

Insights of the Different Sectors on the Readiness for the Implementation of DOST Smart and Sustainable Communities Program (SSCP)

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Abstract: This research investigated the multi-sectoral readiness of Barcelona, Sorsogon, to implement the Department of Science and Technology (DOST) Smart and Sustainable Communities Program (SSCP). Utilizing a qualitative descriptive research design through the lens of the Quadruple Helix model, the study evaluated the insights and perceptions of twenty-five purposively sampled key informants from the Government, Academe, Industry (farmers and fisherfolks), and Civil Society Organization (CSO) sectors to transition into a "Smart Community". Findings revealed an "aspirational but fragmented" readiness; while the LGU sector perceived the program as operationally ready and politically well-supported, its implementation is constrained by multi-sectoral silos, a fragmented data management system, and severe infrastructure limitations across the academe, industry, and CSO sectors. Identified opportunities for community empowerment and socio-economic growth are currently offset by barriers such as an unstable internet and signal connectivity gap, physical infrastructure limitations, climate vulnerability, and grassroots technology anxiety. Other existing infrastructures and governance policies provide a strong baseline of active transactional modules, physical facilities, and supportive state directives, but their actual deployment is heavily constrained by localized system fragmentation, data silos, and severe educational resource deficits. Key challenges include a perception of total technological dependency and high maintenance risks, with sustainable adoption heavily constrained by an operational fear of mechanical downtime, generational software resistance, and institutional personnel burnout. To address these structural gaps, the study proposed a strategic implementation plan designed to improve execution by shifting from simple hardware distribution to establishing a human-centric support ecosystem. Core strategies focus on multi-sectoral governance synchronization, inclusive digital literacy interventions, centralized data integration, and permanent financial sustainability mechanisms. Ultimately, this research provides a localized, evidence-based roadmap for fourth-class municipalities to achieve smart advancement while balancing technological progress with institutional and human readiness to prevent social exclusion in rural innovation.

Keywords: *Smart and Sustainable Communities Program, Community Readiness, Quadruple Helix, Digital Divide, Barcelona Sorsogon.*

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I. INTRODUCTION

In an increasingly interconnected and rapidly urbanizing world, the drive towards smart and sustainable communities has become a global imperative. Smart community programs—defined by the integration of digital technologies, environmental sustainability, and participatory governance—are now being prioritized to address pressing challenges in climate change, resource depletion, urban-rural inequality, and inclusive development. However, while global frameworks and technological innovations continue to expand, the successful implementation of smart and

sustainable initiatives heavily depends on a community's readiness multidimensional concept encompassing its capacity, willingness, and contextual alignment to accept and sustain change.

In response to the evolving needs of society, governments are now expected to deliver public services that are reliable, trustworthy, accessible, and responsive to the needs of all communities. However, to effectively implement these technological innovations, the government needs to assess the community's readiness. Understanding the community's capacity and willingness to adopt new

technologies allows the government to align its digital services with public needs and ensure successful implementation.

Community readiness is a critical yet often overlooked dimension of development. It is the extent to which a community is prepared—socially, structurally, institutionally, and behaviorally—to implement change. Without adequate readiness, even well-intentioned and well-funded programs face resistance, underutilization, or complete failure. This is especially true for initiatives that require behavioral shifts, participatory governance, and digital adaptation, such as smart and sustainable community programs.

Countries across continents have pioneered smart and sustainable community models by embedding digital infrastructure into their development strategies while promoting citizen participation and environmental protection. In Finland, the city of Tampere adopted smart urban governance that integrates community engagement with digital public services (Kitchin, 2020). In Singapore, the Smart Nation initiative emphasizes not only technological innovation but also community involvement in co-designing public policies (Smart Nation Singapore, 2023). Meanwhile, South Korea's U-City projects, such as in Songdo, demonstrate the role of the national government in fostering localized smart systems, yet challenges persist in ensuring equitable access and social cohesion (Shin, 2021). International experiences emphasize that while technological resources are critical, the readiness of communities remains a vital prerequisite for success.

The Philippines has been gradually aligning itself with global trends through government-led initiatives that promote Science, Technology, and Innovation (STI) for inclusive development. The Department of Science and Technology (DOST), through programs like the Smart and Sustainable Communities Program (SSCP), seeks to improve local governance, public services, and environmental stewardship using science-based solutions. The program aims to integrate sustainable practices in waste management, renewable energy, ICT integration, disaster preparedness, and agriculture while ensuring that these are community-driven and inclusive.

A smart city/community uses Information and Communications Technology (ICT) to improve the quality of life for citizens, enhance service delivery, foster a competitive economy, and promote a sustainable environment. In 2022, DOST adopted a broader framework, like the "Expanded Framework on the Development of Smart, Resilient, and Sustainable Cities and Communities," to guide its smart city development efforts. This framework serves as a guide in conceptualizing and prioritizing research aimed at developing active, vibrant, and sustainable cities by leveraging smart city solutions. It highlights the importance of building data infrastructure and integrating it into management decision support tools for cities to spur innovations and to help solve complex urban problems. Smart city solutions are also thought to identify opportunities for citizens to pursue prosperity and fulfillment, especially in emerging and rapidly growing regions.

In 2015, Cauayan City in Isabela was declared the first 'smart city' in the Philippines. Sources across the web show that the city has implemented various digital solutions to improve traditional networks and services, benefiting both citizens and businesses, such as the installation of free Wi-Fi in 65 barangays, a Citizen ID system, a dedicated city app, and a Digital Farmers Program (Department of Science and Technology [DOST], 2026).

Just like Santiago and Cauayan City, there are other cities in the country that are improving their communities. According to DOST Undersecretary for Regional Operations Sancho A. Mabborang, as of 25 June 2025, about 91 LGUs are already enrolled in the Smart and Sustainable Communities Program (SSCP) of the DOST, and around 10-15 cities are on the waiting list. This number exceeds the agency's target number of 80 LGUs (Philippine Information Agency [PIA], 2025).

Moreover, a survey conducted by the Department of Interior and Local Government (DILG) and World Bank in 2023 showed that 70 percent of the 115 urban LGUs are preparing for smart city development, 61 percent have ongoing smart city initiatives, and 56 percent have established policies to support the said development (Mondares, 2025). A critical challenge, as highlighted in the World Bank & DILG Report (2024), is the integration of these smart plans into the local government units' (LGUs) Comprehensive Development Plans (CDPs). This underscores the importance of understanding the insights of different sectors on the implementation of the program.

Briones (2018) described how digital illiteracy and inadequate training impede the adoption of smart agricultural practices, particularly in underserved areas. Similarly, Paderanga and Cayetano (2019) examined how LGUs lack institutional capacity to implement smart city initiatives, despite having access to funding and planning tools. The DOST-PCIEERD (2020) pilot evaluation reported that although smart technologies were deployed in selected communities, the sustainability of interventions remained questionable due to poor stakeholder engagement and limited local ownership. Dizon, et al., (2021) reinforced this by stressing that top-down implementation of smart programs without strong grassroots participation often leads to tokenism rather than transformation. These studies emphasized the national-level bottlenecks that can hinder the diffusion and success of smart programs, framing the importance of studying community readiness as a decisive factor in program success.

While national policies are in place, many Local Government Units (LGUs) remain uneven in their capacity to adopt and sustain such programs due to varying levels of readiness, community participation, infrastructure, and awareness (NEDA, 2023). In the CARAGA Region, particularly in Agusan del Sur and Butuan City, efforts have been made to adopt smart farming techniques and flood warning systems under DOST-funded projects. However, adoption remains slow due to limited digital literacy among farmers. A readiness assessment revealed that many

community members were not fully informed or involved in the planning phase, reducing ownership of the project and sustainability of outcomes (DOST-Caraga, 2020).

In Central Visayas, the introduction of smart transportation systems and waste-to-energy projects was met with mixed responses. While urban centers like Cebu showed moderate readiness due to better infrastructure and civic participation, smaller towns in Bohol lagged due to a lack of technical capacity, financial constraints, and unclear accountability among implementing agencies. An assessment conducted by a local academic institution concluded that failure to assess readiness prior to implementation led to project delays and increased public skepticism or doubt (Jaca et al., 2020).

In Iligan City and parts of Lanao del Norte, smart city projects are funded by DOST and other agencies focused on digital health systems and energy-efficient community infrastructure. However, community resistance rooted in unfamiliarity with the technology and limited orientation hindered full utilization of the system. The region's multiethnic composition and history of conflict also demand a more tailored readiness approach that accounts for socio-cultural dynamics (Andal & Rivera, 2019). These regional experiences underscored a recurring theme: without proper community readiness assessment, the success of smart and sustainable programs becomes uncertain, regardless of funding or technical support.

The Bicol Region has shown strong participation in DOST programs, particularly those focused on disaster risk reduction, agriculture, and community empowerment. However, regional disparities in terms of socioeconomic status, access to infrastructure, and technical capacity persist. Studies conducted in Bicol show a mixed level of readiness among LGUs. Guevarra et al. (2019) assessed climate-smart agriculture programs in Albay and found that readiness was high only in LGUs with strong political will and civil society partnerships. Robosa and Roces (2020) examined smart education tools in Camarines Sur and found resistance due to a lack of digital infrastructure in rural schools. Meanwhile, the work of Almadro et al. (2022) on energy-smart barangays in Catanduanes highlighted that community readiness was limited by weak coordination among stakeholders and insufficient public awareness. These studies affirm that Bicol, while participative, still faces readiness gaps that need to be addressed before full implementation of smart community programs can take place.

The province of Sorsogon has also been actively engaged in DOST initiatives, especially through its Provincial Science and Technology Office in collaboration with the LGUs. With programs focused on agricultural innovation, disaster resilience, and water and energy systems, Sorsogon presents itself as a promising site for smart community development. The municipality of Barcelona in the province of Sorsogon stands as one of the targeted sites for the implementation of the DOST Smart and Sustainable Community Program. While many municipalities in the Philippines express interest in smart city/community

development, they often face challenges such as funding limitations, lack of digital infrastructure, and shortages in technical competencies, making municipalities like Barcelona, which are already actively pursuing sustainable and community-centric projects, more readily equipped to leverage DOST's support for further smart community transformation. The DOST prioritizes LGUs that are believers in the power of science, technology, and innovation to improve socio-economic conditions, and Barcelona's ongoing efforts suggest such a commitment.

The researcher's decision to pursue this study is driven by a dual perspective as both a practitioner within the DOST overseeing the SSCP. While the national framework provides the technical blueprint for smart development, the actual success of these interventions is often decided at the intersection of policy and people. Having facilitated the program's rollout, the researcher has observed that technical readiness is only one side of the coin; the subjective insights and perceived readiness of various sectors—from local officials to grassroots beneficiaries—form the true foundation of sustainability. By focusing on Barcelona, Sorsogon, this study aimed to move beyond top-down implementation by identifying the specific socio-technical gaps and sectoral expectations that can either accelerate or hinder progress. Consequently, this study sought to capture these localized voices to ensure that the implementation of the SSCP in Barcelona is not just smart by definition, but sustainable by practice.

➤ Objectives

The study evaluated the socio-technical landscape and sectoral alignment of the Municipality of Barcelona, Sorsogon, to determine its holistic readiness for the institutionalization of the DOST Smart and Sustainable Communities Program.

Specifically, it evaluated the insights of the different sectors regarding the readiness to implement the DOST Smart and Sustainable Communities Program in Barcelona, Sorsogon. Assessed how different sectors perceive the distinct opportunities and barriers in the implementation of the Smart and Sustainable Communities Program initiatives. Determined the current infrastructures and governance policies that support the implementation of the SSCP as perceived by the different sectors. Identified and analyzed the perceived challenges of the different sectors regarding the implementation of the SSCP in the municipality. And designed a strategic implementation plan aimed at enhancing the readiness of the different sectors for the sustainable implementation of the SSCP.

II. METHODOLOGY

The research adopted a descriptive-qualitative research design focused on exploring the lived experiences, perceptions, and institutional readiness of stakeholders in Barcelona, Sorsogon. This approach is particularly suited for this inquiry as it allowed the researcher to delve into the nuanced "socio-technical landscape" of a 4th-class coastal municipality where readiness is not just a technical state, but a

multidimensional construction shaped by human, social, and governance factors. By utilizing a qualitative lens, the study bridged the gap between national program objectives and the actual functional capacity of the community to manage and sustain science-based interventions.

The primary data collection method involved purposive sampling to gather in-depth insights from the "Quadruple Helix"—composed of representatives from the Local Government Unit (LGU), Industry (specifically farmers and fisherfolk), Academe, and Civil Society. Data were gathered through a Focus Group Discussion (FGD), designed to elicit detailed narratives regarding the community's sectoral insights, perceived barriers, and existing administrative policies. This methodology ensured that the findings were not merely "top-down" assessments but are grounded in the grassroots realities of the coastal and agricultural barangays, effectively capturing the diversity of digital literacy and technical capacity across the municipality.

For the analysis phase, the study employed Thematic Analysis enhanced by an In-Vivo Coding model. In-Vivo coding was utilized as a first-cycle coding method to prioritize the "authentic voice" of the participants by using their own verbatim words and local phrases as the primary codes. This is particularly crucial in the context of Barcelona, Sorsogon, to ensure that the unique local dialect, cultural nuances, and specific terminologies used by farmers and fisherfolk are preserved throughout the analysis.

This involved iterative stages of data immersion, where the researcher identified "In-Vivo" segments that capture the essence of sectoral readiness, followed by second-cycle pattern coding and thematic mapping to synthesize the qualitative data into a coherent evaluation. To ensure the credibility and trustworthiness of the results, the researcher utilized data triangulation, comparing these "In-Vivo" insights across different sectors and local literature to validate the identified challenges and opportunities. Ultimately, this qualitative process—grounded in the actual language of the stakeholders—provided the evidence-based foundation required to develop a localized Implementation Plan that is culturally sensitive and institutionally sustainable for Barcelona, Sorsogon.

III. RESULTS AND DISCUSSION

The results were organized through a systematic thematic analysis and employed with an In-Vivo coding model to preserve the authentic voices of the participants. These qualitative findings were synthesized from the collective narratives during the FGD with the Quadruple Helix sectors—Local Government Unit (LGU), Academe, Industry, and Civil Society Organization (CSO)—to provide a comprehensive view of the municipality's socio-technical landscape.

A. *The Insights of the Different Sectors Regarding the Readiness to Implement the DOST Smart and Sustainable Communities Program in Barcelona, Sorsogon*

➤ *Digital Progress Versus Sectoral Silos and Infrastructure Limitations*

The insights of the participants emphasized that while Barcelona's LGU exhibits high technical readiness, administrative competence, and strong political will to digitalize public services, a severe geographical digital divide persists and a deep operational mismatch across the academe, industry, and civil society sectors. Consequently, the successful implementation of the DOST SSCP is heavily bottlenecked by erratic internet connectivity, unstable power supplies, and fragmented data systems between central and remote areas, and an absence of formal institutional channels to connect the LGU with resource-constrained external sectors. To bridge this operational disconnect, the municipality must transition from isolated departmental successes toward centralized planning and a unified infrastructure framework driven by cross-sectoral coordination.

A high concentration of insights and responses from the LGU and forward-thinking sectors indicated that while municipal offices are highly motivated and operationally ready, this progress is heavily bottlenecked by systemic infrastructure gaps and uncoordinated sectoral operations. Key LGU offices are actively scaling up their digital systems under a multi-sectoral framework, driven by ongoing capacity-building and strong executive backing. This operational readiness is clearly felt when LGU-Participant 4 claimed, "We are no longer just dreaming of a paperless system; we are already living it."

The LGU sector demonstrated a notable state of technical readiness driven by active software programs and digitized public databases. For instance, local health staff are already competent in using live digital systems, as LGU-Participant 4 further explained, "Our recent ClinicSys Refresher Training and the fact that we have already uploaded basic health data for 93% of Barcelonanons into the PhilHealth eKonsulta system shows that our staff is digitally competent and our systems are already operational." This administrative readiness is equally evident within municipal business and tax units, which are actively shifting toward automated workflows. Supporting this, LGU-Participant 3 noted that the municipal treasury has already digitized its tax collection processes, asserting, "The LGU of Barcelona continues to evolve by remaining open to innovative ideas and adopting smart technologies. In fact, several innovation projects have been implemented to enhance the delivery of public services."

However, across the other three sectors—especially the Industry (local micro-entrepreneurs), CSOs, and far-flung school sites—there is a strong consensus that erratic internet connectivity and an unstable power supply in Barcelona are major roadblocks. This reveals a stark operational mismatch where the public sector's advanced software tools outpace the actual technical capacities of the community. The LGU

recognizes this digital divide as a systemic challenge, noting that while there is strong political intent to digitalize services, the basic telecommunications infrastructure in a 4th class municipality is still lagging.

The data indicates a clear operational disconnect between central municipal areas and isolated communities, severely hampering uniform preparation due to unequal access to utility signals and baseline gadget poverty among grassroots producers. Academe-Participant 7 reinforced this by stating, “We are still developing since not all areas have the equipment and the signal to use technology in learning. Especially in far-flung areas where Internet connection is limited or not accessible.”

Therefore, while individual offices display high standalone readiness, these localized successes remain vulnerable to systemic utilities issues and behavioral tech-hesitancy caused by a lack of specialized training. This balancing perspective was captured by LGU-Participant 2, who explained, “The LGU’s primary strength lies in the strong political will of the Municipal Mayor. However, in terms of data management, we need to centralize it to document individual office successes and share it with other sectors.”

- *Departmental and Sectoral Silos in Standalone Public Workflows*

Participants from the LGU sector heavily emphasized their technical readiness by showing how frontline offices have successfully moved away from slow, paper-based workflows toward active digital platforms. The routine utilization of local health systems and electronic records demonstrates that municipal employees possess the foundational computer literacy needed to absorb the more advanced administrative tools to be introduced by the SSCP.

However, because these systems function strictly within internal local government networks, they operate as standalone departmental and sectoral silos. The complete absence of formal institutional channels prevents these public-sector innovations from being synchronized or communicated with the external sectors, leaving localized advancements completely isolated from the broader community.

- *Modernizing Local Finance and the Readiness Mismatch*

LGU participants reported significant operational preparation within their business and tax offices, highlighted by an ongoing transition to automated payment systems and digital licensing interfaces. This financial modernization reduces manual paperwork, speeds up the collection of local revenues, and builds the transparent, reliable administrative foundation necessary for sustainable smart town governance.

Nevertheless, this transition uncovers a massive readiness mismatch: while the municipal treasury is fully equipped to deploy electronic services, the external sectors—specifically local micro-entrepreneurs and civil society associations—face severe material resource limitations, which prevents them from linking uniformly with the LGU’s modernized financial framework.

- *Connectivity Bottlenecks and the Geographical Digital Divide*

Data from the academe, industry, and CSO sectors revealed a deep geographical divide in communication access between the town center and remote communities. Unstable internet signals and poor telecommunications network coverage in mountainous or coastal barangays create highly unequal baselines, which isolates local classrooms and small businesses from participating uniformly in the digital network. This physical utility bottleneck is compounded by extreme gadget poverty among grassroots primary producers, meaning that even if network signals improve, the absolute lack of basic personal devices among marginalized stakeholders will continue to stall town-wide digital alignment.

- *Limited Access to Specialized Equipment and Technology Anxiety*

While the academe sector possesses foundational computing facilities and technical knowledge, participants explained that their preparation is constantly limited by a lack of advanced specialized laboratories and standardized equipment. Similarly, local micro-entrepreneurs and retailers remain heavily dependent on manual operations because they lack direct institutional access to physical smart production tools.

This material deprivation fuels an intense generational divide and deep-seated technology anxiety among independent traditionalists. Because these workers lack access to modern equipment, they harbor a profound fear of technical breakdowns and a natural behavioral resistance to software, starkly contrasting with the high operational confidence of organized, previously mechanized cooperatives.

- *Decentralized Data and the Need for a Multi-Sectoral Coordination Authority*

Planning representatives noted that while individual municipal units show high standalone readiness, their isolated successes are weakened by scattered data systems. The municipality’s data management is entirely decentralized, leaving individual sectoral wins and departmental records scattered across independent networks without a single synthesizing dashboard. To build lasting structural readiness for the SSCP, the local government with the external sectors must move away from sectoral and departmental silos, and establish a centralized data management system managed by a multi-sectoral technical coordination authority. This planning body is required to design shared data policies, bridge resource gaps, and connect separate sectoral wins into a single, coordinated town framework, ensuring a unified and balanced transition toward a Smart Community.

- *Human Adaptability Amidst Resource and Collaboration Gaps*

Across the academe, CSO, and grassroots industry sectors, readiness is characterized by high human willingness and psychological adaptability that are severely constrained by a lack of physical tools. While teachers, CSO community leaders, and LGU workers are highly receptive to innovation, their potential is muted by a lack of specialized hardware, technical literacy gaps among the general public, and unequal

equipment distribution between central and remote school sites. Furthermore, while the program is viewed as a powerful unifying framework, stakeholders stress that actual operational readiness depends on establishing formal, multi-sectoral collaboration channels that prevent traditional top-down administrative silos.

A majority of responses from the Academe sector described their readiness through the lens of potential and human willingness, characterizing the environment as moderately ready but developing. This group of participants emphasized that while human capital—specifically teachers and school administrators—is highly adaptable and receptive to technological interventions, the physical infrastructure necessary to sustain a smart ecosystem remains inadequate. This complex dynamic is evident when Academe-Participant 8 emphasized, “Our sector is moderately ready to engage with the SSCP. The education sector has skilled and dedicated teachers who are adaptable to new teaching methods and technologies.”

Consequently, the overall readiness of the academe sector remains restricted by these structural limitations rather than a lack of interest. Strong human potential is constantly weakened by training gaps and resource constraints, proving that basic awareness does not automatically translate to operational readiness. Academe-Participant 9 provided a direct look into these daily constraints, explaining, “As a teacher, I would describe our sector’s readiness as moderate but constrained. While teachers are willing and adaptable, limitations in internet connectivity, lack of devices, and minimal access to digital systems hinder full readiness.” Participants noted that moving past program orientations and into functional application requires a substantial increase in direct government intervention and resource allocation to handle narrow technical capacities.

In terms of institutional collaboration, participants saw the DOST SSCP as a powerful unifying framework, but clear mechanisms for collaborative governance must be fully established. The LGU saw itself as the primary facilitator, while the Academe is eager to provide research and extension support. However, local industry and CSOs expressed a feeling of sometimes being left out of high-level policy planning, indicating that genuine readiness requires moving past isolated operations and building continuous, specialized capacity-building programs that bridge all four sectors together.

- *Willing Workers Facing a Lack of Tools*

The academe sector highlighted a resilient workforce where teachers and school heads show strong personal adaptability and a high willingness to learn new digital systems. However, their ability to apply these skills is strictly held back by the ongoing lack of hardware and basic instructional technologies, thus, their strong human capacity is constantly muted by a lack of operational tools.

- *Gaps in Technical Literacy Among the General Public*

While municipal officers and academic personnel feel highly confident in their basic digital literacy, they expressed

concern that the general public and grassroots members of local associations might struggle with advanced smart systems. Participants noted that without extensive training, the gap in technical skills among ordinary citizens will prevent wide-scale community adoption.

- *The Need for Hands-On Training and Government Subsidies*

Participants across sectors explained that moving from basic program awareness to actual practical application requires direct government funding and continuous technical training. Because current local readiness is limited by narrow technical skills, there is an urgent demand for subsidized device distribution and continuous hands-on workshops to fully prepare the local workforce.

- *Unequal Resource and Equipment Distribution*

The data showed that readiness within the academe sector is highly fragmented due to an unequal distribution of equipment among local schools. While a few central institutions enjoy a collaborative environment with basic laptops, many remote stakeholders lack access to modern digital tools, making localized adjustments a necessity before any widespread program deployment.

- *Bridging the Divide in Multi-Sectoral Collaboration*

Although stakeholders viewed the SSCP as a great way to bring the community together, they pointed out that clear, formal methods for multi-sectoral teamwork are still missing. The LGU acts as the main driver and the academe offers research support, but the industry and CSO sectors feel disconnected from high-level planning, showing a strong need for more inclusive local governance.

- *Leadership Support, Cultural Traditions, and Grassroots Needs*

The data revealed that while municipal leadership provides a strong political push for digital modernization, a deep socioeconomic divide exists between organized cooperatives—who are highly ready due to past mechanization projects—and independent traditionalists who remain bound to ancestral, climate-dependent practices. Ultimately, this demonstrates that while digital curiosity and readiness are driven by a desire to attract the youth back to local farming, grassroots acceptance remains heavily restricted by severe gadget poverty, an immediate need for local ordinances, and a demand for low-cost, practical technologies.

While the LGU focuses on administrative speed and the Academe focuses on digital literacy, grassroots industry producers and CSOs operate on an entirely different baseline, remaining tightly anchored in ancestral, climate-dependent practices. This specific friction was candidly shared by Industry-Participant 15, who stated, “Sa technology, diri pa kami masyado handa kay nakabase pa kami sa tinuro san amo magurang—manual na pagtanom tapos hulat lang san uran. Pero sa willingness, handa kami makaaram kun makakabulig man tabi ini sa amo ani.” (“In terms of technology, we are not yet ready because we still rely on what our parents taught us—manual planting and waiting for the rain. But in terms of

willingness, we are ready to learn if this can somehow help our harvest.”)

This sense of structural readiness and digital curiosity is strongly shared by organized CSOs and progressive agricultural groups who have already moved from heavy manual work to modern production methods. Cooperative members explained that their previous experience with mechanized technology programs gave them the operational confidence needed to scale up their production, as directly shared by CSO-Participant 22 who proudly stated, “Reading ready na kami. Dati, manual sana an trabaho niamo, pero nagbalyo na kami sa mechanized na proseso.” (“We are at high state of readiness. Before, our work was manual but transitioned to a mechanized process.”) In the same way, organized farming groups feel ready to take on a bigger role because they have seen how technology improves their output, as Industry-Participant 13 highlighted, “Naka-tikim na kami san bunga kan teknolohiya, kaya handa na kami sa mas malawak na programa. Dati, limang fbulan an hulat sa suka, ngunyan sarong semana na sana dahil sa DOST.” (“We have tasted the fruits of technology, so we are ready for a broader program. Before, we waited five months for vinegar, now it’s just one week because of DOST.”)

However, severe material deprivation among independent traditional producers completely stalls the migration to digital registries due to an absolute lack of personal hardware. CSO-Participant 17 highlighted this baseline limitation: “Handa na kami, kaya lang kaipuhan niamo sin mga gadgets. Gusto niamo gamiton an digital registration system, pero kadaklan sa namo wara ngani cellphone.” (“We are already ready, it’s just that we need gadgets. We want to use the digital registration system, but most of us don’t even own a cellphone.”) Despite these severe physical hurdles, the production sector remains highly aspirational, viewing technological modernization as a distinct demographic requirement to prevent the collapse of the local primary workforce by appealing to the next generation. Industry-Participant 12 underscored this strategic potential, asserting that, “Modernized farming is the solution to bring back the interest of the youth.”

- *Strong Support from Municipal Leadership*

Participants noted that the town’s overall capacity to adopt new technologies is heavily accelerated by the open-mindedness and political commitment of the municipal leadership. This supportive executive environment allows local departments to quickly test, propose, and implement creative workflows without facing long bureaucratic delays or institutional stagnation.

- *The Need for Local Smart Town Policies and Ordinances*

LGU and academic stakeholders discussed the status of local laws, data privacy measures, and digital transformation plans that protect and support local innovation. They observed that while community goodwill is high, formal legislative backing and official local ordinances specifically tailored for smart programs are still in their earliest stages of development.

- *The Divide Between Organized Cooperatives and Individual Workers*

The production sector faces a deep internal split, balancing the high operational confidence of organized cooperatives against the heavy tech-hesitancy of independent traditionalists. While institutionalized groups are ready to scale up due to past project exposures, independent farmers and fishers remain held back by a reliance on ancestral methods and a natural fear of complex systems.

- *Climate and Economic Hardships as Drivers to Learn*

Readiness among local producers and grassroots associations is uniquely driven by immediate threats to their daily livelihoods, such as unpredictable weather shifts and changing sea temperatures. This high-stakes environment forces farmers and fishers into a hands-on, learning-by-doing state of preparation where they actively test climate-resilient alternative workflows to survive economically.

- *Curiosity Blocked by a Lack of Basic Gadgets*

Although there is an intense collective curiosity among local associations to replace traditional paper logbooks with digital tracking records, severe poverty among individual members completely stops this transition. Grassroots digital readiness is fundamentally bottlenecked by a lack of personal property, as a large majority of independent producers do not even own a basic smartphone.

- *Cheaper Tools as a Requirement for Local Acceptance*

Unlike the LGU or academe which can absorb new software platforms through institutional public budgets, local industry producers can only achieve genuine readiness when technologies are highly affordable. For grassroots acceptance to happen, the tools must be cheap to maintain, easy to use, and proven to bring an immediate, tangible increase to household income.

- *Using Modern Technology to Keep the Youth in Agriculture*

Grassroots industry sectors viewed the introduction of digital tools as a necessary demographic shield to prevent the collapse of the local farming and fishing workforce. Modernizing traditional workflows is viewed as a vital strategy to renew youth interest in agriculture, bridge the generational gap, and secure the long-term food security of the entire municipality.

B. *The Perceptions of the Different Sectors Regarding the Opportunities and Barriers in the Implementation of the Smart and Sustainable Communities Program Initiatives*

➤ *Institutional Opportunities for Governance, Local Economy, and Academic Modernization*

Across all sectors, stakeholders interpreted the program as an opportunity and institutional catalyst for economic growth, automated public transactions, and advanced classroom learning. Local micro-entrepreneurs saw an immediate opening to scale up livelihoods through digital marketing and advanced packaging, while local government and health sectors anticipated replacing slow paperwork with faster, data-driven registries. This shared developmental

optimism positions the municipality to advance traditional development phases and adopt highly collaborative innovation frameworks.

All sectors viewed the program not just as a technological upgrade, but as a direct vehicle for community empowerment, automated market expansion, and modernized governance. The opportunity to scale up local livelihoods and eliminate bureaucratic red tape drives high collective enthusiasm. The industry sector specifically, the local micro-entrepreneurs and agricultural cooperatives saw a massive opening to break out of localized, manual markets through digital e-commerce and advanced processing. This sense of economic opportunity is vividly captured by Industry-Participant 11, who noted, “Dako ini na opurtunidad para sa samuyang mga paratinda digdi sa Barcelona. Kung may digital marketing asin modernong packaging hale sa DOST, mas madali na kami makaka-benta sa luwas kan Sorsogon.” (“This is a big opportunity for our sellers here in Barcelona. If there is digital marketing and modern packaging from DOST, we can easily sell outside of Sorsogon.”) This desire for value-addition is mirrored by fish processors like Industry-Participant 20, who emphasized, “An pinakadako na oportunidad amo ang mapataas ang kalidad san mga produkto gamit ang mga technology san DOST.” (“The biggest opportunity is value addition through the DOST smart technologies.”)

Simultaneously, the LGU, CSO, and Academe sectors perceived the program as an accelerator for data-driven public workflows, grassroots health integration, and enhanced digital learning. The LGU sector saw an opportunity to replace slow, redundant paperwork with automated loops, such as a unified patient QR ID code and DOST early warning systems. As LGU-Participant 5 enthusiastically shared, “The opportunity here is the institutional advancement. By partnering with DOST, Barcelona can skip long, traditional phases of development and directly adopt smart, transparent governance tools that make public service delivery faster and more reliable.” This vision of unified public service is supported by CSO-Participant 25, who explained that their biggest dream is “to have a ‘one-stop’ digital record for every resident so that no patient’s history is lost between the barangay and the RHU.”

This administrative optimism is shared across frontline offices, with LGU-Participant 6 confirmed, “Our personnel can quickly adjust to new software.” Furthermore, transport groups see logistics opportunities, as CSO-Participant 22 shared, “if the SSCP can link our digital stores (Shopee/Lazada) with a smarter local transport or pickup system, our shipping costs will go down and our reach will expand.”

The academe sector looked at the SSCP as an essential vehicle for developing global competitiveness and environmental awareness. Academe-Participant 8 asserted that “the SSCP will empower students with the right tools and knowledge to support innovation. Smart technology can make our lessons more engaging and interactive.” This instructional advancement is expected to simplify multi-stakeholder

administration, with Academe-Participant 7 added that “students will be globally competitive, teachers will have ease in doing their job. Transactions with parents and other stakeholders will be easier.” Supporting this perspective, Academe-Participant 3 observed, “We welcome digital portals because it means less heavy paperwork for teachers.” Furthermore, educators look forward to better access to regional knowledge networks, while the overall framework provides a structured venue for schools to collaborate with the LGU and local cooperatives to turn academic research into practical, localized technological solutions.

- *Smarter Packaging, E-Commerce, and Market Reach*

Participants from the Industry and CSO sectors strongly perceived the SSCP as an ideal mechanism to transition from traditional raw material selling to high-value processing. Access to DOST’s product standardizations, automated vacuum-sealing tools, and digital payment networks presents an immediate opportunity to bypass costly middlemen and lower local shipping costs. By linking local goods with popular platforms like Shopee or Lazada, micro-enterprises can easily expand trade networks beyond the provincial boundaries of Sorsogon.

Furthermore, this technological transition is seen as a way to preserve local culinary heritage while meeting modern market safety demands. Stakeholders noted that institutional backing from DOST gives local products a competitive edge through professional labeling and barcode integration. This compliance with national market standards builds commercial confidence among local cooperatives, transforming micro-entrepreneurs from survival-based producers into modern, competitive agri-business operators.

- *Faster Public Services and Automated Health Records*

LGU and CSO participants viewed the SSCP as a catalyst for institutional modernization that can completely change how citizens interact with government offices. Implementing automated permitting systems, a unified patient QR ID registry, and digital real-time records eliminates slow bureaucratic red tape, secures data continuity from rural barangays to the main hospital or RHU, and builds a faster, more reliable public service environment.

This digital shift also promises to dramatically improve emergency medical interventions and social welfare distribution within the municipality. By digitizing health datasets, frontline disaster responders and rural health units can access critical patient backgrounds instantly during flash floods or climate crises. This administrative efficiency reduces processing wait times at the municipal hall, ensuring that marginalized residents receive basic medical care and social subsidies without manual clerical delays.

- *Modern School Tools to Prepare Students for Global Competitiveness*

Academe sector perceived the SSCP as a powerful vehicle to modernize local classrooms and upgrade traditional learning methodologies. Educators explained that utilizing interactive digital tools will make daily lessons far more engaging for students, spark local innovations, and simplify

administrative transactions between school heads, teachers, and parents.

Additionally, this digital integration is anticipated to bridge the information gap between urban academic hubs and rural institutions in Barcelona. Access to smart tools enables local teachers to utilize rich multimedia resources and participate in real-time virtual training, raising the local standard of public instruction. By exposing students to contemporary scientific databases early on, the academe can better cultivate a tech-savvy generation equipped for higher education and global employment.

➤ *Infrastructure Gaps, Unstable Utilities, and Climate Barriers*

The qualitative data revealed barriers and deep-seated anxieties that Barcelona's fragile physical and digital landscape cannot support an interconnected network without urgent structural upgrades. Operational readiness is severely bottlenecked by weak internet dead zones in rural barangays, obsolete computer equipment, and a highly unstable power grid that threatens local producers with severe material losses during blackouts. This utility friction is compounded by intense climate anxiety, as stakeholders fear that expensive high-tech assets will simply be destroyed by the town's frequent typhoons and coastal floods.

Participants voiced a deep-seated anxiety that Barcelona's current physical and digital landscape cannot support an interconnected smart system without immediate, heavy structural upgrades. The primary physical barriers revolve around the municipality's erratic utility services, old hardware, and vulnerable geographical layout.

The digital divide is felt deeply by sectors operating in rural, mountainous, or coastal barangays, where basic telecommunications infrastructure is weak or non-existent, leaving many areas without phone or internet signals. This immediate friction was clearly articulated by Academe-Participant 12, who stated, “We cannot talk about smart classrooms or digital portals when our day-to-day reality is marked by weak internet signals and frequent brownouts. In remote school sites, we spend more time waiting for web pages to load or dealing with power fluctuations than actually using technology.”

This digital inequality is compounded by obsolete institutional equipment, as Academe-Participant 7 reported, “the available desktops at our school are not updated, and some of it are very old, not all can connect to the internet.” Highlighting this systemic deficiency, Academe-Participant 5 remarked, “Saro sana an projector niamo digdi kaya pila-pila an paggamit san maestro nan maestra.” (“We only have one projector here, so teachers have to take turns using it.”)

Furthermore, local producers suffer from fluctuating electricity rates and a lack of immediate tech support when equipment malfunctions. Industry-Participant 13 discussed this burden of unstable power grids and absent technical assistance, noting, “Pabago-bago an presyo san kuryente. Kaipuhan mi san mga makina na stable asin barato na

kuryente para magdanay na 'smart'. Tapos, kun magkaproblema man an gamit hali sa DOST, wara kami sin experts na makahingayad tulos.” (“Fluctuating electricity prices. Our machines need stable, affordable power to stay 'smart'. Also, if the DOST equipment has a glitch, we don't have local IT or mechanical experts to fix it immediately.”) This concern is echoed by agricultural operators, with Industry-Participant 16 stating, “Kun mag-brownout habang napaprocess kami tapos napan-os, laking lugi sa materyales.” (“If a power outage occurs while we are processing and it spoils, it causes huge material losses.”)

Compounding these utility issues, the industry and CSO sectors pointed out that Barcelona's geographic vulnerability to typhoons and floods places expensive physical assets at constant risk. As CSO-Participant 14 candidly pointed out, “Maski gusto niamo mag-adopt kan digital logbooks o modernong makinarya, natatakot an mga para-oma na maraot sana ini pag nagsulod an bagyo. Ang pinaka-barrier niamo digdi ay baka mag-invest kita sa mamahaling sistema tapos maraot lang nan dire magamit dahil sa baha asin kawalan kan kuryente.” (“Even if we want to adopt digital logbooks or modern machines, rice farmers are afraid these will just be destroyed when a typhoon enters. Our main barrier here is that we might invest in expensive systems only for them to be washed away by floods and power outages.”)

• *Weak Internet Signals and Outdated Hardware*

Across all sectors, unstable internet dead zones and obsolete computing equipment are identified as crippling barriers to the SSCP. Participants emphasized that without an upgraded, reliable internet service provider and a proper 1:1 computer-to-student ratio, digital learning platforms and automated business tools will remain out of reach, effectively doubling the administrative workload for local teachers and operators who must constantly revert to manual backups.

This technological scarcity creates an uneven operational landscape within the municipality, where central town entities progress while outlying barangay schools and home-based retailers remain disconnected. Obsolete desktop units cannot support contemporary web-based software, leading to profound operational friction. Without systemic device upgrades from institutional partners, any digital municipal platform will experience major user dropouts due to baseline hardware failures.

• *Unstable Power Grids and Absent Tech Support*

Local producers reported that frequent electricity blackouts and fluctuating power prices create an expensive operational barrier for running electronic machinery like mechanical dryers. Furthermore, because Barcelona completely lacks local IT professionals or mechanical technicians, any unexpected software glitch or equipment failure cannot be repaired quickly, threatening long-term project operations.

This deficiency creates operational vulnerability for community associations processing high-value local crops. When a specialized device breaks down, operations grind to a halt for weeks while waiting for technicians to travel from

urban centers like Legazpi City or Manila. This prolonged downtime discourages micro-entrepreneurs from adopting electronic machinery, as they prefer reliable manual methods over unpredictable automated tools that lack immediate local maintenance.

- *Climate Vulnerability and the Fear of Asset Destruction*

Grassroots producers and CSO leaders highlighted that Barcelona's high exposure to typhoons, flooding, and harsh coastal weather poses a constant threat to advanced technological investments. The lack of weather-resilient facilities creates a high-stakes barrier that discourages small agri-fishery businesses from migrating to electronic platforms out of fear that expensive systems will be washed away.

This environmental vulnerability introduces persistent risk into local development planning. Stakeholders are deeply hesitant to commit tight capital resources to expensive digital hardware when municipal buildings lack typhoon-proof housing. Consequently, climate anxiety acts as a psychological and financial barrier, stalling institutional automation until the municipality can guarantee resilient physical facilities to protect these high-tech investments.

- *Budget Limitations, Technology Anxiety, and Human Realities*

The findings demonstrated barriers that while psychological willingness to innovate is high, sustainable adoption is heavily restricted by tight local tax revenues, grassroots gadget poverty, and deep-seated technology anxiety among elderly workers. A critical shortage of internal IT personnel leaves municipal systems vulnerable to data privacy risks, while transport groups worry that high setup costs might drive up commuter fares for low-income residents. However, this friction highlights a strategic demographic opportunity to use modernized, tech-driven farming tools to attract the younger generation back to agriculture and revitalize the aging workforce.

Data revealed a complex landscape where high psychological willingness is challenged by narrow local tax bases, technology anxiety, and traditional work habits. Institutional budget constraints heavily restrict the LGU and Academe, preventing them from purchasing high-end systems due to a restricted municipal revenue share. As LGU-Participant 1 remarked, "Being a 4th-class LGU means our Internal Revenue Allotment (IRA) or National Tax Allotment is highly restricted. We have competing priorities like basic health, agriculture, and social welfare. Allocating millions for software maintenance or subscription fees is a heavy financial barrier that we cannot sustain without national government subsidies or long-term DOST funding." This fiscal constraint is exacerbated by an internal administrative shortage. LGU-Participant 2 raised concerns over structural gaps in management, highlighting a "lack of centralized and integrated data management system across offices and absence of ICT office to manage the system."

This absence of a dedicated IT department leaves local systems vulnerable, with CSO-Participant 21 identifying "data privacy and hackers as a primary barrier" to community trust.

Similarly, cooperative leaders worry about transport costs, with CSO-Participant 24 shared that "wara pa man kami sin mga public charging stations niyan. Tapos, igwa man sin paghadit na basi an 'Smart' transport maging rason san pagmahal san pamasaha." ("We don't have public charging stations yet. Also, there is a fear that 'Smart' transport might mean higher fares.")

At the community level, economic limitations manifest as severe gadget poverty and software resistance. CSO-Participant 5 exposed this stark reality, stating, "Paano mi gagamiton an smart apps kung wara man kami sinti pangbakal nin cellphone, lalo na pangbakal nin data load?" (How can we use the smart apps if we don't even have money to buy cellphones, let alone buy data load?) This poverty combines with tech anxiety among traditional workers. Industry-Participant 18 candidly admitted, "Dae mi aram paano gamiton an 'smart' apps." ("We don't know how to use the 'smart' apps yet.")

This human resource gap directly mirrors health system barriers, with LGU-Participant 4 identified "limited digital literacy among marginalized patients as a barrier to health equity." This is further validated by LGU-Participant 7, who added, "Dae gabos na namamanwaan ay tatao mag-pindot kan makabagong technologies." ("Not all citizens know how to operate the modern digital technologies.") System operators also expect behavioral resistance, with LGU-Participant 3 highlighting "concern regarding resistance from end-users in accepting and adapting to the program," while LGU-Participant 1 identified "warning fatigue" as a behavioral barrier.

However, this socio-economic friction revealed a demographic opportunity: utilizing modern technologies to solve the aging farming workforce crisis. Industry-Participant 8 highlighted this dual dynamic, explaining, "An mga gurang na para-oma digdi, lalo na idtong mga nagsusunod lang sa turo kan magurang na manual na pagtanom, natatakot talaga sa computer. Pero nakikita niamo na kung hihimuon na 'modernized' o gagamitan san smart tools ang pag-uuma, mabalik ang interes kan mga kabataan na mag-stay digdi sa Barcelona kesa mag-manila." ("The old farmers here, especially those who just follow what their parents taught them through manual planting, are really afraid of computers. But we see that if we make farming 'modernized' or use smart tools, the interest of the youth to stay here in Barcelona instead of going to Manila will return.")

To capture this potential, stakeholders emphasized breaking institutional silos, as CSO-Participant 10 explained, "The opportunity of the SSCP is that it can bring us all to one table—LGU, academe, industry and CSO. But the barrier is our old habits of working in silos. If the government treats us as mere recipients of technology rather than active co-designers of the policy, then the smart community will fail to be genuinely inclusive."

- *Limited Public Budgets and Recurring Software Overhead*

LGU and planning representatives explained that a 4th-class municipality's restricted revenue limits its capacity to

sustain digital programs. The high cost of acquiring advanced corporate systems, combined with recurring annual licensing and subscription fees, forms a massive fiscal barrier that makes the smart program difficult to maintain without permanent external subsidies or long-term financial assistance from other NGAs.

This monetary strain restricts the LGU's ability to recruit full-time software administrators or fund vital system upgrades. Since public funds are rightfully funneled into immediate necessities like agricultural aid and medical assistance, tech maintenance fees are often viewed as an impractical luxury. For the SSCP to remain sustainable over time, external financial models must shift away from short-term grants toward long-term budgetary support.

- *Shortage of ICT Personnel and Technical Literacy Gaps*

The LGU faces an internal administrative bottleneck due to the complete absence of a dedicated municipal ICT office and a shortage of technical personnel. This lack of centralized data management leaves records vulnerable to fragmentation, while the parallel digital illiteracy and gadget poverty of grassroots citizens fuel technology anxiety and software resistance.

This workforce deficit is compounded by data privacy fears and vulnerabilities to cyber threats. Without certified cybersecurity personnel to monitor municipal networks, stakeholders worry that public databases could face breaches, eroding public trust in automated services. Bridging this skill gap requires extensive training programs for municipal staff alongside basic, patient tech tutorials for the general public to counter tech anxiety.

- *High Setup Costs and the Threat of Rising Public Fares*

Transport and industry sectors expressed concern regarding the financial burdens tied to building smart utility systems, such as public charging stations for e-mobility tools. Cooperative leaders worry that high initial infrastructure investments and expensive operating overhead costs will ultimately force drivers to increase passenger fares, passing the financial burden onto the public.

This economic anxiety demonstrates how structural improvements can trigger unintended financial stress for low-income residents. If smart transport investments drive up commuting fares, the program risks alienating the very public it aims to serve. Consequently, grassroots transport operators insisted on government subsidies for vehicle conversions and public charging stations to keep passenger rates affordable for daily commuters.

- *Attracting Youth to Farming and Breaking Governance Silos*

Socio-economic barriers revealed strategic opportunities for community renewal. Introducing modernized, solar-powered, or tech-driven agricultural tools can effectively re-brand local farming to inspire the younger generation to stay in the municipality. To achieve this, local governance must move away from top-down silos and treat industry and CSO

leaders as active co-designers of policy rather than passive recipients of technology.

By transforming manual agriculture into a modern, data-driven livelihood, Barcelona can curb the migration of young workers to major cities like Manila. This demographic shift could revitalize the aging rural workforce and strengthen the local economy. Achieving this vision requires a shift in local governance, moving from top-down decision-making toward cooperative spaces where small business owners and community leaders work alongside LGU planners to build a genuinely inclusive smart community.

C. The Current Infrastructures and Governance Policies to Support the Implementation of SSCP as Perceived by the Different Sectors

➤ *Digital Onboarding Progress and Data Management Gaps*

Across all sectors, participants acknowledged that while a fully integrated smart town ecosystem does not yet exist, individual sectors have established current infrastructures and have already taken concrete, standalone steps toward digitalization. The LGU has established a firm digital baseline through automated services, electronic health systems, and digital payment frameworks like Paleng-QR. Crucially, while the LGU has initiated preliminary administrative steps toward centralizing its data management system, it still lacks a functional, unified digital dashboard to systematically integrate these scattered departmental records. Ultimately, this shows that while municipal workers and local market vendors are already competent in using standalone digital tools, the absence of a centralized dashboard remains a critical governance gap that must be addressed to achieve full program integration.

The LGU utilizes automated transactional systems like eBOSS, digital health registries like iClinicSys, and cashless Paleng-QR initiatives to streamline public services and economic activities. These fragmented yet active electronic platforms establish an ideal entry point that is structurally ready to absorb more advanced DOST software integrations.

Furthermore, the LGU has established a strong digital baseline by passing key municipal laws, ordinances and using automated software to speed up public transactions and medical monitoring. As LGU-Participant 3 detailed, local governance is supported by a “legislative framework comprising ordinances on innovation, and the Comprehensive Development Plan, we also have committee chairperson on science and technology, all of which collectively foster a digitized environment ready for future integration with the eLGU system.” This is reinforced by PalengQR, the eBOSS (Electronic Business One-Stop Shop) and collection systems through digital cash transfers like Landbank LinkBiz and communication channels such as the “WeWork Barcelona PH platform.”

In public healthcare, the LGU runs automated registries to capture field data efficiently. LGU-Participant 4 noted that their digital setup relies on “our interconnected HIS (Health

Information System) consisting of iClinicSys, iHomis+, and e-Konsulta, and our Birthing Facility which already functions as a primary data-capture point.” This digital governance framework directly connects with local business and agricultural operations, enabling grassroots stakeholders to adopt cashless payment setups.

The integration of national financial programs helps small-scale farms move into modern retail markets. Industry-Participant 11 highlighted how these digital tools open up new economic opportunities for local growers: “Sa digital naman, kaiba na kami sa Paleng-QR smart initiative, kaya an mga turista asin mga taga-dini makakabakal na san mi mga produkto—arog san mga organic na gulay—paagi san cashless.” (“On the digital side, we are already part of the Paleng-QR smart initiative, so tourists and locals can now buy our produce—like organic vegetables—cashless.”)

However, despite these localized successes and early executive efforts, multiple participants emphasized that these data streams remain siloed. While the LGU has taken preliminary steps toward centralizing data management within the broader LGU system, they do not have a centralized dashboard yet to consolidate, view, and analyze municipal information in real-time, leaving department records highly fragmented.

- *Automated Government Software, Cashless Payments, and the Dashboard Deficit*

The current administrative infrastructure within Barcelona’s local government is anchored by active electronic services and automated transaction modules. Through the enforcement of the eBOSS and the integration of Landbank LinkBiz, the LGU has successfully digitized business permits and revenue collections, reducing long processing times for the public. This transactional framework is mirrored in public health management, where interconnected systems like iClinicSys, iHomis+, and e-Konsulta transform localized clinics and birthing facilities into real-time data-capture hubs that secure patient records directly at the grassroots level. This digital shift extends to the local economy through the Paleng-QR smart initiative. By introducing cashless payment tools to public markets, the policy connects local growers and vendors directly with modern, tech-savvy consumers and visiting tourists.

However, a major structural vulnerability in this digital transition is the complete absence of a centralized operational dashboard. While the municipal government has taken preliminary steps toward centralizing data management across its various systems, the lack of an integrated digital dashboard means that financial, health, and administrative data remain locked within separate departmental silos. LGU-Participant 2 reiterated that “in terms of data management, we need to centralized it to document individual office successes and deficiencies.” Without a central dashboard to visualize and synthesize these scattered data tracks, the LGU cannot easily track long-term town trends, leaving the municipality’s digital framework operationally fragmented and short of a true smart town ecosystem.

- *Centralized Workspace Channels and Mobile Communication Links*

To maintain smooth internal management and fast multi-sectoral planning, the municipality heavily relies on online communication networks like the WeWork Barcelona PH platform. This communication setup bridges the gap between different government offices, allowing for transparency and communication. Nevertheless, because this platform acts strictly as a communication tool rather than a data warehouse, it cannot compensate for the lack of a proper management dashboard, thus, the actual raw data and public transaction records must still be manually shared across separate institutional networks.

- *Shared Buildings, Transport Networks, and Eco-Rules*

The data demonstrated that the municipality possesses a solid physical, logistical, and environmental infrastructure foundation to support sustainable development. Flagship installations like the AgriHope farming hub and the 7K Program production centers provide grassroots cooperatives with shared workspaces, while a modernized jeepney fleet handles clean energy transport. This tangible infrastructure is strongly backed by rule-based coastal conservation codes and national maritime registries like FishR, ensuring the town’s physical assets are prepared for data-driven management.

The physical processing facilities, transport road networks, community volunteer groups, and eco-friendly resource rules support agricultural, coastal, and cooperative operations in Barcelona. Grassroots agricultural groups rely on specialized production buildings and physical supply routes to keep local businesses running. Industry-Participant 11 stated that their physical road network connects remote fields directly to local markets: “An AgriHope mismo saro na sa flagship na infrastructure niamo, kaibahan an mga greenhouse para sa mga high-value crops, plant nursery, asin an spring-fed na patubig. Saro pa, an mga farm-to-market roads saro sa mga importante na social asin physical networks na nagkokonekta san mga harayo na umahan derecho sa Kadiwa specialty stores sa sentro.” (“AgriHope itself is a flagship infrastructure with its greenhouses for high-value crops, a plant nursery, and a spring-fed water system. Furthermore, the improved Farm-to-Market Roads are vital social and physical networks that connect our remote farm sites directly to the Kadiwa specialty stores in the town center.”)

In the cooperative sector, production is driven by shared facilities and local state backing. CSO-Participant 23 shared that “the 7K Program infrastructure provides the production building and raw materials, while our DOST-funded processing equipment provides the technical base. The LGU’s support for innovation is our strongest governance asset,” a baseline supported by CSO-Participant 22’s mention of active “shared service facilities.” Modern transport initiatives and community volunteer networks provide the physical and human support system needed to roll out wide-scale program developments. CSO-Participant 24 noted that local transport already operates under national upgrade rules: “The existing Modern Jeepney Fleet serves as our backbone. This is supported under the Public Utility Vehicle Modernization

Program.” To manage fieldwork and data gathering, CSO-Participant 25 pointed to an existing “network of volunteers as a human infrastructure ready to handle ground-level data collection.”

In coastal communities, local governance focuses on sustainable fishing rules and national registration tools to protect marine lifelines. Industry-Participant 18 shared that “local policies protect marine environments by standardizing fishing gear with specific mesh sizes to prevent the capture of juveniles.” To keep these programs organized, Industry-Participant 19 noted that fishers are systematically enrolled in the “Fisherfolk Registration (FishR) system to guide government assistance and policy-making,” utilizing physical landing stations and coastal protection outposts.

- *Modernized Farming Hubs and Shared Production Centers*

Barcelona’s physical infrastructure is supported by flagship agricultural installations and shared processing centers that cater to local cooperatives. The AgriHope facility stands out as a prime example, boasting greenhouses for high-value crops, dedicated plant nurseries, and an efficient spring-fed irrigation network. Backed by an improved network of farm-to-market roads, these installations allow rural farmers to transport fresh harvests directly to centralized Kadiwa specialty stores in the town center, cutting out costly middlemen.

For the processing and manufacturing sector, local production is sustained by municipal initiatives like the 7K Program, which provides community groups with physical workspace buildings and essential raw materials. When combined with shared service facilities and specialized DOST processing machinery, these hubs allow local associations to scale up their production and improve product packaging. This institutional backing serves as a powerful governance asset, transforming small-scale producers into structured, tech-supported business units.

- *Modernized Public Transport and Grassroots Volunteer Networks*

The physical mobility of goods and people across Barcelona is anchored by an upgraded public utility fleet. Modern jeepneys operated by local transport cooperatives like BGSTRANSCO and BULTRASCO serve as the clean energy backbone of the municipality, running in full compliance with the national Public Utility Vehicle Modernization Program (PUVMP). This modernized transport framework ensures that as local e-commerce expands, a reliable, eco-friendly logistics network is already in place to move products across municipal borders.

Equally important is the town’s human infrastructure, which relies heavily on organized community volunteer groups and local health workers. These field teams are highly active across all rural barangays, serving as a ready-made ground network for municipal data gathering, health tracking, and disaster response. This combination of an updated transport fleet and dependable volunteer networks give the

municipality a strong social and physical framework capable of implementing large-scale smart town programs.

- *Sustainable Fishing Rules and National Maritime Registries*

In Barcelona’s coastal zones, current governance support takes the form of strict environmental conservation policies and maritime tracking tools designed to safeguard municipal waters. Local ordinances promote the mandatory use of eco-friendly and smart fishing methods, such as the Matalino fishing traps (standardized crab pots and squid nets). These specialized gears feature precise mesh size regulations that allow juvenile fish and young eels to escape, ensuring long-term marine reproduction.

To support these conservation laws, the municipality relies on the national Fisherfolk Registration (FishR) database, alongside physical fish landing stations and coastal patrol outposts. Systematically registering local fishers allows the government to tailor its financial assistance, distribute modern fishing equipment fairly, and design data-driven marine preservation laws. This established rule-based setup ensures that the local blue economy is structurally prepared for smarter, data-driven coastal management.

- *School Funding Gaps and Outdated Laboratory Equipment*

The academe sector provided a strong policy foundation for the SSCP through national K-12 and MATATAG curriculum mandates that make digital literacy and climate awareness mandatory. However, the actual deployment of these learning directives is severely bottlenecked by aging computer hardware, a shortage of laboratory devices, and local funding deficits. To bridge this technical skills gap, the LGU is strategically developing the upcoming Colegio Digital to serve as a centralized, TESDA-certified training hub for the local workforce.

The academe sector supports smart city concepts through national learning directives that make computer training and climate awareness mandatory in local classrooms. Academe-Participant 8 explained how current school programs match the main goals of the SSCP: “Our school have computer laboratories, and basic digital tools and equipment like computers, laptop, projector. Also, the K-12 and MATATAG curriculum already includes ICT integration and environmental education, which supports the idea of a smart and sustainable community.”

However, while national education mandates provide a clear policy direction, actual school computer laboratories face serious shortages and run on outdated hardware. Academe-Participant 9 pointed out that while there are “DepEd ICT integration programs (DepEd Computerization Program) such as DO 78 s.2010, implementation is often limited by resource constraints at the local level.” These physical shortages limit what students can do in the laboratory, with Academe-Participant 6 confirming that “while we have some computers and internet, the hardware is often outdated or insufficient for the scale of Smart education.” To resolve these training issues and bridge the

digital skills gap, the municipality is building an advanced training hub—the upcoming Colegio Digital—which LGU-Participant 3 noted “aims to bridge the digital skills gap through TESDA-certified courses.”

Overall, it reveals an infrastructure bottleneck within Barcelona's academic sector. While national mandates like the MATATAG curriculum establish a solid policy foundation for technology and environmental training, the actual deployment of these programs is heavily restricted by aging school computers, limited laboratory devices, and local funding deficits.

- *National Education Mandates and ICT Classroom Integration*

The policy framework supporting smart community concepts within Barcelona's educational system is driven by national learning directives. The K-12 and MATATAG curricula require the integration of Information and Communications Technology (ICT) and environmental sustainability courses into daily student lessons. By embedding digital literacy and climate awareness directly into the basic education framework, local schools ensure that the younger generation is naturally oriented toward the core values of a smart and sustainable community.

This instructional framework is physically supported by basic computer laboratories, laptops, and multimedia projectors distributed across local campuses. These tools allow educators to break away from traditional chalkboard methods and introduce interactive learning modules. Because these educational guidelines are already a mandatory part of the local school system, they provide an established policy pipeline for training a tech-proficient workforce ready to operate future municipal systems.

- *Local Resource Scarcity and Aging School Hardware*

Despite the clear policy goals set by national mandates like the DepEd Computerization Program (DO 78 s.2010), the actual condition of local school infrastructure is severely limited by a lack of funds and resources. School administrators frequently report that their available computer laboratories do not have enough working devices to maintain a healthy student-to-computer ratio. Much of the existing hardware is outdated, runs on slow operating systems, and cannot handle contemporary educational software or stable internet connections.

This resource gap creates a bottleneck where teachers must teach modern digital concepts using insufficient or broken equipment. While the policy guidelines are excellent on paper, the physical scarcity of hardware limits hands-on training for students in outlying or marginalized barangays. Without targeted financial investments to replace these aging computer units, the academe sector will struggle to fulfill its role as the primary training ground for the municipality's smart transition.

- *Advanced Training Hubs to Close Local Technical Skill Gaps*

To directly address the shortages within local schools and upgrade the technical skills of the local workforce, Barcelona is actively investing in new institutional education frameworks. A key governance initiative is the development of the upcoming Colegio Digital, an advanced municipal training hub designed to offer specialized tech education. As noted by local planning representatives, this facility will specialize in providing TESDA-certified technology courses and advanced digital literacy workshops for residents.

The creation of this municipal training hub shows a smart governance strategy to close the local digital divide. By providing a centralized, well-equipped facility for high-level technical training, the Colegio Digital will serve as a bridge for high school graduates, local farmers, and government employees to gain competitive digital skills. This localized educational infrastructure ensures that the community will not have to rely on expensive external tech experts to run and maintain the incoming DOST smart networks.

- *D. The Perceived Challenges of the Different Sectors Regarding the Implementation of the SSCP in the Municipality*

- *High Technology Maintenance Costs and Infrastructure Fragility*

Participants across all sectors perceived challenges are the municipality's lack of immediate technical repair capabilities and the fragile state of local internet and hardware infrastructure. The findings revealed a widespread fear that shifting to mechanized systems creates an absolute point of no return where a single technical breakdown will paralyze operations and wipe out daily incomes. Consequently, stakeholders emphasize that without local repair experts and weather-resistant hardware, the program's long-term operational reliability remains highly vulnerable.

Across the industry and CSO sectors, transitioning to technology creates a serious operational vulnerability because stakeholders can no longer revert to old workflows during a system malfunction—marking a financial “point of no return.” CSO-Participant 22 expressed a deep anxiety regarding technical downtime and the immediate economic damage it causes: “Niyan na mechanized na kami, kun maraot man an makina o an digital na sistema, diri na kami pwedeng magbalik sa manual na diri nawawaran sin kwarta. Kaipuhan nanggad niamo sin mga lokal na eksperto sa paghingayad.” (“Now that we are mechanized, if a machine or a digital system breaks, we cannot go back to manual without losing money. We need local repair experts.”) This operational fragility is mirrored in agriculture, where equipment failure completely breaks commercial ties. Industry-Participant 13 warned: “If the machine breaks and we can't fix it, we lose our momentum, income, and our market trust.”

LGU administrators and transport cooperatives shared these worries, focusing on how basic hardware performance issues and lack of maintenance can halt essential public services. LGU-Participant 4 highlighted that unstable internet

remains a constant threat to real-time data syncing across frontline municipal offices. In terms of physical hardware, LGU-Participant 1 expressed concern that specialized parts for advanced sensors might be difficult to source locally, leading to a waste of municipal resources if the equipment fails. For transport groups, the challenge lies in climate durability and asset disposal. CSO-Participant 24 noted that “electric vehicles only work if parts are reliable and easy to maintain.”

- *The Point of No Return and Costly Mechanical Downtime*

Shifting from traditional manual labor to automated processing creates a state of total technological dependency for local cooperatives. Once an association redesigns its assembly lines around computerized packaging or mechanical food dryers, it cannot simply return to slow manual methods when a system crashes without suffering devastating material waste and financial losses. This operational vulnerability means that any delay in fixing a broken machine directly stops daily production, causing grassroots groups to miss commercial deadlines and lose the trust of external retail buyers.

This fragility is worsened because Barcelona entirely lacks localized technical support and specialized repair shops. When a machine fails, local operators are helpless, forced to pause all income-generating work for weeks while waiting for specialized mechanics to travel from distant urban centers. To protect vulnerable local producers, stakeholders insist that the rollout of the SSCP must include the creation of an immediate, town-based technical support team rather than just delivering high-tech equipment.

- *Hardware Unreliability and Climate Durability*

The practical rollout of smart infrastructure faces severe physical challenges due to Barcelona’s harsh coastal weather and steep roads. Transport operators expressed strong doubts regarding whether lightweight electronic vehicles can safely navigate flooded streets during the rainy season or climb steep slopes with heavy cargo. Furthermore, public planners worry that advanced digital sensors will quickly deteriorate under the province’s humid conditions, resulting in broken municipal assets if specialized replacement parts cannot be bought in local markets.

➤ *Digital Divide, Technology Anxiety and Generational Exclusion*

The qualitative data highlighted challenges such as deep generational and geographical divide that threaten to marginalize elderly workers and remote rural residents who lack digital literacy. Traditional farmers and fisherfolk expressed intense psychological anxiety over using expensive gadgets, fearing they might break the tools or misinterpret complex digital instructions. This creates a collective worry that rigid high-tech requirements will lead to subsidy inequity, where only tech-literate citizens benefit from municipal assistance.

A prominent challenge identified by grassroots industries is a deep-seated technological anxiety among older food producers who fear being sidelined by modern

interfaces. Industry-Participant 15 explained how advanced technology risks creating a fractured community: “Daghan sa amo an may edad na, kaya igwa sin takot na basi maraot an mga mahal na gamit o kaya diri niamo mainitindihan an mga instructions na digital.” (“Many of us are old and we are afraid we might break the expensive equipment or not understand the digital instructions.”) This is closely tied to low technical literacy in rural areas, where Academe-Participant 7 observed that without proper skills training and simple instructions, expensive equipment will simply not be used by the community.

This social divide causes significant anxiety regarding government partiality, as traditional workers worried that high-tech entry requirements will cut them off from public assistance. Industry-Participant 17 worried about a widening gap in municipal aid distribution: “Basi an mga maaaram lang an makakakuha san gabos na subsidiya, habang an mga tradisyunal naman basi malimutan na sana.” (“The smart ones will get all the subsidies, while the traditional ones might be forgotten.”) This economic anxiety is compounded by harsh market conditions where large-scale buyers control trade; Industry-Participant 20 added that even with better technology, if large buyers drop local prices, grassroots profits remain critically small.

- *The Generational Divide and Fear of Expensive Equipment*

Barcelona’s agricultural and fishing industry workforce is predominantly composed of older individuals who have spent decades mastering physical, manual methods. Forcing these senior food producers to interact with complex digital software interfaces or touch-screen registries triggers severe tech anxiety, rooted in the fear that they will accidentally break expensive government-funded assets. This generational gap is widened by language barriers, as most digital instructions are written in complex English terms that do not translate easily into the daily dialogue of rural workers.

This lack of local understanding results in immediate software resistance, where older workers actively avoid using new digital setups. Academic and CSO community leaders observed that when high-tech tools are delivered without long-term, skills training, the equipment is often left untouched in storage boxes. To prevent this waste, smart policies must prioritize slow, hands-on workshops that respect the learning speed of elderly community members.

- *Subsidy Inequity and Market Exploitation by Large Buyers*

The introduction of high-tech requirements for public programs creates an intense fear of subsidy inequity among traditional laborers. Small-scale farmers and fisherfolk worried that if government aid, fuel vouchers, and agricultural grants are tied strictly to online registration portals and digital tracking apps, only the highly educated or tech-literate citizens will capture those public funds. This dynamic threatens to deepen rural poverty, pushing traditional workers further away from municipal safety nets.

This social anxiety is intensified by unequal market conditions where large-scale wholesale buyers dictate local

trade values. Grassroots producers point out that even if DOST technology successfully helps them process more organic vegetables or dried fish, their profits will remain critically low if monopoly buyers continue to drop local prices at landing centers. Consequently, industry stakeholders stressed that technology alone cannot save local livelihoods unless it is supported by governance policies that protect small producers from unfair market pricing.

➤ *Overworked Personnel, Sustainability Gaps, and Data Trust*

Institutional findings revealed a challenge that introducing advanced software without hiring dedicated technical staff heavily strains existing personnel and causes operational burnout. Furthermore, LGU administrators are deeply concerned about the long-term financial survival of the program within a tight 4th-class municipal budget once external funding ends. These concerns are coupled with a critical focus on data privacy, as stakeholders note that any data breach would completely destroy public trust in local institutions.

In institutional settings, introducing new software without hiring dedicated technical staff strains personnel and slows down adoption. Academe-Participant 8 explained that digital setups often increase administrative duties: “The biggest challenges are increased workload for teachers, lack of continuous training, and insufficient technical support.” Academe-Participant 9 added that slow internet acts as a permanent bottleneck for digital curriculum delivery, overwhelming teachers who must manage manual and digital data at the same time. Similarly, LGU-Participant 3 noted that “adapting to new digital systems may be difficult for some personnel and end-users, requiring continuous training and support to ensure smooth adoption.”

The long-term survival of the program depends on steady funding and strict digital privacy protections to prevent data leaks. LGU-Participant 3 emphasized that “sustaining the program financially could be challenging, as ongoing maintenance, upgrades, and integration of new technologies require consistent funding. Data security and privacy will need careful management to protect sensitive information and maintain public trust.” To address this, system operators suggest institutionalizing a Smart Maintenance Fund and partnering with specialized agencies for technical assistance, as noted by LGU-Participant 2. For the cooperative and health sectors, protecting digital records is vital to keeping public confidence; CSO-Participant 21 warned that if a security breach occurs, the organization will lose the trust of its members completely.

• *Personnel Fatigue and Administrative Burnout*

The administrative integration of the SSCP is heavily challenged by the reality of workforce fatigue within public schools and government offices. When new software applications, digital grading networks, or electronic health registries are rolled out, they are typically assigned to existing teachers and clerical workers without lowering their current manual workloads or hiring dedicated technical support teams. This double data-entry requirement—where workers

must log transactions both on paper and online due to slow internet bottlenecks—leads to severe job burnout.

This problem is worsened by a lack of continuous, structured training for system operators. Frontline employees are often expected to master complicated database interfaces after just a single, brief introductory workshop. Without regular, professional training and dedicated IT assistants to manage network troubleshooting, public workers will continue to view digital tools as exhausting administrative burdens rather than helpful upgrades, slowing down the program's adoption.

• *Financial Sustainability Gaps and Data Security Vulnerabilities*

From a governance lens, the ultimate hurdle for the SSCP is securing long-term funding to sustain network security and pay for annual system upgrades. Low-income municipal budgets are structurally ill-equipped to handle recurring software maintenance fees once the initial DOST grant coverage ends. To prevent these platforms from going offline, system operators emphasize the urgent need for local lawmakers to pass ordinances that establish a permanent Smart Maintenance Fund backed by national technical agreements.

Alongside financial sustainability, managing data privacy is a critical requirement for maintaining public trust. If a centralized municipal database—containing sensitive medical histories from iClinicSys or private financial logs from cooperative registries—experiences a cyberattack or data leak, community trust will instantly vanish. Stakeholders warn that building a smart community requires rigid security frameworks and partnerships with specialized cybersecurity agencies to prevent data leaks from ruining the organization's standing with its members.

Finally, complete content and organizational editing before formatting. Please take note of the following items when proofreading spelling and grammar:

E. Proposed Implementation Plan Designed to Enhance the Readiness of the Different Sectors in the Implementation of the Smart And Sustainable Communities Program (SSCP).

➤ *Rationale:*

The Smart and Sustainable Communities Program (SSCP), initiated by the Department of Science and Technology (DOST), serves as a key localized modernization initiative designed to foster technological innovation, ecological preservation, and sustainable economic growth across municipal sectors. While the SSCP demonstrates strong alignment with national digital transformation goals and sustainable development frameworks, findings from this study reveal critical implementation challenges that limit its baseline effectiveness and long-term sustainability.

Stakeholders identified multi-sectoral silos, a deeply fragmented data management system, and severe infrastructure limitations as major concerns, indicating an unequal operational landscape prior to full program execution.

Traditional producers' and marginalized stakeholders' apprehension toward advanced digital platforms reflects behavioral challenges related to technology anxiety, software resistance, and a profound generational divide. Moreover, the complete absence of a centralized operational dashboard, paired with acute gadget poverty and connectivity bottlenecks in remote areas, points to severe gaps in inter-agency communication, resource distribution, and system integration. Persistent issues such as hardware obsolescence in classrooms, a lack of localized smart town ordinances, and manual data-capture methods among independent traditionalists further underscore the need for improved planning, multi-sectoral coordination, and institutionalized support networks. In response, a structured, comprehensive, and sustainable implementation plan was developed that integrates a human-centric support ecosystem, multi-sectoral governance synchronization, inclusive digital literacy interventions, centralized data architecture, and permanent financial sustainability mechanisms to strengthen SSCP implementation across all quadruple-helix sectors in the municipality of Barcelona.

➤ *Objectives:*

• *General:*

This proposed implementation plan intends to systematically enhance the operational readiness, technical capabilities, and adaptive capacity of the quadruple-helix sectors in Barcelona, Sorsogon, transforming a fragmented local landscape into an inclusive, highly integrated, and structurally sustainable Smart Community.

• *Specific:*

- ✓ Establish an institutionalized, Smart Barcelona Multi-Sectoral Technical Working Group (SBTWG) to break

down sectoral silos and synchronize the LGU's high digital readiness with the resource-constrained Academe, CSO and Industry sectors, ensuring a unified and balanced smart community transition.

- ✓ Deploy offline-capable digital tools with localized Bicolano-Tagalog interfaces to overcome connectivity gaps and linguistic barriers, and bridge the digital divide through intergenerational mentoring and community-based training specifically for elderly farmers, fisherfolk, and marginalized residents.
- ✓ Develop a unified municipal data dashboard that integrates siloed departmental applications and data into a centralized enterprise architecture.
- ✓ Institutionalize a "Smart Maintenance Fund" and a "Municipal Technological Support and Innovation Unit" through an ordinance to provide local troubleshooting and financial sustainability, thereby mitigating the fear of technical downtime and hardware failure.

➤ *Scope of Work*

- Infrastructure Upgrading: Sourcing of offline-capable tools and modernizing hardware in schools and agricultural hubs.
- System Integration: Development of an integrated municipal data center to link health (HIS), treasury, and business permitting systems.
- Capacity Building: Execution of a "Municipal-wide Digital Literacy Caravan" and "Peer-to-Peer Mentoring" programs.
- Policy Institutionalization: Drafting of ordinances for a "Smart Maintenance Fund" and "Green Loan" facilities.

➤ *Schedule of Activities*

Table 1 Proposed Phase-by-Phase Schedule of Activities for the Implementation of SSCP in Barcelona

Phase	Target Activities	Target Accomplishments and Objectively Verifiable Indicators (OVI)	% Weight	Responsible Person/ Sector	Timeline
Phase 1: Multi-Sectoral Mobilization & Governance	* Mapping of existing sectoral capacities and connectivity gaps. * Formalization and convening of the inter-sectoral planning body.	* 100% formalization of the smart community governance structure. * OVI: Signed Executive Order and approved organizational charter officially establishing the Smart Barcelona Multi-Sectoral Technical Working Group (SBTWG) with representatives from the LGU, Academe, CSO, and Industry sectors.	15%	LGU, DOST, Academe Heads, CSO Leaders, and Industry Representatives	Month 1-2
Phase 2: Institutional Policy & Financial Sustainability	* Legislative drafting, committee hearings, and multi-sectoral consultations for the dedicated support fund and maintenance unit.	* 100% legislative approval of the financial and institutional sustainability mechanisms. * OVI: Approved and published Municipal Ordinance in the local gazette institutionalizing the "Smart Maintenance Fund" and legally establishing the "Municipal Technological Support and Innovation Unit (MTSIU)."	15%	Sangguniang Bayan, LGU Finance Committee, and SBTWG	Month 3-4

Phase 3: Core Enterprise Architecture & Data Integration	* Development, procurement, database migration, and pilot testing of the central data infrastructure.	* 100% functional integration of siloed departmental software applications and data streams. * OVI: Technical deployment sign-off and active server uptime logs of the Unified Municipal Data Dashboard running on a secure centralized enterprise architecture.	25%	DOST, LGU ICT Staff, SBTWG, and Systems Developers	Month 5-7
Phase 4: Field Deployment & Localized Digital Literacy	* Distribution of offline-capable equipment. * Launch of localized community training and intergenerational mentoring networks.	* Minimum 85% technology adoption and verified baseline proficiency among targeted grassroots groups. * OVI: Signed equipment turnover certificates and localized training attendance logs verifying the completion of the Digital Literacy Caravan using Bicolano-Tagalog interfaces for at least 85% of target elderly farmers, fisherfolk, and marginalized residents.	25%	DOST, SBTWG, Academe Tutors, Industry Cooperatives, and CSO Volunteers	Month 8-10
Phase 5: Technical Support & Infrastructure Operationalization	* Physical setup of the technical unit. * Staff onboarding and deployment of troubleshooting hubs to eliminate downtime fears.	* 100% operational readiness of the local maintenance and troubleshooting infrastructure. * OVI: Office activation order, signed technician deployment rosters for the staffed MTSIU, and a functioning helpdesk ticket log for real-time hardware and software troubleshooting.	20%	MTSIU Staff, LGU Executive, DOST, and Local Technical Experts	Month 11-12
TOTAL PROJECT WEIGHT:			100%		

➤ *Project Management Team and Sectoral Roles:*

The following will be the institutional arrangement in the conduct of the proposed implementation plan:

• *Local Government Unit (LGU) Sector*

✓ *Project Chairperson (Municipal Mayor)*

- Exercises executive authority over the SBTWG, providing the political will and administrative backing required to break down departmental silos.
- Certifies the formal integration of all municipal offices—such as Health (iClinicSys) and Treasury (eBOSS)—into the single enterprise data ecosystem.
- Sangguniang Bayan (Legislative Committee)
- Drafts, reviews, and enacts the required municipal ordinances to institutionalize and legally protect the "Smart Maintenance Fund" and the MTSIU.

✓ *LGU Planning & Finance Officers*

- Manages the allocation and regular auditing of the Smart Maintenance Fund to ensure long-term financial sustainability and continuous tool maintenance.

✓ *Municipal Technological Support and Innovation Unit (MTSIU)*

- Operates as the frontline troubleshooting helpdesk, providing rapid software updates, hardware repairs, and maintenance to mitigate stakeholders' fears of technical downtime.

• *Department of Science and Technology (DOST)*

- ✓ Serves as the primary funding and technical oversight body, ensuring all program components align directly with national DOST Smart and Sustainable Communities Program (SSCP) frameworks.
- ✓ Directs the deployment, localization, and quality control of offline-capable digital tools featuring Bicolano-Tagalog interfaces for grassroots communities.
- ✓ Supervises the technical design, system integration, and deployment of the Unified Municipal Data Dashboard and its underlying enterprise architecture.
- ✓ Provides specialized technical training and advisory support to the newly established Municipal Technological Support and Innovation Unit (MTSIU).

• *Academe Sector*

- ✓ Coordinates and deploys IT/Computer Science faculty and advanced students to serve as the core technical drivers for the "Digital Literacy Caravan."
- ✓ Spearheads the intergenerational mentoring network by training student volunteers to conduct hands-on, localized technology workshops for elderly and traditional stakeholders.
- ✓ Hosts and co-manages school-based Community Tech Hubs, ensuring physical troubleshooting infrastructure and digital laboratories are accessible to the public.
- ✓ Assists the LGU and DOST in monitoring data-interoperability rates and conducting continuous social-impact evaluations of the smart town transition.

- *Civil Society Organizations (CSOs) Sector*

- ✓ Serves as the primary bridge between the public sector and remote or mountainous communities, ensuring inclusive local governance and multi-sectoral coordination.
- ✓ Organizes and manages the field logistics for the localized Digital Literacy Caravan within marginalized pilot barangays.
- ✓ Gathers direct feedback on technology anxiety, software usability, and local acceptance from grassroots members to report back to the SBTWG.
- ✓ Mobilizes community volunteers to maintain and secure the localized offline digital tools deployed in rural areas.

- *Industry Sector*

- ✓ Serves as the primary test-bed for integrating modernized production tools, digital tracking registries, and automated business interfaces into the local market.
- ✓ Facilitates peer-to-peer knowledge transfers where mechanized, highly confident cooperative members mentor independent traditionalists facing technology anxiety.

- ✓ Collaborates with LGU finance officers to pilot the Green Loan Facility and automated payment systems among grassroots retail and agricultural markets.
- ✓ Identifies and reports material resource limitations, such as gadget poverty or utility fluctuations, to ensure the SBTWG can calibrate hardware distribution.

➤ *Proposed Resource Allocation Framework*

- Financial: 40% Infrastructure/Hardware; 30% Smart Maintenance Fund & Municipal Technological Support and Innovation Unit salaries; 20% Capacity Building; 10% Monitoring/Innovation Circles.
- Human Resources: Formation of a Smart Barcelona Multi-sectoral Technical Working Group (SBTWG) and a Municipal Technological Support and Innovation Unit (MTSIU).
- Physical: Utilization of existing MDRRMO Centers, Colegio Digital Barcelona and school computer labs as "Community Tech Hubs."
- Technical and Technological Resources: Provision of offline-capable and localized digital tools and other climate-resilient and smart production toolkits, and sustainable green utilities infrastructure.

➤ *Risk Management Plan*

Table 2 Proposed Risk Management Plan for the SSCP Implementation

Objective	Identified Risk	Risk Rating	Mitigation Strategy
Objective 1: Establish an institutionalized SBTWG	Institutional resistance or lack of active participation from uncoordinated LGU departments and external sectors.	Moderate	• Enact an Executive Order to mandate participation. • Bind membership to key performance indicators (KPIs). Establish an official quarterly multi-sectoral reporting framework.
Objective 2: Deploy localized, offline-capable digital tools	Behavioral tech-hesitancy and generational resistance among independent, traditional grassroots producers.	High	• Deploy student-led intergenerational mentoring networks. Integrate familiar Bicolano-Tagalog interfaces. • Focus early rollouts on high-incentive, practical, low-cost tools that show an immediate increase in household income.
Objective 2: Deploy localized, offline-capable digital tools	Erratic internet connectivity, poor network signals in remote barangays, and unstable power supplies.	High	• Mandate that all software toolkits possess full offline data-capture capabilities. • Deploy solar-powered utility support assets and alternative power back-ups at community tech centers.
	Grassroots producers completely lacking the personal devices or modern smartphones required to interface with digital systems.	High	• Establish localized, physical Community Tech Hubs within existing school labs and local centers. Implement a Municipal Green Loan Facility and seek state resource subsidies to distribute basic functional gadgets.
Objective 3: Develop a unified municipal data dashboard	Fragmented departmental records causing integration failures, data privacy leaks, or system incompatibility.	Moderate	• Enact local smart town data-sharing policies and privacy protocols. • Utilize a secure, centralized enterprise data architecture managed by trained ICT systems developers with

			strict access controls.
Objective 4: Institutionalize a fund and the MTSIU	Hardware failures or technical breakdowns occurring after project turnover due to a lack of local parts or budget.	Moderate	Institutionalize a permanent 30% Smart Maintenance Fund via a formal Sangguniang Bayan ordinance. Hire and onboard certified local technical experts directly into a permanent Municipal Technological Support and Innovation Unit (MTSIU).

➤ *Expected Outputs:*

- An officially institutionalized, quadruple-helix governance body that actively synchronizes the LGU's digital capabilities with the resource-constrained academe and industry sectors to ensure a balanced municipal transition.
- The deployment of offline-capable and localized software packages and field sensors, supported by a functional "Municipal-wide Digital Literacy Caravan" and intergenerational mentoring networks to overcome connectivity gaps and language barriers for elderly and marginalized stakeholders.
- A fully functioning, centralized data engine and enterprise architecture that successfully bridges, integrates, and visualizes previously siloed departmental applications in real-time.
- An official municipal ordinance and dedicated local team (Municipal Technological Support and Innovation Unit) backed by a permanent budget allocation (30% Smart Maintenance Fund) to provide immediate troubleshooting, manage school-based "Community Tech Hubs," and guarantee hardware/software operational sustainability.

IV. CONCLUSIONS AND RECOMMENDATIONS

Based on the interpreted data, the researcher concludes that the LGU sector perceived the SSCP as operationally ready and politically well-supported, but its implementation is constrained by a multi-sectoral silos, fragmented data management system and severe infrastructure limitations as perceived across academe, industry and CSO sectors. The quadruple sectors perceived the SSCP as an opportunity and powerful institutional catalyst for community empowerment and socio-economic growth, but its sustainable adoption is heavily constrained by barriers including the unstable internet and signal connectivity gap, physical infrastructure limitations, climate vulnerability, and grassroots technology anxiety. The quadruple sectors perceived the current municipal infrastructure and governance policies as a strong baseline of active transactional modules, physical facilities and supportive state directives, but its actual deployment is heavily constrained by localized system fragmentation, data silos and severe educational resource deficits. The quadruple sectors perceived the challenges in the implementation of the SSCP as a source of total technological dependency and high maintenance risk, but its sustainable adoption is heavily constrained by an operational fear of mechanical downtime, generational software resistance, and institutional personnel burnout. The proposed SSCP implementation plan is

designed to improve execution through a human-centric support ecosystem, multi-sectoral governance synchronization, inclusive digital literacy interventions, centralized data integration, and permanent financial sustainability mechanisms.

Based on the foregoing conclusions, the following recommendations are proposed: (1.) Establish an institutionalized, Smart Barcelona Multi-Sectoral Technical Working Group (SBTWG) to break down sectoral silos and synchronize the LGU's high digital readiness with the resource-constrained Academe, CSO and Industry sectors, ensuring a unified and balanced smart community transition. (2.) Deploy offline-capable digital tools with localized Bicolano-Tagalog interfaces to overcome connectivity gaps and linguistic barriers and bridge the digital divide through intergenerational mentoring and community-based training for elderly farmers, fisherfolk, and marginalized residents. (3.) Develop a unified municipal data dashboard that integrates siloed departmental applications and data into a centralized enterprise architecture. (4.) Institutionalize a "Smart Maintenance Fund" and a "Municipal Technological Support and Innovation Unit" to provide local troubleshooting and financial sustainability, thereby mitigating the fear of technical downtime and hardware failure. (5.) The proposed SSCP implementation plan by strengthening human-centric support ecosystems, synchronizing multi-sectoral governance, deploying inclusive digital literacy interventions, integrating centralized municipal data architectures, and institutionalizing permanent financial sustainability mechanisms be adopted and operationalized.

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