influence from Gender Equality to the women's involvement, with an average score 0.059, and influence from Women Empowerment to the women's involvement, with an average score 0.049 and a maximum influence score 1.

In understanding the key factors that impact women's involvement in tourism sustainability, researchers analyzed how variables affect sustainability in the BBN structure. This analysis will assign five main nodes as target nodes with 100% probability. The selection of these factors is also based on strength influence score to the women's involvement. In analyzing using GeNIe software, they are indicated with "evidence" arrows, according to Figure 9.
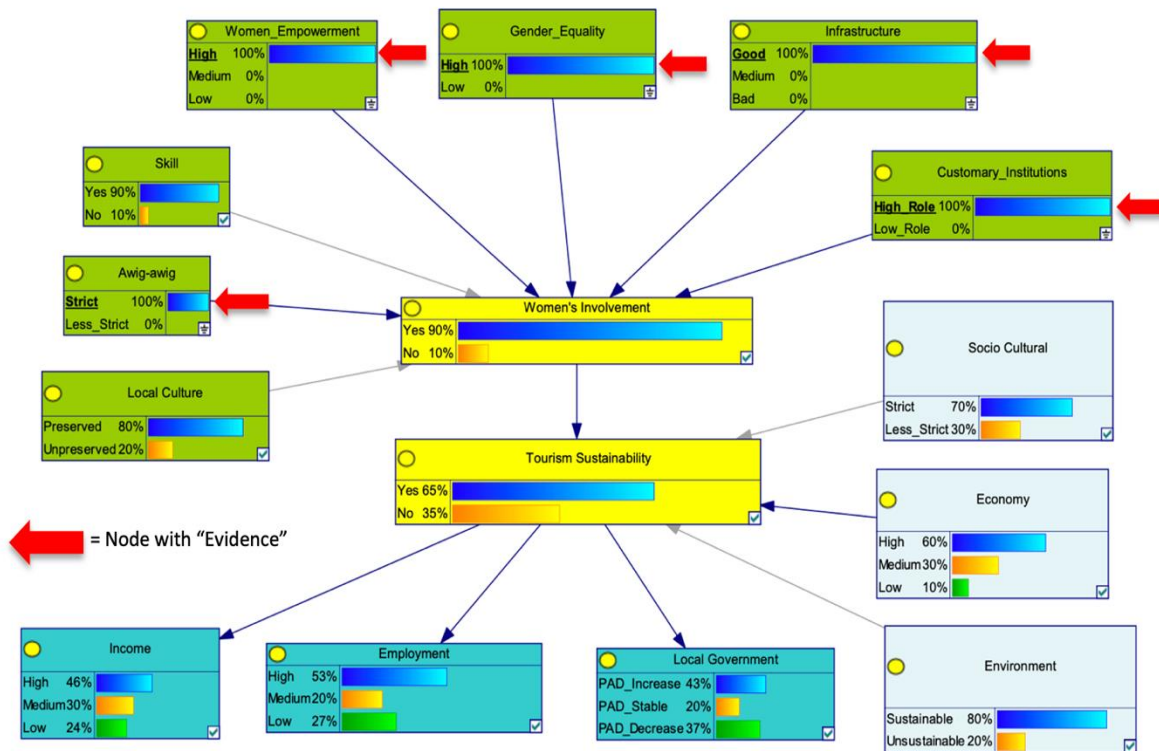

Figure 9. BBN Structure with Evidence
Source: Author's estimation using GeNIe, 2024

According to Figure 9, assigning 100% probability to "Strict" to Awig-Awig, "High" to Women Empowerment, "High" to Gender Equality, " Good" to Infrastructure, and "High Role" in Customary Institutions causes women's engagement rate to increase by 20%, from the initial 70% to 90% at the next probability. The establishment of five main nodes with a 100% probability also has an impact on increasing tourism sustainability by 5%, which was initially 60% to 65%. When there is an increase in tourism sustainability, there is an increase in the probability of a 4% increase in people's income, a 3% increase in the probability of employment of Penglipuran residents, and a 3% increase in the probability of increasing the PAD of Bangli Regency.

Women's empowerment has a significant impact on increasing women's involvement in tourism. Village governments often conduct several trainings and mentoring sessions to improve women's skills, thereby promoting women empowerment in tourism. This approach aligns with human capital theory, which asserts that investing in human resources has a profound effect on enhancing productivity and involvement in tourism. Research on women empowerment from a human capital perspective reveals its positive impact on sustainable development. The findings

demonstrate how women can redefine and negotiate their identities and roles while challenging societal norms that limit their potential (Suárez, 2018).

Women in Penglipuran Village are empowered to become women tourism entrepreneurs by establishing various businesses that support tourism, such as stalls, gift shops, restaurants, and homestays. Women tourism entrepreneurs are recognized as key actors in social innovation and can reshape unsustainable elements (Pécot et al., 2024). In the tourism sector, women's entrepreneurship has been linked to sociocultural, poverty growth and alleviation, increased engagement, well-being in rural areas, achievement of sustainable development goals, and social change (Domecq et al., 2022).

In line with endogenous growth theory, infrastructure improvement is a major factor in encouraging long-term economic growth. High-quality infrastructure increases efficiency and accessibility, which boosting tourism productivity. Effective infrastructure supports sustainable tourism activities and contributes to improving community welfare. Customary institutions in Penglipuran Village play a significant role in establishing rules and norms that support women's involvement in tourism. These institutions can encourage women's participation through inclusive and equitable policies and ensure that women have equal opportunities to contribute to and benefit from the tourism sector. In accordance with institutional economic theory, which emphasizes the role of institutions in shaping economic behavior and social interaction, these institutions play an important role in determining how resources are distributed and used in society. Increasing gender equality in Penglipuran Village is supported by an awig-awig named Karang Memadu, which upholds equality between women and men. Driven by supportive culture and societal norms, women will gain avenues to engage in tourist (Joo et al., 2020). By increasing the role of women in economic and social activities, communities can achieve a better balance in resource use and improved quality of life, which is in line with the sustainable development goals and Sustainable Development Goals point five. Without gender equality, tourism sustainability cannot be achieved (Alarcón & Cole, 2019). furthermore, (Pickel-Chevalier & Yanthy, 2023) state that gender equality is essential in analyzing tourism's capacity to function as a vector of sustainable development.

Women's involvement in tourism significantly contributes to sustainable tourism development. Their participation enhances community value by amplifying positive impact and mitigating its negative impact (Elshaer et al., 2021). Women also promote sustainable tourism practices, such as efficient waste management and protection of the village environment. Women are considered to be the spearhead guardians of local traditions and culture. The involvement of women in tourism can ensure that aspects of culture and tradition in Penglipuran Village are promoted and preserved as tourist attractions to create tourism sustainability. In the long term, sustainable tourism will generate income for the surrounding community and creates numerous new jobs, reducing unemployment. Sustainably managed tourism supports the use of local resources and investment in infrastructure, all of which contribute to stable and sustainable economic growth. Thus, enhancing women's involvement in tourism not only supports economic development but also strengthens the foundation of long-term sustainability for Penglipuran Village.

4. CONCLUSIONS

Based on the analysis and discussion presented, this study highlights a new approach using MICMAC to analyze the key factors influencing women's involvement in tourism. The results identify seven key factors significantly impacting women's involvement: Awig-Awig, Women Empowerment, Gender Equality, Infrastructure, Customary Institutions, Culture, and Skills. The BBN model developed within the assessment framework was employed to rank these factors and demonstrate how changes in variables affect the level of women's involvement in tourism sustainability in Penglipuran Village. The strength influence score analysis determined the strength of each variable's influence on women's engagement and tourism sustainability.

The findings of this study have significant implications for policy and practice. Firstly, the study emphasizes the importance of addressing the infrastructure and customary institutions supporting women's tourism involvement. This includes ensuring that women have equal access to resources and opportunities, along with encouraging gender equality and women empowerment. Secondly,

the study highlights the role of culture in shaping women's involvement in tourism, emphasizing the need for cultural sensitivity and understanding in tourism development. The findings also have implications for future research using MACTOR and MULTIPOL methods could help identify various influential actors and formulate policy recommendations to increase women's involvement in tourism sustainability in Penglipuran Village.

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