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Aims and Scope

Asia-Pacific Journal of Rural Development is a peer-reviewed journal that provides a platform for publication of articles in all areas of rural development. The aim of this journal is to provide a platform for policy makers and academicians to promote, share and discuss various new issues and developments in different areas of rural development. The journal publishes conceptual, empirical and review papers in the form of research articles, reports of ongoing research, analyses of current and topical practice, policy issues relating to rural development field notes and book reviews. The journal is peer-reviewed and adheres to a rigorous double-blind reviewing policy in which the identity of both the reviewer and author are always concealed from both parties.

Subject areas include any thematic areas related to sustainable integrated rural development aligned with Sustainable Development Goals (SDGs). The thematic areas are including but not limited to the following:

- Sustainable use of natural resources
- Management of rural areas in transition
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- Agro processing and rural market
- Rural livelihoods and poverty reduction
- Education and skill development
- Entrepreneurship and financial inclusion
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- Renewable energy for rural consumption
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Article

The Supply-Side Story of Zero Tillage Service Provision in the Eastern Gangetic Plains: Perspectives from Machinery Owners

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Abstract

A vibrant fee-for-hire service provision economy is required in the Eastern Gangetic Plains (EGP) to ensure that resource-poor smallholder farmers can access and benefit from agri-mechanisation. While the literature on sustainable agri-mechanisation (with an emphasis on Conservation Agriculture-based Sustainable Intensification) has focused on the potential impact on farmer livelihoods, there has been a significant gap in understanding the supply constraints that limit the availability of machinery for smallholders. Using a novel qualitative thematic coding approach based on machinery owner experiences, this study aims to fill this gap, highlighting issues around the inclusiveness of current approaches to encourage machinery services provision and the economic viability of doing so. The findings of this study are not only informative but also have practical implications for future work. To address key constraints, we identify five focus areas for future research, alongside the need to explore with communities their preferred methods to access machinery. In doing so, this work enables a more holistic understanding of the next steps to encourage widespread and equitable agri-mechanization across the EGP.

Keywords

Zero tillage, agricultural mechanisation services, agricultural machinery, decision-making dartboard, service providers, Eastern Gangetic Plains

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Introduction

Agricultural mechanization has the potential to help farmers enhance the efficiency of farming operations, alleviate drudgery, improve crop productivity and address labor shortages (Erenstein & Laxmi, 2008; Gathala et al., 2021). However, challenges for widespread adoption persist, particularly among resource-poor smallholder farmers in the South Asia. In South Asia's Eastern Gangetic Plains (EGP), while mechanisation is still limited compared to other regions, the prevalent use of the rotavator has paved the way for a shift towards 'sustainable agri-mechanisation' that balances increased productivity without compromising the sustainability of the longer-term farming system.

To address this, research increasingly emphasises 'Conservation Agriculture-based Sustainable Intensification (CASI)' systems that advocate for minimal or zero tillage (ZT) systems, coupled with crop diversification and stover retention practices, offering multiple benefits to farmers without compromising sustainability. While these practices have long gained traction in larger-scale commercial settings in developed countries, adoption of ZT systems is also growing among South Asian farmers, especially in the western Indo-Gangetic plains in Punjab and Haryana, India (Brown et al., 2018).

Over the past two decades, considerable research and promotional efforts have been active in the EGP, emphasising the numerous benefits that CASI can bring to farmers in the region. These efforts highlight CASI's potential to enhance soil health, agricultural productivity, and food security (Dixit et al., 2019). Additionally, CASI offers a solution to labour scarcity issues, with studies demonstrating its impact on saving time and reducing drudgery for farmers in the EGP (Brown et al., 2021; Chaudhary et al., 2022; Gathala et al., 2021).

In their study, Chaudhary et al. (2022) observed that farmers in the EGP frequently highlighted the advantages of saved time and reduced drudgery as critical benefits of CASI, directly affecting human labour requirements. The benefits of ZT have been well documented in the EGP, ranging from improved soil quality and reduced resource requirements (seeds, water, labour) to the utilisation of extra time for alternative livelihood options (Aryal & Kattel, 2019; Brown et al., 2021; Chaudhary et al., 2022; Erenstein, 2009; Hobbs et al., 2019). Furthermore, Brown et al. (2023) found that CASI farmers diversified their cropping systems, while Chaudhary et al. (2022) observed improved socio-economic conditions, increased community respect and more leisure time for pursuing diverse interests and opportunities among CASI-utilising farmers.

Recognised for its potential, ZT stands out as an agricultural technology gaining momentum in South Asia, supported by governmental and non-governmental initiatives (Gathala et al., 2021; Karki et al., 2021; Timsina et al., 2023). However, despite the emphasis on this commitment, it has not materialised for most smallholders in the EGP (Brown, Paudel et al., 2021). The primary challenge is that farmers in the EGP, who are resource-poor with limited financial and land resources, have difficulty procuring machinery for their farms (Mottaleb et al., 2016; Paudel et al., 2019). This limitation hinders wider adoption, as demonstrated by instances in Nepal where farmers discontinued ZT not due to poor

technology performance but because of a lack of access to machinery (Brown, Paudel et al., 2021; Chaudhary et al., 2023; Keil et al., 2015).

Consequently, resource poor small-scale farmers in the EGP face a critical need for a 'fee-for-hire' machinery economy. Without such a system, the wider adoption of more sustainable agri-mechanisation remains unattainable (Ghimire et al., 2021; Keil et al., 2016). Keil et al. (2015) underscored the importance of service providers in facilitating farmer access to the machinery, emphasising that without them, ZT becomes an inequitable pathway that primarily benefits large and wealthier farmers.

While there is an increasing focus on the benefits of ZT for smallholder farmers in the EGP, there is limited exploration of establishing a supporting network of service providers for smallholder farmers. The economic applicability and profitability of ZT service provision are under-researched, especially in the relatively new context of the EGP (Krishna et al., 2012). Existing literature on ZT service provision in South Asia predominantly concentrated on the comparatively more affluent and production-intensive Western Gangetic plains of India (Landers, 2001; Malik & McDonald, 2019), leaving a noticeable gap in understanding the comparatively underdeveloped EGP. Current research conducted in the EGP, primarily in the Indian state of Bihar, has concentrated on farmers' experiences, with little investigation across the EGP from Southern Nepal to Northern Bangladesh. Brown, Samaddar et al. (2021) are the only qualitative research concentrating on the region's decision processes, attitudes and complexity of ZT service provision. However, it mainly focuses on providing direct seeded rice (DSR) service in two communities in Bihar. Therefore, researching ZT service provision is pertinent in the EGP at present, considering the recent expansion of CASI in the EGP in the last few decades (Gathala et al., 2021), and recent studies in the EGP have only addressed aspects of farmers' experiences (Chaudhary et al., 2022; Chaudhary et al., 2023; Karki et al., 2023; Suri et al., 2023). Thus, service provision of ZT in EGP warrants more research, particularly in the Rabi season when ZT is more likely to be successful than in Kharif, where there are additional complexities such as insufficient rainfall and service providers who were perceived by farmers as unhelpful and unsupportive (Brown, Samaddar et al., 2021).

Recognising this gap, we conducted a targeted qualitative study with ZT machinery owners to understand the processes and constraints they face in providing ZT services in the Rabi season (winter). This study aims to fill the existing gaps in the literature by examining the decision processes and constraining factors that ZT service providers face every day by (a) capturing the ZT service provider perspectives through their learning and implementation processes as well as ongoing business strategies, (b) identifying community perceptions about ZT service provision and (c) analysing how these factors interact and influence upsurge in ZT service provision.

The findings of this article offer valuable insights into improving future interventions that can catalyse ZT uptake. Understanding the experiences and perceptions of individual service providers can help identify enabling actions at national and regional levels, contributing to policy interventions that promote the scaling up of ZT service provision in the EGP. This article will be helpful to policymakers

and development organisations seeking to understand the necessary interventions for enabling sustainable agri-mechanisation among resource-poor smallholder farmers.

Methodology

Technological implementation

In the EGP, ZT can be applied in regions that utilise both two-wheel (Bangladesh) and four-wheel (India and Nepal) tractors. The ZT planter equipment is compatible with each type of tractor, although the attachment methods vary by type (Figure 1). The unifying characteristic for both attachments is eliminating the need for intensive tillage of the soil prior to planting.

Analytical Framework and Questionnaire Module

This research is underpinned by the 'Decision-making Dartboard' (DmD) framework that was applied to explore service provision contexts for DSR in Bihar, India (Brown, Samaddar et al., 2021) and farmer experiences with ZT in the EGP (Chaudhary et al., 2022). The DmD framework stems from the 'Livelihood Platforms Approach' (Brown et al., 2017), which has been used to explore the decision-making contexts of farmers throughout Africa (Anibaldi et al., 2021).

A question schedule was created based on the DmD framework to explore the different resources and functional levels that impact respondents' decision-making. The semi-structured question schedule consisted of seven distinct modules.

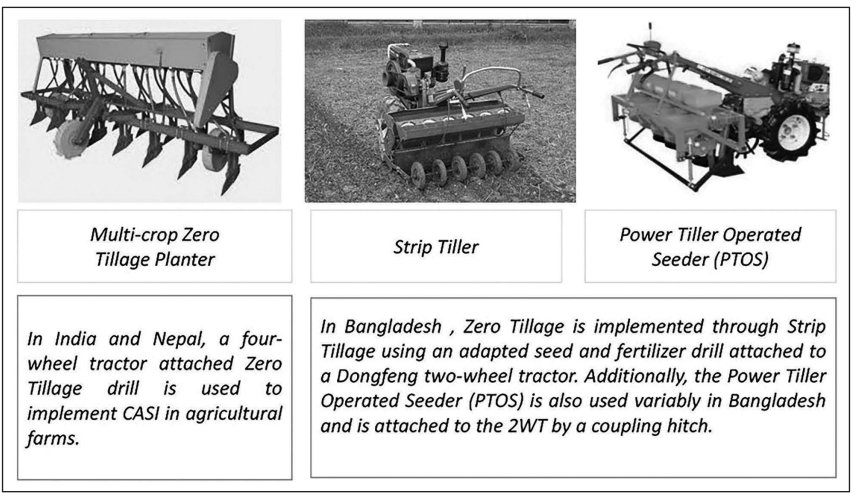


Figure 1. Three CASI Machinery Investigated in This Study.

Photo credit: Israil Hossain, CIMMYT

Note: (Left to right) the multi-cop ZT planter, strip tillage machine, and power tiller operated seeder.

Module 1 collected primary demographic data using KoboCollect software. The remaining modules focused on different elements influencing the decision to provide ZT services to farmers in their communities. Modules covered significant decision points, including the respondent's agricultural identity and future aspirations, learning processes, livelihood constraints, ZT perceptions and ZT support structures. To focus on ZT service provision, particular emphasis was placed on exploring the context of community support, demand and context.

The schedule was designed with adaptability, meaning the interview focused on the respondent's key decision-making processes while being unified in analysis by the DmD framework. To enable later analysis, the question schedule explored all 24 elements of the DmD framework. The core objective was to enable respondents to explore their service provision experiences related to ZT machines holistically, including constraints and drivers of ZT uptake within their communities.

Study Locations and Respondents

This study was implemented across six selected study locations based on a thorough pre-screening process related to CASI project interventions present in the EGP since 2013. Gathala (2021) provides the methodology of selecting each location (based on agroecological suitability for CASI) alongside the results of more than 400 trials conducted with farmers to justify the performance of CASI at selected locations. All five selected locations (Cooch Behar and Malda in India, Rajshahi and Rangpur in Bangladesh, and Sunsari in Nepal) had substantial ZT research and extension activities implemented in communities since 2014.

Within each identified location, a purposive selection of communities sought a diversity of user typologies of ZT machinery in Rabi season. Three types of communities in each location were targeted to ensure a diversity of respondent types: one high-adoption community, one comparatively low-adoption community and one recent adoption community. Given the purposive sampling, each of the identified machinery owners in this analysis had at least minimal demand that would warrant service provision across each location.

This work is part of a more extensive study exploring the constraints to farmers' uptake of ZT systems. The overall study aimed to capture a variety of different farmer typologies along the different stages of the process of adoption based on the 'Stepwise Process of Mechanisation Framework' (Brown, Paudel et al., 2021) and the 'Process of Agricultural Utilisation Framework' (Brown et al., 2017). This was done to ensure that the experiences and constraints of various stages within an adoption process were captured to inform broader implications in increasing CASI scaling efforts. This larger dataset consists of 288 interviews, which form various typologies.

Within a snowball sampling methodology (see Chaudhary et al., 2022), farmers from various ZT user typologies who had been interviewed were asked to identify their service providers for this sub-study. In-depth qualitative interviews were then conducted with identified machinery owners. During this process, 30 service providers were identified. It should be noted that the methodology is not

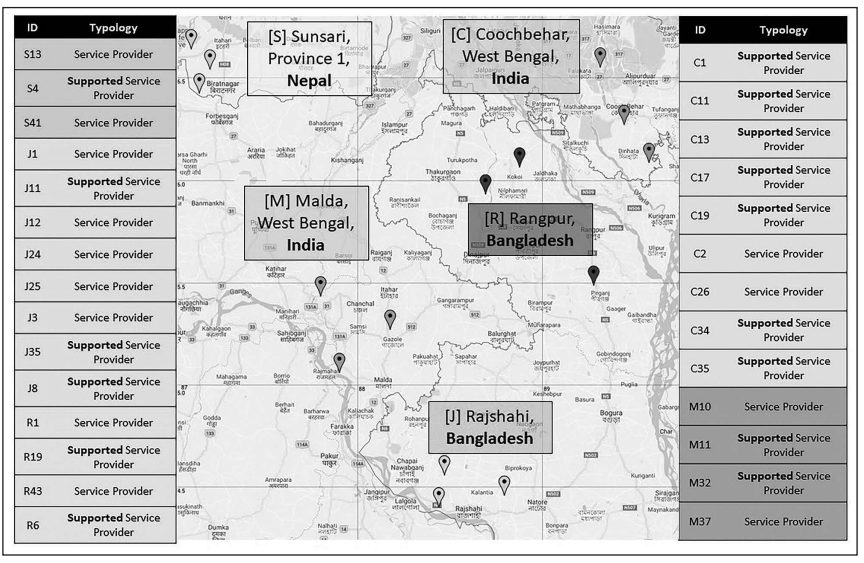
intended to represent communities; rather, it is meant to reflect a range of experiences that have occurred in the communities studied.

Survey Implementation

This study delves into the experiences and perceptions of farmers currently providing ZT services to other farmers in their surrounding communities in the 2019 Rabi (winter) season. Some identified service providers were also supported by projects promoting the adoption of CASI to become service providers. Respondents were classified as either supported service providers (marked as TSP for 'Trial Service Providers' in quotation ID) or unsupported service providers in line with the process of agricultural mechanisation framework (Brown, Paudel et al., 2021) to have a nuanced understanding of their respective experiences.

In this study, unsupported service providers have self-invested in their business and were not receiving ongoing financial support from the government or projects. In contrast, supported service providers are the operators currently receiving financial support from projects or the government. A total of 29 respondents were identified as ZT service providers across five locations: 8 in Rajshahi, 4 in Rangpur, 10 in Cooch Behar, 4 in Malda and 3 in Sunsari (Figure 2). These 29 respondents came from 14 communities, and their recordings were of 19 hours and 18 minutes of the interview.

Five enumerators were comprehensively trained in qualitative semi-structured data collection and assigned to different locations based on their language skills. All undertook the same training and were guided by a single lead enumerator who



ID	Typology
S13	Service Provider
S4	**Supported** Service Provider
S41	Service Provider
J1	Service Provider
J11	**Supported** Service Provider
J12	Service Provider
J24	Service Provider
J25	Service Provider
J3	Service Provider
J35	**Supported** Service Provider
J8	**Supported** Service Provider
R1	Service Provider
R19	**Supported** Service Provider
R43	Service Provider
R6	**Supported** Service Provider

ID	Typology
C1	**Supported** Service Provider
C11	**Supported** Service Provider
C13	**Supported** Service Provider
C17	**Supported** Service Provider
C19	**Supported** Service Provider
C2	Service Provider
C26	Service Provider
C34	**Supported** Service Provider
C35	**Supported** Service Provider
M10	Service Provider
M11	**Supported** Service Provider
M32	**Supported** Service Provider
M37	Service Provider

Figure 2. Survey Locations Along with Interview ID and Typology.

provided guidance and support as needed during the data collection process and to ensure standardisation of implementation across the study locations. All interviews were conducted and recorded in local languages to ensure fluid discussion and accurate exploration of concepts and themes. All interviews were recorded with the consent of participating respondents. Surveys occurred from August 2019 to December 2019, after Rabi planting but before Rabi harvest, to reduce any recall bias in responses.

Analytical Tools

Demographic information was summarised using Microsoft Excel, while all cleaned English transcripts were analysed in Dedoose qualitative software (Dedoose.com) and thematically coded using the DmD framework. A separate analysis process was followed compared to the farmer-level study in Chaudhary et al. (2022) due to the difference between ZT farmers and ZT service providers. A codebook based on the DmD was developed with the following parent codes: Evaluation of Service Provision, Evaluation of ZT, Procurement of ZT machinery, Evaluation of ZT Service Provision, ZT perception in the Community and Generic Constraints. The codebook included 24 additional child codes that explored the perceptions, inputs and influences on the supply of agricultural services (e.g., information systems, business strategy and implementation requirements) along with broader service provider-defined influences (motivation and experience, support network and government influence). In total, 1,819 excerpts were coded to the 24 themes defined by the codebook. The results are summarised with representative quotations of identified themes and concepts. Representation of results follows a unique identifier that associates location and interview number (e.g., M21 references to Malda interview number 21).

Results and Findings

All 29 service providers were male, with an average age of 40. Almost all respondents had received some form of primary education or higher, with only 2 identifying as illiterate. Over half of the respondents had completed higher secondary school. Respondents came from diverse religious backgrounds, including Christian, Muslim and Hindu households, and Other Backward Castes (OBC) and Scheduled Tribes (ST).

Most service providers had previous training in ZT services, averaging 4.5 years of ZT experience (ranging from 1 to 12 years), with only four service providers noting no prior training. During the Rabi season of 2019, each respondent provided ZT services to 48 customers, cultivating 31.5 hectares of land per service provider. Additionally, they cultivated 7.78 hectares per service provider of personal land using ZT in Rabi 2019. Eleven service providers had purchased ZT drills themselves, averaging 3.5 years since purchase, while others accessed the ZT drills through either group ownership via farmers clubs, village groups or cooperatives or provided by agricultural development projects.

Machinery Performance, functionality, and Spare parts Availability

Respondents expressed concerns about the performance of ZT machines, regardless of whether they were attached to two- or four-wheel tractors. A reoccurring issue was the inconsistency in reliable seed drop, particularly within—not uniform seed sizes such as maize (e.g., 'The seeds should fall equally, and there should not be any gaps in between. This happens mostly in the case of maize. It does not happen for wheat and mustard' R1 [SP]). Ensuring suitable conditions for successful implementation also posed challenges when integrating ZT with other CASI elements such as stover retention (e.g., 'In dry fields we have to run the tractor very slowly. If there is too much stover, we have to lift the ZT machine and remove the stover from time to time' S4 [TSP]) or where soil moisture was not ideal (e.g., 'ZT machine cannot work in an excessive wet ground … The tyres get jammed' M37 [SP]). To mitigate these issues, ZT service providers in four-wheel tractor locations often recruit an extra employee to monitor the machine's performance from behind the machine, for example,

> When you start the tractor, you have to keep a person at the back of the tractor. He observes whether the seeds and the fertilizers are falling or not. Sometimes, mud gets stuck in there. We give him a stick and tell him to hit the pipes occasionally. S13 [SP]

In Bangladesh, for two-wheeled tractors, there were common concerns about the tiresome nature of walking behind the tractor, which limited overall functionality. Since service provision often involves traveling to dispersed locations on foot, this was an exhausting experience, for example,

> The problem with this strip-till machine is that you have to walk with the machine. Not only when you operate and use the machine, but also when it has to be taken to another village … there is no other way to take it but walk. J35 [TSP]

Concerns were also raised regarding the functionality of four-wheeled tractors, particularly on small fields where multiple turns were necessary. Inefficient processes in such scenarios could lead to time-consuming implementation of ZT and potential gaps in planting areas, resulting in unsatisfactory plantation for customers, for example,

> If the corners of the field are left barren while sowing with ZT machine then they will not be happy, they will suffer a loss of 20 kg...We have to keep these things in mind when operating the ZT machine so that there are no gaps anywhere in the field. S41 [SP]

Combining perceptions of machinery performance and functionality led many to conclude that the ZT machinery was unsuitable for local needs and conditions.

Most respondents highlighted the difficulty of finding necessary spare parts for their machinery, a challenge that was particularly pronounced in Sunsari and Bangladesh. These respondents indicated the need to travel substantial distances to obtain the required parts for regular repairs of the ZT machine (e.g., 'Machine

parts are not available here in the village. If any part breaks down, then we have to go to the Rajshahi Town office to get the replacements' J35 [SP]).

Financial and Human Resource Constraints

Machinery Procurement

As machinery owners, respondents from India and Nepal were generally aware of the availability of subsidies and loans provided by government offices to purchase ZT machines for service provision (e.g., 'We got to know about this from the agricultural development office; we have to invest 35% [as a Custom Hiring Centre {CHC}], and the rest would be lent out by the government' C19 [TSP]). However, the availability of loans and subsidies was perceived as insufficient to incentivise machinery purchases. There was an understanding, particularly among unsupported service providers, that these subsidies were unlikely to enable them to become unassisted machinery owners because the ZT implement was a relatively small investment compared to the purchase of tractors to which the ZT implements had to be attached (e.g., 'The price of the tractor is sky high. If we want to buy a tractor, we must spend at least 9 lakh rupees to 10 lakh rupees. But to buy the ZT machine we need a small amount of money' C34 [TSP]). To offset the high expense of tractor ownership, some respondents in West Bengal opted for group ownership through farmers clubs and village groups (e.g., '[ZT] maize production was good that year. After that, everyone wanted to buy the ZT machine. Through the farmers club, we bought the machine together' C2 [SP]).

Economic Returns

Respondents were split on the financial benefits that came from ZT service provision. Some identified that providing these services was transformational to their livelihoods, for example,

> We had a house made of mud before, but now we have a concrete house … I have also bought two bigha land. I spent my money building a shop and bought products for that shop. I educated my children, got them married, and spent a lot of money. All of this started from my ZT service provision business. J1 [SP]

A more complex financial landscape emerged, with loan repayment protocols being frequently highlighted as a common issue (e.g., 'If he doesn't earn one day, then the 12-13 lakhs worth loans that he has taken to buy the tractors will become more and more difficult to repay' R43 [SP]). Often, the return on investment for ZT machinery was perceived as limited (e.g., 'I didn't make much profit with this [ZT] machine' J25 [SP]). A common reason cited for this was the restricted operational timeframe for the machine, mainly associated to the sowing season (e.g., 'If they provided such a machine which I could drive for 12 months then I wouldn't have had any problem' R6 [TSP]). For certain supported service providers, financial viability was further constrained by requirements to offer services as reduced costs to farmers from supporting organisations (e.g., 'Sir from agricultural offices

told me that as they have given the ZT machine to me, I should serve the people for a little amount of money. That is why I provide this service' J11 [TSP]).

Economic performance was also often discussed compared to other economic uses of the tractor compared to ZT. For instance, respondents in Bangladesh often preferred allocating their machine to the power tillage implement, which was viewed as more profitable (e.g., 'I have a power tiller of my own, and I use it to till the lands for farmers. With that, I also provide services for tillage for wheat and other crops; I till for people in exchange for money' J12 [SP]). The narrative of tillage as a stronger economic performer was strongly prevalent when comparing the number of passes that could be charged to farmers in any plot, which was multiple for conventional tillage and once for ZT, for example,

> Farmers that own tractors can use this ZT machine, but they are not buying because they see that if tractor does tillage four times, then they get paid for four times work. It would kill their livelihood if they could till only once with ZT. M32 [TSP]

Accessing Landlocked Customers

The location of land that customers had was also commonly identified as a constraint to the provision of ZT services. If the respondents cannot reach viable ZT customers because adjacent plots block off their land, they potentially lose out on customers and related profits. In West Bengal, where land was not road adjacent, other farms often blocked machinery access to customer plots (e.g., 'This year some farmers in our area could not use ZT because they delayed in harvesting their previous crops … We can't enter their fields with our machines since it would affect the crops of other farmers in the adjacent plots' M10 [SP]). To ensure access to all customer's plots and reduce transit time, respondents in Cooch Behar scheduled service provision timings based on specific cropping seasons (e.g., 'The way we set up our schedule is by listing the place we must go on a particular day, we also plan our estimates similarly' C1 [SP]), and this helped service providers manage demand (e.g., 'I write the time and date in my notebook, that our machine will be going to a particular place on a particular day. It cannot go to all the different places at the same time' C2 [SP]).

Reliable Operators

Respondents indicated that there tended to be a shortage of skilled operators and a lack of after-sales services that influenced their decision to provide agricultural services (e.g., 'One problem is that I can fix the power tiller by myself and whatever part goes bad, I can find it within my reach, but for this ZT machine, there is no expert mechanic in the locality yet' J11 [TSP]). Where operators were available, there was often a distrust of them and their skills to correctly implement ZT (e.g., 'Operators are having trouble because they do not know how to use it [ZT]. I teach them whenever I go there, and they do well. However, they start being careless when I depart until I return' S4 [TSP]). Respondents often then feared that these issues with the operators might damage their machines (e.g., 'If we hire drivers, then they drive carelessly. They take the tractor here and there. Sometimes they might end up causing damage to the machine' S4 [TSP]) that could

potentially create financial losses for respondents. To tackle this issue, respondents frequently enlisted skilled operators from different communities, notably in India (e.g., 'We did not have a driver. There was no good field worker. They came from very far' C34 [TSP]) who they felt were more skilled and therefore trustworthy.

Informational Resource Constraint

Personal Information Systems

Respondents across the regions knew they were well connected with information sources outside the community. Nearly all respondents had strong ties with extension services (e.g., 'At first, I go to the farmer's club and ask the technicians there or discuss it with the people who are there' M37 [SP]). This connectivity enabled respondents to serve as conduits for neighbouring farmers to access information sources (e.g., 'He [a community farmer] also comes seeking advice, and if I have information, I provide him. If I can't help him, I ask him to go to the Agriculture Development Office or meet the scientists, and we can get the correct information from there' M32 [TSP]).

Many respondents emphasised that access to information sources, which enabled them to offer ZT services, acted as a catalyst for changing their status within the community (e.g., 'The other farmers did not come earlier [for information]. They started coming to me after I became a ZT service provider' C11 [TSP]). Respondents often perceived that community members now saw them as important knowledge holders (e.g., 'The farmers from our area see me in a different perspective now. Many times, if there is any problem in the farmers field, they directly come to my place' C2 [SP]), and that had elevated the respect the community had for them (e.g., 'People have started to respect me more because I have shown them a right path and given the right advice. Even if I cannot advise them correctly, I tell them where to go or where they will get the necessary and correct information' M32 [TSP]).

Convincing Customers

Respondents observed increased demand due to recognising the positive performance associated with ZT(e.g., 'People have noticed that the production is good, less time is required, working in the field is convenient, fewer labourers are required … Everyone has started to trust this. Now, agriculture is done using ZT' C35 [TSP]). Despite farmers' positive perceptions, respondents noted that the broader community still harboured distrust toward ZT practices (e.g., 'I have to use the technique to show to beginners that ZT works. A lot of them are sceptical as to how crops can be cultivated without tilling the land' M32). Respondents identified a need for further sensitisation based on demonstrations, for example,

> I think there needs to be practical trials. For example, if I am doing strip tillage, I will first have to take some land from the farmers and do strip tillage there as a trial. We have to call the farmers and show how it is done so they can adopt it themselves. J35 [TPS]

> I provided service to 20 farmers for the first time. Initially, before applying the ZT machine, we provided them with a demonstration and showed that crops can be produced even without tilling the field … That demonstration helped us gain their faith in this method. They understood this would give them a good harvest. M10 [SP]

Subsidies were also consistently mentioned as a requirement to stimulate initial uptake by potential customers (e.g. 'The first time we used strip tillage, for showing people our company paid the price and if God wills, this time we will rent it out' R19 [TSP]; 'Later on, I managed to convince them to try by saying that the agriculture office would provide them with the seeds and fertilizers along with the hire charge of the tractors' S41 [SP]).

Discussions

Respondents in this study identified challenges they encountered when providing ZT services, offering fresh insight into what may be done to ease constrained service supply in the EGP. While considerations exist across the four resource types investigated (physical, human, financial and informational), it appears that there is a common narrative that weaves together for the ultimate evaluation that ZT service provision is not possible unless structural changes help foster a more enabling environment for service provider economies.

The first finding of this study is that respondents did not find informational resources to be a limiting factor when providing services. They found themselves in a position of high connectivity and perceived themselves as key information sources for others in the community. This gave them the confidence to promote their services in the community, often backed with additional project-oriented support structures. However, given that informational resources for most farmers in the EGP are limited as per previous studies (Keil et al., 2017), this poses a considerable constraint to the emergence of new service providers and the inclusiveness of the service providers economy. If only farmers with strong existing networks who are well connected continue to become service providers, it potentially creates inclusivity issues, as identified by Keil et al. (2015). This issue can limit new economic opportunities only to those already relatively well off, with additional considerations of how those might only service some subsets of their community and not others, primarily based on caste, as identified by Brown, Paudel et al. (2021). Overall, this would question how inclusive promoting an individual-based service provision economy is and thus raise valid questions on whether government-sponsored machine hiring centres or CHCs may be a comparatively more inclusive option (despite known and likely issues with such structures).

Outside of informational resources, respondents in this study identified issues with physical, financial and human resources and how these can all be linked to a unifying and underlying query that respondents posed: Is ZT service provision profitable? The results of this study also find that uncertain economic returns were a deterring factor in investing in ZT machinery and subsequently partaking in its

service provision. While some respondents raised the fact that they found ZT service providers to be catalytic to their livelihood status, most respondents identified key issues related to financial viability. The key issues leading to this query are complex upfront and repayment costs, hiring scarce extra operators, unproductive machinery downtime and a limited customer base (orange, blue, yellow and green in Figure 3, respectively). This combined and compared poorly with other activities that could use the tractor for more profitable activities (black, Figure 3). While often not explicitly expressed by respondents, this raises substantial questions on whether providing ZT services to small-scale farmers in the EGP can be a profitable business venture.

Such findings conflict with prior studies that reflect the region's theoretical financial profitability of ZT service provision. For example, Kiel et al. (2017) identified the theoretical profitability of ZT SP in Bihar, India. The difference in findings likely reflects a broader capture of implications of ZT SP not previously modelled for, given the qualitative approach this study takes instead of an econometric lens. The findings are also broadly consistent with the findings of Brown, Samaddar et al. (2021), who found a broad range of tangible implementation issues with ZT SP in the Kharif season, including a limited customer base and performance issues, which also led to machinery owners to question the profitability of providing ZT services. Despite the financial profitability identified by ZT farmers (Chaudhary et al., 2022), studies in the EGP indicate that, concerning ZT service providers, smaller-scale tractor-owning farmers emerge as the most rational recipients for purchase subsidies on ZT drills and constitute the primary audience for business development training (Keil et al., 2016). The results of this study indicate that certain service providers have experienced profitable outcomes while others have not significantly benefited from offering ZT services. Given the

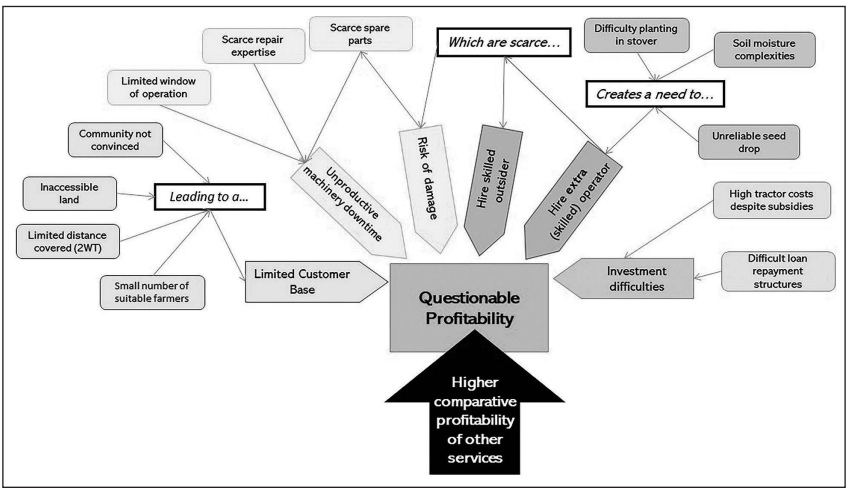


Figure 3. Visual Depiction of the Relationship Between Identified Physical, Financial and Human Resource Constraints and the Overarching Query of ZT Service Provision Profitability in the EGP.

nascent stage of ZT service providers in the EGP, it is essential to conduct renewed research to thoroughly comprehend the long-term implications on the livelihoods of these machine providers and assess their success in offsetting loans acquired for ZT purchases through generated profits. Thus, establishing a feedback mechanism for machine-producer companies is crucial, particularly addressing area-specific problems such as functionality and spare parts emerging in this study, as this can contribute to developing more farmer-friendly machinery.

With regard to physical resources, our findings revealed that respondents were concerned that the machinery is not yet capable of strong and reliable technical performance, which was notably apparent for seed drop issues, as it could hinder reliable performance and result in reputational losses for respondents, compounding the overall business losses. This is consistent with Chaudhary et al. (2022) and Brown, Samaddar et al. (2021), who also highlight that farmers are deterred by poor machine functionality, especially when there are limited mechanics and after-sale facilities in the vicinity. The findings are also consistent with Kumari et al.'s (2018) and Miah et al.'s (2017) findings that identify limited after-sales facilities despite additional years since their studies and this research. This suggests that more efforts are required to address this key constraint.

Another persisting constraint is the identified lack of access to subsidies and the perceived high costs of agricultural machinery. Even with existing subsidy support, machinery remains expensive, especially when considering the need for tractors to operate attachments, making ownership likely viable for very few farmers. This may limit service provision livelihood options to wealthy farmers who already have tractors or can afford to procure one. This is consistent with Keil et al. (2017) findings that ZT service provision might be only financially viable for the wealthy. This is particularly complicated given the high use of tractors on non-agricultural services and perhaps points to a need to adapt subsidy schemes to be more targeted at the activity level rather than the procurement level, as suggested by Brown, Samaddar et al. (2021). Agriculture is the primary livelihood in the EGP (Gathala et al., 2021). For instance, in West Bengal, in the EGP, there is a heightened level of indebtedness among agricultural households compared to other states, with the percentage of holdings being lower than the percentage of agriculturally indebted households in the region (Maurya & Vishwakarma, 2021), presenting challenges for loan repayment. The conclusions of this study have significant implications for increasing the number of ZT service providers in the EGP, particularly in issues that are likely to resolve over time as technology progresses from introduction to use, as well as issues that are unlikely to resolve over time. For instance, as more machinery is introduced, spare parts and skilled mechanics will likely increase to service the (currently limited) demand. However, the constraints highlighting the machinery's limited use are more important for future scaling. For instance, current machinery could be considered 'not fit for context' given concerns over operating in small plots for 4-wheel tractors (given the EGP has highly segmented farming plots) and issues with 'walk-behind' rather than 'ride-on' operation for the two-wheel tractor that is likely to limit machinery to personal use. Some of the identified flaws will need additional research and development to create better ZT machinery prototypes.

For instance, two-wheel tractors are inherently difficult to use for servicing dispersed locations and involve substantial fatigue for operators as they must walk behind the machine for extended periods. Newer prototypes of two-wheeler ZT attachments could be adjusted to have seats, or farmers in Bangladesh might have to shift into the four-wheeler economy, which may require more significant capital investment.

In this light, we identify five key areas for continued focus to grow the ZT service provision economy in the EGP:

- The single operator model appears unlikely to overcome the well-established issues with seed drop and other reliable plating issues related to soil moisture and stover cover. To address this, efforts should focus on increasing the use of and growing the skills of 'secondary operators' who monitor the attachment for correct seed drop in various soil moisture and stover conditions and are trained to monitor any seed drop issues. If these secondary operators come from local communities, the cost may not be substantial and could generate local employment opportunities for youth.
- To catalyze ownership among farmers, emphasis on issues such as repair and maintenance, with support from government agencies, private sector partners, and local organizations.
- Given the complexities of servicing small and dispersed farmers, efforts should consider promoting shared cropping arrangements to overcome landlocked and small farm issues, whereby communities come together to employ ZT services. This will benefit farmers and service providers and could be combined with the recent growth of output cooperatives to be more inclusive of farming activities from pre-planting to marketing.
- Given the complexities of tractor procurement, governments could consider alternative subsidy systems to enable wider applicability and access to agricultural machinery. These could include a discourse on making tractor rental or ownership possible for those without extreme upfront costs or unpayable loan conditions.
- Given an ongoing lack of sensitisation related to new agricultural practices and corresponding low demand for services, further efforts to understand the complexities of information systems in the EGP are warranted. Strengthening efforts to encourage inclusive informational and extension systems through farmers' groups and collectives that work towards fostering community-wide, inclusive information dissemination options is warranted.

Future projects may wish to focus on the above leverage points to support the individual service provider model. Further research would also be warranted to understand farmers' preferences for access to machinery and if they might prefer individual service provider models or other mechanisms like government-sponsored CHCs that could assist village-level group purchases. While it is broadly accepted that a vibrant service provision is required to enable smallholder farmers in the EGP to access machinery services, this study shows that the models and

mechanisms to achieve this require more thought and debate, as well as inclusive initiatives, to ensure opportunities for both machinery owners and smallholder farmers.

Conclusion

The findings indicate that the fee-for-hire service provision model is influenced by various factors and limitations, with resource-constrained smallholder farmers in the EGP being central to ensuring equitable access to and benefits from agricultural mechanisation. While ZT service providers are already benefiting from significant lifestyle improvements and economic advantages brought on by this service provision economy, this study reveals that there are still significant limitations related to ZT's technological performance and financial viability, disrupting ZT's expansion in the EGP.

Currently, the ZT machinery fee-for-hire service provision is still in the initial phase of dissemination and, as such, faces the usual impediment of low demand, including issues with machinery performance, limited skilled operators and spare parts. Much of this will likely resolve with time, increased machinery experience and awareness. However, to fully encapsulate the benefits of service provision, respondents identified key factors that need improvements to make both community farmers and their processes more efficient. To address these constraints, we identified five key areas of focus for future work, including (a) increased skill development of secondary operators for ZT to help manage machinery reputation and reduce incurred losses, (b) an increased focus on the provision of maintenance services including well-trained mechanics and spare parts availability, (c) improved planning towards crop plantation time to avoid issues related to landlocked farmers, (d) alternative subsidy system that is favourable to a broader range of farmers and better accessibility and (e) better information dissemination networks to ensure efficient distribution of ZT-related information to all members in the community. Collectively, these actions can help farmers overcome issues about accessibility, affordability and inclusivity, allowing all farmers within the community to accrue the benefits promised of ZT and encourage widespread and equitable adoption of ZT services across the EGP, ultimately benefitting ZT SPs.

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Article

Locked-in to Dirty Fuel for Cooking: A Micro-Ethnographic Study in a Rural Area in Nusa Tenggara Timur, Indonesia

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Abstract

Ensuring sufficient access to clean and safe energy is a pre-requisite for enhancing the quality of human life. However, in some regions, such as Pitai village in Nusa Tenggara Timur, East Indonesia, people face challenges in accessing safe and clean energy, leading to the problem of energy poverty. Despite the government's introduction of LPG in 2007, many households in Pitai continue to rely on firewood for cooking fuel. This article aims to investigate why most rural households in Pitai, Kupang and Nusa Tenggara Timur are still trapped in using dirty fuels like firewood, and how they perceived and accepted LPG after the national transition programme. To achieve this, a micro-ethnography study was conducted in Pitai village. The study's results reveal that most of the community still prefers using firewood, which is more comfortable than LPG. Additionally, an inadequate supply of LPG, coupled with the abandonment of the firewood supply, has led to a lack of interest in adopting LPG. Consequently, the price of LPG remains higher than that of firewood, further discouraging its adoption. Addressing the issue of energy poverty in Pitai requires a comprehensive approach by the government involving providing adequate LPG supply and initiatives to raise awareness and change perceptions about LPG usage. By overcoming these challenges, the community can transition towards cleaner and safer energy sources, improving their overall quality of life. On the other hand, the government must address the

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accessibility and affordability of the LPG supply chain to inland areas, taking into account the challenges posed by the archipelagic nature of the country.

Keywords

Firewood, LPG, energy poverty, rural energy, energy transition

Introduction

Most scholars and leaders have concluded that energy is a prominent and vital component of human existence (Clancy et al., 2003; Lambrou & Piana, 2006). Access to reliable and safe energy is crucial for social and economic development (Chakravarty & Tavoni, 2013; CIFOR, 2010; Nussbaumer et al., 2012). However, many individuals continue to suffer from energy poverty, which hinders their ability to afford adequate energy for heating or cooling options (Fuller & McCauley, 2016). Furthermore, they face challenges in accessing enough clean, modern energy sources (Sumiya, 2016). Approximately 2.4 billion people, constituting one-third of the global population, rely on firewood for cooking and boiling water (FAO, 2016a). In developed countries, firewood is predominantly used by rural households, while in developing nations, it is utilised by both urban and rural households (CIFOR, 2010). Additionally, rural communities in developing countries are more likely to depend on firewood than urban populations (Stabridis & van Gameren, 2018). This significant issue has garnered international attention, prompting it to be included as one of the goals in the United Nations-determined Sustainable Development Goals (SDGs) to ensure access to sufficient, reliable, clean and modern energy for all worldwide society by 2030 (Tàbara et al., 2020).

Scholars from both developed and developing countries acknowledge that wood fuel has the potential to be a source of renewable energy (CIFOR, 2010). However, a consensus among scholars indicates that heavy reliance on firewood harms the environment and human health (FAO, 2016b). It is widely believed that the use of firewood is closely linked to deforestation (Baland et al., 2010; Mckay et al., 2014) and contributes to approximately 7% of global emissions (FAO, 2016a). The combustion of firewood for cooking leads to the creation of indoor air pollution (IAP), which has adverse effects on human health (Han & Wu, 2018), particularly respiratory diseases. Consequently, people suffering from respiratory problems experience reduced participation in the labour force (Stabridis & van Gameren, 2018).

Indonesia is among the Asian countries facing energy poverty challenges (Khanna et al., 2019). Gratefully, the introduction of LPG in 2007 has been a significant step forward. This initiative has successfully encouraged people who were using kerosene and firewood to switch to LPG (Andadari et al., 2014). As of 2019, LPG access in Indonesia had reached an impressive 79.90% (BPS, 2020a), contributing to a notable shift in cooking fuel usage from kerosene and firewood to LPG (Astuti et al., 2019).

However, it is important to note that not all areas in Indonesia had equal access to LPG. The inequality of opportunities between western and eastern regions in Indonesia contributes to a lack of education in rural areas, consequently affecting environmental awareness. In Nusa Tenggara Timur, LPG consumption remained

relatively low compared to other regions. In 2019, only 1.2% of households in Nusa Tenggara Timur used LPG for cooking (BPS, 2020b). Additionally, about 70.94% of households in this region continued to rely on firewood, significantly higher than the national average of 14.04% for firewood users in Indonesia (BPS, 2020b). Consequently, Nusa Tenggara Timur has become the area with the highest number of firewood users in Indonesia, and the transition to LPG has been slow despite its massive introduction in 2007.

The underdeveloped supply chains in eastern Indonesia, attributed to the islands' remoteness, present a significant obstacle as they result in costly infrastructure investment. Moreover, the relatively low awareness of LPG aggravates the issue, contributing to its increased expense (Dartanto et al., 2020). Consequently, it has become imperative for the Indonesian government to prioritise enhancing the accessibility of the energy transition.

Given the reasons mentioned earlier, this study aims to address two primary research questions. First, it seeks to understand why people in Pitai village have continued to rely on firewood for their energy needs. Second, it aims to explore how these individuals perceive and accept modern energy sources, such as electricity and LPG, in an energy transition context driven by government policy. By investigating these research questions, this study intends to shed light on important aspects of energy usage in the region. The findings may offer valuable insights that contribute to providing cleaner energy solutions for households, reducing energy poverty and promoting energy justice in Indonesia. Ultimately, the study outcome can pave the way for more effective policies and interventions to accelerate the transition towards sustainable and accessible energy options, benefiting the environment and the well-being of local communities.

Firewood Use in Rural Areas

Firewood Use and Its Impact on the Environment and Health

Scholars have observed that the combustion of firewood in traditional stoves results in IAP creation, which poses several health risks. This combustion releases a range of air pollutants, including total suspended particles (TSPs), carbon monoxide (CO), sulphur dioxide (SO_2), nitrogen oxides (NO_x) and carbon dioxide (CO_2) (Gabisa & Gheewala, 2019; Reyes et al., 2015). The emissions from firewood burning also include additional hazardous substances such as ethylene (C_2H_4), volatile organic compound (VOC), polycyclic aromatic hydrocarbons (PAH), PM_{10}, high methane (NH_4), CO and nitrous oxide (N_2O) (Reyes et al., 2015). Of these pollutants, CO contributes to both short-term and long-term health effects. Long-term exposure to TSP, SO_2 and NOx is associated with chronic health effects, including respiratory issues, cardiovascular disease and other respiratory-related illnesses (Ballard-Tremeer & Jawurek, 1996).

Researchers have extensively studied the adverse health effects of combustion from dirty fuels, particularly IAP. It has been found that IAP is responsible for approximately 1.6 million deaths annually (Stabridis & van Gameren, 2018). Certain groups, such as women, young children, older individuals and those

suffering from pre-existing diseases, are particularly vulnerable to the adverse health impacts of exposure to firewood combustion in the household (Stabridis & van Gameren, 2018). Scholars have established a clear correlation between firewood combustion and respiratory illness. Rinne et al. (2006) conducted a study that revealed that exposure to biomass combustion, such as firewood, reduced pulmonary function in children living in homes that used biomass for cooking compared to those using cleaner fuels like LPG. Chronic bronchitis, asthma and acute respiratory infections have been identified in households that rely on firewood for cooking (Pant, 2008). McKay et al. (2014) conducted a study in Indonesia, demonstrating that individuals who cooked with firewood had 11.2% lower lung capacity than those using cleaner cooking fuels. Silwal and McKay (2015) further supported this finding, showing that people who cooked with firewood had lower lung capacity than those who used cleaner fuel.

Some scholars proposed using improved cookstoves as a potential solution to reduce IAP from firewood combustion. Dutta et al. (2007) found that improved cookstoves could reduce around 20%–49% of CO and $PM_{2.5}$ emissions. Sharma and Jain (2019) further demonstrated the benefits of improved cookstoves, reporting a reduction of about 21%–62% in PM_{10}, 20%–80% in $PM_{2.5}$, 24%–87% in PM_1 and 19%–93% in CO emissions. Armendáriz-Arnez et al. (2010) showed a 21% reduction in TSP after using an improved cookstove. Some scholars have also explored alternative fuels like pellets to reduce firewood emissions (Jagger & Das, 2018). Nepal et al. (2011) found that while improved cookstoves may reduce emissions, they could increase firewood demand compared to open-fire stoves. Additionally, Alnes et al. (2014) observed that the concentration of CO in the indoor environment was more closely related to the type of fuel used than the specific stove technology employed.

The impact of firewood consumption on deforestation has been a long-standing debate among scholars. While Reyes et al. (2015) and others have argued the potential influence of firewood consumption on deforestation, there is growing evidence that forest exploitation for firewood contributes to deforestation (Odihi, 2003; Subedi et al., 2014). Deforestation, in turn, leads to various eco-environmental problems, including soil erosion, desertification, human diseases and loss of time for education and recreation (Liu et al., 2008). Despite the evidence supporting the link between firewood consumption and deforestation, some scholars have argued that the role of firewood in deforestation is minimal (Subedi et al., 2014) or lacks significant impact (Lee et al., 2015).

Based on the reviews above, considering its negative impact on human health and the environment, the utilisation of firewood, primarily as a source of cooking fuel, should be diminished.

Energy Use in Rural Area

Generally, energy consumption in rural households tends to be lower than in urban households (Wang, 2014). However, in many developing countries, there is a notable reliance on firewood and biomass as the primary energy sources, even in rural areas. This trend is observed across different income levels, with firewood

commonly used by low-, middle- and high-income households. For instance, in Bangladesh, approximately 92% of rural households use biomass and 52% rely on firewood as their primary energy source (Miah et al., 2010). Similarly, in India, as of 2011, 77% of rural households used biomass for their energy needs (Ravindra et al., 2019). However, there was a slight decline by 2010, with 72.6% of users utilising biomass and 18% relying on firewood (Bhattacharya, 2015).

Transitioning from traditional cooking fuels to more advanced cooking technologies or cleaner fuels can be challenging, particularly in rural households. Studies have shown that households relying on conventional cooking fuels, such as firewood and biomass, have less intention to replace them with induction cooking stoves compared to those already using LPG as their cooking fuel (Banerjee et al., 2016). In Bangladesh, the adoption of cleaner fuels has been limited, with only 2% of rural households having switched to cleaner options (Ravindra et al., 2019). This low adoption rate indicates that replacing traditional energy with advanced cooking technology or cleaner fuels faces various barriers and constraints.

However, some households use multiple sources of energy, such as LPG and firewood (Hartono et al., 2020). They may employ an LPG stove for frying foods while opting for a firewood stove to boil water and cook rice. This practice is more prevalent in rural areas, particularly since the introduction of modern fuels. In such instances, individuals using modern energy sources in their homes are not entirely free from using dirty fuels, such as firewood.

The Determinant of Firewood Use

Energy ladder theory is the most commonly accepted theory for understanding energy consumption patterns. This theory suggests that higher-income households adopt more modern fuel sources (Hosier & Dowd, 1987; Reddy et al., 2000; van der Horst & Hovorka, 2008). In Indonesia, as of 2018, 44% of rural households that relied on firewood for cooking were low-income (Hartono et al., 2020). However, there is substantial evidence to suggest that higher-income households continue to use traditional energy sources, such as firewood, instead of adopting more modern alternatives (Ballard-Tremeer & Jawurek, 1996; Mirza & Szirmai, 2010; Treiber, 2013).

The absence of modern energy sources, such as LPG, forces people to resort to various fuels, with firewood being the primary choice (Hartono et al., 2020). The availability of firewood supply is a crucial factor influencing this choice (Astuti et al., 2019). Firewood is often collected freely from many sources. The surplus firewood in rural areas can meet the demand from urban households (Cline-Cole et al., 1988). However, the distance to the market, from rural to urban areas, plays a pivotal role in determining the preference for firewood as a fuel (Silwal & McKay, 2015), which might lead to reduced usage. Moreover, firewood prices become expensive in some instances due to high market demand coupled with limited supply, prompting more people to rely on firewood over other fuels.

Rural areas often lack modern energy infrastructure, resulting in a scarcity of modern energy supplies. Consequently, many people in these areas cannot access or afford such energy sources, leading them to use any available fuel, such as

firewood, which tends to have a high supply. The reliability of fuel supply becomes a crucial factor influencing the adoption of different energy sources (Kowsari & Zerriffi, 2011).

Due to limited supply, the prices of modern energy have increased, creating barriers to its widespread use (Jan et al., 2012). This situation has even prompted people to switch to using firewood (Baiyegunhi & Hassan, 2014) due to its lower cost than modern energy. Firewood, being available for free, has become a preferred option for many (Hosier & Kipondya, 1993), often collected from their gardens or fallen tree branches (Miah et al., 2010). Consequently, most firewood users opt to collect firewood rather than purchase it.

Education is pivotal in enhancing people's knowledge, consequently improving their household economic situation. Therefore, Miah et al. (2011) argue that education significantly influences fuel use. Moreover, education fosters awareness about the health effects of traditional energy, often leading to a greater understanding of its impact on health. However, the lack of awareness regarding the long-term health effects of conventional fuel usage (Howells et al., 2010) has contributed to the persistence of traditional fuel adoption in rural households, with firewood being used without considering the health effects and risks associated with its combustion.

The cooking frequency significantly influences the type of fuel households use (Miah et al., 2011). The cooking methods employed, the types of food prepared and the quantity cooked all play a role in determining fuel consumption. Consequently, cultural tradition also considerably impacts fuel choices (Ravindra et al., 2019; Treiber et al., 2015).

Methodology and Data

The study was conducted in Pitai, a village in the Sub-District of Sulamu, District of Kupang, Province of Nusa Tenggara Timur, Indonesia. Pitai village is situated at 9.99° south latitude and 123° east longitude. It is located 9 km from Sulamu and 37 km from Kupang. The village sits 500 m above sea level, and its terrain mainly consists of hillsides. Pitai covers an area of 30.44 km^2, which accounts for 11.29% of the total area of the Sulamu Sub-District. The location of Pitai village is depicted in Figure 1.

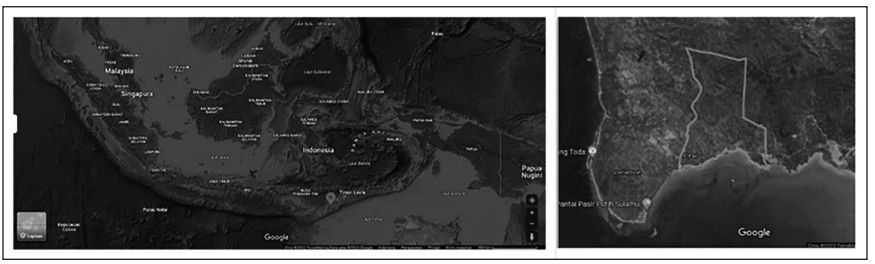

Figure 1. The Location of Pitai Village.

In 2019, the population of Pitai was 966, with a total of 233 households and an average household size of four people (BPS Kabupaten Kupang, 2019). As per the data from BPS Kabupaten Kupang (2020a), most villagers were engaged in farming, including fishing and breeding, accounting for approximately 36.54% of the population. Pitai village had two nursery schools, one primary and one secondary school. Around 10% of the population was reported to be illiterate, while approximately 42.2% and 46.8% had completed primary school and junior high school, respectively (Prasetiyawan, 2020). Regarding healthcare facilities, there was only one health centre in the village, staffed with five health workers but without a physician. Around 72.26% of the population also owned mobile phones, and this village had a strong internet signal. However, it is worth noting that approximately 69.7% of the roads in Pitai were gravel roads (see Figure 2).

This study investigates why Pitai society uses firewood for cooking, while most households in Indonesia use LPG. Ethnography is chosen for this study as it is highly effective in revealing intricate details of social phenomena that may not be easily captured through interviews alone (Murto et al., 2020). Full-scale ethnography typically requires extended periods in the study location by the investigator (Bryman, 2012). However, conducting a full-scale ethnography was not feasible due to the constraints of the fieldwork being part of the community engagement programme called Kuliah Kerja Nyata (KKN) Nusantara. Instead, a micro-ethnography study was conducted to meticulously gather insights into the energy usage behaviour of the Pitai Village community.

In this study, data collection was primarily gathered through daily observation of the society's cooking behaviour, engaging in conversations with the community members and actively listening to their discussions. Ethnography is mainly an observational approach, where the investigator spends a specific period conducting fieldwork to gain an in-depth understanding of the culture and social dynamics (Silverman, 2010). However, ethnography also allows investigators to

Figure 2. Housing and Road in Pitai Village.

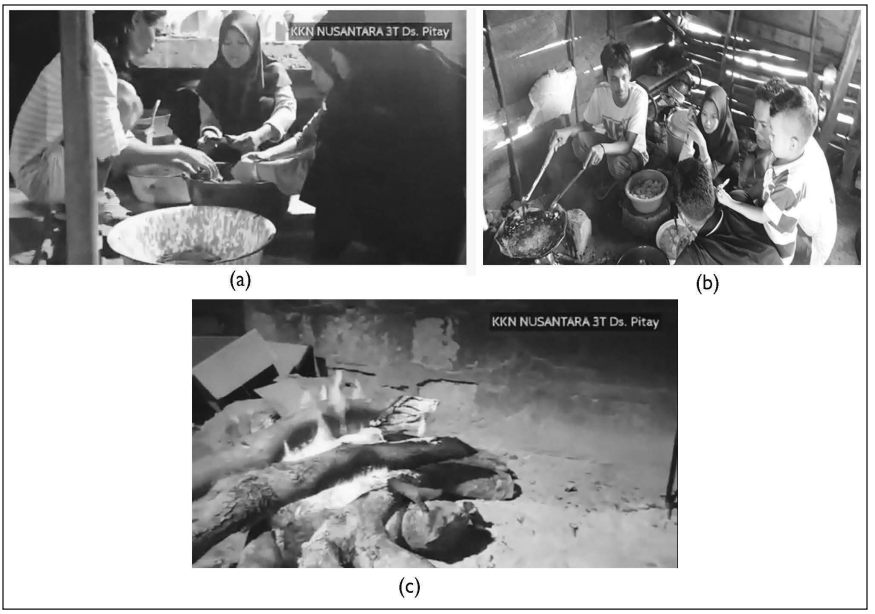

Figure 3. (a) Cooking Preparation Activity with the Native, (b) Cooking Activity and (c) Firewood Stove.

ask questions and engage in narratives with the participants to gather additional insights (Jonker & Pennink, 2010). This combination of observation and interactive inquiry helped uncover valuable information about the energy usage behaviour of the Pitai Village society.

In this study, the investigators closely observed the household's cooking activities to understand their behaviour. In certain instances, to enhance participant acceptance and gather more information, the investigators actively engaged in cooking activities alongside the participants. Some of these activities were documented through photographs, as shown in Figure 3. Alongside the photos, detailed observations of human behaviour during cooking and conversations with households were recorded in notes and on the recording devices.

During conversations, the investigators conducted interviews by asking pertinent questions to elicit narratives, which is valuable for collecting information from participants (Hammersley, 2006). Additionally, structured interviews were conducted with select participants representing the broader village community.

The observations focused on the daily lives of participants, particularly their cooking activities. This encompassed their behaviours in gathering fuel for cooking, the types of food they consumed, the timing of fuel changes and their electricity usage pattern. The observations also covered activities supporting cooking, such as their meal and drink routines. Throughout the observation process, the observers conversed with and interviewed the participants. For those with limited time for in-depth conversations, some questions from a questionnaire were used to gather additional information. This comprehensive approach allowed for

thoroughly examining participants' cooking habits and energy usage behaviour in their daily lives.

Before engaging in conversation, the participants were asked for their consent to record the discussion using electronic recorders or note-taking. To ensure the confidentiality of all narratives, anonymity was carefully considered and respected throughout the study. The study participants consisted of residents of Pitai who had either been born in the village or lived there for over 10 years. Approximately 25 participants willingly agreed to engage in conversations with the observers. Among these participants, five were the community leaders chosen to represent the community in this study.

Results and Findings

In 2018, the electrification rate in Nusa Tenggara Timur was reported to be 90.82% (BPS, 2019a). Although access to electricity in Pitai began in the 1980s, most residents continued to rely on lanterns, torches and kerosene-fuelled lighting for illumination instead of electric lighting until 2018. According to data from BPS Kabupaten Kupang (2019), nearly all Pitai residents started using electricity in 2018. Additionally, BPS Kabupaten Kupang (2020b) recorded 131,022 households using electricity in the Kupang district, with an average electricity consumption of 1,244.44 kWh. Based on this data, it can be assumed that Pitai households consumed similar amounts of electricity.

Pitai households had good access to modern energy for lighting purposes. In addition to lighting, electricity was used for entertainment, such as watching television and charging mobile phones. The availability of electricity allowed them to access television for information and entertainment. With the widespread use of mobile phones, electricity was essential for charging the phone batteries, enabling faster communication and modern technology. However, despite having access to electricity, most Pitai households continued to rely on firewood for cooking. Although kerosene was available in Pitai, the data from BPS Kabupaten Kupang (2020a) showed that seven villages in Sulamu Subdistrict, including Pitai, used more firewood than kerosene. Table 1 summarises firewood consumption in Pitai from 2005 to 2019. While the number of households using electric lighting in Pitai significantly increased in 2019 compared to 2018, with more than 90% of households using electricity for lighting, most still preferred firewood for cooking.

Firewood Use in Pitai: Cultural or Institutional?

According to BPS (2019b) data, 26.9% of households used kerosene in the Province of Nusa Tenggara Timur, while only 0.52% and 1.6% used electricity and LPG for cooking, respectively. Based on the observation in Pitai, the most modern fuel used by the Pitai society was kerosene, and no one used LPG for cooking. However, firewood remained the most common cooking fuel among households, indicating that most people in Pitai rely on traditional fuel for their cooking needs.

Table 1. Lighting and Firewood Use from 2005 to 2019.

	Lighting (households)				
Year	Electricity	Non-Electricity	Firewood (households)	Wood	References
2005	74	–	195 m^3	72,200 m^3	BPS Kabupaten Kupang, (2006)
2007	76	–	225 m^3	797,572 m^3	BPS Kabupaten Kupang, (2008)
2008	76	–	250 m^3	736,235 m^3	BPS Kabupaten Kupang, (2009)
2010	78	121	850 m^3	900,000 m^3	BPS Kabupaten Kupang, (2011)
2012	93	139	40 m^3	208,792 m^3	BPS Kabupaten Kupang, (2013)
2013	–	–	25 m^3	2,931.78 m^3	BPS Kabupaten Kupang, (2014)
2014	–	–	50 m^3	26,722,954 m^3	BPS Kabupaten Kupang, (2015)
2015	125	144	60 m^3	26,722,954 m^3	BPS Kabupaten Kupang, (2015)
2016	128	123	70 m^3	26,722,954 m^3	BPS Kabupaten Kupang, (2017)
2017	206	123	150 m^3	6,722,954 m^3	BPS Kabupaten Kupang, (2018)
2018	245	1	150 m^3	6,722,954 m^3	BPS Kabupaten Kupang, (2019)
2019	245	1	180 m^3	673,468 m^3	BPS Kabupaten Kupang, (2020a)

Cooking using a traditional stove fuelled by firewood has been a common practice among ancestors worldwide, and this was also true in Pitai. Most people in Pitai were accustomed to using open-fire stoves for cooking. During the conversation with native Pitai individuals, several reasons were identified for why firewood remained the preferred fuel choice:

> Firstly, cooking with firewood stove has been a deeply ingrained part of our culture, passed down through generations. Our ancestors did it this way, and so do we. Secondly, while some of us have access to electricity, the availability of LPG is very limited in our area. Therefore, many households cannot use firewood. (Narratives, 40 years old)

Another narrative of Pitai stated, 'Searching for firewood in the forest has been a common practice for society in Pitai, mainly because of the abundant wood source available. Gathering firewood from the forest has been a tradition for generations' (Native Pitai, 36).

Approximately 75% of the participants in this study emphasised that the ease of obtaining firewood is the primary factor influencing its use for cooking. The abundant availability of firewood from nearby forests and their gardens makes it readily accessible. According to data from BPS Kabupaten Kupang (2020a), Pitai possessed a total forest area of 783 hectares, with 97% designated protected forest. The forest area constituted 25.7% of the village's total land area. Despite being smaller than other villages in Sulamu sub-district, most households in Pitai relied on firewood for cooking. However, the production of firewood from the forest was relatively small. In 2019, Pitai's forest produced only 180 m^3 of firewood, whereas the total wood production from the forest was significantly higher, reaching 673 thousand m^3, according to BPS Kabupaten Kupang (2020a).

All the narratives also unanimously emphasised that free access to firewood was the key to using it for cooking. They collected firewood not only from nearby forest areas but also from their garden or farmyard. This practice significantly reduced their cooking expenses, allowing them to allocate the money they saved for essential needs such as food, education or clothing.

In 2007, the government of Indonesia introduced LPG to society to promote modern energy usage (Astuti et al., 2019). However, for some reason, most Pitai residents did not show much interest in using LPG. Some conversations with the Pitai residents shed light on their perspectives. One participant stated,

> In this modern era, electricity is available in most places here. However, there are still some areas where electricity is not accessible. While few people use LPG for cooking, its usage is quite limited. Additionally, we face difficulties in finding kerosene. On the other hand, we are fortunate to have an abundant source of firewood, which serves as a ready fuel option. (Narrative, 36 years old)

Another participant confidently expressed, 'We don't need LPG. Our forest provides an abundant source of firewood, which is free, whereas LPG is costly. So, none of the people here need LPG' (Narrative, 66 years old).

From the narrative's conversation, four main reasons emerged why most Pitai residents preferred using firewood over LPG. The first reason is the lack of knowledge about LPG usage. Since many Pitai residents did not know that LPG cylinders and stoves were unfamiliar with their usage, knowledge about LPG could be disseminated through various channels such as books, television, radio or social media. Nowadays, social media, which is accessible through mobile phones, plays a crucial role in delivering information and knowledge to society. Fortunately, most Pitai residents had mobile phones (BPS Kabupaten Kupang, 2020a), granting them reasonable access to information. However, the information about LPG in Pitai mainly came from television. Although television shared positive and negative news about the LPG programme, the negative news, such as LPG cylinder blasts in some areas, created fear and reluctance in society towards using LPG. This fear and apprehension constitute the second reason LPG was not preferred by the society in Pitai compared to firewood.

The third reason for the lack of acceptability of LPG in Pitai was the rarity of its supply, which directly affected its market price. Due to the limited availability of LPG in Pitai, its price has become higher. In contrast, firewood is easily and

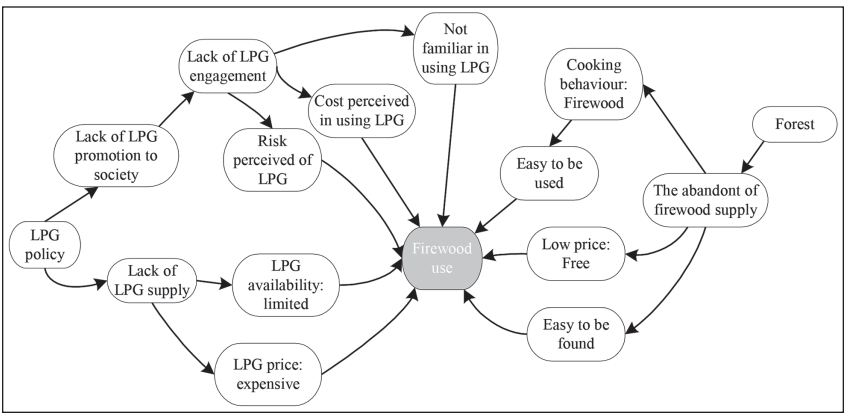

Figure 4. The Reason Society Uses More Firewood than LPG.

freely accessible in the residents' gardens and the nearby forest. This stark contrast in availability and cost influenced society's perception that LPG use was more expensive than firewood, discouraging them from adopting it. The high cost associated with using LPG constitutes the fourth reason why Pitai residents were hesitant to embrace LPG. The conceptual determinant behind the prevalent use of firewood by most people in Pitai is illustrated in Figure 4.

The Acceptance of LPG Among the Pitai Society

Firewood use for cooking was dominant in Pitai, despite 77.6% of Indonesian households using LPG for cooking (BPS, 2019a). According to BPS (2020b), approximately 1.2% of households in Nusa Tenggara Timur used LPG, while 70.94% of households continued to rely on firewood.

In the 1980s, electricity was introduced in Pitai, and households had access to television. However, a few narratives were unaware of the news or advertisements about the LPG programme on television. Those who were aware viewed the LPG programme positively, recognising its faster and easier cooking benefits. Unfortunately, LPG was unavailable in Pitai, leading them to perceive it as only intended for urban households. Additionally, some narratives mentioned financial constraints as a barrier to purchasing LPG. Despite acknowledging the advantages of LPG, some individuals still prefer to use firewood for cooking.

Television news and advertising about LPG programmes significantly influenced people's perceptions. The following conversations were depicted from the narratives during the study:

> I would still choose to use firewood even if the government introduced LPG. Firewood is more affordable, and I always consider the cost when making decisions, including the choice of cooking fuel. We have an abundance of firewood readily available for free, which helps us save money. Therefore, we did not feel the need for LPG at all. If LPG is not available here because it does not offer significant

> benefits, then the people in Pitai would not use it. They adopt something based on its economic advantages. If LPG provides substantial benefits, they might consider using it. Similarly, if kerosene offered certain benefits, they would use kerosene. (Narrative, 66 years old)

> Some people wanted to use LPG, but they considered its cost. Moreover, the supply of LPG is limited, making it challenging to find. The LPG market is not available here. Meanwhile, our society is still rooted in our traditional cooking culture, where we predominantly use firewood. We have an abundant supply of firewood. If, in the future, the supply of firewood becomes scarce, society will be willing to explore other fuel options that offer benefits, such as kerosene-fuelled stoves or LPG-fuelled stoves. However, if the price of LPF rose significantly, they would revert to using firewood. (Narrative, 40 years old)

> We are interested in using LPG because it helps us cook easier and faster. We must go to the forest to find firewood when we cook on a firewood stove. However, with an LPG stove, we stay home, plug in the LPG cylinder, and turn on the stove. It is that easy. (Narrative, 36 years old)

The news about the accident caused by LPG explosions during the early introduction of LPG in Jawa Island created a negative image in society, leading people to lose interest in using LPG. Based on the conversation with narratives, there were three categories of people in terms of their interest in using LPG: those who were not interested, those who were undecided and those who were interested. These categories are presented in Figure 5.

People who believed that firewood supply in Pitai would always be abundant were unlikely to consider adopting LPG. They had plentiful cooking fuel sources without spending a single cent. However, the limited supply and expensive price

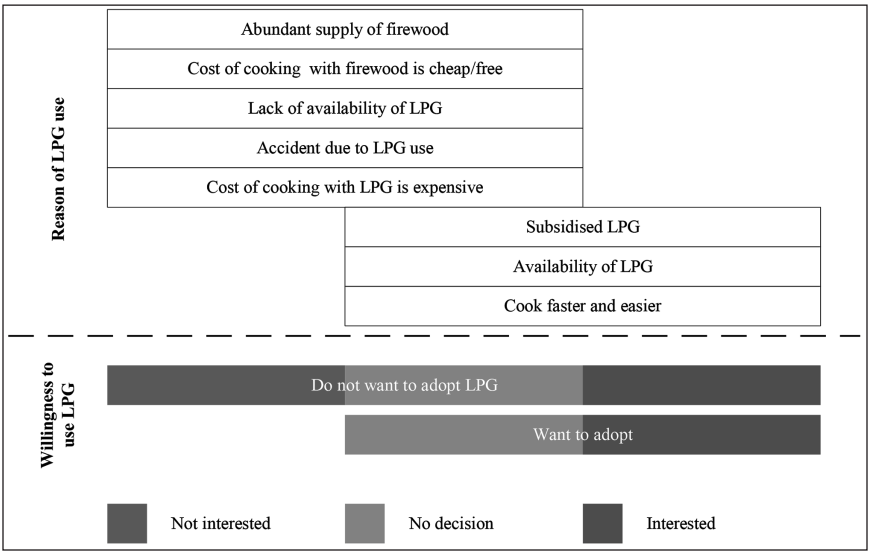

Figure 5. The Category of Intention to Adopt LPG.

of LPG in Pitai made people hesitant to adopt it. Some members of the Pitai society were indecisive about using LPG. They recognised that LPG could help them cook faster and easier, but concern about availability, price, and the risk of accidents influenced their willingness to adopt it. On the other hand, some Pitai residents had a positive outlook on LPG, which motivated them to consider adopting it despite its scarcity in the area. The benefits of cooking with LPG outweighed the challenges for them.

Discussions and Conclusion

Cooking with firewood is an ancient tradition among the people of Pitai, passed down through generations by their ancestors. This cultural bond has been deeply ingrained in them since birth. Meanwhile, the lack of information on how to use LPG has made them uncertain about operating LPG stoves. Moreover, they have come across information about the risks associated with LPG, further reinforcing the perception that firewood is a safer option. Despite living in the modern era with easy access to information through the internet, television, radio and newspapers, individual barriers still exist, with some people reluctant to embrace LPG. To address this, it is recommended that the government play a vital role in providing sufficient information to society about the benefits of using modern energy sources. Educating the public can generate interest in and acceptance of LPG, leading to a smoother transition towards its adoption.

Furthermore, the scarcity of LPG supply, coupled with the abundance of firewood and the high price of LPG, significantly impacts the reluctance of Pitai people to consider using LPG. A study by Pattanayak et al. (2004) highlights that rural dwellers in Indonesia are economic-rational decision-makers regarding energy usage. This pattern is also evident in Pitai society, where they make rational decisions about cooking fuel. They weigh the perceived benefits and conclude that LPG would not provide them significant advantages. This perception should be dismissed by furnishing comprehensive information about the advantages of LPG, particularly its positive impact on human health.

Despite the availability of LPG in Pitai, most people there are hesitant to switch to it, as there is a strong preference for using firewood. It is a common trend that fuel switching to LPG is more prevalent in urban areas than in rural areas (Pant, 2008). This explains why many households in rural regions, including Pitai, still rely on firewood for cooking. Additionally, rural energy consumption is influenced by cultural traditions shaped by the local natural environment and socioeconomic factors (Liu et al., 2008). The choice of cooking fuel is determined by various factors, such as food structures, types of food and techniques (Ruiz-Mercado et al., 2011). These factors collectively contribute to the prevailing use of firewood in Pitai, despite the availability of LPG.

Ensuring access to clean and affordable energy is crucial for human well-being. In Pitai village, there are potential solutions to reduce the reliance on firewood. One approach is to introduce renewable energy sources like biogas to rural communities, which has been shown to decrease the dependency on firewood

(Lewis et al., 2017). While firewood is renewable, its adverse effects on IAP can be mitigated through improved cookstoves (Ballard-Tremeer & Jawurek, 1996). These improved cookstoves reduce IAP and decrease the demand for firewood, thus helping to combat deforestation (Adrianzén, 2013). It is recommended that introducing an improved cookstove in Pitai could be beneficial since many residents still prefer firewood over modern fuels like kerosene and LPG. However, it may not always guarantee immediate success (Troncoso et al., 2007). By promoting renewable energy alternatives and adopting improved cookstoves, Pitai hopes to move towards a more sustainable and environmentally friendly energy consumption pattern, ensuring its residents a healthier and cleaner environment. However, market analysis, robust supply chains and price discounts should be considered to ensure its diffusion success (Pattanayak et al., 2019).

As an alternative approach, implementing a rising price strategy for firewood could be considered to reduce its consumption (Schueftan et al., 2016). However, this should be complemented by subsidising clean fuel options for society. A study by Cardoso and González (2019) in Mexico demonstrates that fully subsidised LPG significantly decreased firewood usage. Similarly, some areas of Indonesia observed a positive impact on firewood consumption where LPG was extensively introduced and subsidised. Unfortunately, this massive introduction of subsidised LPG did not extend to Pitai village.

Another viable alternative is to provide access to various fuels as an appropriate strategy to enhance energy supply security (Treiber et al., 2015). Meanwhile, access to modern fuels like LPG in Pitai may incur additional costs. Exploring potential renewable energy sources such as solar energy, biogas and hydroelectric energy can be a practical approach. These renewable energy options promise sustainability and may be well-suited for implementation in Pitai village. By diversifying energy sources and promoting renewables, Pitai can achieve greater energy resilience and reduce its dependence on firewood, leading to a more environmentally friendly and economically sustainable energy landscape.

The utilisation of firewood in developed and developing countries serves distinct purposes. In developing countries, firewood often serves as a primary energy source for domestic use, while in developed countries, rural societies may value firewood for its recreational and cultural significance (CIFOR, 2010). Education is crucial in addressing energy poverty and climate vulnerability, as it can potentially transform social attitudes and behaviours (Tàbara et al., 2020). Studies have shown that education can influence people's choices regarding firewood usage (Adrianzén, 2013; Baland et al., 2012). A recent study shows that education positively correlates to traditional biomass energy usage (Han et al., 2018; Mottaleb et al., 2017). By promoting awareness and understanding of sustainable energy alternatives, education can foster a shift towards more environmentally responsible practices, reducing the reliance on traditional firewood usage and promoting cleaner and more efficient energy solutions.

Furthermore, augmenting investments in modern and clean energy infrastructure can significantly enhance energy accessibility for society (Wang et al., 2015)—the transition towards cleaner energy sources and advancements in

technology (Howells et al., 2010). Donor organisations can play a crucial role in improving access to modern and clean energy for communities (Kees & Feldmann, 2011). Forming partnerships with international organisations also bolsters access to modern energy sources (McDade, 2004). In the context of Pitai, the local government should demonstrate a solid commitment to emphasising and enhancing investment in cleaner energy for the betterment of society.

Finally, the energy ladder theory posits that economic development positively correlates with increased modern energy consumption. Thus, enhancing the development in Pitai village holds the potential to uplift human prosperity and well-being. This progress can have a cascading effect on education by raising awareness about the benefits of using clean energy and improving the affordability of modern energy options for society. As the community advances on the energy ladder, this shift towards cleaner and modern energy sources becomes increasingly feasible, paving the way for a more sustainable and prosperous future.

Observing perspectives within the Pitai community, future research should investigate the significance of adopting renewable energy alternatives near firewood. This exploration becomes crucial if the community, as a whole, is unwilling to embrace non-renewable energy sources like LPG, considering factors such as accessibility, pricing and cultural considerations. Moreover, the limitation of this research is that the study is confined to a specific location. Therefore, future research should consider expanding the study to include additional locations.

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Article

Community Participation in Development Planning: A Socio-Historical Analysis of Its Strengths and Weaknesses

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Abstract

Numerous studies and development theorists have identified the potential of community participation (CP) in development planning. However, limited studies have synthesised existing literature to compare its strengths and weaknesses. This article, therefore, fills this knowledge gap by synthesising critical academic perspectives to (a) contrast the case for and against the promotion of CP theory in development planning and (b) detail its historical effects and contributions to the water service delivery sector. Overall, findings on the weakness reveal that (a) participation at times overrides existing legitimate decision-making processes, (b) reinforces the interest of the already powerful through knowledge acquisition and manipulation, (c) drives out those advantages participation cannot provide, and (d) leads to opportunistic behaviours, that is, free-rider syndrome. On the strengths, participation can lead to the realisation of (a) improved project design, (b) increased project acceptability, (c) a more equitable distribution of benefits, (d) increased resource mobilisation, and (e) improvements in sustainability parameters. Taken together, the authors premise that unless these strengths and weaknesses are fully documented and appreciated from a historical standpoint, efforts to take full advantage of CP as a theory in development planning will remain futile.

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Keywords

Community participation, potable water delivery, strengths and weaknesses, development planning

Introduction

As a theory, community participation (CP) has become conventional wisdom and can be seen as monolithic among those who have not read deeply on the topic. Consequently, as social scientists, we are expected to apply our analytical skills in examining and re-evaluating theories and concepts. This is a difficult task because it often calls for disentangling romantic ideals that might have intrinsic emotional appeals. This article, therefore, aims to contribute to this debate from a socio-historical paradigm and detail the case for and against the promotion of CP in development planning. Specifically, the authors answer two research questions: (a) what are some of the strengths and weaknesses of CP as a dominant theory in development planning? (b) Using specific case studies, what are some of the historical contributions of CP in water service delivery? The authors accomplish this task by employing the purposive sampling technique to put together information gathered from several sources.

To obtain relevant academic literature on the case for and against promoting CP, the authors performed keyword searches in prominent search engines, including Google Scholar, Science Direct and Web of Science. The authors relied on books, peer-reviewed academic literature and published reports from websites to evaluate CP's contribution to water service delivery.

Purposive sampling is defined as a non-probability sampling method and occurs when elements selected for the sample are chosen by the judgement of the researcher. This is because the researchers believe they can obtain a representative sample using sound judgement. In our case, this was supported by the fact that out of the over 2,456 articles and other relevant secondary literature generated, the authors only sampled studies that have undergone peer review. In addition, the authors used *EndNot*e X4, a reference management software package, to manage some literature sources. Titles and abstracts of the retrieved references were scanned to determine their eligibility for inclusion in this study. All these procedures allowed us to improve the quality of this study while minimising any potential biases.

The rationale for this socio-analytical historical review is supported by the fact that different scholars have identified some constraints encountered when introducing CP in development planning. Some of these constraints reflect the difficulty in altering established administrative procedures. Most development workers and national governments do not enter serious dialogue with local communities. In most cases, they restrict participation to mobilising cheap and unpaid labour through knowledge acquisition and manipulation (Das, 2014). Government officials, whether professionals or technicians at the local project level, have sometimes been unwilling to change their established perspectives and procedures to allow information sharing and decision-making. In so doing, the projects

they initiate are often designed and implemented without considering a particular community's needs or human and financial capacities (Mandara et al., 2017). By assembling these constraints and strengths into one coherent paper, the authors hope to promote a deeper understanding of these variables drawn from different contexts.

The authors argue that some of the strengths and obstacles to realising the full potential of CP arise because some of the parameters are poorly understood or treated as interdependent. Second, safe water provision in the developing world has been a key target and political rhetoric among governments and international development agencies for decades. However, most recent data still show that despite remarkable progress since 2000, the proportion of people without safe water remains high (van Vliet et al., 2021). The authors argue that this problem has continued to exist partly due to a limited understanding of the complex mosaic of pros and cons of CP, especially when it relates to water service provision. This article promotes a deeper understanding of the complex mosaic of parameters and the effectiveness of CP in development planning in general and water provision in particular.

The article is organised as follows. First, the authors review the socio-historical case for CP. In so doing, the authors rely on the contribution of prominent 20th-century scholars on this subject, that is, Mahatma Gandhi, Julius Nyerere, Paulo Freire, Elinor Ostrom, Arturo Escober, Michael Cernea and Robert Chambers. In the second section, the authors focus on the case against CP. The authors follow this by historically detailing and evaluating studies examining CP's effects on water provisioning. In the final section, the authors highlight the main findings and provide suggestions for future reviews.

The Case for CP in Development Planning

Some of the most influential works that illuminate with regards to the promotion of CP in development planning are Mahatma Gandhi's (1962) essay on the village *Swaraj* in India, Julius Kambarage Nyerere's (1967) development philosophy on the creation of *Ujamaa* villages in Tanganyika, Paulo Freire's (1970) *Pedagogy of the Oppressed*, Coralie Bryant and Louise White's (1980) experiences with small rural farmers in the Zambia, Robert Chambers' (1983) advocacy work on *putting the last first*, Elinor Ostrom's (1990) *the common pool resources*, Bill Cook and Uma Kothari's (2001) essay on *participation as the new tyranny* and perhaps Amartya Sen's (1999) concept of capability approach, where he argued that the poor are capable of changing their own lives if only they can be given the freedom to do so. The ensuing question, therefore, is, what has been the reasoning behind these scholars' CP advocacy?

In a monograph titled *Village Swaraj*, first published in 1962, Gandhi strongly argued for promoting CP as a viable strategy in development planning through the organisation of village *Panchayats*—the oldest system of local government in India. As an institution, Panchayat consists of three layers: *Gram Panchayat* at the village level, *Block Panchayat* at the intermediate level, and *Zilla Panchayat* at

the district level. Traditional Panchayats consisted of elderly and wise people chosen by the community. Gandhi's idea of creating the Panchayats system aimed to ensure greater participation of the people. To Gandhi, this would lead to more effective and robust mechanisms for implementing rural development projects like improving village agriculture, health and hygiene, transportation, irrigation and cattle welfare.

Gandhi was dedicated to the cause of rural reconstruction through the promotion of CP at the core of resource management and the promotion of productivity. In Gandhi's terms, the concept of decentralisation was to ensure that each village bore the stamp of a little republic, self-sufficient in its vital wants, organically and non-hierarchically linked with the larger spatial bodies, but most importantly enjoying the freedom of deciding the affairs of their community. Gandhi wanted political power distributed among the villages and those who inhabited those villages. The Panchayat Raj system was the most ideal vehicle for initiating this social and economic freedom.

Gandhi's close reading of the strengths of CP is further articulated in Rahman (1985), Galjart (1981, 1982), Roling (1987) and Fals Borda (1988). The key argument made in the preceding works is that any effective development model should adapt to the people involved in the process's social, economic and political contexts. One, they contend poverty is structured and has its roots in the economic and political conditions of the people it affects. So, to tackle the problem of poverty, it is important to develop the capacity of the people it affects so that they can participate and influence the forces that control their lives. Two, development programmes or projects since the early 1980s had largely ignored most of those living below the poverty line. So, there is a need to re-think new development interventions to ensure that the neglected majority can benefit from development initiatives.

The authors contend that a significant proposition emerging from the foregoing argument is the need for more grassroots public involvement in the development process. In other words, it is through participatory development that the community's competencies can be developed and appropriately utilised. Moreover, focusing on local capacity building and grassroots engagement promotes inclusiveness and resilience. It promotes community agencies to address local issues and balance competing interests.

Similarly, Nyerere (1968) has been credited as the first post-colonial president to coherently employ qualitative anthropological techniques in articulating and aligning traditional African participatory ethos into the mainstream development agenda. As a progressive scholar, Nyerere advocated for a model of development planning in Tanzania anchored on the principles of the *Ujamaa* dialectic—a Kiswahili word for familyhood and communalism (Nyerere, 1968). With the idea of Ujamaa, he popularised the idiom of self-reliance, unity, communal work and inclusive, non-exploitative development. In Nyerere's philosophy inscribed in the *Arusha Declaration* (1967), the idea of *Ujamaa* villages was translated into a communal political-economic management model, which meant (a) managing community natural resources (e.g., land, water or wealth) collectively at the village level to maximise production capabilities to the benefit of those who depend

on it and (b) cultivating and fostering self-reliance by transforming economic and cultural attitudes of the masses in the villages. These ideas were later called villagisation, translated into Kiswahili as *Kushirikiana na Kujitegemea*. *Ujamaa* values, in principle, included concepts such as communalism, collective production, egalitarian distribution and universal obligation to work.

Stoger-Eising (2000) has posited that there are similarities between Nyerere's political ideas and those of Rousseau. Nyerere's ideas represented an attempt at fusing Kantian European liberalism with the ethos of African communitarianism. Note that Ujamaa was founded on a development philosophy anchored on the pillars of freedom, equality and unity. According to Nyerere, there must be equality because it enables people to work cooperatively. There must be freedom because it unleashes individual ingenuity. And there must be unity because it promotes peace, security and well-being.

Osabu-We (2000) observed that the Ujamaa debate was intended to encourage communal concepts of African cultures, such as mutual respect, common property and communal labour, through local initiatives. One might argue that Nyerere's contribution to the roots of CP from an African perspective situates him among the pantheons of leading global development theoreticians. This is because, when African values and practices were cast as backward, atavistic and antithetical to the project of modernity, he operationalised the concept of CP into the African development agenda. His vision contrasted sharply with some of his critics. To critics on the ideological left, Nyerere's Tanzania was merely a professed socialist state whose leadership elite either abandoned or never really undertook the class-based struggle for a genuinely socialist society (Shivji, 1974). To those on the right, Nyerere and the ruling elite were seen as having robbed Tanzanian society of the personal freedoms, private incentives and individual rewards essential for transitioning to a modern, prosperous and democratic society. Lane (1999), for instance, observed that the former Tanzanian dictator, Julius Nyerere, significantly contributed to the economic destruction of his potentially wealthy nation. The authors would argue that this was a misrepresentation of Nyerere's vision.

The next significant pro-participatory contributor within the academy of development planning is Paulo Freire (1970). Freire developed the idea of liberation through the promotion of constructive community dialogue. Freire proposed a unique concept named dialogic in the book titled The Pedagogy of the Oppressed. In this idea, Freire argued that people in an oppressed society must go through a revolution to be socially, economically or politically successful. According to Freire, an actual revolution could only be attained through community cooperation, unity, organisation and cultural synthesis of the oppressed. A true revolution could not succeed if leaders of such a revolution do not respect the citizens, their expression or their participation in power (Freire, 1970, p. 126). A true revolution had to be accountable to the people and speak frankly to them about its achievements, mistakes, miscalculations or difficulties. In Freire's *dialogic* philosophy, the disadvantaged could only succeed if their members and leaders were constantly engaged in collaborative communication. This meant that success required cooperation, which could only be achieved through the complete and genuine

participation of the entire community. Like Gandhi and Nyerere for Freire, CP was the key to success in any developing society.

One can, therefore, contend that the views of classical development planning theorists like Gandhi, Nyerere or Freire were relevant in answering our first research question by showcasing the empirical and theoretical evidence supporting the promotion of CP in development planning. Mansuri and Rao (2004) have argued that they contributed immensely to streamlining the earlier waves of participatory development planning, which lukewarmly began in Africa and Asia in the late 1940s. During this period, according to Uphoff et al. (1979), the main reason for promoting CP in development projects, especially by the British colonialists in Africa, was to supposedly prepare the colonies for a peaceful transition to independence (Uphoff et al., 1979). The other reason was to win the *hearts and minds* of the natives. For these reasons, the English mainly concentrated their efforts in English-speaking African colonies. Under the auspices of animation rurale, the French also focused their efforts on African Francophone countries (Charlick, 1980). However, the United States of America was the most significant contributor to the promotion of CP ideals in the developing world (Nagle, 1992). Nagle noted that by 1962, the U.S. Foreign Assistance Agency had channelled approximately $50 million to its Community Development Division through the USAID. The funding was distributed to 30 different African countries, and it was utilised to ensure that the voices of the natives were incorporated into community development projects.

The Case Against CP in Development Planning

In the mid-1960s, funding for community development projects began to dry up, and in early 1970, almost all direct funding to these programmes came to a standstill (Mansuri & Rao, 2004). Two reasons have been prescribed for this development. One, field studies data from the French *animation rurale* started discounting and questioning the benefits of citizen involvement in development planning. As confirmed by Charlick (1980), qualitative and quantitative data from the French participatory-based programmes showed that these programmes were top-down systems that did not account for the views of the natives.

Lane Holdcroft (1982) confirmed the narrative, which reported that most of the projects were being rejected by the people. He wrote,

> Participation, a major goal in the community development strategy, proved to be the most difficult and elusive goal. Participation by nearly all segments of rural society, including the landless, was rarely accomplished in any of the community development programs. In most instances, village development workers tended to identify with the traditional village elites to whom most of the program benefits accrued. (Holdcroft, 1982, p. 30).

Similar sentiments were highlighted in the work of Bill Cook and Uma Kothari (2001), David Mosse (2001) and Weil (2005). Weil, for example, noted that the collapse in the promotion of community development in the 1980s can be

attributed to the rise of the political elites and the promotion of liberal development orthodoxy at the time. This directly challenged the radical populism of community development at the time, and apartheid South Africa or Zaire under Mobutu are examples of these occurrences.

In a recent book, Uma Kothari and Bill Cook showcased participation as tyranny by applying anthropological techniques to three accounts. First, it questioned whether participatory facilitators override existing legitimate decision-making processes. Second, whether group dynamics lead to participatory decisions that reinforce the interest of the already powerful. The third question is whether participatory methods could be alienating. In agreement with these intriguing questions, both scholars argue that international development workers have misused participation to force their agendas on the poor. In some cases, the poor have been sidelined to the peripheries of the mainstream development route.

Mosse (2001) supports the preceding views and challenges the participatory populist accounts flouted mainly by the World Bank. Using project-based quantitative and qualitative illustration, Mosse argued that what is often viewed as local knowledge within the participatory pantheon are perceptions shaped by the development agencies' staff and elites who oversee most government institutions. Mosse has called such behaviours the acquisition and manipulation of 'planning knowledge' in disguise of incorporating and utilising local knowledge. Parfitt (2004) put it vividly that participation as a viable strategy for promoting local knowledge is just a seductive technique employed by international development agencies to pursue top-down development agendas.

Still, on the weakness of participation, the most influential work worth exposing is Hardin's (1968) *Tragedy of the Common* and Oslon's (1973) essay on the logic of collective action. In *The Tragedy of the Commons*, Hardin provides a qualitative account that might lead one to doubt the effectiveness of CP in development planning and management. Hardin uses a common grazing area analogy to illustrate the logical structure of his model. He begins by asking the readers to conceptualise a situation on farmland where all farmers have a right to graze their animals. He then examines the structure of this situation from the lens of a rational herder. Each herder receives a direct benefit from his animals and suffers delayed costs from the deterioration of the commons when his and others' cattle overgraze. Each herder is motivated to add more and more animals because he receives the direct benefit of his animals and bears only a share of the costs resulting from overgrazing.

In short, Hardin's model tried to cement the economic theory, often used to validate why natural resources managed communally are usually unsuccessful. From Hardin's illustration, each actor seemed locked up in a system where everybody tried to maximise their interest and reproduced what he termed 'the tragedy of the commons' (Hardin, 1968). Notwithstanding, Harding typology is not universal, that is, consider the case of the Aborigines of Australia or the Native Americans. For the Aborigines, there is nothing like resource overexploitation. This is because spirits or other supernatural forces provide resources such as water or land and should be used to serve the community (Anderson, 1996). Everybody has a responsibility for how the community uses such resources.

A prototype of Hardin's argument is advanced in Olson's *The Logic of Collective Action*. Olson challenged the arguments that Bentley (1949) and Truman (1958) flouted. Under the mythology of collective action, both Bentley and Truman argued that individuals with common interests would voluntarily act to try and maximise such interests. Olson instead argued on the contrary to this belief. In one of the most frequently mentioned lines in his book, Olson (1973) proposes that 'unless the number of individuals is quite small, or unless there is coercion or some other special device to make individuals act in their common interest, rational self-interested individuals will not act to achieve their common or group interests'.

At the heart of Hardin and Oslon's arguments is the free-rider problem Smith (1723–1790) once veiled as the invisible hand. The free-rider problem arises in collective action when individuals develop no incentive to help produce public goods. The reason that influences their actions is that they will benefit regardless of their contribution. The same reasoning applies to the game theory, the prisoner's dilemma, where both individuals are unwilling to cooperate to get a better outcome (Oslon, 1973). The truth is that despite making rational choices, they become worse off. To correct the free-rider problem, economists like Acheson (1989) instead called for privatisation, not CP, as the best recipe for managing development projects. He said common-property resources, whether land, water, roads or even community hospitals, were prone to overexploitation because no one was incentivised to invest or conserve their future.

Today, some economists still borrow such ideas when arguing against the promotion of CP in development planning. Mansuri and Rao (2004) have argued that such behaviours generated a great deal of pessimism in multilateral development institutions about the viability of local collective action in the provision of public goods. These arguments, therefore, led to the creation of a strong movement in favour of state provision of public goods, which began in the late 1970s and continued into the early 1980s. Specifically, in delivering community-based water services, most economists argued, as Piccioto (1997), that institutions are better managers because they provide formal and informal rules that govern people or group behaviours. By laying down strict laws, he argued that institutions are better at development planning because they can scale down individual or group opportunistic behaviours or even punish free riders. For these reasons, at the beginning of the 1980s, most governments assumed the management and control of almost all development initiatives such as community water provision, transportation, irrigation, schooling and national infrastructural development projects in nearly all African countries (Mansuri & Rao, 2004).

CP in Natural Resource Management

In the mid-1980s, qualitative and quantitative evidence emerged on how poorly the African states managed resources and public goods, including corruption and excessive expenditure in urban and rural water schemes (Calderisi, 2006). The explanations for these failures ranged from the inability to embrace liberal

democratic institutions to the aftershocks of colonisation (Ayitteg, 1999). The failures led to a new momentum and interest in reintroducing CP as a better tool for managing natural resources and public facilities. Bryant and White (1980) and Robert Chambers (1983) were two influential scholars worth crediting for this process. In their work with rural farmers in Zambia, Bryant et al. found that despite being labelled as not having the technical know-how, the farmers were highly rational. They had mastered some sophisticated farming techniques such as shifting cultivation, crop rotation, selection of seeds and mixed cropping. They shared these techniques among themselves, and the overall crop yields in their communities massively increased. Bryant and White found earlier assumptions that rural peasant farmers were stuck in traditional values to be based on faulty premises. For these reasons, they became very influential in advocating for the reintroduction of CP within development planning.

Similarly, Robert Chamber's extensive work in Malawi began to showcase the power of CP in resource management. Using participatory rural appraisals, Chamber's work revealed that local knowledge mattered for the success of rural or urban development programmes. Indeed, he argued most development programmes in Africa had failed because researchers and policymakers had not appreciated the value of local knowledge. For example, Chambers noted a disastrous case where a foreign agricultural officer directed rural farmers on new farming methods yet applied techniques that were only applicable in winter-prone Europe.

The other prominent work on CP in natural resource management is Elinor Ostrom (1990). Specifically, Ostrom influenced participatory development by reevaluating older concepts like the free-rider problem, the game theory and the tragedy of the commons. By applying the rational choice theory and insights from development economics to ecological preservation, Ostrom demonstrated that the much-celebrated economic model of private property is not the only way of managing resources from depletion. Ostrom brings forth the Torbel, Switzerland example, where farmers tend their private crops but share a common meadow to graze their animals during the summer months (Ostrom, p. 62). In this village, Ostrom has shown that despite several interests within the community, they have effectively developed rules and laws that harmoniously regulate the use of communally owned property.

To support her hypothesis, Ostrom uses another example from Japan, where extensive common lands have existed and been controlled by local village institutions for centuries without Hardin's 'tragedy of the commons' taking place. Ostrom further highlights the case of Zanjera irrigation communities in the Philippines to demonstrate how these small rural communities, through a participatory process, have devised rules to govern and choose officials tasked with guarding and maintaining their irrigation systems and canals. All the technologies used for irrigation in these communities are local and efficient. Because farmers rely on local irrigation techniques, this has made it possible for upcoming small farmers to band together to construct other irrigation systems on previously non-irrigated land, benefiting the entire community.

All the preceding observations have immensely contributed to reenergising the international development agencies and national governments to reintroduce CP into the mainstream development agenda. Cornwall (2002) noted that since 1991, the CP has become what the famous French sociologist Michel Foucault termed *political technology.* In other words, it is a powerful tool used to manage and control projects and development processes. Woodford-Berger and Nilsson (2002) have acknowledged that since the 1990s, efforts have been made to *scale up* and *institutionalise* participation beyond community-based settings to link it to other broader issues of governance, public sector management and institutional strengthening, democracy, human rights, decentralisation and privatisation. A sourcebook was published in 1996 and was entirely dedicated to learning the techniques of participatory development (World Bank, 1996). Currently, the Bank's policy position is that CP is mandatory in all its funded projects to promote transparency and accountability and achieve project sustainability (World Bank, 2002, 2004).

CP in Potable Water Delivery

In the domain of potable water provisioning, several projects have been established under the paradigm of CP. The assumptions are based on (a) local communities working with organisations and institutions are better positioned to construct and maintain sustainable water supplies (Cernea, 1992). (b) Beneficiary involvement lowers the cost of water production and supply maintenance (Ditcher, 1992). (c) Participation targets the community's needs through incorporating and adapting local knowledge (Chambers, 1997). (d) Participation promotes equity regarding water distribution within a defined community. In the coming section, the authors highlight some key studies undertaken to evaluate the effects of CP in water management.

Research by Kreysler (1969) is among the earliest studies to demonstrate the technological impacts of CP in water production. Using data collected through focus group discussions, Kreysler analysed the decision-making process in a village community-managed water scheme in Tanzania. The findings showed that after months of intense consultation, the beneficiaries rejected using bamboo pipes and open concrete channels. Instead, the beneficiaries chose a more sophisticated piping network because they appeared more sustainable than the open concrete channels or bamboo pipes. Contrary to the Tanzanian case, in Laos, a study by Versteeg (1977) of a hand pump and piped water system by immigrants found that the community preferred bamboo pipes instead of a sophisticated water system. Vesteeg noted that the beneficiaries developed a well-functioning and cheaper water suction system using bamboo sticks in this case.

Similarly, Cochrane (1970) in Gilbert Island, Kiribati also described the design of a well by local community handymen in a resettlement project. Cochrane observed that the design of the local handymen, in consultation with the beneficiaries, proved to be superior to those proposed by the officials of the World Health Organization. The design was less expensive and more efficient in its

production of water. Similarly, a study by Segaar (1979) in the Javanese mountain in India showed that a locally developed water supply system constructed with bamboo sticks was very satisfactory to the extent that the modern supply systems could not match it at the time.

Despite a few drawbacks, studies all over the developing world, especially in Africa, have shown that CP facilitates efficiency in the delivery of potable water. Recent studies have also confirmed this observation. Here is a list of key studies that have used either quantitative, qualitative or mixed methods to analyse the prowess of CP in the potable water delivery sector.

A study by Narayan (1995) of 121 rural water projects in 48 countries found that participation was a significant indicator of overall effectiveness in rural community-managed water schemes. Sara and Katz (1998) also investigated the impact of participation on the sustainability of community-managed water schemes and found that sustainability was higher where CP was encouraged. Similarly, Kleemeier (2000) found that CP was instrumental in establishing sustainable rural water projects in Malawi. Gross et al. (2001) found that a high level of CP was positively associated with sustained rural water and sanitation service delivery. Also, Isham and Kahkonen (2002) found that CP, specifically through labour contribution, leads to better outcomes in public water supply schemes in Indonesia, India and Sri Lanka.

Recent studies by Ananga (2015), Ananga et al. (2017, 2020), Prokopy (2005), Das (2009) and Sara and Davis (2012) draw similar conclusions. Ananga et al. employed chi-square tests and found that beneficiaries of water systems involving CP practice better hygiene, for example, cleaning water storage containers and protecting water sources than beneficiaries of non-CP systems. Prokopy used regression analysis to reconfirm that certain participatory variable like capital cost contribution and household involvement in decision-making significantly contribute to the effectiveness of community-managed rural water schemes. Priyan Das's research found that participatory variables such as a partnership between water users and government bodies were significant predictors of the effectiveness of community-managed water schemes within urban peripheries. However, studies in Kenya caution that not all types of participation enhance community members' sense of ownership of rural water schemes. In the pantheon of CP, a sense of ownership is an essential barometer for establishing the causality of sustainability in community-managed water schemes.

As indicated above, mounting empirical evidence has justified the promotion of CP as a tool for success in development planning, especially water service delivery. However, some researchers are cautious of these findings. They have stated that CP should not be treated as a panacea of development. For instance, Bamberger (1986, p. 10) details a series of weaknesses in why CP should not be seen as a solution for potable water provisioning and management. Formerly, he observed that the promotion of CP may delay project start-ups because there may be too many people to consult. Subsequently, CP may lead to budgetary chaos. Well-organised communities may exert pressure and widen the range of services beyond the ones stipulated in the initial budget of water schemes.

Additionally, communities that are part of politically unstable societies may have much wider problems that could lead to conflict, which may paralyse the potable water scheme projects altogether. Furthermore, in such societies, the projects may be hijacked by those in higher economic or political strata, curtailing the intended benefits for the commons. Finally, involving communities through CP may increase their expectations beyond what can be provided by the project. This can hinder the sustainability of potable water schemes after their completion. Similar findings are identified in Njoh's (2002, p. 240) study of the Mutengene self-help water project in Cameroon.

Nagle (1992) and Mosse (2001) analysed CP statistically in USAID water projects and found that CP techniques may lead to increased management and administrative staff. Hence, it is cautioned that this may affect project outcome since revenue meant for project development could be redirected to hiring bureaucrats. Similarly, Mosse found that participatory exercises are mostly open-ended public events, inherently political and reflect local relations of power, authority and gender. Correspondingly, Platteau and Abraham (2001) present evidence on how African elites capture water projects in the name of CP. They argue that rural African communities are often led by dictatorial solid leaders who can dominate the participatory process in a manner that directly benefits them because of the poor flow of information.

Chauhan (1983) and Cernea (1992), in a study of eight projects, concluded that even though CP was established at the project initiation, the people who implemented it and made water flow from the taps were dedicated professionals rather than beneficiaries. Similarly, Cernae's studies on 25 development projects revealed that without sound institutional capacity, CP was insufficient in terms of project success.

Concluding Remarks

Throughout the previous sections, the authors have employed historiography to demonstrate that over the past 60 years, the viability of CP in development planning has been vigorously debated and tested. Subsequently, based on this review, the authors can attest that CP is an important theory that has informed policy within the development planning sector for decades. Paradoxically, scholars have acknowledged that as a theory, it has strengths and weaknesses. These include the fact that (a) participation might sometimes override existing legitimate decision-making processes, (b) reinforce the interest of the already powerful through knowledge acquisition and manipulation, (c) drive out those advantages participation cannot provide, (d) lead to opportunist behaviours, that is, free-rider syndrome, (e) involving many people could, at times, be expensive and thus lead to paralysis, and (f) endlessly hold development investments hostage to unproductive activism.

On the strengths, participation can lead to (a) improved project design, (b) increased project acceptability, (c) more equitable distribution of benefits, (d) increased resource mobilisation, (e) improvements in sustainability parameters,

and (f) promoting and protecting the hygiene quality of potable water. Taken together, the authors conclude by premising that unless these strengths and weaknesses are fully documented/appreciated from a historical standpoint, efforts to take full advantage of CP as a theory in the development arena will remain futile.

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Article

Identifying Development Priority Areas Using Index of Dissatisfaction: A Case Study of a Coastal Town in the Philippines

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Abstract

In local planning practice, subjective well-being (SWB) approaches continue to gain traction. For the past two decades, researchers have devised tools that generate action or priority lists, such as by asking self-reported life satisfaction or satisfaction levels across aspects of their lives (e.g., health, finances). These listings are especially beneficial for rural areas where local income and other resources are inadequate and misdirected. This article examines residents' perceptions of a rural coastal community in the Philippines on various personal and related factors affecting their well-being. A comprehensive collection of quantitative tools (e.g., principal component analysis, seemingly unrelated regression, and Index of Dissatisfaction (IDS) scores) were used to identify priority development areas and to understand the factors influencing such decisions. The research process, which was both comprehensive and inclusive, took into account various locations, ages, levels of formal education, household sizes and employment characteristics, which have distinct choices. This broad scope of the research ensures that the voices and needs of all residents are heard and considered, promoting a sense of fairness and equity in the planning process and making the audience feel more informed and involved in the process of regional development.

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Keywords

Index of Dissatisfaction, perceptions of residents, development priority areas, coastal community, Philippines

Introduction

Identifying development areas, known as 'priority development areas' or more informally as 'problem areas' is a crucial economic and management policy tool for promoting regional development (Isaev, 2017). It is a strategic approach that guides leaders and decision-makers in addressing the most pressing current issues (Community Toolbox, n.d.; Larson, 2010) for inclusive and sustainable development (Corrigan & Adams, 2003; Foote, 2019). This participatory approach to local planning, which involves stakeholders, ensures that the urgent concerns of those involved are given due consideration. The findings of this study, which highlight the importance of health care and education facilities, local employment industries, family relationships and marine protected areas (MPAs), can serve as a practical guide for leaders and decision-makers in fostering regional development in similar contexts.

One approach to determine which areas need improvement[1] is to look at residents' well-being and the aspects of their lives that are lacking. The terms 'life satisfaction' and 'quality of life' are often used interchangeably to refer to '*well-being*' (McAllister, 2005). Delgado and Marin (2016) defined well-being as a holistic approach to life, where people have the means to live the way they want and have the ability to improve themselves given the existing opportunities. Various dimensions, such as social, economic, ecological, cultural and institutional, contribute to a person's well-being (Camfield et al., 2009). Through the years, indexes on various aspects of well-being have been developed for decision-makers and managers in determining priority areas for improvement in the local community (Costanza et al., 2007; Hagerty et al., 2001). Increasing the interest in life satisfaction in policymaking is vital for local stakeholders. Hence, providing information on what is important and what satisfies them is vital for community development (Park et al., 2018; Scoones, 2009). Thus, the success of any development strategy requires understanding community well-being.

One criterion of a good quality of life is when the needs of the people at a particular time are met, and another is how much they deem important these needs are. Focusing on these two and aggregating the population's responses will reveal the community's problem areas'. There is also a special interest in studying the development priorities of rural coastal areas. They are often characterised as natural-resource dependent, socio-disadvantaged, prone to unplanned development (Millennium Ecosystem Assessment, 2003) and limited in local budget. Some studies examine the well-being of urban, semi-rural and rural dwellers, sometimes comparing the perceived quality of life among the groups (Millward, 2013; Sørensen, 2014). While life satisfaction in urban areas is mainly studied (Larson, 2010; Millward, 2013), studies on rural satisfaction often focus on small communities (Millward, 2013) and on local stakeholders' perceptions (Larson, 2010; Larson et al., 2015).

There are mixed findings regarding the perceived quality of life among rural populations. Some rural residents are least contented (Millward, 2013), particularly with education and medical services (Park et al., 2018). One interesting finding is that the rural residents from richer countries have high life satisfaction, while rural residents from poorer countries have low life satisfaction (Sørensen, 2014). Residents are also reported to be more satisfied with personal factors but less satisfied with national affairs (Larson, 2010). Economic hardships and lack of government and business services and opportunities, among others, are said to be the culprits for dissatisfaction with national life (Cummins et al., 2003). It is also argued that the well-being of the rural population depends on providing ecosystem services (Delgado & Marín, 2016; Larson, 2010). As mentioned earlier, rural poor in developing countries rely heavily on natural resources for their livelihood. Hence, ecosystem degradation has a more severe impact on them (Millennium Ecosystem Assessment, 2003). Moreover, opinions towards various aspects of life satisfaction are also dependent on demographics (Alih, 2017; Schmitz & Brandt, 2022), location attributes (Guevara-Rosero, 2022; Porio & See, 2017) and other social indicators, as many studies have found.

With the limited insight into the quality of life of the rural population and how the ecosystem influences their well-being, there is a need to investigate their well-being from the perspective of local stakeholders. Since livelihoods in rural areas of developing countries are drawn significantly from natural resources (Delgado & Marin, 2016), responses and perceptions should be taken directly from them (Scoones, 2009). A participatory approach from diverse stakeholders to guide how to manage the resources and improve the well-being of the general population contributes to the success of regional planning, development and decision-making (Lebel et al., 2015).

This study examined the life satisfaction of rural residents of Concepcion, Iloilo, using an index developed by Larson (2010). This approach uses the measurement of quality of life suggested by Costanza et al. (2007). Specifically, this study investigates the respondents' problem areas that need improvement. The article also intends to examine what socio-demographic factors affect respondents' life satisfaction levels and the implications of this relationship.

Methodology

Case Study Area

This study was conducted in the coastal municipality of Concepcion (Figure 1) (Municipality of Concepcion, 2017), a rural municipality of the Province of Iloilo (Department of Trade and Industry, 2020), which is surrounded by the municipalities of San Dionisio, Ajuy and Sara. It comprises 25 barangays (smallest community unit), 14 on the mainland and 11 on small, remote islands. About 70% of the residents rely heavily on municipal waters for their livelihoods (International Movement of Development Managers, 2008; United Cities and Local Governments, 2010).

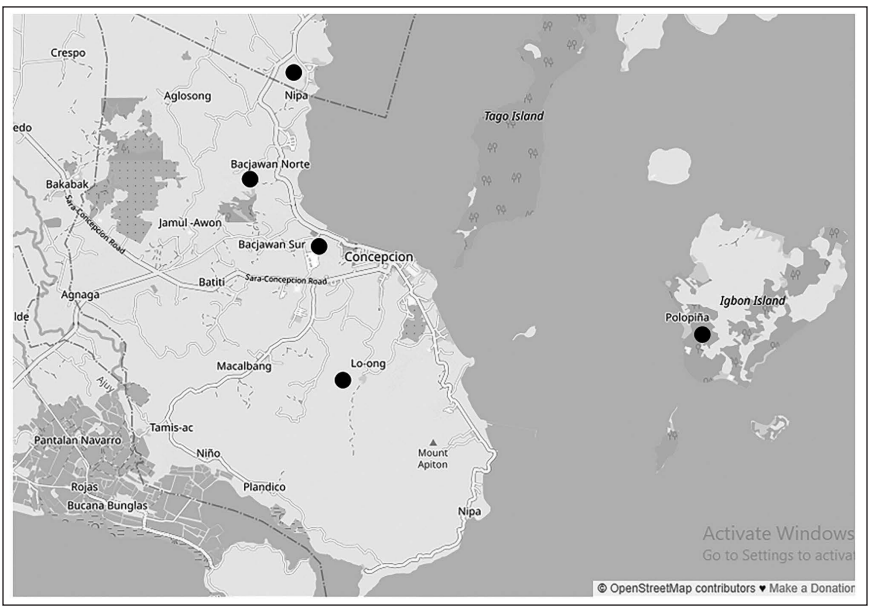

Figure 1. Map of the Municipality of Concepcion and Study Sites.

Source: OpenStreetMap Foundation (OSMF), n.d.

In 2000, Concepcion experienced several economic and social hardships. Illegal fishing, characterised by destructive methods, increased in the municipality and caused severe damage to marine resources. The consequent depletion of resources caused further difficulties as their livelihood was threatened. As migration to the town increased, residents were constrained regarding quality education, decent health and social services. The bleak situation made Concepcion the poorest municipality of Iloilo, with 87% of its households considered poor (International Movement of Development Managers, 2008; United Cities and Local Governments, 2010).

Data Collection

A pretest of the research instrument was conducted among 50 randomly selected residents in Barangay Poblacion, Concepcion, in April 2018. The well-being and life satisfaction questionnaire was translated into the local dialect (Hiligaynon). Several well-being factors were presented, wherein respondents had to choose and rate the level of importance from 1 (the lowest) to 100 (the highest). Moreover, participants were asked to rate their level of satisfaction from 1 to 100, with the chosen factor identified as important. The Full-World Model of the Ecological Economic System (Costanza et al., 1997) provides a general framework, following the main concept of Ekins (1993) and highlights an ecological economics view of the wealth creation process—financial, natural, social, manufactured and human capitals. The model advocates complementarity between forms of capital

and states that the shortages of one form significantly limit the productivity of the other (Costanza et al., 1997). During the pretest, not all variables were deemed significant in the context of coastal populations. Thus, the final questionnaire included four categories with four well-being factors each:

(1) Financial capital (values that you can get from the workplace): Personal income; income of family, friends and relatives; permanent or secured employment, fair income/benefits.
(2) Natural capital (values that you can get from the environment): Presence of MPAs; fish catch; water quality; resilience or capacity to recover from natural/man-made hazards.
(3) Social capital (values you can get from the community): Family relationships; personal and family freedom and security; good governance; participation in social/leisure activities.
(4) Manufactured capital (values that you can get from infrastructures provided by the government): Hospitals, industries/workplaces, roads, schools.

For the proper survey, sample communities were selected based on population size and logistic reasons. Five coastal communities were purposely chosen as study sites, four from the mainland and one from the islands. The mainland barangays were Loong, Nipa, Bacjawan Norte and Bacjawan Sur, while the island barangay was Polopiña. From 10,142 households, 250 were randomly selected to represent these communities using Yamane's (1967) formula. Proportionate sampling was employed to determine the appropriate number of sample households that should be taken from each barangay. In all, 55 respondents came from Loong, 48 from Nipa, 34 from Bacjawan Norte, 50 from Bacjawan Sur and 62 from Polopiña.

Analysis

The primary analysis is the redeveloped Index of Dissatisfaction (IDS) (Larson, 2010). This is a non-monetary approach, which combines the scores of importance and satisfaction of residents. Respondents were asked to pick which well-being factors they deemed necessary and then rate their satisfaction level with these chosen factors. The ratings are as follows:

- Level of importance—Likert scale from 1 to 100; and
- Level of satisfaction—Likert scale from 1 to 100.

To determine the mean importance of a factor k, a number of n respondents chose k as relevant to overall well-being out of the total N respondents ($n_k \leq N$). It is computed as:

$$\underline{I}_k \frac{\Sigma_{i=1}^{n_k} I_{ik}}{n_k} \quad (1)$$

Equation (2) was used to estimate the mean dissatisfaction score (DS). The satisfaction score assigned by the respondent to each item (S_{ik}) is used to calculate the DS ($D_{ik} = 100 - S_{ik}$). The estimate is the mean dissatisfaction across all n_k residents.

$$\underline{D_k} = \frac{\Sigma_{i=1}^{n_k} D_{ik}}{n_k} \tag{2}$$

Then, Equations (1) and (2) were used to compute the IDS for each factor k:

$$\text{IDS}_k = \frac{n_k}{N} \cdot \underline{I_k} \cdot \underline{D_k} \tag{3}$$

Interestingly, the scale used in this study is from 1 to 100 instead of 1 to 10, as per Larson (2010). During the pretest, respondents relayed that they can understand and visualise the scale (1–100) better than the 1–10.

The factors are then ranked by their IDS scores, from the highest to the lowest. Since this is a compound index, three things can influence the IDS score: The number of respondents choosing the factor, the corresponding rate of importance and the satisfaction rate. Factors with high scores mean that more respondents perceive them as highly important and are highly dissatisfied with the current status of these factors. Hence, high scores indicate greater priority from managers and policymakers if they want to improve the well-being of their constituents.

Next, principal component analysis (PCA) was employed to determine the well-being factors that primarily contribute to life satisfaction. PCA is a statistical technique that reduces large data sets into smaller ones while maintaining most of their variation. The reduction is done by identifying directions, called principal components (PC), along which the projections have the maximum variance. The few components are linear combinations of the original variables (Ringner, 2008). This method can confirm or add more depth to the information provided by the IDS method.

Moreover, this study applied seemingly unrelated regression (SUR) to verify the determinants of life satisfaction, with PCs as dependent variables against socio-demographic variables as explanatory variables. The SUR is a regression estimator that simultaneously estimates multiple models. The models may seem unrelated but the equations are correlated in error terms (Lin et al., 2014).

Results

Respondent Profile

Respondents were personally interviewed using the guide questionnaires. Of the 250 questionnaires that were administered, 250 were also completed. Table 1 shows the socio-demographic profile of these residents. The majority of the interviewed residents were female (69.2%). About 81% are married, and on average, there are 5 members in the family. Only 5.2% of the respondents had permanent work, with 49.2% either having no job or working at home. The average level of

Table 1. Socio-demographic Profile of Respondents (n = 250).

Characteristics	Mean (Std. Dev.) or Frequency Distribution
Sex	Female (69.2%) Male (30.8%)
Age, in years	44 (15.8)
Marital status	Married (81.2%) Unmarried (18.2%)
Household size	4.8 (2.0)
Education, in years	8.58 (3.1)
No. of children in the household	1.7 (1.5)
No. of adults in the household	3 (1.4)
If any household member works abroad	32 (12.8%)
House tenure	Owned (88.4%) Not owned (11.6%)
Type of work	Formal work (50.8%) Informal work (49.2%)
Employment status	Permanent (5.2%) Not employed but working at home (32%) Casual/job-hire (20.4%) No work (17.2%) Other work arrangements (16%) Own business (8.4%) Retired (0.8%)
Job classification	Salaried (19.2 %) Non-salaried (22.4%) Others (8.8%) Not applicable (49.6%)
Industry employment	No formal work (49.2%) Wholesale and retail trade, repair of machinery (16.8%) Agriculture, forestry and fishing (18.8%) Administrative and support service activities (7.6%) Construction (2.8%) Transportation and storage (2.4%) Electricity, gas, steam and air-conditioning (1.2%) Accommodation and food service activities (0.4%) Education (0.8%)

education was 8 years, indicating that respondents usually drop out during middle school. It can be observed that employment in agriculture, forestry and fisheries was 18 %, whereas the municipality profile indicates that 70% of the locals dependent on the coastal waters. This is because the respondents were usually the wives left at home while the husbands were out working. This was also evident in the proportion of females were interviewed.

The IDS

The IDS score of each economic and environmental value is computed using Equations (1)–(3). The scores identify which areas are important to residents and whether there is a gap between what they deem important and their degree of satisfaction (i.e., dissonance). The higher the IDS score, the more the respondents believe this particular area needs more attention. Table 2 shows the IDS scores, weighted importance (WI), DS and the proportion of the respondents selecting this particular variable. Among the 16 variables, respondents only chose the well-being domains that mattered to them. Hence, the percentage selection can also be viewed as the ratio of respondents over the total sample that decided to rate this variable according to how they perceived the variable to be important and how dissatisfied they were with the current situation of the variable.

Respondents selected '*family relations*', '*schools*', '*hospitals and other health care units*', '*marine protected areas*' and '*roads*' as the most critical factors for their well-being (fourth column of Table 2). On the other hand, '*hospitals*', '*infrastructures for industries*', '*fish catch*', '*personal income/salary*' and '*roads*' topped their most dissatisfied list. When IDS scores are computed, results reveal that respondents were most concerned with manufactured capital, such as 'hospitals', 'infrastructure for industries', and 'schools', 'and job security', as a form of financial capital also ranked high. In separate interviews with local officials, residentsexpressed the need for additional infrastructures (i.e., hospitals, roads, industries for work, schools). '*Good governance*' was chosen by 48.8% of the respondents. Good governance is often referred to as anti-corruption and strong politics in the Philippines (Medalla & Balboa, 2010).

For the second part of the analysis, the relationship between the socio-demographic factors of respondents and their IDS scores was explored. Since there were 250 respondents and 16 variable groups, steps were taken to ensure that PCA was suitable to perform. First, a correlation matrix was determined. Results show that the correlations between the pairs of 16 statements ranged from 0.0001 to 0.5310, while the value of the determinant of the correlation matrix is 0.0370. The Kaiser–Meyer–Olkin was measured to determine the adequacy of sampling the data. The value 0.7337 implies that PCA is appropriate (Yong & Pearce, 2013). Lastly, the value of Bartlett's test of sphericity is 0.000, which indicates the suitability of data reduction (IDRE, 2017).

PCA, a data reduction technique, collapsed the 16 '*values*' into groups. The whole idea of PCA is that there is a correlation among the variables, and this technique can estimate the structure of these variables (Wold et al., 1987). Based on the correlation, the variables can then be grouped into a new single construct called PC (Abdi et al., 2013) or 'factors'. The combinations of PCs or factors are constructed to be uncorrelated. The first component stores the most information about the original data, the next component the following most information and so on. Every component has a corresponding eigenvalue, which reveals the information contained in the component. How many components to keep depends on the eigenvalues (Abdi et al., 2013). For this study, components with eigenvalues greater than one were kept and used to describe the data. Of the PCs, five had eigenvalues greater than one.

Table 2. Index of Dissatisfaction (IDS) Score, Weighted Importance, Dissatisfaction Score and Percentage of Respondents Selecting the Different Factors (n = 250).

Rank	Value	IDS Score	Weighted Importance	Dissatisfaction Score	% Selecting
1	Hospitals and other healthcare units	1,764.12	96.04	32.80	56.0
2	Infrastructures for industries/ workplace	1,291.13	93.20	26.04	53.2
3	Job security	1,044.98	94.33	20.98	52.8
4	Schools	806.79	97.79	14.03	58.8
5	Fish catch	781.45	92.35	25.80	32.8
6	Good governance	775.61	91.53	17.36	48.8
7	Roads	714.80	95.61	23.36	32.0
8	Water quality	656.20	93.16	21.22	33.2
9	Marine protected areas	614.15	95.72	18.65	34.4
10	Personal income/salary	530.40	89.90	25.00	23.6
11	Fairness of pay received from work	527.17	92.36	20.39	28.0
12	Personal/family freedom and security	457.53	94.14	14.46	33.6
13	Resilience and capacity to recover from calamities	389.26	86.81	15.15	29.6
14	Family relations	376.99	97.97	7.23	53.2
15	Income of family, friends and other relatives	315.51	87.16	17.75	20.4
16	Participation in social activity	299.60	87.81	16.40	20.8

Table 3 presents the five components retained after PCA was run. Each component contains the variables that are highly correlated to it. The strength of the correlation is revealed by the factor loadings. Factor loadings with scores higher than 0.5 were kept to help determine the group label (Greiner et al., 2009). Meanwhile, items with scores higher than 0.3 were kept in the final group. The PCA generated five groupings and named them based on statement characteristics: Infrastructures, governance and job security, income and basic needs, family income and relationships and resilience and other social aspects. The results of the IDS scores reveal that infrastructures like roads, schools, hospitals and industries are the main factors determining respondents' well-being. Second on the priority list of respondents are good governance and job security.

The five components were then regressed against socio-demographic variables using SUR. The SUR was used since the same explanatory variables were used for the five components and the factors have an inherent interrelationship with one another. The SUR shows the best linear unbiased estimators for the parameters of five regression equations. By doing this, the test reveals more in-depth characteristics of respondents when choosing factors that contribute to their well-being. Table 4 shows the results of SUR.

Breusch–Pagan tests show heteroskedasticity in factors of income and basic needs, family income and relationships, resilience and other social aspects. Robust

Table 3. Principal Component Analysis (PCA) Components with Factor Loadings and Average Index of Dissatisfaction (IDS) Scores of Groups, Concepcion Iloilo Philippines, Indicate Year Here (n = 250).

Infrastructure	Governance and Job Security	Income and Basic Needs	Family Income and Relationships	Resilience and Other Social Aspects
Roads (0.57) Schools (0.52) Hospitals (0.47) Industries (0.36)	Good governance (0.73) Permanent job (0.41)	Personal income (0.67) Water quality (0.44)	Income of my family, friends and other relatives (0.57) Family relations (0.55)	Personal/family freedom and security (0.62) Participation in social activity (0.55) Resilience (0.45)
Average IDS scores: 1,119.75	870.44	573.25	364.92	322.87

Table 4. Resident Socio-demographic Characteristics that Explain Index of Dissatisfaction (IDS) Scores (n = 250).

Characteristics	Infrastructure	Income and Basic Needs	Governance and Job Security	Family Income and Relationships	Resilience and Other Social Aspects
Age		–		–	
Barangay	+	+			
Employment status			–		
Household size	+	+		+	
Education	+				
Household income					+
R^2	0.1578	0.0998	0.0766	0.1526	0.0949

Note: A significance level of at least P < .10, (+) signifies that the variable is significant and positively correlates with the component value. (–) signifies that the variable is significant and negatively correlates with the component value.

standard errors were employed for SUR to correct this. Table 4 shows how the characteristics of respondents and the newly collapsed groups are related. Of the 13 socio-demographic variables, six have established significant correlations. Those indicated by the plus (+) sign indicate that the variable is significantly and positively related to the group. In contrast, the negative (–) sign indicates that the variable is significantly and negatively related. Blanks signify no significant relationship between the variable and the specific factor. The significance level is set at 0.10.

The study further reveals that barangays Nipa and Polopiña show more concern with infrastructures (i.e., hospitals and other health care units, the infrastructure of industries, schools, and roads) than Bacjawan Norte. On the other hand, Nipa is located on the mainland but still shows considerable interest in

infrastructure. Those with bigger household sizes and higher education also expressed more concern about infrastructure than those with fewer household members and lower levels of education.

Findings show that younger people with bigger household sizes were more concerned with income and basic needs than their counterparts. Respondents from Barangay Nipa likewise showed greater concern with this factor than those in other barangays. Similarly, the young, with more household members, showed more interest in family income and their relationships with one another.

It is also interesting to note that those with casual or temporary jobs were less concerned with good governance and job security than those with secured or permanent jobs. This goes to say that people with permanent jobs were more interested in good governance and having secured jobs. Finally, respondents with higher incomes (those with income greater than PhP10,000) expressed more concern with resilience during calamities (e.g., typhoons) and other social aspects than their lower-income counterparts (those earning less than PhP5,000).

Discussions

Infrastructure is a precondition to economic development. They are indispensable for facilitating the production of goods and services, market access, employment and technological advancement (Grum & Kobal Grum, 2020). Thus, it is no surprise that numerous studies have found infrastructure such as roads, hospitals and education essential to individual well-being. In this study, most wellbeing aspects residents found unsettling were infrastructure-related. Perceptions about infrastructure were different based on location, household size and education. Polopiña is an island barangay, making access to infrastructure, particularly healthcare facilities, difficult. Also, as more household members require access to infrastructure, it becomes a concern for the entire family. This implies that individuals with longer formal education desire greater access to hospitals, schools, roads and job-producing industries. The municipality has no hospital, and the nearest medical facility is 21 km distant in a neighbouring town. There are 11 island barangays in Concepcion, and passenger transportation service (i.e., boat) from the mainland to these islands (and vice versa) is limited and infrequent (one trip in the morning and one trip in the afternoon, as of data collection). In a medical emergency on the islands, the patrol boat that monitors MPAs is also used to transport patients to the mainland. Furthermore, despite the islands' beautiful scenery, clear waters and relaxing beaches, they cannot maximise their tourism potential due to a lack of essential tourist amenities (e.g., roads and toilets) on these islands. Typically, tourists travel by boat for a day excursion and then spend the night in hotels on the mainland.

Residents expressed discontent with education as a social infrastructure. In 2015–2016, the elementary education literacy rate was 92.69%, while the completion rate was only 58.67%. Efforts have been made to enhance residents' education level, but most support is provided at the elementary level. Effective

policy-making is connected to education. For example, during the interviews, local officials stated that due to the low level of education of the local populace, it is challenging for them to explain the marine resource protection and management regulations they have implemented.

Numerous studies clarify the relationship between infrastructure and well-being. Various types of infrastructure promote well-being, such as regional infrastructure (e.g., paved roads, sewerage, etc.) (Guevara-Rosero, 2022) and social infrastructure (e.g., health care, community services, etc.) (Grum & Kobal Grum, 2020; Schmitz & Brandt, 2022; Vaznonienė & Kiaušienė, 2018). The current investigation contradicts the findings of Gareis et al. (2021) regarding minor German towns, wherein they used the concept of borrowing size (Alonso, 1973) that explains the relatively high prosperity of minor cities despite their dissatisfaction with local infrastructure. The results of this study suggested that the municipality has not yet reached '*satiation*' concerning fundamental services, such as infrastructure (Diener & Seligman, 2004). Infrastructure development in the Philippines is heavily biased toward the National Capital Region and other regional centres, per Porio and See (2017). In addition, the contribution of infrastructure to life satisfaction varies by location (Guevara-Rosero, 2022; Porio & See, 2017) and individual characteristics (Porio & See, 2017; Schmitz & Brandt, 2022).

Financial aspects (e.g., income, means of subsistence) and those associated with earnings (e.g., infrastructures that support industries) contributed significantly to well-being. Intriguingly, water quality and MPAs were valued highly, which may be connected to the town's expanding fisheries and tourist industries. According to the 2017 Municipal Profile of Concepcion, the average monthly household income is PhP4,421.80 ($82), well below the national poverty threshold for that year. Fisheries and agriculture are the primary industries; unemployment was approximately 34%. Of the employed, 78% engage in agriculture and fishing, 11% in services and 4% in commerce. Residents also generated income through the production and/or sale of fish crackers, banana crisps (and other dehydrated fruits and vegetables) and squid rings.

Western Visayas has a growing cottage industry due to increasing tourist and population demand. In addition to other revenue-generating activities (such as growing lettuce and raising livestock), these are supported by the Concepcion local authority. On the other hand, conservation of marine ecosystem services through protection and multiple uses may increase fish catch. Demand for tourism also has increased over the past decade, allowing residents to diversify their sources of income and lessen their dependence on these marine resources. Numerous studies have demonstrated that economic factors contribute to one's happiness. The contribution is significantly higher in developing countries or rural areas (Porio & See, 2017), where basic needs (such as infrastructure) are not yet addressed.

Although the municipality has a long history of establishing MPAs in the region, 'MPA' ranked ninth on the IDS, indicating moderate discontent among respondents. Notably, respondents ranked MPA as one of the most essential but expressed low discontent with its current state. This suggests that respondents

recognise the importance of MPA in enhancing their quality of life and are dissatisfied with its current impacts on their lives. During interviews, municipal officials confessed to dealing with perennial problems in MPA implementation, especially during closed seasons. They are positive, however, in the acceptability of MPAs and other conservation efforts. Initially, fishermen protested because they believed access to their source of income was restricted, but as marine resources improved over time, so did their fish yield and income. Thus, they eventually become supportive of marine conservation.

Social capital, such as '*family relations*', '*participation in social activity*' and '*income of family acquaintances and other relatives*', is another form of financial capital ranked near the bottom of the IDS list. Ironically, '*family relations*' have the highest WI but the lowest DS, placing it at the bottom of the IDS rankings. During the interviews, residents felt insufficient community-related activities in the municipality (e.g., events such as festivals and sports) that they could do with their family and friends.

Efforts have been made to resolve the aforementioned issues. First, there is the construction of 20 daycare centres and 8 primary and elementary schools, the distribution of workbooks and textbooks and the establishment of vegetable plantations to provide students with more food. Specifically, Barangay Loong received a reading centre, a facility for children and a training centre. As education is also a factor in gaining employment, the municipality supports the tourism industry by ensuring residents have the formal educational requirements for those seeking employment. Currently, the municipality offers tour guide training for those interested in assisting tourists during tours of the islands. Second, the municipality advocates participatory resource management by having campaigns that promote pro-environmental behaviours, such as taking responsibility for the conservation and protection of natural resources. The increase in fish capture was the result of incorporating local stakeholders into the protection of marine ecosystems. In addition, the programme produced alternative agricultural technologies that ensured the sustainability of agriculture. These initiatives increased the residents' access to employment and income opportunities while protecting the environment. Third, the programme improved public health by reducing morbidity, mortality, maternal mortality and water-borne diseases.

In addition, it encouraged family planning and provided social health insurance for 1,233 recipients (United Cities and Local Governments, 2010). Lastly, the municipality's acute poverty prompted the local government to implement policies and reforms to improve its socioeconomic conditions. The goal of the 'Zero Poverty 2020' programme is to eradicate poverty by the year 2020. From that point forward, the local government endeavoured to enhance the living conditions of its citizens by constructing infrastructure, improving health services, reforming education and managing its resources. Seven MPAs have been designated in the municipality since 1999. These MPAs were established to manage the marine ecosystem better and, eventually, to enhance the residents' standard of living and income. The initiatives improved economic conditions to the extent that in 2004, approximately 47% of the population lived in destitution (United Cities and Local Governments, 2010).

Conclusion

This study introduced the IDS as an aggregated policy tool for identifying '*action lists*' or '*potential development areas*' in a Philippine rural town. Utilising IDS to identify '*problem areas*' is beneficial for informing local policymakers, who can then use this information to improve the quality of life for their constituents.

Infrastructures are the most significant contributors to the well-being of respondents in Concepcion. Based on the IDS scores and PCA groupings, the quality of life of respondents will improve if the local government prioritises '*hospitals and other health care units*', '*schools*', '*roads*' and '*infrastructures for industries*'. This finding can assist policymakers in determining action plans for the development of a municipality consistent with their goal of attaining '*Zero Poverty*'. As respondents identified their most significant concerns, '*infrastructures*' in this context can also be regarded beyond the physical structures. For instance, respondents are interested in developing the healthcare system rather than hospitals. Instead of roads, the locals may be concerned with the connectivity of the transport system. The findings suggest that planning efforts should be differentiated as perceptions vary across different factors. While the study was done in four mainland barangays and one island barangay, the perception of residents in other areas, particularly in other island barangays, may differ. In island communities, priorities for development should include infrastructure that enables livelihoods and socialisation (e.g., basketball courts and community grounds). Looking at other rural communities, many experienced similar problems with infrastructure, especially in communications infrastructure, such as the Internet (Abreu & Mesias, 2020). The group of quantitative analyses presented here is promising as it provides unfiltered opinions on various aspects, which assist in areas often overlooked by policymakers. However, further research on its validity and transferability must be conducted to understand its complete adoption in local policymaking. The current study encourages researchers to look into how this tool could be used for planning, including its theoretical and practical applicability.

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Note

1. Other examples of tools for development priority settings include ecosystem services modelling (Duarte et al., 2016), decision-support tools (Mabin et al., 2001) and multi-criteria decision analysis (Baltussen & Niessen, 2008).

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Article

Gender, Education and Socio-economic Diversity in the Civil Service of Bangladesh: The Case of Administration Cadre

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Abstract

This study explores the dynamics of the bureaucracy of Bangladesh, focusing on three main dimensions of diversity (demographic, informational and socio-economic) over 20 years from 2001 to 2020. In particular, the study investigates whether and how the distribution of administration cadre officials, in terms of gender, education and socio-economic status, has changed over this period and whether the pay scale of 2015 has affected the composition of officials working in the administration cadre service. In the case of gender (demographic) diversity, we found that the representation of female officials has gradually increased over time but showed a slight downward trend in the later periods. We have also found that since the introduction of the 8th pay scale, the bureaucracy has become more diversified regarding the officials' educational (informational) background. In particular, the share of civil servants with an Engineering and Computer Science background has sharply increased during the 35th–37th BCS. In contrast, the share of officials with an Arts and Social Science background has dropped significantly. By analysing the education and occupational status of officials' fathers, we observe that introducing the pay scale positively affects the diversity in bureaucracy by increasing the representation of officials from less well-off socio-economic backgrounds. Although the share of officials whose fathers were farmers showed an initial downward trend, it has marginally improved after introducing the pay scale. In a survey of admin cadre officials, we observed that the introduction of the pay scale had not affected the representation of officials from rural areas.

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Keywords

Gender diversity, socio-economic diversity, representative bureaucracy, rural representation

Introduction

Earlier studies on the bureaucracy of Bangladesh, especially studies conducted in the 1980s, 1990s and early 2000s, were highly critical of the government machinery. These studies painted the organ as an elitist, non-responsive one that did not try to address the needs and concerns of the marginalised and vulnerable groups of the society (Huque, 1997; Huque & Rahman, 2003; Jahan, 2006; Zafarullah, 1987; Zafarullah & Huque, 2001). Recent studies, however, indicate a different trend and show that the bureaucracy is becoming more responsive and citizen-friendly and is keen to come up with innovative solutions to assist the underserved groups of the population (Baniamin et al., 2020; Shahan et al., 2021).

Although these studies have indicated that the inclusion of a new generation of bureaucrats who are willing to represent and reflect the demands of the citizens at large is possibly changing Bangladesh's service delivery spectrum, no detailed empirical study has been conducted to explore whether the demographic and socio-economic composition of the civil service has changed over time (Shahan, 2021).

Empirical studies indicate that passive representation (PR) can lead to active representation and will likely make the bureaucracy more responsive. As mentioned earlier, in Bangladesh, we have no idea about the bureaucracy's 'representativeness'. Moreover, we do not know whether (and to what extent) critical events like introducing a new pay scale in 2015 have affected PR. This research addresses this gap while relying on the 'representative bureaucracy' framework.

The primary objective of the research is to explore the dynamics of Bangladesh's bureaucracy, focusing on the representativeness of different socio-economic classes over 20 years from 2001 to 2020. In particular, the study investigates whether and how the distribution of administrative officials, in terms of gender, education and socio-economic status, has changed over this period and whether the pay scale of 2015 has affected the composition of officials working in the administration cadre service.

Since the 'greater representativeness' of the bureaucracy is likely to result in 'greater access to service delivery' for the underserved groups, it is essential to understand how representative the bureaucracy of Bangladesh has become over time. Therefore, the central research question that the study is trying to address is—does the bureaucracy of Bangladesh mirror the demographic composition of the country, especially in terms of socio-economic characteristics, ethnic and gender composition, and educational attainments of the students who are eligible to apply for the civil service? Furthermore, it is important to understand that Bangladesh's bureaucracy has undergone several changes over the last decade, and probably the most important of these changes is the introduction of a new pay scale—the National Pay Scale of 2015. In this study, we also want to understand

the effect of introducing this pay scale on the representativeness of the bureaucracy. Therefore, our second research question is: What is the impact of the pay scale of 2015 on the representativeness of the Bangladeshi bureaucracy?

In this study, the representativeness of different groups in the bureaucratic services has been explored by investigating the level and trend in the diversity of administrative officials. A diversified workforce provides a favourable environment for developing innovative ideas. Studies have also shown that increased diversity in the bureaucracy leads to improved integrity in organisations. Choi et al. (2018) found that increased female representation in bureaucracy leads to increased organisational integrity. According to this study, an increase in organisational integrity may result from female bureaucrats being more likely to fight gender-based inequality than their male counterparts.

Moreover, the nature of diversity influences the creative activity in teams. Parthasarathy et al. (2011) identified three forms of diversity in work groups: demographic, informational and value diversity. Diversity in terms of age, gender and ethnicity is defined as demographic diversity. Differences among workforce members in terms of educational background are considered informational diversity. Finally, diversity in terms of values, beliefs and attitudes is categorised as value diversity. In addition to these three dimensions of representativeness, the diversity of bureaucracy in terms of socio-economic classes is a crucial indicator of PR in bureaucracy. Therefore, this study focuses on the administration cadre's demographic, informational and socio-economic diversity. In particular, the study explores how diversity in bureaucratic services has evolved from 2001 to 2020 and how the introduction of the 8th pay scale has affected the diversity in civil service.

In the next section, we discuss the literature on representative bureaucracy, focusing on the evolution of the concept and its importance for delivering public services to citizens of the country. The third section presents the study's methodology and explains the data used for empirical analysis. The study's findings are analysed in the fourth section. Finally, the last section concludes the article.

Literature Review

The Evolution of the Concept

The idea of representative bureaucracy was first coined by Kingsley (1944), whose main argument was that if the government reflects the composition of its population in terms of skills, beliefs and class, it would be successful in protecting democratic values and representing its citizens. Kingsley considered bureaucracy as an instrument for establishing a democratic state, and as such, he was arguing for a bureaucracy that would reflect the marginalized classes of the society. Levitan (1946) and Long (1952) argued that since bureaucracy includes appointed unelected officials, the most effective way to ensure bureaucratic responsibility and accountability is to design an entity that reflects the population it serves.

Even though earlier studies on representative bureaucracy mainly highlighted its demographic composition, they did not explain how an increased civil service representativeness would positively affect the democratic state. Mosher made this critical contribution in the 1970s. Mosher (1968) noted that bureaucrats' socialisation experiences play a significant role in developing their beliefs and values, influencing how they interpret their roles and responsibilities when entering the civil services. Therefore, the bureaucracy that represents the diverse socio-economic classes of society will be more responsive to the needs of different communities.

From this perspective, Mosher draws a connection between passive and active representation. Of these two, PR focuses on exploring whether the bureaucracy of a country mirrors the demographic origins of the population (of that country), especially in terms of race, gender, ethnicity, social class, or other characteristics. If PR is ensured in bureaucracy, it is expected to ensure inclusivity and democracy (Bowling et al., 2006; LeRoux, 2009; Moldovan, 2016).

Over the last 30 years, several studies have been conducted in different parts of the world, and these studies provide empirical evidence that PR is translated into active representation. In other words, previous studies found that if the bureaucracy mirrors the socio-economic features (such as average income and occupation of bureaucrats' parents) and demographic characteristics of the country (measured in terms of gender, race and ethnicity), it would be more sympathetic, friendly and responsive to the needs of its citizens and more considerate in delivering services to the marginalised population (Keiser et al., 2002; Kennedy, 2014; Riccucci & Van Ryzin, 2017; Selden, 1997; Sowa & Selden, 2003). Therefore, the theory of active representation emphasises that a representative bureaucracy will advocate for the people it represents and be more responsive to their needs.

Bishu and Kennedy (2019), based on a content analysis of 92 journal articles on representative bureaucracy, concluded that the existing literature is mainly based on two dimensions of representativeness: gender and ethnicity. The authors also observed that the literature is geographically concentrated primarily in the context of the United States: 77% of the journal articles explore bureaucratic representativeness within this country.

Research Trends in Representative Bureaucracy

The literature on representative bureaucracy can be divided into three main waves: PR, passive to active representation and the link between passive and symbolic representation.

PR or Descriptive Representation (1970–1990)

This dimension was the primary focus of empirical studies on representative bureaucracy that emerged in the 1970s and continued until the 1990s. However, it has re-emerged as a 'focus of study'—possibly due to SDG (as SDG focuses on inclusivity and responsive service delivery). Efforts are now being made to understand and explore how inclusive or representative the bureaucracy is.

This strand of literature mainly asks to what extent the bureaucracy mirrors the demographic composition of the country or the community it serves. In particular,

the studies in this area examine whether the bureaucracy reflects the racial or gender composition of the country (national level) or the districts (sub-national or local level). In some cases, the officials' socio-economic status has been considered to see whether they adequately represent the economic classes they serve. In analysing the socio-economic status of the officials, studies have mainly used the following features—occupation of parents (of the officials), income of the parents and educational level of the parents.

Passive to Active Representation (1990–Present)

Several studies show that PR can translate into active representation under certain conditions. Studies explore whether PR leads to active representation in the educational sector, health services, law enforcement and emergency service provisions. It is important to note that in the case of representative bureaucracy (and studies related to passive to active representation), the goal is to explore whether 'greater representativeness' results in 'greater access' for the underserved groups. In particular, the studies ask whether a change in representativeness results in more responsive service delivery or more allocation for underserved groups, given that public officials are supposed to support clients or constituents like them. In addition, the studies also try to discover the factors that allow PR to materialise into active representation.

Representative Bureaucracy in Bangladesh

In Bangladesh, very few studies have been conducted to explore the degree or nature of passive representativeness, and no study has been undertaken so far to explore whether passive representativeness may indeed result in active representation. Since 2000, several studies attempted to measure the degree of representativeness of women in the civil service of Bangladesh. The earlier studies in this domain concentrated on the 'glass ceiling concept' and explained in detail the challenges women face to be a part of the civil service. These studies mostly drew attention to the low share of female officials within the civil service. They explored how limitations within the public personnel management system of Bangladesh led to '…discrimination in recruitment, placement, advancement, mobility and training' (Zafarullah, 2002).

Later studies, however, focused more on female officials' representativeness and acknowledged that women's representation in higher civil service was gradually increasing. However, these studies did not provide a systematic analysis and could not identify the female officials' origin (i.e., their educational or socio-economic background (Sultan & Jahan 2016; Ahmed & Jahan 2018).

Methodology and Data

The study explores socio-economic diversity in bureaucracy, focusing exclusively on the officials belonging to the administration cadre. This study's main research questions are examined using primary and secondary data from various sources. For quantitative analysis, the study uses two different data sources—the database

of training recipients at the BCS Administration Academy (BCSAA) and primary data from a survey of officials.

The study mainly focuses on administration cadre officials who were recruited after 2000. Between 2001 and 2020, recruitment notifications were published for 20 BCS examinations, 15 of which corresponded to administration cadre officials.

The BCSAA dataset contains information on 3,164 admin officials who were recruited from the 20th to 35th BCS examinations (excluding the 23rd and 32nd) and received training at BCSAA. This BCSAA database contains basic information about training participants, including their characteristics, educational qualifications and parents' education and occupation. However, one limitation of the BCSAA dataset is that it does not contain information about the socio-economic status of the bureaucrats during their primary and secondary schooling stage, whether they lived in rural or urban areas, or whether they had access to electricity or TV during their childhood.

A survey was conducted for a sample of 209 officials to collect additional information about the administration cadre officials. The survey was implemented in two stages. In the first stage, primary data were collected from a new cohort of BCSAA training participants to include additional batches. The survey of training participants consists of 100 officials, 95 of whom belong to 35th–37th batches including 76 officials from the 37th BCS. In the second stage, the survey was conducted on a sample of officials from the 20th to 34th BCS batches, which provided information and responses from 109 officials. The sample was distributed across different batches of BCS officials to ensure representation from different batches. The sampling frame includes the list of government officials currently working as deputy, senior assistant and assistant secretaries in various ministries. Descriptive and analytic statistics are constructed using primary and secondary data to evaluate the trend and evolution of representativeness in the bureaucracy.

Results and Findings

Gender Diversity in BCS Administration

This section shows the status and trend in gender diversity, an indicator of demographic diversity, based on the analysis of recruitment notifications of MoPA. Figure 1 shows the percentage of female officials among administration cadre officials from 2001 to 2021. Within these 20 years, in the first five recruitment notifications (21st–27th), the average percentage of females was 24%, which increased to 31% in the second five (28th–33rd) and reached 33% in the last five recruitments. The percentage of females reached its lowest at 21% in the 22nd BCS, the leading recruitment notification published in November 2003. From the 22nd to the 30th BCS, female representativeness increased consistently to 35%. Representation of females reached its highest at 38% in the 34th BCS, the results of which were notified in May 2016. However, it is worth noting that female representation has dropped to 28% in the 37th BCS, which increased to 31% in the 38% BCS. This phenomenon may be due to increased competition in the BCS

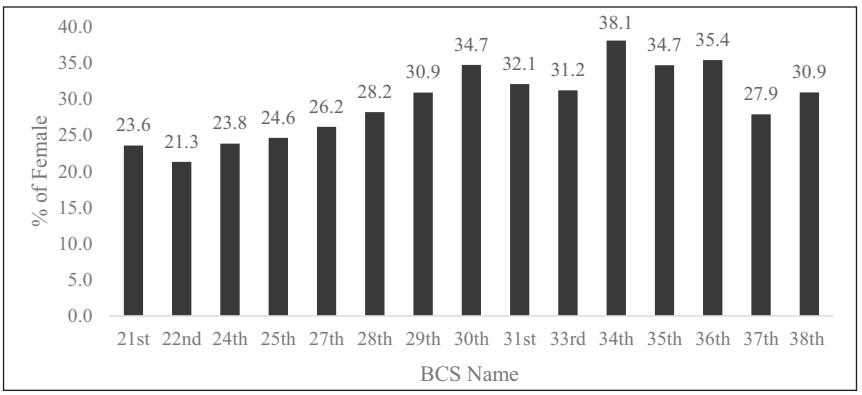

Figure 1. Percentage of Females in Admin Cadre (2001–2021).

Source: Authors' calculation based on recruitment notifications of Ministry of Public Administration (MoPA).

examination after the initiation of the pay scale in 2015. The findings, nevertheless, indicate that from a gender perspective, the administration cadre of the civil service of Bangladesh has become more representative over the years.

As discussed earlier, if bureaucracy reflects the diversity of the society in terms of attributes of its population (gender, race, religion, etc.), then it can be identified as the presence of PR in bureaucracy. In the above discussion, it is observed that the representation of women has increased on average in the last decade compared to the preceding one. However, the proportion of women is still much below its proportion in the general population.

Table 1 presents the representativeness of females based on BCSAA and survey data. The results for the 37th BCS batch are based on the survey data of officials interviewed during a BCSAA training programme. From the 20th to the 36th BCS, the results show the representation based on BCSAA data that covers the training participants in earlier batches. In the case of the 36th BCS, information was available for only 53 officials. Table 1 also summarises the primary dataset of this study, which has been used to understand the long-term trend in representation.

Table 2 shows the representation by period, with officials from five different groups of BCS batches in each period. From Table 2, it is clear that the representation of female officials increased by around 5% on average from the second to fourth period. But the share of females declined by around 5% in the fifth period (35th–37th). This result raises the question of whether the pay scale hike is the main reason for this downturn in female representation from the 35th Batch.

Informational or Educational Diversity in BCS Administration

This section shows the pattern of representativeness in terms of the educational background of administration cadre officials. Using the combined dataset, Table 3

Table 1. Distribution of Administrative Officials by Gender (BCSAA & Survey Data).

BCS Batch	Female	%	Male	%	Total (*N*)	%
20	53	18.7	230	81.3	283	100
21	35	19.8	142	80.2	177	100
22	59	21.2	219	78.8	278	100
24	80	24.7	244	75.3	324	100
25	48	24.5	148	75.5	196	100
27	73	28.2	186	71.8	259	100
28	51	26.3	143	73.7	194	100
29	68	28.7	169	71.3	237	100
30	91	34.5	173	65.5	264	100
31	68	30.1	158	69.9	226	100
33	86	35.3	158	64.8	244	100
34	97	38.8	153	61.2	250	100
35	74	32.0	157	68.0	231	100
36	11	20.7	42	79.3	53	100
37*	21	27.6	55	72.4	76	100
Total	904	27.89	2,337	72.11	3,241	100

Source: Authors' calculation based on BCSAA & Survey data.

Note: *Data for the 37th batch are collected from a survey of training participants at the BCSAA.

Table 2. Distribution of Officials by Gender and Period (BCSAA & Survey Data).

BCS Batches	Female (*N*)	%	Male (*N*)	%	Total (*N*)
20–22	147	19.9	591	80.1	738
24–25, 27	201	25.8	578	74.2	779
28–30	210	30.2	485	69.8	695
31, 33–34	251	34.9	469	65.1	720
35–37	108	30.0	252	70.0	360
Total	917	27.9	2,375	72.1	3,292

Source: Authors' calculation based on BCSAA & Survey data.

presents the overall status and pattern of changes in the distribution of admin officials in terms of their area of specialisation in higher studies. It appears that a significant proportion of the BCS officials completed their university-level education in subjects that belong to the Science discipline (42%), of which 17.1% studied Biological Science, 18.3% Science (others) and 6.6% Engineering or Computer Science (ECs). The rest of the officials completed their university-level education in Social Sciences (23.8%), Arts (23.1%) and Business Studies (11.3%).

Regarding the proportion of representation in each group of BCS batches, an exciting scenario emerges in the diversity of representation. In particular, a significant shift is observed in the distribution after the fourth period, from the 35th batches

Table 3. Educational Background (Main Discipline) of BCS Administration Officials.

	Group of BCS Batches					
	(1)	(2)	(3)	(4)	(5)	
HE Subject	20–22	24–25,27	28–30	31,33–34	35–37	Total
Arts	21.3	25.2	28.5	21.9	13.8	23.1
Biological Science	15.7	16.5	18.1	18.5	16.6	17.1
Business Studies	9.4	12.9	11.2	10.6	13.2	11.3
Engineering/CS	3.0	5.2	5.0	7.9	17.2	6.6
Science (Others)	25.1	15.6	13.5	17.4	20.9	18.3
Social Science	25.6	24.7	23.6	23.7	18.3	23.8
Total	100.0	100.0	100.0	100.0	100.0	100.0

Source: Authors' calculation based on BCSAA & Survey data.

onward. The share of officials from Arts has increased steadily in the first three groups of BCS batches from the 20th to 30th BCS. However, a sharp decline in the share of officials with Arts background has been observed in the 4th and 5th group of officials. Although the share of officials from the Social Science discipline fluctuated around 24% between the 20th and 34th BCS (periods 1–4), it has dropped to 18.3% in the 5th group containing the officials of the 35th to 37th batches. A reverse trend is visible in the case of the share of officials having a science background, which increased from 43.9% in the fourth group to 54.7% in the 5th group. This jump is mainly driven by the increase in representation of officials having Engineering or Computer Science (ECs) background, where the share of this group more than doubled (7.9%–17.2%) from the 4th to 5th period. The above findings suggest a significant shift in the distribution of BCS admin officials has occurred after the introduction of the pay scale in 2015. The analysis below also found that the shift in academic discipline of recruited officials after the introduction of the pay scale occurred with a simultaneous change in the type of university.

Table 4 shows the distribution of recruited BCS officials according to the type of university from which they completed their degrees before joining BCS[1]. Given the available data, a significant change is observed in the representation of officials from Dhaka University and that of Engineering University (which includes all the engineering universities of the country). First, the share of Dhaka University declined from 60.8% in the first group (20th–22nd) of BCS to 48.5% in the 2nd group (24th, 25th, 27th) of BCS and fluctuated around 50% from the 24th to 34th BCS. Second, the representation of Dhaka University in BCS recruitment has dropped significantly from 51.1% in the 4th group to 40.3% in the 5th group.

On the other hand, the representation of the Engineering University category depicted a sharp increase from just 3.8% in the 4th group to 12.8% in the 5th group of officials. Interestingly, although the representation of Dhaka University has declined after the introduction of the pay scale in 2015, the proportion of students from other public universities has increased from 8.8% to 13.6% over the same period. The above findings suggest that the introduction of the 8th pay scale

Table 4. Educational Background (Type of University) of BCS Administration Officials.

	Group of BCS Batches					
	(1)	(2)	(3)	(4)	(5)	
HE University	20–22	24–25,27	28–30	31,34	35–37	Total
Agricultural University	3.9	5.7	9.2	5.5	7.2	6.2
Chittagong University	5.1	6.9	6.0	5.5	7.2	6.1
Dhaka University	60.8	48.5	49.1	51.1	40.3	51.0
Engineering University	2.7	4.2	3.0	3.8	12.8	4.5
Jahangirnagar University	5.0	6.0	5.0	7.6	5.6	5.7
Medical College	0.1	0.1	1.0	0.8	2.8	0.8
National University	10.0	15.3	9.5	8.8	5.3	10.5
Not available	0.4	0.5	0.6	0.4	0.8	0.5
Others	0.8	0.5	0.0	0.2	0.0	0.4
Private University	0.7	0.9	2.2	1.1	1.9	1.3
Public University (others)	5.4	6.8	6.6	8.8	13.6	7.5
Rajshahi University	5.0	4.5	7.8	6.5	2.5	5.4
Total	100.0	100.0	100.0	100.0	100.0	100.0

Source: Authors' calculation based on BCSAA & Survey data.

is likely to contribute to improving the informational diversity of the administration cadre. In the next section, using a regression framework, we formally test whether the introduction of the 8th pay scale has increased the informational diversity of the administration cadre.

The 8th Pay Scale and Informational Diversity

In Tables 3 and 4, we observe that the representation of officials from Engineering and Computer Science backgrounds was the lowest before the introduction of the pay scale. Thus, we start our analysis with specification (1), where we test the impact of the 8th pay scale on the representation of this group compared to all other disciplines. The primary regression specification is as follows:

$$lnEmp_{it} = a + \tau_t + \delta_1 ECs + \beta_1 ECs \times PS_t + \varepsilon_{it} \quad (1)$$

where $lnEmp_{it}$ is the log of the number of officials with a higher education in subject i (or from university i), in BCS batch t. For example, Emp_{ECs20} indicates the number of officials in the 20th BCS batch who completed their graduation in ECs discipline (or from an engineering university). ECs is a dummy variable representing Engineering or Computer science discipline (or engineering university). PS_t indicates the year after the introduction of the 8th pay scale, taking the value 1 from the 35th to the 37th BCS. τ_t is a set of BCS batches or time dummies.

To explore whether the introduction of the 8th pay scale has also affected the representation of officials of any other discipline, we modify specification (1) by

including a set of discipline-specific intercepts α_i and the interaction between each discipline specific dummy and the post pay scale dummy PS_t.

$$lnEmp_{it} = \alpha_i + \tau_t + \beta_1 ECs \times PS_t + \beta_2 AR \times PS_t + \beta_3 BS \times PS_t + \beta_4 BioS \times PS_t + \beta_5 OSc \times PS_t + \epsilon_{it} \quad (2)$$

where *AR, BS, BioS* and *OSc* denote Arts, Business Studies, Biological Science and Other Sciences, respectively, and Social Sciences is used as a base category. Table 5 shows the regression results for subject level analysis. In column (1), the coefficient on Engineering or CS (−1.301) and that on the interaction term (1.395) indicate that the introduction of the 8th pay scale has a strong positive impact on the recruitment of admin officials from the ECs discipline.

In column (2) of Table 5, using Social Sciences as the base category, we observe that the admin cadre has become more informationally diverse with the introduction of the 8th pay scale by raising the number of officials with higher education in ECs, BS and BioS. However, the results of the last two groups are not statistically significant. As the number of observations used for calculating the number of officials by discipline is significantly small for the 36th and 37th batches, we exclude these two batches in column (3). Now, the interaction coefficients of BS and BioS are statistically significant.

Table 6 presents the results of the representation of administrative officials by university. In line with the findings in Table 5, there was a significant jump in the number of officials from engineering universities in the batches recruited after the pay scale's introduction. Interestingly, the representation of other public and private universities has also increased after the introduction of the pay scale compared to Dhaka University, while the representation of National University has declined relative to the base category.

Diversity in Socio-economic Background

This section analyses the socio-economic background of the BCS officials, focusing on the fathers' educational qualifications and occupations[2].

Table 7 shows the education level of the fathers of BCS officials[3]. Interestingly, the representation of officials whose fathers' education levels were below undergraduate (Below Secondary, SSC and HSC) has increased from 43.5% in the 4th group to 49.0% in the 5th group. In contrast, the representation of officials having more than higher secondary level education has decreased slightly from 48.7% to 47.9%. Although the share of missing observations has dropped simultaneously by 4.71% between the two periods, Table 7 still indicates a move towards an increase in representation from less well-off socio-economic backgrounds.

Table 8 shows the regression results using the log of the number of officials by educational qualifications of fathers as the dependent variable. In column (1) of Table 8, using the full sample (excluding the 33rd batch), we observe that the coefficient on the interaction term between the Below Secondary and PS_t is positive and statistically significant at 10% level, whereas the interaction coefficient corresponding to SSC is positive but statistically insignificant. As the

Table 5. Effects of Pay Scale on the Recruitment of Officials by Academic Discipline.

	(1)	(2)	(3)
Engineering or CS	−1.301***	−1.604***	−1.604***
	(0.124)	(0.128)	(0.129)
Arts		0.00	0.00
		(0.085)	(0.086)
Business Studies		−0.826***	−0.826***
		(0.089)	(0.090)
Biological Science		−0.365***	−0.365***
		(0.074)	(0.075)
Science Others		−0.327***	−0.327***
		(0.109)	(0.110)
Engineering or CS × PS	1.395***	1.549***	1.457***
	(0.240)	(0.334)	(0.129)
Arts × PS		−0.487	−0.147*
		(0.319)	(0.086)
Business Studies × PS		0.356	0.597***
		(0.304)	(0.090)
Biological Science × PS		0.217	0.318***
		(0.272)	(0.075)
Science Others × PS		0.681	0.04
		(0.412)	(0.110)
BCS Batch (year) Dummies	Yes	Yes	Yes
Constant	3.879***	4.182***	4.182***
	(0.141)	(0.134)	(0.136)
R-squared	0.701	0.85	0.801
N	90	90	78

Note: The log of the number of officials with a degree in the subject i is the dependent variable. All regression used BCS batch-specific dummy variables. Robust standard errors are reported in parentheses. *$p < .10$, **$p < .05$, ***$p < .01$.

representations of these two groups were the highest in the first period (20th–22nd BCS), we show the results by excluding these three batches in column (2), where both the interaction coefficients appear to be positive and statistically significant. Therefore, based on the regression results, the 8th pay scale positively impacts the representation of officials from less well-off socio-economic backgrounds.

Table 9 shows the occupational status of the officials' fathers, which is a key indicator of the socio-economic status of the civil servants. A related question of interest is whether the representation of officials from rural backgrounds has changed with the introduction of the pay scale. Although the BCSAA dataset does

Table 6. Effects of 8th Pay Scale on the Recruitment of Officials in terms of University.

	(1)	(2)	(3)
Engineering	−0.391**	−2.584***	−2.584***
	(0.151)	(0.138)	(0.140)
Agricultural		−2.109***	−2.109***
		(0.134)	(0.136)
Chittagong		−2.135***	−2.135***
		(0.132)	(0.134)
Jahangirnagar		−2.159***	−2.159***
		(0.138)	(0.139)
Rajshahi		−2.120***	−2.120***
		(0.131)	(0.132)
Public Others		−1.980***	−1.980***
		(0.125)	(0.126)
National		−1.546***	−1.546***
		(0.136)	(0.138)
Private		−3.590***	−3.590***
		(0.198)	(0.200)
Medical		−4.102***	−4.102***
		(0.199)	(0.201)
Engineering × PS	1.074**	1.572***	0.984***
	(0.412)	(0.411)	(0.140)
Agricultural × PS		0.484***	0.237*
		(0.184)	(0.136)
Chittagong × PS		0.37	0.535***
		(0.453)	(0.134)
Jahangirnagar × PS		0.429**	0.153
		(0.186)	(0.139)
Rajshahi × PS		−0.525*	−0.327**
		(0.289)	(0.132)
Public Others × PS		0.994***	0.770***
		(0.229)	(0.126)
National × PS		−0.219	−0.614***
		(0.363)	(0.138)
Private × PS		1.116***	0.555***
		(0.278)	(0.200)
Medical × PS		1.836***	1.404***
		(0.272)	(0.201)

(Table 6 continued)

(Table 6 continued)

	(1)	(2)	(3)
BCS Batch (year) Dummies	Yes	Yes	Yes
Constant	2.508***	4.702***	4.702***
	(0.439)	(0.166)	(0.168)
R-squared	0.036	0.877	0.88
N	150	150	130

Note: The log of the number of officials having a degree from a university is used as the dependent variable. All regression used BCS batch-specific dummy variables. Robust standard errors are reported in parentheses. *p < .10, **p <.05, ***p < .01.

Table 7. Education Level of the Officials' Fathers.

The education level of fathers	Group of BCS Batches					
	(1)	(2)	(3)	(4)	(5)	
	20–22	24–25,27	28–30	31,34	35–37	Total
Below Secondary	15.2	10.0	8.1	10.9	14.2	11.5
SSC	18.1	13.0	13.1	14.7	15.9	14.9
HSC	12.6	17.1	18.9	17.9	18.9	16.7
BA/BCom/BSc	29.2	34.3	35.1	30.7	30.4	32.2
Masters or above	17.9	16.3	16.0	18.1	17.6	17.0
NA	7.0	9.4	8.9	7.8	3.1	7.7
Total	100	100	100	100	100	100

Table 8. Effects of Pay Scale on Socio-economic Diversity (by Fathers' Education).

	(1)	(2)
Below Secondary	–0.437*** (0.126)	–0.589*** (0.129)
SSC	–0.123 (0.102)	–0.237** (0.110)
Below Secondary × PS	0.588* (0.335)	0.740** (0.339)
SSC × PS	0.458 (0.335)	0.572* (0.340)
Constant	3.904*** (0.199)	4.025***
R-squared	0.392	0.427
N	84	66

Note: The dependent variable shows the log of the number of officials whose fathers' educational qualifications fall under level i. All regression used BCS batch-specific dummy variables. Robust standard errors are reported in parentheses. *p < .10, **p < .05, ***p < .01.

not contain information regarding the locational background of the officials, we can get some indication regarding the change in representation from rural backgrounds by analysing the occupational background of the officials' fathers. In particular, we observe that the proportion of officials whose fathers were farmers declined steadily in the first four periods, from 20th to 34th BCS, but increased to

Table 9. Occupation of the Officials' Fathers.

	Group of BCS Batches					
	(1)	(2)	(3)	(4)	(5)	
Fathers' Occupation	20–22	24–25,27	28–30	31,34	35–36	Total
Banker	1.2	2.4	2.7	2.5	3.2	2.3
Business	17.9	15.4	17.0	22.7	29.6	18.9
Doctor	1.2	0.6	1.0	1.1	1.4	1.0
Engineer	0.4	0.1	1.3	0.0	0.0	0.4
Farmer	19.9	16.9	14.4	12.0	14.8	16.1
Government Service	33.6	34.7	39.4	40.6	36.6	36.6
Lawyer	2.4	4.6	2.0	2.3	1.4	2.8
Not available	4.3	5.8	5.3	6.5	2.5	5.1
Others	0.7	0.4	0.0	0.0	0.4	0.3
Private Service	1.8	3.7	0.9	0.0	0.7	1.7
Teacher	16.6	15.3	16.0	12.4	9.5	14.8
Total	100.0	100.0	100.0	100.0	100.0	100.0

Source: Authors' calculation based on BCSAA & Survey data.

14.8% in the 5th period from 12.0% in the 4th period. This is consistent with the above findings that the representations of officials whose fathers' education was less than undergraduate level have increased over the same period. The above results provide some evidence supporting the argument that the increase in pay scale has encouraged individuals from less well-off backgrounds or rural locations to join the civil service. While the share of officials whose fathers were involved in government services has shown an increasing trend from the first to fourth period, it has declined after the introduction of the pay scale.

As the business category includes various activities, it is not clear whether an increase in representation from this category indicates an increase in the share of more well-off or less well-off households. By separating the business category occupation in terms of educational attainment of the fathers, it is observed that the proportion of officials whose fathers were involved in business and achieved SSC or below level of education increased in both the 4th and the 5th period, while the business category with HSC or above level of education has increased mainly in the 5th period.

The effects of the 8th pay scale on the distribution of officials by occupational status of their fathers are presented in Table 10. Column (1) uses data from the 20th to 36th BCS and column (2) uses data from the 24th to 36th BCS batches, excluding the 33rd batch. In both columns, government service is considered as the base category. It is observed that the representation of most of the key socio-economic classes (occupational status of fathers) has increased after the introduction of the pay scale, except for teachers and other categories. However, only the interaction term between Business (SSC or Below) and the pay scale dummy is statistically significant. Overall, the results provide evidence in favour of increased representation from lower socio-economic classes.

Table 10. Effects of Pay Scale on Socio-economic Diversity (Fathers' Occupation).

	(1)	(2)
Business (SSC or Below)	−1.614***	−1.762***
	(0.165)	(0.205)
Business (HSC or Above)	−1.292***	−1.237***
	(0.148)	(0.189)
Doctor or Engineer	−3.062***	−3.138***
	(0.188)	(0.211)
Farmer	−0.845***	−0.937***
	(0.103)	(0.103)
Private Service	−3.496***	−3.480***
	(0.338)	(0.392)
Teacher	−0.885***	−0.944***
	(0.121)	(0.102)
Others	−1.273***	−1.196***
	(0.122)	(0.116)
Business (SSC or Below) × PS	0.736**	0.884***
	(0.295)	(0.324)
Business (HSC or Above) × PS	0.386	0.331
	(0.538)	(0.564)
Doctor or Engineer × PS	0.477	0.553
	(0.803)	(0.830)
Farmer × PS	0.152	0.244
	(0.266)	(0.272)
Others × PS	−0.04	−0.117
	(0.275)	(0.278)
Private Service × PS	0.421	0.404
	(0.417)	(0.466)
Teacher × PS	−0.277	−0.218
	(0.289)	(0.289)
Constant	4.819***	3.070***
	(0.240)	(0.277)
R-squared	0.819	0.83
N	104	80

Note: The dependent variable is the log of the number of officials whose fathers' occupation falls in group i. All regression used BCS batch-specific dummy variables. Robust standard errors are reported in parentheses. *p < .10, **p < .05, ***p < .01.

Diversity in Socio-economic Background: Findings from the Survey Data

In the previous section, the trend in representativeness was observed for a range of respondents' characteristics, including the officials' educational backgrounds and the education and occupation of their fathers. However, a range of other socio-economic backgrounds remains unknown. This section focuses on a range of socio-economic characteristics of the respondents along with their educational background based on the survey of civil service officials. The sample is divided into two parts before and after the introduction of the pay scale in 2015: officials of 20th–34th BCS Batches and 35th–37th BCS batches.

Characteristics of the Survey Respondents

Out of a sample of 209 officials, 54.5% belong to the 20th–34th BCS group and 45.5% belong to the 35th–37th BCS group (Table 11). In terms of gender, around 34.9% of the respondents are female and 65.1% are male (Table 11).

Based on the combined dataset, the share of females in the 35th–37th group is 30%, which is slightly lower than the estimated share of 31.6% from survey data. Conversely, the share of females in the survey data for the 20th–34th BCS group was 37.7%, which is significantly higher than the corresponding figure from the combined dataset. Therefore, the proportion of the females in the survey data is higher than the actual representation of females in the BCS administration.

The sample is quite balanced in terms of the respondents' ages. In Table 12, the average age of the females is 37.3, and that of the males is 38.0.

The average age of the female respondents (41.2) is slightly lower than that of males (43.6) in the 20th–34th BCS group, whereas for the 35th–37th BCS group, the average age of the two groups is almost equal (31.7 and 31.8 years). In terms

Table 11. Distribution of Respondents by Gender and BCS Batches.

BCS_Gr_SVY1	Category	Freq.	Percent	Category	Frequency	Percent	Total
20th–34th BCS	Overall	114	54.5	BCS 35–37	95	45.5	209
Full Sample	Female	73	34.9	Male	136	65.1	209
20th–34th BCS	Female	43	37.7	Male	71	62.3	114
35th–37th BCS	Female	30	31.6	Male	65	68.4	95

Source: Authors' calculation based on Survey data.

Table 12. Average Age of the Respondents.

BCS_Gr_SVY1	Category	Average Age	Category	Average Age
Full Sample	Female	37.3	Male	38.0
BCS 20–34	Female	41.2	Male	43.6
BCS 35–37	Female	31.7	Male	31.8
BCS 20–34	Overall	42.7	BCS 35–37	31.8

Source: Authors' calculation based on Survey data.

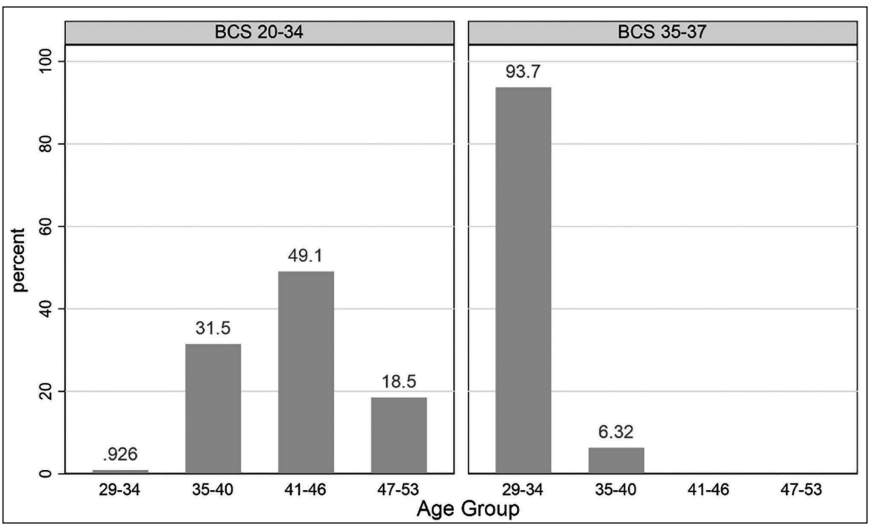

Figure 2. Distribution of Officials by Age Group (Survey Data).

Source: Authors' calculation based on Survey data.

of age group, 93.7% of the respondents in the 35th–37th BCS group fall within the range of 29–34 years, whereas in the 20th–34th BCS group, the proportion of respondents is highest in the 41–46 years group (Figure 2).

Representation from Rural Areas

The respondents were asked whether they lived in an urban or rural area during their primary and secondary education, separately. In the case of primary education, the representation of officials from urban and rural areas has changed only marginally between the two BCS groups.

Figure 3 shows that in the 20th–34th BCS group, 47.2% of the respondents lived in rural areas during their primary education level, which is 48.4% for the 35th–37th BCS group. However, in the case of secondary education, the share of respondents who lived in rural areas is marginally lower for the 35th–37th BCS group compared to the 20th–34th BCS group (Figure 4). Therefore, the location-wise direction of change in the distribution after the introduction of the pay scale is not conclusive from the survey data. Thus, the introduction of the pay scale does not affect the representation of officials with rural backgrounds. This is consistent with our earlier analysis; we observed that the introduction of a pay scale has no statistically significant impact on the representation of officials whose fathers were farmers.

Access to Television During Childhood

Access to Television

Two interesting facts emerge from Figures 5 and 6, which show the percentages of officials who had access to TV during their primary and secondary education,

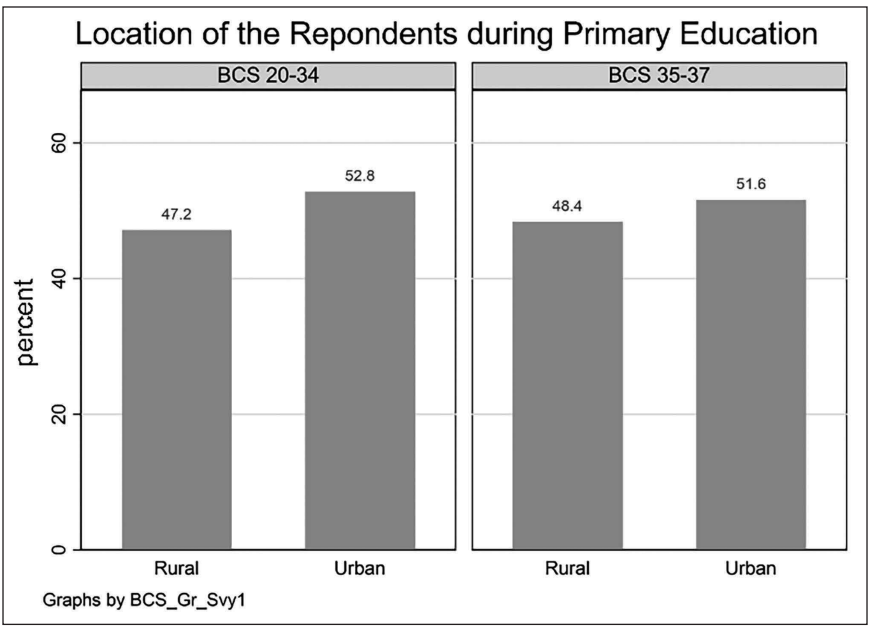

Figure 3. Residential Location of the Bureaucrats During Primary Education.

Source: Authors' calculation based on Survey data.

respectively. First, access to TV has increased from primary to secondary education level for both the 20th–34th and 35th–37th BCS groups. This feature is most likely to result from increased access to TV at the country level over time. Second, the proportion of officials who had access to TV in primary or secondary education has increased in the 35th–37th group compared to the 20th–34th BCS group. However, based on this finding, it cannot be concluded that the representative of more well-off households has increased because access to TV has increased in the nation as a whole over time, reflecting the upgradation of the wealth status of the general households.

Educational Background of the Respondents

In our earlier analysis based on the combined dataset, we observed that the proportion of officials with Engineering or Computer Science backgrounds increased significantly (more than doubled) after the introduction of the pay scale in 2015. Table 13, based on the survey data only, echoes the same conclusion, where the share of officials with ECs background is around 20% for the 35th–37th group, which was just 1.8% for the 20th–34th BCS group. On the other hand, the share of officials with Arts background has decreased significantly after the introduction of the Pay Scale.

The proportion of officials whose fathers had Masters or higher education level is around 21% for both the 20th–34th and 35th–37th BCS groups (Figure 7). However, an interesting shift has been observed in other education levels. The

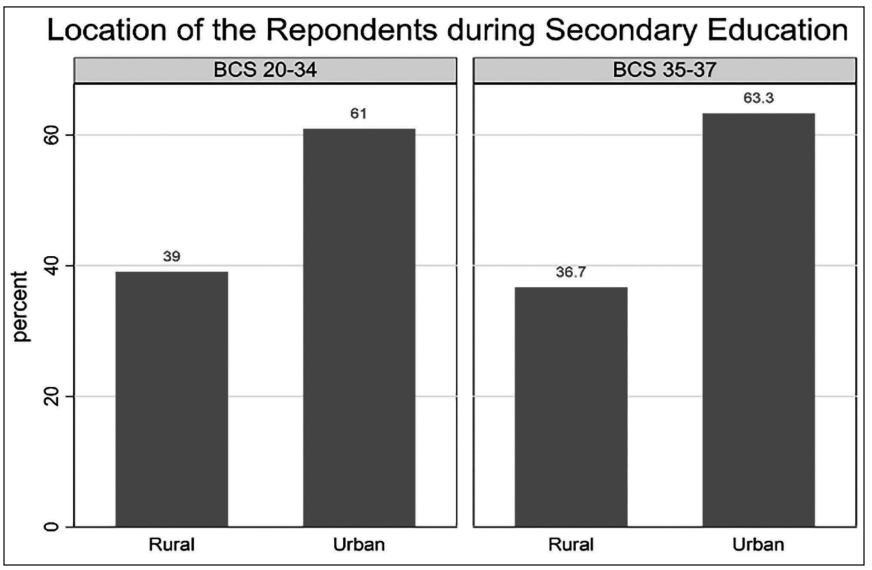

Figure 4. Residential Location of the Students During Secondary Education.

Source: Authors' calculation based on Survey data.

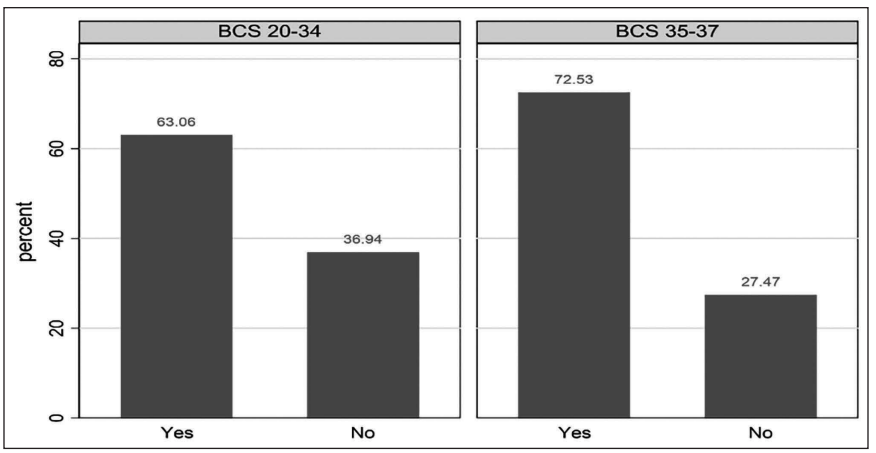

Figure 5. Access to Television During Primary Education.

Source: Authors' calculation based on Survey data.

proportion of officials with fathers having BA/BCom/BSc has declined from 46.0% in the 20th–34th to 37.9% in the 35th–37th BCS group, while the share of SSC/HSC group has increased from 19.5% to 30.5% in the second group. The above findings suggest that the representativeness of officials with less well-off socio-economic status has increased in the BCS administration cadre.

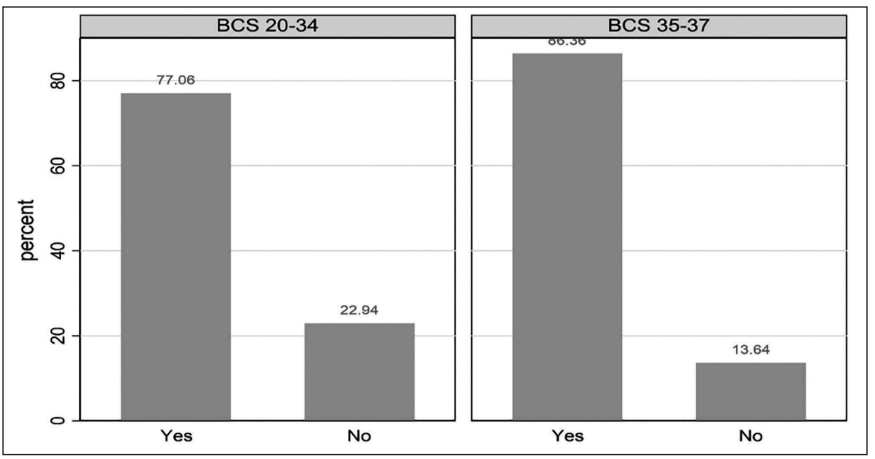

Figure 6. Access to Television During Secondary Education.

Source: Authors' calculation based on Survey data.

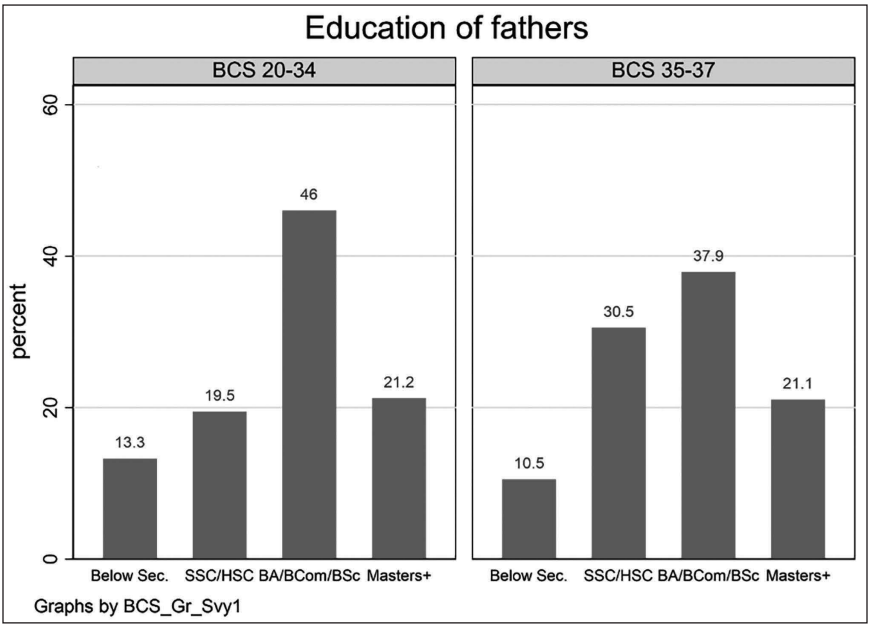

Figure 7. Education Level of Fathers by BCS Batches (Survey Data).

Source: Authors' calculation based on Survey data.

Table 13. Main Subject of Study in Higher Education (in Percent).

HE	BCS 20–34	BCS 35–37	Total
Arts	32.43	12.6	23.3
Biological Science	0	11.6	5.34
Business Studies	15.32	13.7	14.56
Engineering/CS	1.8	20.0	10.19
Science (others)	38.74	32.63	35.92
Social Science	11.71	9.47	10.68
Total	100	100	100

Source: Authors' calculation based on Survey data.

Conclusion

The importance of diversity in bureaucracy is well-recognised in the global literature on public administration and public policy. At the same time, there is a wider agreement that as the bureaucracy becomes more representative, the entity becomes more sympathetic to the needs and concerns of the marginalised groups, religious, ethnic and racial minorities, and tries to be more responsive to address citizens' demands. Unfortunately, however, in the context of Bangladesh, the utility of representative bureaucracy has remained largely ignored, and we have a minimal idea of how representative our bureaucracy is or whether the current level of representativeness can effectively translate into active representation. From this perspective, this study plays an important role in filling the gap in our current state of knowledge.

This study focuses on three key dimensions of diversity in bureaucracy: demographic, informational and socio-economic. By analysing the data on officials of the administration cadre services over 20 years, in this study, we explore how the composition of the civil service is gradually changing and how representative it has become over time. Our study shows that contrary to the perceptions championed by the earlier studies and popular perception, the administration cadre service experienced significant changes during the study period, and the 8th pay scale played an important role in increasing the diversity in civil service. In the case of gender (demographic) diversity, we found that the representation of female officials has gradually increased over time but showed a slight downward trend in the later periods. The bureaucracy has become more diverse in terms of the educational background of the officials. We found that the share of civil servants with an Engineering and Computer Science background almost doubled during the 35th–37th BCS compared to the 31st–34th BCS. In contrast, the share of officials with Arts and Social Science backgrounds has dropped significantly over the same period. Based on the findings, it can be argued that the distribution of BCS admin officials has changed after the introduction of the pay scale in 2015.

The main indicators of socio-economic background also show noticeable changes over the study period. The representations of bureaucrats with fathers'

having below undergraduate (Below Secondary, SSC and HSC) level education has increased significantly in the last period. The distribution of officials based on fathers' occupation has shown interesting changes over time. One noticeable observation is that the share of officials whose fathers were farmers declined gradually in the first four periods but increased in the fifth period, that is, after the introduction of the pay scale, while the scenario is just the opposite for the officials whose fathers were involved in government services. However, based on the regression analysis, the 8th pay scale has no statistically significant impact on the representation of officials whose fathers were farmers. In the survey of officials, we also found that the representation of officials who lived in rural areas during their primary or secondary education has not been affected by the introduction of the pay scale. Overall, we observe that the introduction of the pay scale positively affects the diversity in bureaucracy by increasing the representation of officials from less well-off socio-economic backgrounds.

However, it must be acknowledged that the scope of the current study has been limited. We have focused only on the administration cadre services. Still, a more extensive study encompassing the entire bureaucracy is required to understand the actual level of PR and the possibility of translating PR into active one. At the same time, in this study, we have considered gender, educational background and socio-economic background (measured through the civil servants' fathers' occupation and education) to measure the level of PR. Still, due to a smaller sample size, we could not consider religious or ethnic representation. Further study is required to capture all these concepts. Furthermore, a large-scale survey-based study is needed to understand the change in value structure within the civil service, which will evaluate the changes taking place within the civil service starting from 1972 and not just in the last 20 years. These are some key areas where further research is necessary.

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Notes

1. It should be noted that the name of the university was not available for a significant fraction of the officials of the 33rd batch. Therefore, in Table 4, the 4th group contains only the officials of the 31st and 34th batch.
2. The combined dataset contains the education level of fathers for all the BCS batches. But the occupation of fathers is not available in the survey data. In addition, education level and occupation of fathers are not available for a large portion of the 33rd batch officials. Therefore, the analysis on the occupation of father excludes observations of 37th batch officials from the 5th group and 33rd batch officials from the 4th group.

And the analysis on education level of father excludes observations of the 33rd batch officials only from the 4th group.

3. Table 7 should be analysed with a caveat in mind that around 7%–9% observations were missing from the 1st to 4th group.

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