Smart Shrinkage for Sustainable Rural Rejuvenation in Malaysia: Evidence from Batu Pahat District, Johor

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DOI: https://doi.org/10.47772/IJRISS.2026.101000095

Received: 16 October 2026; Accepted: 21 October 2026; Published: 30 October 2026

ABSTRACT

Rural shrinkage is becoming an increasingly important planning challenge as villages experience youth out-migration, population ageing, weakening local economies and changing land-use functions. Yet Malaysian rural development remains largely framed around growth and physical upgrading, while smart shrinkage has received limited empirical attention. This paper examines the applicability of smart shrinkage as an adaptive planning approach in Kampung Minyak Beku, Batu Pahat district, Johor. An exploratory quantitative case study was undertaken using a structured questionnaire with 29 household heads or household representatives. Twenty-five indicators covering economic, social, physical/environmental, institutional and digital-readiness dimensions were analysed using descriptive statistics, mean scores and reverse coding. The findings reveal a pronounced demographic-economic core to shrinkage: the social dimension recorded the highest mean score (4.56), followed by the economic dimension (4.26). The most critical indicators were youth out-migration (4.86), an increasing proportion of older residents (4.83), low youth participation in leadership (4.76), smaller household size (4.72) and population decline (4.59). By contrast, institutional capacity and digital readiness remained comparatively stronger. Retrospective before-after perceptions also suggest that improvements in infrastructure, service delivery and digital use did not remove deeper demographic and livelihood pressures. Community priorities centred on participatory planning, youth empowerment, institutional collaboration, optimisation of public facilities, local economic diversification, productive use of idle land and digital capability. The study argues that smart shrinkage offers a useful rural planning lens when rejuvenation is understood as adaptation, right-sizing and quality-of-life improvement rather than population growth alone.

Keywords: Rural shrinkage, smart shrinkage, rural rejuvenation, youth out-migration, rural sustainability

INTRODUCTION

Rural areas across many countries are undergoing demographic and economic restructuring marked by population decline, youth out-migration, ageing, weakening employment bases and reduced use of land and services (Kamarudin et al., 2025). Although shrinkage has been extensively discussed in urban and regional studies, its rural expression can be especially consequential because small settlements have limited demographic buffers, narrower labour markets and a higher dependence on a few local economic activities. International studies show that rural population loss is not merely a numerical decline; it can alter household structures, service viability, social networks, local leadership and the productive use of land (Johnson & Lichter, 2019; Li et al., 2023; Makkonen & Inkinen, 2023). Malaysia is not spared from these processes. Rapid urbanisation, internal migration and long-term changes in agriculture have reshaped rural communities, while younger residents frequently leave for education and employment in larger urban centres (Abbas & Binsin, 2008; Abdul Rashid et al., 2012; Marzuki & Jais, 2020). Local studies have also identified vacant and idle houses, reduced agricultural activity and changed rural-urban relations as symptoms of uneven rural transformation (Abdullah & Zainudin, 2022; Bahrudin et al., 2025). However, Malaysian rural policy and development practice still tend to respond to decline through additional projects, infrastructure and growth-oriented intervention. Such measures may be necessary, but they do not automatically address the underlying demographic and livelihood processes that produce shrinkage.

Smart shrinkage offers a different planning logic. Building on the earlier idea of smart decline, it accepts that some places may not return to continuous demographic growth and therefore asks how a smaller community can remain liveable, functional and resilient (Popper & Popper, 2002; Hollander, 2011; Peters et al., 2018). In rural contexts, this can involve right-sizing facilities, reusing underutilised land, strengthening local livelihoods, sustaining social infrastructure, using digital tools strategically and improving quality of life for residents who remain. Rather than treating population growth as the only measure of success, smart shrinkage shifts attention towards adaptation, resource optimisation and community capacity (Makkonen & Inkinen, 2023; Yang et al., 2024). Kampung Minyak Beku in Batu Pahat, Johor provides a useful case through which to examine this approach. The coastal village has traditionally depended on fishing and small-scale local activities, but has experienced youth out-migration, ageing, reduced livelihood stability and declining visitor activity. At the same time, it has recently received physical and service improvements through the Kampung Angkat MADANI initiative, creating an instructive setting in which improvements in infrastructure can be considered alongside longer-term demographic and economic pressures. The central question is therefore not simply whether the village has received development, but whether its underlying capacity to remain socially and economically viable is being strengthened.

This paper has two objectives: first, to identify the main characteristics of rural shrinkage in Kampung Minyak Beku hence leading to assessing the relative severity of shrinkage using a multidimensional set of indicators; and secondly, to determine smart shrinkage actions based on community priorities. The paper contributes to the Malaysian rural planning literature by translating smart shrinkage from a largely international and urban-regional debate into an empirical village-level framework. It further argues that physical upgrading and shrinkage management should be treated as complementary but distinct planning tasks: infrastructure can improve living conditions, while demographic regeneration, livelihood diversification and community governance are required to address deeper decline.

LITERATURE REVIEW

Rural Shrinkage as a Multidimensional Process

Rural shrinkage is generally associated with persistent population decline and the weakening of economic and settlement functions. Karcagi-Kovats & Katona-Kovacs (2012) identify out-migration, ageing, limited employment opportunities and declining services as common elements, while McGranahan & Beale (2002) emphasise that population loss can be both a cause and a consequence of economic restructuring. In East Asia, rural shrinkage has become closely associated with ageing and the loss of working-age residents, producing long-term challenges for service provision and community continuity (Li et al., 2023). International studies further indicate that shrinkage is spatially differentiated: communities experiencing similar population trends may retain different levels of economic vitality, social cohesion and functional capacity (Johnson & Lichter, 2019; Makkonen & Inkinen, 2023). A single population measure therefore cannot capture the full planning implications of rural decline.

Figure 1 identifies seven interconnected mutually reinforcing drivers of rural shrinkage namely; youth out-migration, low fertility, population ageing, declining agricultural viability, limited employment opportunities, weak infrastructure and services, rural–urban inequality, and environmental pressures. Restricted local employment may encourage young adults to leave and their departure can then accelerate ageing, reduce the size of resident households and limit the local labour pool. In parallel, agricultural restructuring, unstable household income and environmental constraints may weaken traditional livelihoods and the viability of small enterprises. However, not every village experiences all these pressures simultaneously or to the same degree (Jemain & Kamarudin, 2026; Zhang et al., 2025).

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS | Volume X Issue X October 2026

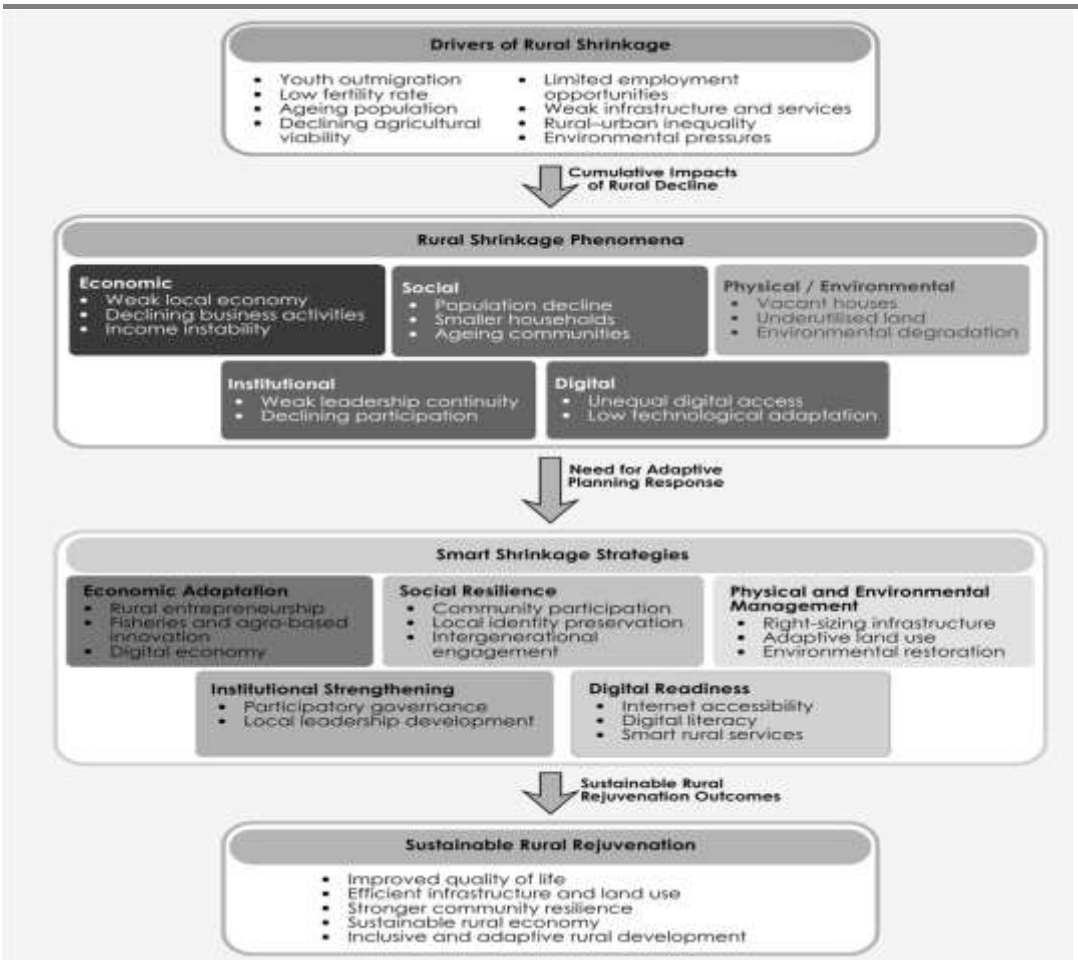

Figure 1. Multidimensional process of rural shrinkage and strategies for rural rejuvenation.

Source: Jemain & Kamarudin (2026: 287)

As explained in Figure 1, rural shrinkage arises from interconnected pressures that can be assessed across five analytical dimensions (Jemain & Kamarudin, 2026). Economic shrinkage involves limited employment opportunities, unstable incomes and declining local businesses. Social shrinkage encompasses population loss, smaller households, ageing, weakening community participation and reduced intergenerational continuity. Physical and environmental shrinkage manifests through vacant housing, underutilised land, inadequate maintenance and environmental degradation. Institutional shrinkage reflects weaknesses in leadership succession, public participation and village development systems, while digital shrinkage concerns unequal connectivity, limited skills and restricted access to digital services. However, institutional and digital conditions may represent adaptive capacities rather than vulnerabilities. These dimensions therefore provide a diagnostic framework, not uniform indicators of inevitable decline (Peters et al., 2018; Yang et al., 2024). They may also reinforce one another: youth out-migration reduces future leaders and entrepreneurs, limited livelihood opportunities accelerate further migration, and underused assets increase the burden of maintaining local services.

Figure 1 also further explained that the smart shrinkage concept provides an adaptive planning response through five complementary strategies: economic adaptation, social resilience, physical and environmental management, institutional strengthening, and digital readiness. Economic adaptation promotes livelihood diversification and local entrepreneurship, while social resilience strengthens community participation and intergenerational relationships. Physical and environmental management emphasises "right-sizing" infrastructure, adaptive land reuse and environmental restoration. Importantly, right-sizing should not imply withdrawing essential services but rather optimising existing facilities according to changing demographic needs. Institutional strengthening promotes participatory governance and leadership continuity, whereas digital readiness supports connectivity, digital literacy and access to rural services. These strategies should be prioritised according to local vulnerabilities and existing capacities rather than implemented uniformly across

all settlements. Ultimately, the sustainable rural rejuvenation outcomes presented in Figure 1 encompass improved quality of life, efficient land and infrastructure utilisation, stronger community resilience, a sustainable local economy and inclusive development. These represent intended planning outcomes rather than automatically achievable consequences of intervention. The framework consequently offers a conceptual pathway for understanding how rural shrinkage challenges can inform adaptive strategies suited to Malaysian rural settlements. Such an approach is particularly relevant to Kampung Minyak Beku, Johor, where the coexistence of demographic pressures, declining traditional livelihoods and recent infrastructure investment provides an opportunity to examine the potential of smart shrinkage as an alternative pathway towards sustainable rural rejuvenation.

Smart Shrinkage as an Adaptive Approach to Sustainable Rural Rejuvenation in Malaysia

Conventional rural development planning has traditionally emphasised population growth, infrastructure expansion and economic development as indicators of progress. However, such growth-oriented approaches may be less appropriate for rural settlements experiencing population decline, youth out-migration, ageing and weakening local economies. Popper & Popper (2002) introduced "smart decline" as an alternative planning perspective that recognises the need to adapt development to demographic realities, while Hollander (2011) emphasised maintaining community well-being rather than pursuing growth as the primary objective. Building upon these perspectives, smart shrinkage advocates strategic adaptation through efficient resource utilisation, economic restructuring, community resilience and improved quality of life, even where population decline persists (Peters et al., 2018; Yang et al., 2024).

Recent studies suggest that effective responses to rural shrinkage depend not only on the severity of demographic and economic decline but also on the ability of local communities to mobilise existing capacities. Peters et al. (2018) emphasised the role of entrepreneurial social infrastructure, particularly collective action and community participation, in enabling small towns to maintain quality of life despite population loss. Similarly, Li et al. (2016) demonstrated that bottom-up initiatives, local leadership and institutional coordination can support rural revival, while Li et al. (2023) highlighted the importance of adaptive service provision, local resource mobilisation and context-sensitive policies in shrinking East Asian settlements. Collectively, these studies indicate that effective rural rejuvenation requires linking local vulnerabilities with existing institutional, social and economic resources rather than pursuing uniform growth-oriented interventions.

Building upon the multidimensional framework of Jemain and Kamarudin (2026), the present study introduces a case-grounded diagnostic-to-action approach to smart shrinkage. As illustrated in Figure 1, the framework distinguishes four interconnected components: (i) diagnosing shrinkage pressures/drivers; (ii) explaining the rural shrinkage phenomena according to community development components; (iii) implementing locally appropriate adaptive planning strategies through phased institutional and community action; and (iv) implementation outputs and longer-term rejuvenation outcomes. The framework extends the earlier conceptual discussion by connecting village-level perceptions with an explicit intervention-selection process. Nevertheless, the proposed relationships remain conceptual and require future empirical evaluation, which in this context, the evaluation indicators for rural shrinkage is presented in Table 1.

Table 1. Analytical dimensions and key indicators for rural shrinkage assessment

Dimension	Key indicators	Analytical meaning
Economic	(1) Household income; (2) agricultural/fisheries productivity; (3) local businesses; (4) employment opportunities; (5) youth migration for work	Strength and continuity of the local livelihood base
Social	(6) Population change; (7) age structure; (8) household size; (9) participation; (10) social relations	Demographic renewal, social cohesion and community continuity
Physical /	(11) Vacant houses; (12) agricultural land use; (13)	Use and condition of settlement

environmental	infrastructure; (14) housing maintenance; (15) environmental problems	assets, land and environment
Institutional	(16) Planning effectiveness; (17) youth leadership; (18) public service delivery; (19) resident participation; (20) community meetings	Local governance capacity and ability to organise adaptation
Digital readiness	(21) Internet coverage; (22) digital skills; (23) device access; (24) digital payments/services; (25) everyday digital use	Capacity to overcome distance and support new services and livelihoods

Source: adapted from McGranahan & Beale (2002); Peters et al. (2018); Makkonen & Inkinen (2023); Yang et al. (2024); Kamarudin et al. (2025); Abdullah & Zainudin (2022).

Table 1 presents 25 indicators across five interrelated dimensions to provide a multidimensional assessment of rural shrinkage. Importantly, these dimensions are not independent, as youth out-migration may simultaneously affect local employment, demographic structure and leadership succession. Furthermore, institutional and digital conditions may represent existing community strengths rather than symptoms of decline. The indicators therefore serve as a diagnostic framework for identifying locally differentiated vulnerabilities and adaptive capacities, rather than assuming uniform deterioration across all dimensions. In the Malaysian context, this approach supports more targeted smart-shrinkage strategies that respond to specific settlement characteristics, community needs and available resources.

RESEARCH METHODOLOGY

Study Area and Research Design

This study employed an exploratory, cross-sectional household survey to examine multidimensional rural shrinkage and community priorities for adaptive rural development in Kampung Minyak Beku, Batu Pahat, Johor (Figure 2). The village was selected as a single case study because of its reported demographic and livelihood challenges, alongside recent improvements in local infrastructure and facilities associated with the Kampung Angkat MADANI initiative. The research examined residents' perceptions of socioeconomic, demographic, physical, institutional and digital conditions. It was designed as a context-specific assessment of rural shrinkage rather than a statistically representative population survey or an evaluation of programme effectiveness.

Population, Sampling and Respondent Selection

Official village information recorded approximately 520 residents, while local verification with a former village head identified 96 occupied houses as the relevant household population. The household was adopted as the unit of analysis, with information obtained from household heads or adult household representatives familiar with local conditions and changes affecting the village. A total of 29 respondents participated in the study through purposive sampling. This non-probability approach was used to obtain information from residents with relevant knowledge or experience of demographic, socioeconomic, physical and institutional changes. Although an online sample-size calculator was consulted during the original study, its probability-based confidence and precision assumptions cannot be applied to the final purposively selected sample. Accordingly, the 29 responses are treated as exploratory, case-specific evidence rather than a statistically representative estimate of village-wide conditions. Purposive sampling enabled the study to obtain perspectives from locally knowledgeable respondents, but it also introduced potential selection bias. In particular, the sample included relatively few younger respondents, which may have limited the representation of younger residents' experiences and aspirations. The findings should therefore be interpreted within the context of the participating households and should not be generalised statistically to the wider village population.

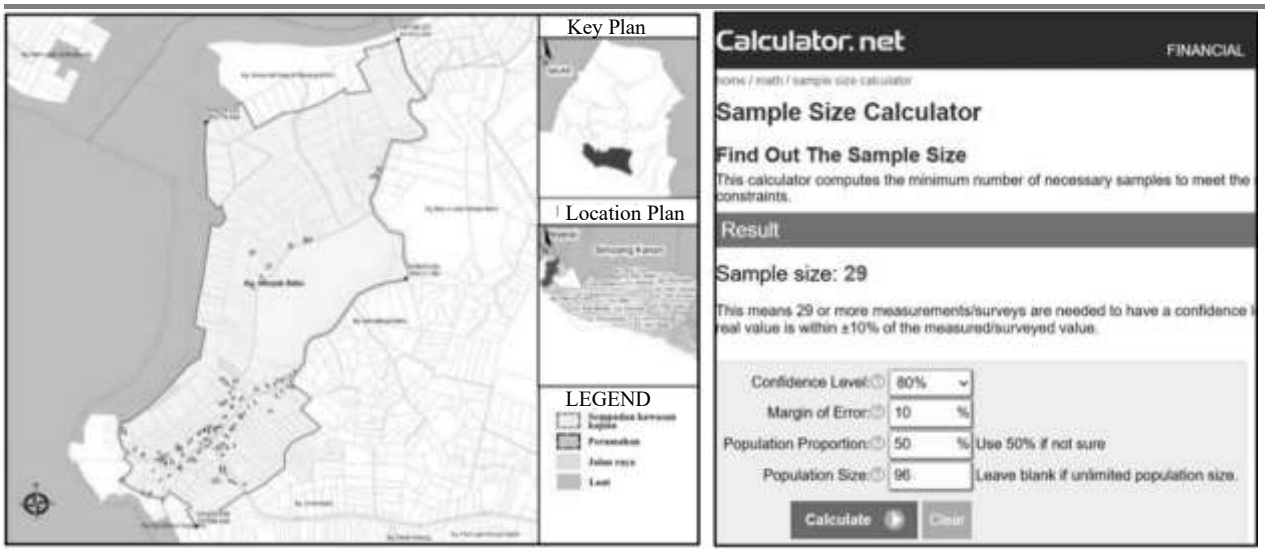

Figure 2. (Left) Map of study area, Minyak Beku village of Batu Pahat District (Source: SCHARM, accessed on 19/07/2026); (Right) sample size calculation (Source: https://www.calculator.net/sample-size-calculator.html)

Questionnaire Design and Data Collection

Data were collected using a structured questionnaire developed around the research objectives and five literature-informed dimensions of rural shrinkage: economic, social, physical/environmental, institutional and digital readiness. Section A recorded respondent and household characteristics through 12 questions. Section B comprised 25 indicators, with five indicators assigned to each dimension and assessed using a five-point Likert scale. Section C evaluated ten proposed smart-shrinkage strategies, followed by two open-ended questions inviting respondents to identify the village's principal challenges and preferred solutions. The indicators were intended to capture both perceived vulnerabilities and conditions that could provide capacities for local adaptation. To ensure consistent interpretation, positively worded statements were reverse-coded using the transformation revised score = 6 − original score. For example, a response of 5 (strongly agree) to the statement concerning stable internet coverage was converted to 1, indicating low perceived digital-related shrinkage. Conversely, negatively worded indicators, such as limited youth involvement in village leadership, retained their original values. A higher final score therefore indicated more severe perceived shrinkage.

The questionnaire also asked respondents to assess village conditions retrospectively, using the period preceding the Kampung Angkat MADANI programme as a reference point and comparing it with their perceptions of current conditions. Importantly, both assessments were obtained during a single survey rather than through independent baseline and follow-up surveys. The resulting comparisons represent recalled perceptions of change and may be influenced by memory limitations and respondents' subsequent experiences. They should not be interpreted as objective measurements of change or evidence of causal programme effects. Field visits and photographic documentation provided contextual information concerning the village environment and available facilities. These observations supplemented the survey but were not analysed as an independent observational dataset.

Data Analysis and Interpretative Limitations

The study used descriptive statistical analysis to summarise respondent characteristics, rural-shrinkage indicators and preferred smart-shrinkage strategies. Frequencies and percentages were used for categorical responses, while mean scores were calculated for the Likert-scale indicators. The five-dimensional scores were derived from the unweighted averages of their respective indicators. Following reverse coding, higher values indicated more severe perceived shrinkage. Mean scores were interpreted using five descriptive categories: 1.00–1.80 (none), 1.81–2.60 (minimal), 2.61–3.40 (moderate), 3.41–4.20 (serious) and 4.21–5.00 (very serious). These categories were employed as descriptive interpretative aids rather than independently validated diagnostic thresholds.

Responses to the two open-ended questions were summarised into thematic categories relating to community challenges and preferred interventions. The analysis reported the frequency and percentage of responses within these categories, providing complementary evidence for interpreting community priorities. These qualitative summaries are treated as supplementary exploratory findings rather than results from a separately designed qualitative study. The interpretation acknowledges several limitations, including the small purposively selected sample, unequal representation of age groups, reliance on self-reported perceptions and potential recall bias. Furthermore, the study did not incorporate a comparison village or a longitudinal evaluation design. Consequently, the analysis focuses on identifying locally perceived shrinkage patterns, adaptive capacities and community priorities without drawing population-level statistical or causal conclusions.

RESULTS AND DISCUSSIONS

Respondent Characteristics and Socioeconomic Transitions

The respondent profile provides important contextual evidence of the demographic and livelihood challenges affecting Kampung Minyak Beku. Of the 29 respondents, 44.8% were aged 51–65 and another 13.8% were above 65, while only 6.9% were aged 19–30. Most respondents (82.8%) had resided in the village for more than 20 years, providing perspectives informed by prolonged familiarity with local conditions. However, the relatively low representation of younger residents also highlights a sampling limitation: the respondents' age distribution should not be interpreted as representative of the village population. More than half of the surveyed households (15 of 29) reported having at least one family member living outside the village. Among these households, 86.7% identified employment as the principal reason for out-migration. This finding suggests a perceived connection between limited local livelihood opportunities and the departure of working-age household members. Nevertheless, the survey cannot establish the village-wide extent or rate of population decline.

Retrospective assessments of employment and household income provide further evidence of socioeconomic pressures. The reported proportion of respondents engaged in fishing declined from 24.1% to 17.2%, while private-sector employment decreased from 17.2% to 10.3%. Meanwhile, respondents reporting retirement increased from 0% to 10.3%. The proportion reporting monthly income between RM2,501 and RM4,850 also declined from 34.5% to 13.8%. Although these changes reflect respondents' recollections rather than independently verified employment or income records, they suggest increasing livelihood vulnerability among participating households. Taken together, these findings indicate that perceived rural shrinkage in Kampung Minyak Beku involves interconnected demographic and economic pressures. This interpretation is consistent with previous research linking rural out-migration, limited employment opportunities and declining local economic functions (Johnson & Lichter, 2019; Li et al., 2023). However, the available evidence supports a case-specific interpretation of these relationships rather than establishing a causal sequence or representative village-wide trend.

Demographic–Economic Pressures and Differentiated Patterns of Rural Shrinkage

Table 2 indicates an uneven pattern of perceived rural shrinkage across the five analytical dimensions. Social shrinkage recorded the highest current mean score (4.56), followed by economic shrinkage (4.26), physical/environmental shrinkage (3.19), institutional shrinkage (2.63) and digital-related shrinkage (1.63). These results suggest that respondents perceived demographic and livelihood pressures as more pronounced than deficiencies in institutional functioning or digital access. Within the social dimension, population ageing (4.83), declining household size (4.72), population decline (4.59) and reduced community participation (4.34) were among the most strongly perceived concerns. The economic dimension reinforced this pattern, particularly youth out-migration for employment (4.86) and limited village employment opportunities (4.62). Their simultaneous prominence suggests that demographic renewal and livelihood development should be treated as interconnected planning priorities rather than separate intervention areas.

The physical/environmental dimension presented a more differentiated pattern. While respondents reported comparatively low current concerns about vacant housing (2.28) and infrastructure deterioration (2.28), housing maintenance (4.03) and environmental problems (4.21) remained significant concerns. This distinction

suggests that satisfactory public infrastructure does not necessarily imply the absence of household-level vulnerabilities or environmental management challenges. Institutional conditions similarly combined perceived strengths and weaknesses. Favourable assessments of village development planning (1.52) and resident involvement in planning (1.31), following reverse coding, contrasted with pronounced concerns about limited youth participation in leadership (4.76) and low attendance at community meetings (4.00). Consequently, institutional capacity should not be treated as uniformly strong. Existing administrative arrangements may provide a useful foundation for rural adaptation, but leadership renewal and wider participation remain important challenges.

Table 2. Comparison of perceived rural shrinkage indicators before and after the Kampung Angkat MADANI program (n = 29)

Dimension	Rural shrinkage indicator	Mean before	Mean after	Shrinkage severity (after)
Economic	1. Declining household income	2.34	4.00	Serious
	2. Decreasing agricultural/livestock productivity	2.52	3.97	Serious
	3. Decline in local businesses	3.10	3.83	Serious
	4. Limited village employment opportunities	3.76	4.62	Very serious
	5. Youth out-migration for better employment	3.97	4.86	Very serious
	Dimension mean	3.14	4.26	Very serious
Social	6. Declining village population	3.31	4.59	Very serious
	7. Increasing proportion of older residents	3.55	4.83	Very serious
	8. Decreasing household size	2.79	4.72	Very serious
	9. Declining participation in community activities	3.07	4.34	Very serious
	10. Weakening community social relationships	2.76	4.34	Very serious
	Dimension mean	3.10	4.56	Very serious
Physical / environmental	11. Increasing vacant or unoccupied houses	2.10	2.28	Minimal
	12. Increasingly uncultivated agricultural land	2.24	3.17	Moderate
	13. Deteriorating infrastructure and public facilities	3.14	2.28	Minimal
	14. Poor housing maintenance	2.45	4.03	Serious
	15. Increasing environmental problems	2.79	4.21	Very serious
	Dimension mean	2.54	3.19	Moderate
Institutional	16. Effective village development planning [R]	2.83	1.52	None
	17. Limited youth involvement in leadership	2.83	4.76	Very serious

	18. Efficient delivery of public services [R]	2.55	1.55	None
	19. Resident participation in development planning [R]	2.03	1.31	None
	20. Low attendance at village/community meetings	3.10	4.00	Serious
	Dimension mean	2.67	2.63	Moderate
Digital readiness	21. Stable internet coverage [R]	3.03	2.00	Minimal
	22. Digital skills among residents [R]	2.90	1.59	None
	23. Household access to digital devices [R]	2.59	1.41	None
	24. Use of digital payments and services [R]	3.00	1.59	None
	25. Use of digital technology in daily life [R]	2.66	1.55	None
	Dimension mean	2.84	1.63	None

Notes. All values are descriptive Likert means (1–5) reported in the PSM; higher scores indicate more perceived shrinkage. [R] denotes positively worded items reverse-coded as 6 − original score. Severity refers to the AFTER mean only: 1.00–1.80 = None; 1.81–2.60 = Minimal; 2.61–3.40 = Moderate; 3.41–4.20 = Serious; 4.21–5.00 = Very serious. Dimension means are the unweighted average of five indicator means.

“Before” and “after” are respondents’ retrospective ratings collected during one survey, not observations from a longitudinal or controlled programme evaluation.

Retrospective ratings also suggested more favourable current perceptions of certain infrastructure and digital conditions than of demographic and economic circumstances. Nevertheless, the before-and-after comparisons were collected through a single survey and are vulnerable to recall bias. They should therefore be understood as perceived changes rather than verified trends or demonstrated effects of the Kampung Angkat MADANI programme. The principal analytical finding is that Kampung Minyak Beku exhibits differentiated vulnerabilities and potential adaptive capacities. Rather than responding to every dimension through uniform physical investment, smart-shrinkage planning should prioritise demographic renewal, livelihoods and environmental management while examining how existing institutional and digital resources can support locally appropriate adaptation.

Community-Identified Challenges and Smart-Shrinkage Priorities

The two open-ended questionnaire items provide supplementary evidence concerning respondents' principal concerns and preferred interventions. The study grouped responses into thematic categories and reported their frequencies. These findings help contextualise the structured survey, although the original individual responses and detailed coding records would be required to verify the consistency of theme assignment. Youth and demographic concerns formed the largest category of reported village challenges (11 responses; 37.9%), followed by economic issues (6; 20.7%). Social concerns and fisheries/agricultural issues each accounted for four responses (13.8%), while tourism-related concerns accounted for three (10.3%) and infrastructure/marketing for one (3.4%). The prominence of demographic and economic themes is broadly consistent with their higher mean scores in the multidimensional assessment.

The open-ended proposals displayed a similar emphasis. Demographic regeneration and human capital development received the largest number of categorised responses (12; 41.4%), followed by local economic diversification and resilience (7; 24.1%). Productive transformation of local resources and asset-based rural rejuvenation each accounted for three responses (10.3%), while adaptive infrastructure management and community cohesion each accounted for two (6.9%). These patterns suggest that participating residents

considered youth engagement, employment and the productive use of local resources to be important components of village renewal. However, the frequencies indicate the relative prominence of themes among respondents rather than their prevalence across all village households.

The structured strategy assessment provides further insight into local preferences. As shown in Table 3, all ten proposed actions recorded mean scores above 4.00, indicating strong support among surveyed respondents.

Table 3. Community-prioritised smart-shrinkage actions in Kampung Minyak Beku (n = 29)

Proposed action	**Mean**	**Strategic purpose**
1. Resident participation in village development planning	5.00	Strengthen community ownership and locally informed decisions
2. Youth involvement in leadership and planning	4.79	Develop future leadership and increase youth engagement
3. Collaboration among JPKK, NGOs and government agencies	4.76	Improve institutional coordination and resource mobilisation
4. Optimise existing public facilities	4.72	Improve the utilisation of existing community assets
5. Improve internet coverage and quality	4.69	Strengthen connectivity and access to digital opportunities
6. Right-size village infrastructure	4.66	Align infrastructure provision with local needs and available resources
7. Provide digital-literacy training	4.62	Develop capabilities for using digital tools and services
8. Reuse idle land for agriculture or community projects	4.45	Restore productive functions to underutilised local assets
9. Strengthen community activities and gotong-royong	4.28	Support social cohesion and community participation
10. Expand local entrepreneurship programmes	4.17	Diversify livelihoods and strengthen local enterprise capacity

From the above table, the highest-rated action was greater resident participation in village development planning (5.00), followed by youth involvement in leadership (4.79) and institutional collaboration (4.76). These priorities indicate strong support for participatory and institutionally coordinated approaches. Importantly, the prominence of community governance does not imply that existing participation mechanisms are sufficient. Instead, it suggests that respondents value greater involvement in shaping future development decisions. The findings also favour a selective approach to infrastructure investment. Strong support for facility optimisation (4.72) and right-sizing (4.66) is consistent with smart shrinkage's emphasis on adapting development to changing settlement needs. However, right-sizing should be understood as improving the appropriateness and efficiency of service provision, not automatically reducing essential facilities.

Digital Readiness: From Connectivity to Socioeconomic Benefits

Digital readiness recorded the lowest perceived shrinkage score (1.63), indicating relatively favourable respondent assessments of internet access, digital devices, skills and everyday technology use. Nevertheless,

favourable perceptions of digital conditions should not be interpreted as evidence that technology has already improved employment, business performance or household income. A critical distinction is needed between digital availability, effective digital participation and measurable socioeconomic outcomes. Access to internet services and digital devices represents an enabling condition, while the development of practical digital competencies determines whether residents can use these resources productively. Potential applications include online marketing of local products, digital payments for small enterprises, tourism promotion, access to agricultural or fisheries information, and electronic public services. However, the study did not measure changes in sales, employment, digital earnings or service outcomes associated with such activities.

The relatively high priority assigned to improving internet quality (4.69) and digital-literacy training (4.62) further suggests that favourable general perceptions of digital readiness coexist with demand for improvements. This distinction is important for policy whereby; digital provision should be connected to identifiable livelihood and service needs rather than treated as a development outcome in itself. For Kampung Minyak Beku, the practical implication is to combine digital training with targeted economic and community initiatives, particularly youth entrepreneurship, local product marketing and community-based tourism. Future evaluations should assess not only connectivity and participation in training but also business adoption, market access, employment opportunities and measurable improvements in residents' access to essential services. Overall, the findings support a smart-shrinkage approach that uses existing institutional and digital capacities to address more pronounced demographic, economic and environmental vulnerabilities. Nevertheless, the proposed relationships between these capacities and sustainable rural rejuvenation remain planning propositions requiring further implementation and evaluation.

Planning and Policy Implications: Towards Capacity-Sensitive Rural Rejuvenation

The findings suggest that smart-shrinkage interventions in Kampung Minyak Beku should prioritise demographic and economic vulnerabilities while mobilising existing community resources. Social and economic shrinkage recorded the highest perceived severity, whereas institutional and digital conditions were comparatively favourable, although neither was free from weaknesses. This differentiated pattern indicates that rural rejuvenation should not depend primarily on further physical expansion. Instead, planning efforts should address youth participation, livelihood diversification and the productive use of local assets through coordinated community and institutional action. A phased implementation approach is proposed to translate these priorities into practical interventions. In the short term, emphasis should be placed on strengthening participatory village governance, youth representation and baseline information concerning livelihoods, land and community facilities. These measures would provide the institutional and informational foundation for subsequent interventions. Medium-term actions should focus on targeted entrepreneurship programmes, digital skills development, fisheries and agro-based livelihood diversification, and adaptive reuse of underutilised assets. Over the longer term, attention should shift towards sustaining viable enterprises, strengthening leadership succession and maintaining accessible public services in accordance with changing community needs.

Importantly, the relatively favourable perceptions of digital readiness should be treated as potential enabling conditions rather than evidence of successful digital transformation. Digital interventions should therefore connect training and connectivity improvements with measurable economic and service-related outcomes, including active business participation, market access and improved access to public services. Similarly, infrastructure right-sizing should prioritise the effective utilisation and maintenance of essential facilities rather than withdrawing services from an ageing population. The proposed approach also requires institutional coordination. Village leadership and community representatives can identify priorities and mobilise participation, while local authorities and relevant government agencies provide technical assistance, planning support and access to eligible development programmes. Potential financing and implementation arrangements should be assessed according to programme eligibility, local capacity and the feasibility of individual projects. Monitoring should distinguish immediate outputs, such as training participation and project implementation, from longer-term outcomes involving employment, enterprise sustainability, social participation and quality of life.

CONCLUSION

This study highlights the multidimensional and uneven nature of rural shrinkage in Kampung Minyak Beku, Johor state, where demographic and economic pressures are more pronounced than physical, institutional and digital challenges. Youth out-migration, population ageing, shrinking household sizes, limited employment opportunities and difficulties in leadership succession emerge as the principal concerns. Nevertheless, comparatively favourable institutional conditions, public service delivery and digital readiness indicate existing capacities that could support rural adaptation. These findings suggest that improvements in physical infrastructure alone may be insufficient to address underlying demographic and livelihood challenges. The study contributes to rural planning literature by applying a multidimensional smart shrinkage assessment within a Malaysian village context and demonstrating the importance of distinguishing between local vulnerabilities and adaptive capacities. From a planning perspective, sustainable rural rejuvenation requires integrated strategies that prioritise community participation, youth empowerment, economic diversification, productive reuse of local assets and appropriate infrastructure optimisation. Rather than pursuing population recovery or physical expansion as the primary measures of success, smart shrinkage emphasises maintaining settlement functionality, community resilience and quality of life under changing demographic conditions. The community-prioritised smart shrinkage actions therefore offer a preliminary planning reference for local authorities and rural development agencies seeking more context-sensitive interventions.

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