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Spatial Distribution, Socioeconomic Profiling, Income Assessment, and Production Determinants of Panday (Blacksmith) Makers in the Municipality of Badiangan, Iloilo

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Index Terms:

panday workers, blacksmithing, indigenous livelihood, spatial distribution, rural enterprise, Badiangan, Iloilo

Abstract. Pandayan is one of the most noble, traditional, and enduring indigenous crafts in the Philip pines, particularly in marginalized rural areas. It provides a vital source of livelihood, cultural identity, and essential agricultural tools for rural communities. This study examined the spatial distribution, demographic profile, household characteristics, and livelihood conditions of panday workers in the Municipality of Badiangan, Iloilo. Twelve panday respondents were purposively selected and surveyed using structured questionnaires, key informant interviews, and geographic coordinate recording. Descriptive statistical methods were employed to analyze spatial, demographic, household, and livelihood variables. Results revealed panday workers were spatially clustered within a narrow geographic and altitudinal range in Barangay Bingawan. All respondents were male and married, with educational attainment ranging from elementary to secondary levels, and all relied solely on panday-making as their primary source of income. Household characteristics were dominated by nuclear family structures with moderate household sizes, indicating strong household dependence on panday-making, reinforced by more than 15 years of work experience among respondents. Agricultural tools—particularly bolos—comprised the main products, while marketing was primarily conducted through direct selling and local market channels. Although panday-making remains economically viable for some respondents, overall livelihood vulnerability persists due to limited productivity, an aging labor force, and constrained market access. The study concludes that panday-making in Badiangan is a culturally significant yet economically fragile indigenous livelihood. Targeted interventions focusing on youth participation, the adoption of appropriate technology, product diversification, and market development are essential to ensure the sustainability and continuity of this traditional craft.

Introduction

Traditional craftsmanship plays a vital role in sustaining rural livelihoods, preserving cultural heritage, and supporting local economies across Philippine municipalities. Artisanship is not merely an economic activity but a cultural expression embedded in community life and local identity (Mojares, 1986; Achanzar, 2007). Recent studies emphasize the importance of documenting and safeguarding traditional crafts as part of the country's intangible cultural heritage (Besmonte, 2022; Candelario-Aplaon, 2025). Among these crafts, panday (blacksmithing) remains an essential livelihood in agricultural communities. Traditional blacksmiths supply tools for farming, construction, and household use despite the proliferation of industrial alternatives (Reedy, 2024; Mascuñana, 1998; Tagupa et al., 2025). Locally produced panday products are valued for their affordability, durability, and adaptability to farmers' specific needs (Panday et al., 2025). However, the sector is largely informal, family-based, and under-documented, limiting policy attention and development support (Casimiro et al., 2024).

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In the Municipality of Badiangan, Iloilo, historically recognized for the "Pandayan Festival of the Panay," panday making persists as both an income-generating activity and a traditional craft transmitted through apprenticeship. Workshops' geographic locations—proximity to agricultural areas, raw materials, and local markets—directly influence production, marketing, and income opportunities (Layaoen et al., 2025; Fening et al., 2022). Household factors such as age, educational attainment, family size, experience, and access to capital and technology further shape productivity and livelihood stability (Hossain et al., 2023; Santosa, 2022).

Despite its economic and cultural importance, panday-making faces constraints from fluctuating market demand, rising material costs, limited supply chains, and competition from mass-produced tools. Without innovation, improved market access, and institutional support, traditional blacksmithing risks declining profitability and long-term sustainability (Fening et al., 2022; Casimiro et al., 2024; Tigist and Alemu, 2024). Integrating spatial mapping with socioeconomic profiling and income analysis provides a holistic approach to understanding panday livelihoods. Spatial analysis can identify production clusters, market accessibility, and geographic constraints, while socioeconomic and income data reveal inequalities and factors affecting income stability (Besmonte, 2022; Layaoen et al., 2025).

Given these gaps, the study aims (a) map the geographic locations of panday makers to determine their distribution across barangays; (b) describe their socioeconomic profiles, including age, gender, educational attainment, household size, experience, and access to resources; (c) analyze income levels, sources, and variability associated with panday-making; and (d) dentify the challenges, determinants, and opportunities affecting blacksmithing production. The findings are expected to inform local government units, development agencies, and policymakers in designing targeted livelihood support programs, skills development initiatives, and spatially informed economic planning. Moreover, this study contributes to the limited empirical literature on traditional metal craftsmanship in rural Philippines by demonstrating the value of integrating spatial, socioeconomic, and income analyses for localized livelihood development planning.

Methodology

The study was conducted in December 2025 in the Municipality of Badiagan, Province of Iloilo (Figure 1), selected for its active community of panday (blacksmithing) practitioners engaged in traditional metalworking that supports agricultural and household livelihoods. Data collection was conducted systematically and ethically to ensure accuracy, reliability, and comprehensiveness. Formal permission was obtained from the Municipal Local Government Unit of Badiagan and the barangay officials of Barangay Bingawan. Coordination meetings with local leaders and agricultural personnel were held to identify active panday makers and schedule survey and focus group activities. A descriptive research design combining quantitative and qualitative approaches was employed to examine the spatial distribution, socioeconomic profile, and income characteristics of panday makers. The quantitative component described demographic characteristics, production practices, and income levels, while the qualitative component explored livelihood conditions, challenges, and perceptions of income sustainability. The study included 12 panday makers from Barangay Bingawan, identified through barangay officials, the local agricultural office, and community leaders. Inclusion criteria were: (a) residency in Barangay Bingawan; (b) active engagement in panday activities during the study; (c) at least one year of experience in blacksmithing; (d) direct involvement in production, forging, sharpening, or fabrication of metal tools; and (e) voluntary participation. Individuals no longer practicing or only indirectly involved (e.g., traders or resellers) were excluded. Given the specialized nature of the livelihood and the limited number of practitioners, purposive sampling was used.

A structured, researcher-developed survey questionnaire collected data on demographic profiles, household and panday characteristics, challenges, opportunities, determinants, and spatial mapping. The questionnaire was validated by a panel of experts in agricultural economics, rural development, social sciences, cultural studies, and research methodology for clarity, relevance, and reliability. Geographic coordinates of Panday workshops were recorded using handheld GPS devices and mobile location applications to generate spatial maps illustrating workshop distribution within the Barangay of Badiagan. Quantitative survey data were encoded, tabulated, and analyzed using descriptive statistics, including frequency counts, percentages, means, and ranges. Qualitative FGD data were analyzed thematically to identify recurring patterns related to production practices, challenges, and income sustainability. Spatial data were visualized using basic geographic information system (GIS) mapping techniques. The study strictly adhered to ethical standards for research involving human participants. Permissions and endorsements were secured from local government and barangay officials. Prior informed consent was obtained from all participants, participation was voluntary, and confidentiality was maintained by excluding personally identifiable information from all research instruments and reports. Cultural sensitivity was observed throughout the study to respect local norms and traditions and to prevent any psychological, social, or cultural harm.

Results and Discussion

Spatial Distribution of Panday Workers

Table 1 presents the geographic coordinates and elevation of the twelve (12) identified panday workers in Barangay Bingawan, Municipality of Badiangan. The longitudinal coordinates ranged from 122.3216°E to 122.5581°E, while latitudinal values ranged from 10.0350°N to 11.3580°N. The majority of respondents were concentrated within the longitude range of 122.32°E to 122.34°E, indicating a pronounced clustering of panday households within the central portion of the barangay. A smaller grouping was observed farther east (122.55°E), suggesting the presence of an extended or secondary production area. Several workers also shared similar latitude coordinates, particularly around 11.0350°N, further confirming a localized concentration of blacksmithing activities.
In terms of elevation, the panday workers were situated between 99 and 124 meters above sea level (masl), with most located within the 101–107 masl range. This relatively narrow elevation band indicates that panday-making activities are predominantly established in moderately elevated and accessible areas. The limited variation in altitude suggests that topography does not significantly constrain the location of blacksmith workshops. Rather, their placement appears to correspond more closely with residential settlement patterns and community accessibility than with environmental limitations. The spatial configuration of panday workers in Barangay Bingawan demonstrates a semi-clustered distribution pattern. Such clustering is characteristic of household-based and family-oriented production systems, wherein workshops are commonly situated adjacent to residences and embedded within kinship networks. Spatial proximity likely facilitates knowledge transmission, labor exchange, and direct access to local clientele. The georeferenced data therefore provide empirical evidence on the organization of this indigenous livelihood system and establish a foundation for future spatial mapping, cultural preservation initiatives, and targeted livelihood development programs.

The observed semi-clustered distribution aligns with documented patterns in traditional blacksmithing communities in both Philippine and international contexts, where production systems are embedded within localized social and economic networks (Mascuñana, 1998; Suryana et al., 2024; Tagupa et al., 2025). Small-scale blacksmithing enterprises are frequently organized as community-based microenterprises that respond directly to agricultural tool demand and nearby market needs. Supply chain analyses further indicate that spatial proximity to customers and material sources enhances operational efficiency and sustainability in such industries (Layaoen et al., 2025). The relatively uniform elevation range recorded in this study reinforces the argument that workshop siting is influenced more by accessibility and settlement structure than by topographic constraints. Beyond economic considerations, blacksmithing represents a form of intangible cultural heritage in which spatial closeness supports apprenticeship systems, intergenerational knowledge transfer, and craft continuity (Achanzar, 2007; Besmonte, 2022). From an enterprise development perspective, localized clustering can generate productive synergies, adaptive capacity, and innovation, particularly when complemented by technological upgrading and institutional support (Fening et al., 2022; Siregar et al., 2023; Riauan, 2022). Technological enhancements, including the adoption of modern forging tools and electrification, have been shown to improve productivity and competitiveness (Santosa, 2022; Voronov, 2025). However, empirical studies also underscore occupational health risks associated with concentrated blacksmithing activities, such as exposure to heavy metals, airborne particulates, and excessive noise (Oginawati et al., 2021; Hafez & Jorgensen, 2024). Taken together, these findings suggest that while the spatial organization of panday workers in Barangay Bingawan strengthens cultural cohesion and economic cooperation, strategic interventions in occupational health, safety standards, and enterprise modernization are essential to ensure the long-term sustainability and resilience of the local blacksmithing industry.

Collecting Number	Panday Worker's Name	Longitude	Latitude	Altitude
P1	Glen Delgado	122.3259	10.0350	119
P2	Raul Valderrama	122.3216	10.5737	101
P3	Edwin Labanero	122.3414	11.0000	101
P4	Stephen Navita	122.3336	11.0350	104
P5	Ernie Caniniro	122.5581	11.0073	105
P6	Leonard Canoniro	122.5540	11.0070	105
P7	Moel Bollero	122.3366	10.5900	107

P8	Vicenti Jandonero	122.3259	11.0350	99
P9	Rodel Ergonia	122.3356	11.3580	104
P10	Russel Alemania	122.3356	11.0350	104
P11	Rodelyn Labarego	122.3225	10.5990	106
P12	Jay Collado	122.3259	11.0350	124

Table 1. Spatial distribution of the geographic coordinate locations of the Panday workers in Barangay Bingawan, Municipality of Badiangan

Demographic Profile of the Panday Worker

Table 2 presents the demographic profile of the pandayan owners in the Municipality of Badiangan, Iloilo. All respondents were male, accounting for 100% of the sample, indicating that panday-making remains an exclusively male-dominated occupation in the area. In terms of age distribution, the largest proportion of pandayan owners belonged to the 60 years and above age group (50%), followed by those aged 31–60 years (41.67%), while only one respondent (8.33%) was below 30 years old. This age structure points to an aging population of artisans with very limited participation from younger individuals. Meanwhile, most of the respondents were married (83.33%), while a smaller proportion were single (16.67%). No respondents reported being divorced, separated, or widowed. Religious affiliation was predominantly Roman Catholic (91.67%), with a small representation from Iglesia ni Cristo (8.33%), reflecting the general religious composition of rural communities in Iloilo. In terms of educational attainment, the majority of pandayan owners had completed elementary education (41.67%), followed by secondary education (33.33%). Only a few respondents attained vocational (8.33%) or tertiary education (16.67%), and none reported having no formal schooling. Monthly income levels varied among the respondents. While the highest proportion (41.66%) earned more than Php 20,000.00 per month, a considerable number earned below Php 20,000.00, including 33.34% who reported monthly incomes below Php 10,000.00. Notably, all respondents (100%) identified panday-making as their sole primary source of income, with none reporting supplementary livelihoods such as agriculture, business, or wage employment.

The exclusively male composition of pandayan owners highlights the gendered nature of traditional blacksmithing, shaped by long-standing cultural norms, physical demands, and prolonged apprenticeship systems that limit female participation (Suryana et al., 2024; Aforka-Emeka and Nwankwo, 2025; Tagupa et al., 2025). The predominance of artisans aged 60 and above points to an aging workforce and raises concerns about intergenerational skill transmission, as younger generations increasingly pursue alternative livelihoods, higher education, and employment outside artisanal crafts (Hawkins, 2025; Reedy, 2024; Hossain et al., 2023; Mojares, 1986; Tigist and Alemu, 2024). Without targeted youth engagement programs, the sustainability of panday-making as both a livelihood and intangible cultural heritage remains uncertain (Besmonte, 2022; Candelario-Aplaon, 2025). The high proportion of married respondents indicates that panday-making functions as a primary household livelihood rather than supplementary income, consistent with patterns observed in Philippine and international blacksmithing communities (Fening et al., 2022; Hossain et al., 2023; Layaoen et al., 2025). Educational attainment is generally low to moderate, reflecting the informal, experiential mode of skill acquisition. While this preserves indigenous craftsmanship, it limits access to business management skills, technological innovation, and broader market opportunities (Casimiro et al., 2024; Siregar et al., 2023; Suzuki, 2023; Mehdi and Sarma, 2022). Income variability among respondents demonstrates that panday-making can be economically viable under favorable conditions—such as stable demand, affordable raw materials, and appropriate technological support—but smaller or less-equipped operations remain financially vulnerable (Fening et al., 2022; Layaoen et al., 2025). The reliance on panday-making as the primary income source reflects strong livelihood specialization and cultural commitment to the craft, yet it also increases susceptibility to external shocks, including rising input costs, health risks, and competition from mass-produced tools (Santosa, 2022; Reedy, 2024; Tigist and Alemu, 2024; Suryana et al., 2024). Overall, the demographic profile depicts a culturally resilient but economically fragile industry dominated by aging male artisans. Ensuring the continuity and sustainability of panday-making requires youth-focused apprenticeship programs, gender-inclusive training, skills upgrading, technological integration, and strengthened market linkages, balancing innovation with preservation of indigenous craftsmanship (Casimiro et al., 2024; Candelario-Aplaon, 2025; Tagupa et al., 2025).

Household Characteristics of Panday Workers

Table 3 presents the household characteristics of the panday respondents in the Municipality of Badiangan, Iloilo. In terms of household size, an equal proportion of respondents (50.00%) had fewer than five family members and between six to ten members. None of the households exceeded ten members. This distribution indicates moderate household sizes, suggesting manageable household dependency levels within the panday community. With respect to family structure, the majority of

respondents belonged to nuclear families (91.67%), while only one respondent (8.33%) reported living in an extended family. No respondents belonged to single, blended, or adoptive family types. This predominance of nuclear households reflects a household arrangement where economic responsibility is largely concentrated on the immediate family unit. Regarding ethnic affiliation, most respondents (75.00%) reported that they were not members of any ethnic group, while a minority (25.00%) identified themselves as belonging to an ethnic community. Among those who identified as part of an ethnic group, all were Panay-Bukidnon (25.00%), while no respondents reported belonging to other ethnic groups listed in the table. In terms of organizational affiliation, a majority of the panday respondents (66.67%) reported being affiliated with at least one organization, while 33.33% were not affiliated with any formal group. Among those affiliated, half of the respondents (50.00%) were regular members, while 16.67% held officer positions. The remaining 33.33% were non-members. The observed household sizes suggest that panday households in Badiangan typically maintain a balance between labor availability and household dependency.

The predominance of moderate household sizes among panday households suggests a balance between labor availability and economic responsibility, allowing family members to assist with tasks such as raw material preparation, tool marketing, and workshop maintenance. Such arrangements are consistent with craft-based and informal livelihoods, where family labor plays a critical supportive role in sustaining small-scale production (Hossain et al., 2023; Mehdi and Sarma, 2022). Nuclear family structures dominate, indicating that panday-making serves as the primary livelihood for immediate household support. Unlike extended families that can pool multiple income sources, nuclear households rely heavily on the consistent earnings of the panday household head, increasing vulnerability to fluctuating demand, rising input costs, and health-related disruptions (Fening et al., 2022; Siregar et al., 2023). Stable production and income flow are therefore essential for household welfare. The presence of Panay-Bukidnon respondents underscores the role of panday-making in sustaining indigenous livelihood practices and cultural identity. Tool-making skills are historically embedded in indigenous knowledge systems and transmitted through community-based learning and cultural norms (Achanzar, 2007; Tagupa et al., 2025; Besmonte, 2022). This dual function of panday-making highlights its importance as both an economic and cultural practice. Organizational affiliation among the majority of respondents reflects social engagement and collective participation within the panday community. Membership facilitates access to social networks, information exchange, and potential livelihood support, while those holding officer positions contribute to coordination, advocacy, and linkage with local government units or development agencies (Casimiro et al., 2024; Riauan, 2022). The limited number of leadership roles suggests opportunities for capacity-building to strengthen governance and participation. The household characteristics of panday respondents in Badiangan—moderate household sizes, nuclear family structures, selective indigenous representation, and organizational involvement—depict a community that is economically dependent, socially interconnected, and culturally grounded, yet structurally vulnerable. Enhancing household resilience through organizational support, livelihood diversification, and culturally sensitive interventions is critical to sustaining both the economic viability and cultural significance of panday-making.

Profile	Distribution	Frequency (n)	Percentage (%)
Number of Family Member	< 5 members	6	50.00
	6 – 10 members	6	50.00
	> 10 members	**-**	**-**
	Total	**12**	**100%**
Type of Family	Single	**-**	**-**
	Nuclear	11	91.67
	Extended	1	8.33
	Blended	**-**	**-**
	Adoptive	**-**	**-**
	Total	**12**	**100%**
Member of Ethnicity	Yes	3	25.00
	No	9	75.00
	Total	**12**	**100%**
Ethnic Group	Not Applicable	9	75.00
	Akalanon	-	-
	Panay-Bukidnon	3	25.00

	Others	-	-
	Total	**12**	**100%**
Affiliated Organization	Yes	8	66.67
	No	4	33.33
	Total	**12**	**100%**
Position in Organization	Non-Member	4	33.33
	Member	6	50.00
	Officer	2	16.67
	Total	**12**	**100%**

Table 3. Household Characteristics of the Panday

Profile	**Distribution**	**Frequency (n)**	**Percentage (%)**
Sex	Male	12	100%
	Female	-	-
	Total	**12**	**100%**
Age	0 – 30 yrs	1	8.33
	31 – 60 yrs	5	41.67
	60 yrs above	6	50
	Total	**12**	**100%**
Civil Status	Single	2	16.67
	Married	10	83.33
	Divorced/ Separated	-	-
	Widowed	-	-
	Total	**12**	**100%**
Religion	Roman Catholic	11	91.67
	Iglesia ni Cristo	1	8.33
	Seventh-day Adventist	-	-
	Baptist	-	-
	Total	**12**	**100%**
Highest Educational Attainment	No Schooling	-	-
	Elementary	5	41.67
	Secondary	4	33.33
	Vocational	1	8.33
	Tertiary	2	16.67
	Total	**12**	**100%**
Monthly Income	< Php 5,000.00	2	16.67
	< Php 10,000.00	2	16.67

	< Php 20,000.00	3	25.00
	> Php 20,000.00	5	41.66
	Total	**12**	**100%**
Primary Source of Income	Panday	12	100.00
	Agriculture	-	-
	Business	-	-
	Employment	-	-
	Integrated	-	-
	Total	**12**	**100%**

Table 4. Demographic Profile of the Pandayan Owners Panday Livelihood Characteristics

Table 4 presents the livelihood characteristics of panday respondents in the Municipality of Badiangan, Iloilo. In terms of work experience, none of the respondents had less than 15 years of experience in panday-making. The majority (66.67%) reported having less than 30 years of experience, while a substantial proportion (33.33%) had been engaged in the craft for more than 30 years. This indicates that panday-making in the municipality is predominantly practiced by highly experienced artisans, reflecting long-term engagement and skill accumulation in the trade. Regarding raw material sourcing, most respondents (66.67%) relied primarily on scrap metals, while the remaining 33.33% purchased steel materials. This suggests a strong dependence on recycled materials for production, likely influenced by cost considerations and local availability. In terms of production output, half of the respondents (50.00%) produced between zero to five finished products per week, while 41.67% produced six to ten pieces weekly. Only one respondent (8.33%) produced more than ten pieces per week. This distribution reflects generally small-scale production levels, characteristic of traditional, labor-intensive blacksmithing operations. With respect to product pricing, the majority of panday respondents (83.33%) reported a price floor of less than Php 1,000.00 per item. Only a small number set prices between Php 1,001.00 and Php 1,500.00 (8.33%) or above Php 1,500.00 (8.33%). This indicates that most products are priced within a low-cost range, making them accessible to local consumers, particularly farmers and rural households.

Figure 3 and 4 presents the cumulative distribution of products manufactured and marketing channels utilized by the panday respondents in the Municipality of Badiangan, Iloilo. Since panday makers often produce multiple types of tools and use more than one selling channel, the frequencies reflect **multiple responses** from the same 12 respondents. All panday respondents (100%) reported producing agricultural tools, particularly bolos, indicating that this product type forms the core output of panday-making in the municipality. Livestock-related tools, such as meat knives, and kitchen tools, including common knives, were each produced by seven panday owners (58.33%). Only one respondent (8.33%) reported producing other specialized items, such as Rambo knives, suggesting limited diversification into non-traditional or specialty products. In terms of marketing channels, all respondents (100%) reported selling directly to buyers, indicating that face-to-face transactions remain the most common mode of exchange. A majority of panday owners (66.67%) also sold their products in local markets, while a smaller proportion (33.33%) relied on middlemen. The use of multiple selling channels suggests adaptive marketing strategies aimed at maximizing sales opportunities within limited local markets.

The extensive experience reported by panday respondents highlights the depth of indigenous technical knowledge embedded in panday-making. Long-term engagement in the craft reflects mastery of traditional forging techniques, familiarity with locally preferred tools, and the accumulation of tacit skills developed through prolonged apprenticeship (Mojares, 1986). Similarly with the findings of Tagupa et al. (20250 and Tigist and Alemu (2024). However, experience alone does not guarantee higher productivity or income, particularly where technological upgrading remains limited. Scrap metals serve as the primary raw material, reflecting economic pragmatism and environmental adaptation. While this ensures affordable and continuous production, reliance on recycled metals may affect product uniformity, durability, and the ability to meet specialized or higher-value market demands (Fening et al., 2022; Reedy, 2024; Mehdi and Sarma, 2022).
Low weekly production volumes underscore the labor-intensive and physically demanding nature of panday-making. Manual forging methods, limited access to mechanized or low-cost productivity tools, and dependence on physical endurance constrain output, consistent with patterns observed in artisanal blacksmithing elsewhere (Santosa, 2022; Hossain et al., 2023; Hafez and Jorgensen, 2024). These conditions point to the need for targeted technological interventions that enhance efficiency while preserving traditional craftsmanship. The predominance of low-priced products indicates that panday makers primarily cater to local markets with limited purchasing power. Although affordable pricing sustains demand, it limits profit margins and constrains income growth. Without value addition, product differentiation, or improved

market linkages, traditional blacksmiths struggle to convert skill into higher economic returns (Casimiro et al., 2024; Layaoen et al., 2025; Siregar et al., 2023). Agricultural tools, particularly bolos, dominate production, reflecting the strong interdependence between panday-making and local farming activities. Such demand-driven production aligns with studies showing that rural blacksmiths prioritize implements that are practical, relevant, and consistently needed by the community (Mascuñana, 1998; Tagupa et al., 2025; Suryana et al., 2024).

Direct selling remains the primary marketing channel, enabling close customer relationships and customization, though limited access to wider markets constrains scalability and income potential (Layaoen et al., 2025; Casimiro et al., 2024; Riauan, 2022). The overall livelihood characteristics of panday respondents in Badiangan reflect a traditional, experience-driven, and small-scale production system that is culturally meaningful and economically functional but structurally constrained. Enhancing productivity through appropriate technology, improving raw material sourcing, adding value through design and finishing, and expanding market linkages can improve income stability while safeguarding cultural integrity. Integrating innovation with traditional practices is essential to ensure the long-term sustainability of panday-making as both a livelihood and an expression of indigenous craftsmanship.

Profile	Distribution	Frequency (n)	Percentage (%)
Years of Experience	< 15 years	-	-
	< 30 years	8	66.67
	> 30 years	4	33.33
	Total	**12**	**100%**
Main Source of Raw Materials	Scrap Metals	8	66.67
	Purchase Steels	4	33.33
	Total	**12**	**100%**
Number of Products Produced per Week	0 – 5 pieces	6	50.00
	6 – 10 pieces	5	41.67
	> 10 pieces	1	8.33
	Total	**12**	**100%**
Price Floor	< Php 1,000.00	10	83.33
	Php 1001.00 – Php 1,500.00	1	8.33
	> Php 1,500.00	1	8.33
	Total	**12**	**100%**

Table 4. Panday Livelihood Characteristics

Challenges Experienced by the Panday Workers

The findings indicate that panday workers in Badiangan perceive the challenges they face across social, environmental, technological, and institutional dimensions as generally moderate, with an overall mean of 3.10%, suggesting that these challenges neither severely impede production nor serve as strong enabling factors. Among social factors, respondents disagreed that limited family or community support constrains panday making, while acknowledging that strong family and community support helps sustain their livelihood. This highlights the continued presence of supportive social networks, even as issues such as declining youth interest in the craft and health-related work limitations are recognized but not considered critical threats. Environmental factors present mixed challenges. Scarcity of raw materials emerged as the most pressing concern, as respondents agreed that it limits production. Other occupational hazards—including exposure to heat, smoke, noise, and variable climate conditions—were rated neutrally, reflecting their recognition as inherent work realities rather than severe impediments. Similarly, access to recyclable materials received a neutral score (3.42%), indicating inconsistent availability that may affect production continuity.

Technological factors reveal both appreciation for traditional methods and openness to modernization. Respondents strongly agreed that access to modern tools could significantly improve output and agreed that skills and technology training would benefit their work. Conversely, they were neutral regarding the current lack of modern tools and disagreed that traditional techniques inherently limit efficiency. This suggests that while traditional knowledge remains central to panday-making, there is recognition of the potential productivity gains achievable through targeted technological

integration. Institutional factors were also perceived neutrally (3.15%). Respondents indicated moderate concern regarding limited access to capital, insufficient government or NGO support, and the potential benefits of institutional programs. Interestingly, the absence of associations or cooperatives was not viewed as a major impediment to market access, reflecting reliance on informal networks and personal connections rather than formal institutional structures. The study reveals that panday workers experience challenges across social, environmental, technological, and institutional dimensions at a generally neutral level, reflecting a livelihood sustained by cultural resilience yet structurally vulnerable. This aligns with prior studies that frame blacksmithing as a culturally embedded practice, maintained through tradition, identity, and community networks rather than formal support (Mojares, 1986; Mascuñana, 1998; Suryana et al., 2024). Socially, respondents emphasized strong family and community support as critical to sustaining panday livelihoods, consistent with observations that craft practices are reinforced through kinship, communal cohesion, and informal knowledge transfer (Achanzar, 2007; Besmonte, 2022). However, neutral perceptions of youth interest highlight weakening intergenerational skill transfer, echoing concerns about declining engagement in artisanal blacksmithing amid modernization pressures (Tagupa et al., 2025; Hawkins, 2025).

Environmental constraints, particularly the scarcity of raw materials, were identified as a key limitation to production. This vulnerability mirrors findings from Philippine, Bangladeshi, and Nigerian blacksmithing communities, where fluctuating access to scrap metals and other inputs directly affects productivity and income stability (Layaoen et al., 2025; Shidiq and Adityama, 2022; Hossain et al., 2023; Mehdi and Sarma, 2022). Although respondents were neutral about workplace hazards and climate variability, prior studies indicate long-term occupational risks from heat, smoke, noise, and metal particulates (Oginawati et al., 2021; Abdullahi et al., 2020; Staseva et al., 2020; Tigist and Alemu, 2024), suggesting normalization of such conditions rather than their absence. Technologically, respondents acknowledged that traditional methods do not inherently limit efficiency but strongly agreed that access to modern tools and skills training could enhance productivity. This underscores that constraints arise from limited technological integration rather than the craft itself. Studies show that low-cost mechanization and skills development can improve output without compromising traditional craftsmanship (Santosa, 2022; Fening et al., 2022; Panday et al., 2025; Reedy, 2024; Voronov, 2025). Institutional challenges were also perceived as neutral, with limited access to capital, government support, or formal programs. This reflects the marginalization of traditional cultural enterprises within policy and financing frameworks (Riauan, 2022; Casimiro et al., 2024). Respondents' reliance on informal marketing networks rather than cooperatives or associations highlights the historical independence of household-based craft production (Suzuki, 2023). Nonetheless, culturally grounded institutional support can enhance income stability and market reach (Candelario-Aplaon, 2025; Aforka-Emeka and Nwankwo, 2025).

No.	Social Factors	n	Interpretation
1	I experience limited family or community support in panday making.	1.8%	Strongly Disagree
2	There is low interest among youth in continuing to make panday.	3.0%	Neutral
3	Health problems affect my ability to work as a panday.	3.3%	Neutral
4	Strong family and community support helps sustain my livelihood.	4.3%	Agree
	Total	**3.10**	**Neutral**
No.	**Environmental Factors**		
5	The scarcity of raw materials limits my production.	4.1	Agree
6	Exposure to heat, smoke, and noise affects my working conditions.	3.0	Neutral
7	Climate conditions disrupt panday production activities.	3.2	Neutral
8	Availability of recyclable materials supports my livelihood.	3.4	Neutral
	Total	**3.42**	**Neutral**
No.	**Technological Factors**		
9	Lack of modern tools reduces my productivity.	3.3	Neutral
10	Traditional techniques limit production efficiency.	2.5	Disagree
11	Access to modern tools can significantly improve my output.	5.00	Strongly Agree
12	Skills and technology training would benefit my panday work.	4.3	Agree

	Total	**3.79**	**Neutral**
No.	**Institutional Factors**		
13	Limited access to capital or credit constrains my livelihood.	3.2	Neutral
14	Government or NGO support for panday makers is insufficient.	3.3	Neutral
15	Absence of associations or cooperatives affects market access.	2.3	Disagree
16	Institutional support programs can improve my income and livelihood.	3.9	Neutral
	Total	**3.15**	**Neutral**
	Overall	**3.36**	**Neutral**

Table 5. Challenges Factors Experienced by the Panday Workers

Determinant Factors Affecting Panday Production

The findings reveal that panday production in Barangay Bingawan is shaped by interrelated spatial, human, economic, and institutional factors, with an overall high level of influence ($\bar{x}$ = 4.8, Agree). Spatial accessibility emerged as a critical determinant, as proximity to nearby barangays enhances customer reach, while distance from suppliers and major markets increases transportation costs and reduces profit margins. This indicates that panday operations remain highly dependent on localized economic networks and community-based demand. Experience was identified as a strong production driver, as longer years of practice improve craftsmanship, product durability, and customer trust. In contrast, formal education was perceived as less influential, reflecting the apprenticeship-based and experiential nature of blacksmithing where skills are transmitted through hands-on training rather than academic instruction. Household responsibilities also affect productivity, particularly in small-scale, family-managed workshops where time allocation is divided between domestic obligations and metalworking tasks. Economic constraints further shape production outcomes, especially the availability and rising cost of raw materials, charcoal or fuel, tools, and electricity. These input-related pressures directly influence production volume and income stability. While steady local demand supports livelihood continuity, competition from factory-made and imported tools exerts moderate pressure by offering lower-priced alternatives. Importantly, respondents emphasized that institutional support—such as skills training, financial assistance, and equipment subsidies—positively enhances production capacity, underscoring the crucial role of local government units and partner organizations in sustaining and modernizing panday enterprises.

The strong influence of location and market accessibility on panday production underscores the inherently localized nature of traditional blacksmithing. Artisans primarily serve nearby farming communities, and proximity to customers directly affects demand, income stability, and production volume. This aligns with Philippine studies highlighting the dependence of craft-based livelihoods on spatial proximity and localized trade networks (Mascuñana, 1998; Suzuki, 2023) and with supply chain analyses showing that transportation distance and access to scrap materials impact efficiency and costs (Layaoen et al., 2025; Shidiq & Adityama, 2022). Experience emerged as a key determinant, emphasizing the importance of tacit knowledge, skill mastery, and craftsmanship. Long-term practice, rather than formal education, develops expertise, reinforces product quality, and builds market trust (Mojares, 1986; Achanzar, 2007; Tigist & Alemu, 2024). The neutral role of educational background suggests that literacy and numeracy may aid basic financial management but are not central to production success. Household size and family responsibilities significantly influence production time, reflecting the dual economic and domestic roles of panday workers. Similar patterns are observed in rural artisanal communities, where household labor participation supports production but can limit overall output (Hossain et al., 2023; Mehdi & Sarma, 2022). Economic pressures, particularly the availability and rising cost of raw materials, fuel, and tools, were identified as major constraints. Input price volatility remains a critical challenge, as reliance on scrap metals and energy-intensive processes directly affects income and productivity (Fening et al., 2022; Siregar et al., 2023). Competition from factory-made tools was perceived as moderate, indicating that handmade tools retain cultural and functional value among local farmers (Suryana et al., 2024; Tagupa et al., 2025). The institutional support from government and organizations was positively perceived, highlighting the potential of training, equipment provision, and financial assistance to enhance productivity without displacing cultural practices. Community-based and culturally sensitive interventions can strengthen both economic viability and heritage preservation (Candelario-Aplaon, 2025; Casimiro et al., 2024). Overall, the findings suggest that panday production is shaped by a combination of spatial, experiential, household, and economic factors, with institutional engagement offering a pathway to sustain this culturally significant livelihood.

No.	**Determinant Factors**	**n**	**Interpretation**

1	The location of the workshop affects my access to customers.	4.1	Agree
2	The distance from markets and suppliers influences my production costs and income.	4.3	Agree
3	My years of experience as a panday significantly improve the quality and marketability of my products.	4.3	Agree
4	My educational background helps me manage pricing, budgeting, and income from blacksmithing.	3.3	Neutral
5	Household size and family responsibilities affect the amount of time I can devote to panday work.	4.3	Agree
6	The availability and cost of raw materials directly affect my productivity.	4.2	Agree
7	Rising costs of fuel, tools, and energy reduce my income from panday making.	4.4	Agree
8	Customer demand for handmade tools determines the stability of my income.	4.2	Agree
9	Competition from factory-made or imported tools affects the sales of my panday products.	3.7	Neutral
10	Support from local government or organizations improves panday livelihood.	4.1	Agree
	Total	**4.8**	**Agree**

Table 6. Determinant Factors Affecting the Production of Blacksmithing in Bingawan, Badiangan

Opportunities in Panday Production

Opportunities for strengthening panday production were generally rated favorable ($\bar{x}$ = 4.35, Agree), indicating an enabling yet evolving environment for livelihood development. Strong family ties and community support function as critical social capital, facilitating labor exchange, apprenticeship, and localized patronage. Material and environmental conditions—including access to recyclable metals, adequate workspace, and proper ventilation—were perceived as supportive of efficient and safe production. Technological opportunities, such as improved forging equipment, exposure to advanced metalworking techniques, and participation in skills enhancement training, were likewise recognized as pathways to increased productivity, enhanced product quality, and improved market competitiveness. Market and institutional mechanisms—including access to loans, grants, subsidies, and promotional programs—were viewed as beneficial for production expansion and income stabilization. However, several developmental dimensions remain underutilized. Youth participation, access to health and social protection services, sustained government support, and cooperative formation received neutral ratings, suggesting gaps in long-term sustainability mechanisms. These findings indicate that while structural and community-based opportunities are present, stronger institutional coordination and intergenerational engagement are necessary to ensure the continuity and growth of panday production in Bingawan, Badiangan.

The positive perception of opportunities underscores the continued viability of panday making, anchored in strong social foundations and emerging development prospects. High agreement on family and community support confirms that traditional blacksmithing operates within kinship-based systems where labor, knowledge, and market relations are socially embedded (Mojares, 1986; Mascuñana, 1998). As with other community-centered craft traditions, sustainability depends more on localized cooperation than on formal organizational structures (Achanzar, 2007). Favorable ratings on material availability suggest that production constraints stem from supply variability rather than chronic scarcity, consistent with findings in other Philippine blacksmithing contexts (Layaoen et al., 2025; Shidiq & Adityama, 2022). Adequate workspace and ventilation further support efficiency and occupational safety, aligning with studies linking proper working conditions to sustained productivity (Hafez & Jorgensen, 2024; Oginawati et al., 2024).

Technological opportunities received high agreement, indicating readiness to adopt improved forging tools and training. Evidence shows that such interventions enhance productivity and product quality without eroding traditional craftsmanship (Santosa, 2022; Fening et al., 2022), supporting integrative models that combine indigenous knowledge with modern technology (Panday et al., 2025). However, neutral ratings on youth engagement signal a critical threat to continuity. Declining participation among younger generations is widely reported in Philippine and global contexts (Tagupa et al., 2025; Hawkins, 2025), and without structured apprenticeship and knowledge-transfer mechanisms, long-term cultural sustainability remains uncertain (Besmonte, 2022; Candelario-Aplaon, 2025). Institutional support, including LGU assistance and cooperative formation, was likewise rated neutral, suggesting limited effectiveness of formal interventions. Although financial access was viewed positively, continued reliance on informal marketing networks reflects patterns common in Philippine craft industries (Casimiro et al., 2024; Suzuki, 2023). The panday production in Badiangan is strengthened by social cohesion, favorable working conditions, and technological openness, but constrained by weak institutional integration and declining intergenerational engagement. Sustained viability will depend on coordinated strategies that reinforce community systems, promote appropriate technological upgrading, improve occupational standards, and institutionalize support mechanisms.

No.	Opportunities	n	Interpretation
1	Strong family and community support sustain panday making.	4.6%	Agree
2	Youth willingness ensures continuity of the craft.	3.7%	Neutral
3	Access to health and social services improves work capacity.	3.2%	Neutral
4	Availability of recyclable or raw materials supports continuous production.	4.4%	Agree
5	Adequate working space and proper ventilation improve safety and efficiency.	4.4%	Agree
6	Stable environmental conditions allow uninterrupted panday operations.	4.2%	Agree
7	Access to modern forging tools significantly increase productivity.	4.6%	Agree
8	Training on modern metalworking techniques improves product quality.	4.1%	Agree
9	Skills and technology training enhance my competitiveness as a panday maker.	4.0%	Agree
10	Access to credits policies (loans, grants, or subsidies) can helps expand panday production.	4.1%	Agree
11	Support from LGUs and national agencies improves my livelihood.	3.5%	Neutral
12	Formation of cooperatives or associations strengthens market access.	3.5%	Neutral
13	Market linkage and product promotion programs increase income opportunities.	4.1%	Agree
	Total	**4.35%**	**Agree**

Table 7. Opportunities Influence the Production of Blacksmithing in Bingawan, Badiangan

Conclusion and Implications

This study highlights panday-making in Badiangan as an indigenous, household-based livelihood that is culturally significant and economically functional, yet structurally vulnerable. The demographic profile—dominated by older, experienced male artisans—reflects a deep accumulation of traditional knowledge, but limited youth participation raises concerns about intergenerational continuity and the long-term sustainability of the craft. Household characteristics reveal predominantly nuclear families with moderate sizes, emphasizing strong reliance on panday-making for immediate family support. While family members contribute auxiliary labor, the limited number of income earners heightens vulnerability to production disruptions and market fluctuations. The involvement of Panay-Bukidnon households underscores the dual role of panday-making in both livelihood provision and cultural preservation. Relatively high organizational participation suggests social cohesion and collective potential, though this remains underutilized for livelihood enhancement. Panday livelihoods are characterized by small-scale, labor-intensive production, reliance on scrap metals, manual forging methods, low output volumes, and modestly priced products. The predominance of agricultural tools, particularly bolos, links production closely to the local farming economy, ensuring steady demand but limiting market diversification. Challenges—including aging labor, limited capital, insufficient technology, inconsistent raw materials, low pricing, and restricted market access—constrain productivity, income growth, and resilience. Experience and skill positively influence technical competence, yet income gains remain limited without support in technology, skills upgrading, and market development.

Despite these constraints, opportunities exist to strengthen the sector. Organizational affiliation can facilitate collective action, skills development, and external linkages. Product diversification, value addition, improved raw material access, and appropriate technological interventions can enhance productivity and earnings without compromising cultural integrity. Expanding market access beyond local buyers and implementing culturally sensitive development programs can further bolster household and community resilience. Overall, panday-making in Badiangan represents a culturally rooted, socially embedded livelihood that sustains rural and indigenous households. Its long-term viability depends on integrated strategies that address demographic and household vulnerabilities, enhance productivity, expand markets, and balance innovation with tradition—ensuring that panday-making remains both economically sustainable and culturally meaningful.

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Data Availability Statement

Data sharing can be requested by submitting a formal request to the author of the study.

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Appendices

No appendices are attached to this study.