UNIVERSITY OF THE PHILIPPINES
OPEN UNIVERSITY

MASTER OF RESEARCH AND DEVELOPMENT MANAGEMENT

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LABORATORY RESILIENCE: ENABLER FOR ORGANIZATIONAL RESILIENCE AND PUBLIC SERVICE CONTINUITY

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08 August 2025

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Biographical Sketch

Olivia Jolongbayan has more than three decades of experience across manufacturing, healthcare, and environmental services. She began her career in laboratory research with the Department of Environment and Natural Resources–Environmental Management Bureau (DENR-EMB) and the National Institute of Molecular Biology and Biotechnology (BIOTECH) at the University of the Philippines Los Baños (UPLB).

Recognized for strengthening organizational resilience, Jolongbayan specializes in Quality, Environmental, Occupational Health and Safety (QEHS) and Business Continuity Management System (BCMS). Colleagues describe her as a compassionate, results-driven leader who motivates teams and integrates diverse functions to achieve operational safety, quality, and sustainability.

Her expertise spans laboratory management, regulatory compliance, risk management, and the implementation and auditing of ISO standards—including quality, environmental, and occupational health and safety systems—along with Lean Six Sigma, behavior-based safety, facility safety management, business continuity, and corporate sustainability.

Jolongbayan volunteers as a QEHS Consultant for DENR-EMB Region III and holds a leadership role in the Association of Safety Practitioners of the Philippines, Inc. (ASPPI), advancing national workplace safety and health standards.

She earned a Bachelor of Science in Chemistry from UPLB, a Diploma in Research and Development Management from the University of the Philippines Open

University and completed the Basic Management Program at the Asian Institute of Management. A Registered Chemist, she also holds credentials as a Certified Lead Auditor for QMS, EMS, OHSMS, and BCMS; Certified Organizational Resilience Specialist; Lean Six Sigma Yellow Belt; Accredited Occupational Health and Safety Practitioner; Pollution Control Officer; and Certified Trainer in behavioral safety and SME business continuity. Her achievements include multiple Managerial Excellence Awards from St. Luke's Medical Center (2012, 2017, and 2019).

Fluent in her professional discipline and deeply rooted in her community, Jolongbayan—who hails from Calaca, Batangas—is unwavering in her commitment to environmental advocacy, sustainability, and the advancement of organizational resilience. Guided by the principles of integrity, stewardship, and service, she approaches leadership with deep respect and compassion for people and the environment. She holds that professional excellence is inseparable from ethical responsibility and never loses sight of humility and goodness—a perspective that informs her advocacy for sustainability and organizational resilience.

Acknowledgement

To our Heavenly Father above – thank you for the boundless grace and the gift of learning arising from your perfect wisdom.
May this undertaking bring glory to your Holy Name.

Thank you to the laboratory personnel and leadership for the trust, cooperation, and camaraderie during my research.

My heartfelt gratitude to my Thesis Adviser, Prof. Jean A. Saludadez, Ph. D., for her invaluable guidance, patience, and encouragement. Thank you as well to the members of the Guidance Committee – Prof. Primo G. Garcia, Ph. D. and Asst. Prof. Leo Mendel D. Rosario, Ph. D.

I am likewise grateful to my family for the unconditional love, and to all who, in quiet ways, embody resilience, compassion, and service to others.

Dedication

To my mother, whose unconditional love and resilience shaped who I am today.

To my only son, whose innocence inspires me to have a beautiful and humble heart;

whose brilliance teaches me to appreciate the ordinary to be extra ordinary.

And to the least, the last, and the lost,

whose inner strength fuels compassion and stirs hope.

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Abstract

This qualitative study investigated how laboratory personnel define and enact resilience within a regional public sector environmental laboratory in the Philippines, and how these practices contribute to institutional resilience and the continuity of public service. Using an ethnomethodological approach, this research examines how resilience emerges from everyday routines, interactions, and work systems – as a dynamic, context-dependent practice. Data from semi-structured interviews and written responses revealed that laboratory resilience is expressed across four temporal domains: (1) risk management (before), (2) response (during), (3) recovery (after), and (4) refinement (post-disruption), each anchored in leadership's resolve to deliver mission-critical services despite disruptions caused by both internal vulnerabilities and external threats.

The analysis of resilience practices revealed three central themes: (1) Leadership – commitment, values, and systems; (2) People – availability, behavior, and competence; and (3) Process Reliability. These themes illustrate how personnel manage uncertainty, uphold accountability, and sustain operational continuity. Resilience was found to be not only technical in nature, but also deeply rooted in cognitive, behavioral, and transformative capacities, as well as in visionary leadership, and strong institutional values.

This study underscored the critical role of laboratory resilience in fostering organizational resilience and maintaining public service continuity. It allows laboratory operations to remain functional, adaptive, and credible amid disruption. The findings of this study contribute to resilience theory and public sector research by demonstrating that resilience is dynamic, ethically grounded, and shaped by the unique demands of frontline regulatory environments.

Keywords: *laboratory resilience; organizational resilience; public service continuity; ethnomethodology; institutional practices; Philippine public sector*

Chapter I

RATIONALE

Global and National Context of Organizational Resilience

It is inevitable for organizations to face disruptive events brought about by natural, man-made, technological, and hazardous material hazards. In 2022, the Philippines was ranked first among the 193 countries in terms of exposure, vulnerability, susceptibility, and lack of adaptive and coping capabilities, as revealed by the UN University – Institute for Environment and Human Security. This risk landscape has disrupted both the private and government sectors including research and innovation activities. In response to this, there have been various demands for organizational research to mitigate and respond to these adversities through organizational resilience. The concept of organizational resilience illustrates the continuum in which organizations anticipate, respond to, bounce back, and learn from unforeseen and disruptive events.

Organizational resilience evolves on a larger “system of systems” with internal and external dependencies. In the case of R & D organizations, a transformative approach to resilience can be practiced in its laboratories in its conduct of studies, testing, calibration, and other operational activities.

At the micro-level, requirements, may include maintaining a specific humidity level, number of air exchanges, or constant temperature to protect lab users, samples, and/or test subjects, and personal protective equipment (PPE). Macro level resilience might involve ensuring availability of key personnel, laboratory supplies, utilities, data, and communication. Disruptors can impact an organization in each facet and level.

The intricacies of these vulnerabilities on organizational resilience have been highlighted at the onset of the COVID-19 pandemic. This global scenario has prompted all sectors to approach resilience with a greater sense of urgency and public service continuity.

Relevance and Contribution of the Study

This research adopts an ethnomethodological perspective in understanding laboratory resilience, offering a substantive, practice-focused viewpoint within the wider subject of institutional resilience. This approach surfaces the tacit knowledge, coping mechanisms, and practical workarounds toward continuity of operations amid disruptions brought about by threats and adversities. Ethnomethodology helps illuminate that resilience is a socially constructed and continuously enacted accomplishment and not only as a structural or procedural outcome. This perspective focuses on the situated actions and interactions through which resilience is enacted in real-time. The findings may guide the creation of more adaptive, personnel-focused, and context-aware public service continuity strategies for government research and service laboratories.

This study intended to develop a theory on laboratory resilience for laboratories in the public sector and to contribute to the emerging studies on resilience that have been undertaken for universities and private R & D organizations. Specifically, the findings in this study revealed laboratory resilience practices inherent to strategic leadership, laboratory infrastructure, and the cognitive, behavioral, and emotional attributes of laboratory personnel in managing challenges and disruptions. Public service continuity applies not only to the laboratory but to the over-all mission of the organization instrumental to the resilience of the country. It is but fitting that as the

government assumes a bigger responsibility amidst external threats and disasters, it must immediately resume the delivery of mission critical functions and services in the event of a disruption. This research offers practical insights to the Environmental Research and Services Laboratory to continuously provide the public and the industries data and information that are crucial to achieving transparent and trustworthy decisions in producing safe, high-quality, and sustainable products and services. With RA 10121 also known as an “Act Strengthening the Philippine Disaster Risk Reduction and Management (DRRM) System”, government agencies are required to implement DRRM measures, and the MC No. 2 Series of 2021 released by the Civil Service Commission on the formulation of Public Service Continuity Plan, this study highlights both employee and institutional resilience which can serve as reference for the laboratory and other ERSL laboratories across regions in the refinement of their public service continuity plans.

Chapter II

REVIEW OF LITERATURE

The World Economic Forum (WEF)'s Annual Global Risks Report, showed that, for 2022, only 3.7% of the respondents are optimistic and 12.1% feels positive and the rest are worried (23.0%) and concerned (61.2%) about the world's outlook. In the said report, the respondents did a comparison of risks/threats categorized as economic, environmental, geopolitical, societal, and technological which they imagined to be a severe problem worldwide on varying timeframes. The survey revealed that environmental threats are on the top ranks on a short (0-2 years) term: extreme weather (31.1%) and climate failure (27.5%); medium (2-5 years): climate action failure (35.7%) and extreme weather (34.6%); and in the long term (5-10 years): climate action failure (42.1%), extreme weather (32.4%), biodiversity loss (27.0%), natural resource crises (23.0%), and human environmental damage (21.7%). This means that climate change is humanity's greatest threat over the coming decade. (WEF Global Risks Report 2022, 17th edition).

There are organizations that experienced these adversities, which resulted in the disruption of delivery of essential services and significant weakening of organizational performance, and meanwhile other organization successfully adapted and learned from these conditions. (Gittell, Cameron, Lim, & Rivas, 2006; Sutcliffe & Vogus, 2003).

In response to these trends in the global risk landscape, there have been various demands for organizational research to mitigate and respond to these adversities through organizational resilience (Williams, Gruber, Sutcliffe, Shepherd, and Zhao, 2017). Resilient organizations are capable of anticipating adversity earlier,

responding quicker, and recovering better than other vulnerable organizations (van der Vegt, Essens, Wahlström, & George, 2015 and Sutcliffe & Vogus, 2003).

Organizational resilience has been studied across various disciplines such as entrepreneurship (Dewald & Bowen, 2010; Hayward, Forster, Sarasvathy, & Fredrickson, 2010), leadership (Gilbert, Eyring, & Foster, 2012), strategy (Gao, Zuzul, Jones, & Khanna, 2017), human resource management (Akkermans, Brenninkmeijer, Schaufeli, & Blonk, 2015; Kossek & Perrigino, 2016), organizational learning (Evenseth, Sydnes, & Gausdal, 2022; Dahlin, Chuang, & Roulet, 2018; Sutcliffe & Vogus, 2003), crisis management (Williams, Gruber, Sutcliffe, Shepherd, & Zhao, 2017). (as cited by Hepfer & Lawrence, 2022).

Earlier studies on organizational resilience were focused on a homogeneous concept and in silos with other disciplines until the research on crisis management and organizational resilience, where capabilities, adjustments, response, and communication were highlighted. (Williams, Sutcliffe, Shepherd, and Zhao, 2017). It can also be applied to R&D organizations on the premise that the complexity of sustainability-led innovation than the conventional innovation driven by market demands rely heavily on resilience amidst uncertainties with its two components: stability and adaptability to achieve high level of efficiency while adjusting to change. (Dong Lv, Tian, Wei, & Xue Xi, 2018).

Stephanie Duchek (2020) proposed that the knowledge base of an organization is an imperative to organizational resilience. This can be realized through resilience capacities and resources at three (3) various stages: 1) resource availability for anticipation, which also positively influences coping and adaptation stages, 2) social resources to foster coping capabilities and 3) authority anchored on expertise and shared responsibilities to nurture adaptation capabilities.

It is possible to argue that crisis management and organizational resilience are mutually shaped at multiple levels operationalized in four stages: (1) reviewing and monitoring the context, (2) testing preparedness, (3) analyzing and assessing responses, and (4) strengthening capabilities. During these stages, resilience management necessitates the ongoing adoption of dynamic processes within an organizational system and its environment. (Tasic, Amir, Tanc and Khaderc, 2019).

Organizational Resilience and Organizational Creativity towards Innovation

Individual and team/functional level. To deal with challenges on innovation projects with numerous stakeholders, there is a need for supporting resources for employees that allow projects to be resilient, i.e., capable of responding constructively without "being agitated under pressure" (Anders Richtnér, 2008). Though it can be argued that employee resilience can develop from these "pressures" and prompt their disruptive creative behavior.

An example of this was revealed in a study by Clercq & Pereira (2019) wherein employees from an organization in Angola believed that it is when they do not have enough time to complete their job under an organizational climate that is workload-heavy and rigid that their resilience emerged spurring their creativity. Furthermore, in study by Santoro, et al. (2021), employee-level resilience was found to have a direct positive effect on their performance when their personal resilience is being valued; thus, this can be used as leverage for entrepreneurs to include in their strategies and actions promoting the resilience of employees. Four-hundred twenty-two (422) R&D Teams from 279 enterprises in China demonstrate that high organizational resilience is anchored on shared vision, willingness to learn, adaptation ability, cooperative awareness, and work enthusiasm (Si-hua Chen, 2016). It was also revealed from a

study of large firms in the US, that there is a significant, positive relationship between levels of resilience and levels of work engagement and innovative work behavior (Roberts, 2016).

Operational Resilience. Agkun and Keskin (2014) revealed in their study of Turkish firms, that, competence level, novel agility, technological turbulence, practicality, and behavioral preparedness are positively associated with product innovativeness whereas competency orientation is negatively related. They also noted that product innovativeness has a moderating role between organizational resilience (cognitive, behavioral, and contextual) and firm performance.

Businesses disturbed by the COVID-19 pandemic who considered creativity as the potion for survival were more able to innovate in terms of step-by-step changes in technology and non-technology domains (products) and management through inspiring leadership, nourishing positive team atmosphere, and appreciation of the potential of each person within the organization). (Dziadkowiec 2021).

Strategic Resilience. World-leading organizations managed the risks brought about by the COVID-19 innovatively using their business continuity plans and organizational resilience and positioned their strategies and response on leadership and change management, customer experience, workforce, operations, and social engagement (Margherita & Heikkila 2021). Italian industries on their perceived sense of urgency and extreme sensitivity of the COVID-19 pandemic, shifted their operations and utilize their R&D innovation capabilities to enhance their resilience and mobilized their resources to cope with the adversity at the organizational level, augmented the coping capacity of the health system, and strengthening social resilience (Bergami, Corsino,

Daood, & Giuri, 2022), one of which is innovation through crowdsourcing (internal, community, open and via broker) to produce novel solutions (Vermicelli, & Grimaldi 2020).

Resilient leadership has also been proven to be deeply interconnected with innovation as experienced by hospitality enterprises that experienced a dramatic impact from the COVID-19 pandemic through actual involvement and thorough planning (Lombardi, Cunha, Giustiniano, 2021). It is worth emphasizing the importance of considering the resilience building blocks when developing a capacity for resilience. This implies a top-down approach while also encouraging bottom-up initiatives.

Management bears primary responsibility for establishing structures and ensuring that adequate resources are not only available but also utilized, that cognitive resources are nurtured, and the emotional climate is considered along processes and product development. It is also critical to address issues and concerns about change, governance, and management decisions, which are seen to stifle creativity. (Richtnér & Hans Löfsten, 2014).

Resilience at the individual level should be a positive factor for an organization to develop resilience capabilities. Personality, such as self-confidence, optimism, beliefs, and belongingness, contributes to an individual's resilience. Group resilience has developed the ability to see failure and imperfections as a source of learning and progress where the combination of psychological safety and accountability is a crucial factor. At the organizational level, the main factors are adaptive structure, creativeness, social capital, and attention to failure. In addition, there is a mutual influence between distinct levels. There is a phenomenon of "level transition" from low to high level. Relationship interactions between members can promote group

resilience, and organizational learning can help groups form organizational resilience. (Xiao and Cao, 2017).

Hepfer and Lawrence (2022) proposed an alternative interpretation in which organizational resilience is viewed as a heterogeneous phenomenon with three major forms – functional resilience, operational resilience, and strategic resilience – each with distinct foundations, dynamics, and outcomes. Aside from individual resilience, organizational characteristics such as systems, processes, structures, strategies, coordination, values, ideologies, skills, or cognitions contribute to organizational resilience.

Because each is associated with distinct foundations and dynamics, the three types of organizational resilience are unlikely to be associated with scaling effects. As a result, it is entirely possible for an organization to have a high level of one type of resilience (for example, functional resilience) but a low level of another.

Forms/level of organizational resilience are viewed differently – individual, functional/group, and strategic as earlier studied where these can be said to be mutual, on a “level-up transition”, and are unlikely to be related to scaling measurement, yet they share commonalities in terms of capacity – cognitive, behavioral, and contextual (connections and resources) (Lengnick-Hall, 2011) and cognitive and emotional (Richner & Lofsten, 2014).

Laboratory Resilience. Business R& D at UK have shown innovation and resilience in addressing the COVID-19 crisis through a) improved collaboration with universities and partners, as well as appropriate facilities, an entrepreneurial culture, and capacity building in research and training; b) paying more attention to businesses’ ability to continue developing the outputs of R&D and innovation into applications developed, thinking more actively not just about value creation through R&D, but value capture as

well. C) increase personnel engagement with the university, provision of accessible facilities, resource availability, and alignment of strategic objectives with university expertise. They have this vision that driving an innovation-led economic recovery will require a strong and resilient system of universities, research institutes, and technology development organizations working in close collaboration with the private and public sectors. (National Centre for Universities & Business, 2021; Tomas Coates Ulrichsen, 2021).

As experienced in an ecological laboratory in France during the COVID-19 pandemic, the laboratory culture that is built on the pillar of in-person communication, sharing of expertise, harmonized social and professional relationship resulting to collaboration, stronger team, well-being, and creativity fosters resilience in the event of crises and a sustainable life-work balance (Arranz, et. al. 2022)

Previous research has investigated on how disaster planning and preparedness can be applied in research and laboratory settings. According to a 2014 publication by the U.S. – the Department of Health and Human Services provided an excellent review of the post-Superstorm Sandy effects on healthcare, which included research labs (Guenther and Balbus, 2014). It was detailed in this study the realization that such an event could occur, and the level of interconnectedness (both physical and operational) across various systems.

To summarize, organizational resilience has been studied across various disciplines such as entrepreneurship, leadership, strategy, human resource management, organizational learning, crisis management, and supply chain management. Recent research on laboratory resilience has been undertaken particularly for university and private R&Ds in response to the COVID-19 pandemic but in the public sector in the Philippine setting remains unexplored.

Chapter III

RESEARCH FRAMEWORK AND RESEARCH QUESTION

The purpose of this research is to develop a theory on laboratory resilience for laboratories in the public sector and to contribute to the emerging studies on resilience that have been undertaken notably for universities and private R&Ds. This also aims to extend what has been left out from empirical works which focus mostly on organizational resilience (functional, operational, strategic) that have been studied across various disciplines such as entrepreneurship, leadership, strategy, human resource management, organizational learning, crisis management, and supply chain management. While there have been studies on universities and private R&Ds, the study on laboratory resilience in the government sector as an enabler for organizational resilience and public service continuity remains under-researched.

Public service continuity applies not only to the laboratory but to the over-all mission of the organization and how this becomes instrumental to the resilience of the larger community (Philippines) and on a global perspective. It is but fitting that as the government assumes a bigger responsibility amidst global threats and local disasters, it must immediately resume its functions or services in the event of a disruption.

This study used an ethnomethodological approach to investigate the phenomena of laboratory resilience, as well as its impact on organizational resilience and public service continuity.

Ethnomethodology is a framework for understanding how people make sense of and deal with others in society which is rooted in the studies of Harold Garfinkel in 1967. This focuses on how individuals develop and use shared methods to make sense and be clear about their social environment. It looks at how they connect with

one another and form social relationships on a day-to-day basis. This paradigm accepts the existence of social facts (rules, norms, and common meanings) but regards them as a phenomenon to be researched rather than an objective reality.

Ethnomethodology looks at meaning in terms of practice (“methods’” people use to accomplish life) and makes use of conversation analysis as the main approach for research wherein the conversation data is collected and analyzed. This approach studies the everyday practices and routines of people, how they use language and other forms of communication to create meaning and make sense of their experiences, looks at the ways in which individuals construct and make sense of their social world, and how people create, maintain, and reproduce social order. It aims to comprehend how humans create meaning or “situational definitions" as a sort of symbolic interaction. Ethnomethodology is also regarded as individualistic because definitions of the situation are derived from how people announce and communicate sensemaking perspectives and viewpoints among themselves.

Research Questions

1) How do laboratory personnel practice laboratory resilience?

2) What do these practices accomplish in promoting organizational resilience of an environmental research and service laboratory engaged in public service?

3) What framework can be proposed to illustrate how laboratory resilience practices accomplish in promoting organizational resilience and public service continuity?

Chapter IV

RESEARCH METHODOLOGY

Research Setting

The study area was conducted at the Environmental Research and Services Laboratory (ERSL) of a government institution at Central Luzon. This choice of research setting is aligned with the ethnomethodological perspective and thematic emphasis on laboratory resilience in the context of the public sector.

First, the role of this institution in providing laboratory sampling and analysis is important in the implementation of regulations, in environmental protection, research, and policy decisions. Thus, it is crucial for the institution and its personnel to be resilient to deliver these services during disruptive events, minimize impact of disruption, resume priority services at a given timeframe, and to restore its capabilities as quickly as possible.

Second, the institution is geographically located at Central Luzon which is vulnerable to natural disasters such as volcanic eruptions (e.g. Mount Pinatubo), typhoons, floods, earthquakes, and man-made hazards brought about by industrial activities. This scenario makes the institution an appropriate research setting to study laboratory resilience practices.

Third, the institution is mandated to comply with resilience-building frameworks such as RA 10121 - Philippine Disaster Risk Reduction and Management Act and its Implementing Rules and Regulations and the Civil Service Commission's Memorandum Circular No. 2, s. 2021 on Public Service Continuity Planning (PSCP).

These policy frameworks underline the requirement for real-world insights into how the public sector, particularly laboratories, adapt and maintain continuity amidst disruptions.

As the focus of this study is solely on the institution's ERSL, the findings that can be generated from this study might be applicable across regions but might not be applicable to laboratories of varying geographical origins and organizational culture.

Research Participants

Ten (10) laboratory personnel and administrative staff were selected as respondents for this study which was conducted from July to December 2023.
The participants included:

AAA-01	Regional Director
CCC-01	Laboratory Analyst
CCC-02	Equipment Engineer
CCC-04	Document Control Staff
BBB-01	Laboratory Quality Manager/Chemist III
CCC-03	Laboratory Analyst
BBB-02	Chemist II
CCC-05	Laboratory Aide
BBB-04	Senior Environmental Management Specialist/Safety Officer
BBB-03	OIC, Laboratory/Section Chief

There are four (4) participants who responded through semi-structured interviews while six (6) responses were generated from the structured

written questionnaires. These respondents were provided with advance information about the objectives of the research, and their consent was sought prior to the study through a letter of request sent to and approved by the Regional Director, and individually before the respective schedule of the interviews and e-mailed responses. Participants were assured that their identity would be coded and that their responses would be treated with utmost confidentiality.

Data Collection

This research utilized both semi-structured interviews and written questionnaire which are two (2) qualitative methods to allow extensive and in-depth views of the participants.

Semi-Structured Interviews

Key personnel within the laboratory including the leadership (Regional Director), laboratory heads (chemists), laboratory analysts, equipment engineer, administrative and frontline support staff were interviewed for 10-15 minutes to gather detailed narratives of how they experienced, managed, and recovered from disruptions. Interviews were guided by open-ended questions, allowing participants to describe their coping strategies, role-specific challenges, collaborative practices, and perceptions of institutional support.

Structured Questionnaire

A questionnaire was administered to six (6) of the ten (10) participants to capture consistent data on resilience-related experiences, perceptions, and practices across roles and functions. This included questions related to their definition of

resilience, laboratory resilience practices, and practices to promote organizational resilience and public service continuity.

Ethical considerations were strictly observed throughout the study. Participation was voluntary, informed consent was obtained, and confidentiality was maintained.

Data Analysis

All audio recordings and questionnaire responses were transcribed and summarized. These transcriptions were validated through participant feedback to ensure accuracy. Data from interviews were further enriched through guided walk-rounds, field notes, observations, and photographs. Supplementary sources such as the laboratory's website, social media accounts, and news articles were also reviewed as secondary data.

A three-phase interpretive coding approach was used.

- First-order coding: raw responses of the participants were coded. The data were tagged with temporal markers – before, during, or after a disruption to locate responses in chronological contexts as indexed by participants.
- Second-order coding: Pattern recognition was subsequently done where repeated codes were grouped by functional similarity.
- Third-order coding: thematic synthesis. The clusters were then synthesized into three main themes: a) Leadership and Governance, b) People and Personnel Practices, and c) Process Reliability. The data were also sorted according to resilience stages: before, during, and after disruption.

Verification - The data that were analyzed were interpreted and compared with the existing literature. The results were presented to the Laboratory Head and participants on December 18, 2023, to gather feedback on interpretations and conclusions.

Reporting - To illustrate the findings, a theoretical model/proposition on laboratory resilience as an enabler for organizational resilience and public service continuity was developed.

Ethical Considerations

This research adhered to standard ethical protocols for qualitative inquiry involving human participants. Prior to data collection, a written letter of request was sent to the Office of the Regional Director prior to the start of the research activities. This study was formally endorsed by the leadership of the institution, and necessary permissions were obtained to conduct interviews and distribute questionnaires within the Environmental Research and Services Laboratory.

Laboratory personnel were informed of the study's purpose, objectives, and intended use of data. They were assured of confidentiality and anonymity, with no personal identifiable information disclosed in any part of the analysis or reporting. They have also signed the UPOU IREC Informed Consent Form for Surveys, Interviews, and Focus Group and they have been given the freedom to withdraw at any point during the research without consequence.

All interview recordings, transcripts, and survey responses were stored securely and used solely for the purpose of this research. Ethical safeguards were in place to protect the dignity, rights, and well-being of all the respondents, in accordance with the established guidelines of the UPOU Institutional Research Ethics Committee (IREC).

Data Presentation

Table 1

Resilience as defined by laboratory personnel

First order codes	Theoretical categories	Themes
"Resilience is good governance and leadership" (AAA-01)	• Governance and leadership	Resolve
"prepare for future crises and disruptions," "assurance that public resources are used responsibly and transparently," "finding dynamic equilibrium in the face of new realities," "balance between bureaucratic rules and innovative strategies"	• Prepare • Responsible • Transparent • Dynamic equilibrium • Balance	Risk Management (Before a disruption – Anticipatory)
"Resilience acknowledges the reality of ever-changing and increasingly complicated disruptors" (AAA-01), "assurance that laboratory services" (AAA-01) "be able to manage stress and emotional well-being" (BBB-04) "resilience is being able to function properly (BBB-03) … even though we face challenges" (BBB-03)	• Acknowledge • Assurance • Manage stress • Function properly	Response (During a disruption)
"Recover from shocks" (AAA-01), "katatagan (stability) (CCC-01)" "capacity to quickly recover from difficulties" "katatagan (stability) of an organization" (CCC-04), "ability to bounce back from a difficulty" (CCC-03)	• Recover • Stability • Quickly recover • Stability • Bounce back	Recover/Resume/ Restore (After a disruption)
"Adapt from shocks" (AAA-01), "how a person adapts to a certain situation or like challenges" (CCC-02), " survival, how to survive despite many challenges" (BBB-01), "how an organization stand firmly against on the grind" (BBB-02), "instill strong practices towards it" (BBB-02), "strength and adaptability" (CCC-05), "adapt positively" (BBB-04), "emotional well-being" (BBB-04) "doing tasked despite challenges" (BBB-03)	• Adapt • Adapt • Survival • Firmness • Strong • Strength • Adaptability • Adapt • Emotional well-being • Firmness	Refine/Adapt/ Transform (Post disruption)

Table 2

Laboratory resilience practices – leadership

Respondent	Descriptive quotes for leadership	Theoretical category
(AAA-01)	"Laboratory Infrastructure," "to set good examples with the industries that we are regulating …by complying with the permits, licenses, and clearances."	Commitment
(BBB-01)	"Individual staff in the laboratory should know and keep it in their mind and by heart their responsibility," "working in the government focuses more on public service and not in individual interest."	
(BBB-04)	As a Safety Officer, it is important (and we safety officers embodies) to be proactive and to ensure the safety of everyone involved.	
(AAA-01)	"And as former laboratory personnel during the early years of my career, I have empowered the Laboratory Head to look into the laboratory infrastructure."	Values
(BBB-02)	"I learned that recognizing the contribution of every individual will help the organization to put each strength of employee in the situation, which in turn, motivates them to work even harder." I believe that as Supervisor, I need to build harmonize relationship by listening to every insight and perspective of every member make mutual solutions that are beneficial to all."	
(AAA – 01)	"To set good examples with the industries that we are regulating, we manage the environmental aspects and impacts of our operations"	
(AAA-01)	"Holistic Management System. The Laboratory Management System has been anchored into the Integrated Management System (IMS)," "Risk Management. The strategic strength-weaknesses-opportunities-threat (SWOT) analysis of the Bureau covers that of the laboratory.	Systems

Table 3

Laboratory resilience practices – People (before a disruption)

Respondent	Descriptive quotes	Concise version of quotes	Theoretical Category
(BBB-01)	Patience and frequently checking for every staff what they need and challenges they are encountering in their work and make an immediate action.	• Frequently checking the needs and challenges of laboratory personnel	Anticipatory/ Preparedness
(CCC-05)	By thinking of possible problems, we might encounter (risk assessment) and formulating possible solutions to address them.	• Thinking of potential problems/Risk assessment • Formulation of possible solutions to address potential problems	
(BBB-04)	Laboratory resilience contributes to the organization resilience by ensuring that it can recover from any challenging circumstances such as ability to handle emergency situations. During the time of disruptions, it is important (and we safety officers embodies) to be proactive.	• Ability to handle emergency situations. • Being proactive in the event of disruptions	
(CCC-02)	I am practicing resilience at work for example, environmental monitoring such as when it is raining, checking for roof leaks, if chemicals in the storage area get wet when it is raining, these are some of the work practices that we are doing. We also check for physical damage on equipment, if they are maintained properly, or if they are calibrated)" "Thus, need to PR early for calibration which is not that easy to process. And I cannot calibrate this equipment or issue	• The earlier, the better that uncalibrated equipment be calibrated. • Anticipate early.	

	calibration certificates or stickers. The earlier the better that they are calibrated.		
(AAA-01)	I have empowered the Laboratory Head to look into the laboratory infrastructure comprising of …competency and proficiency testing.	• Competency and Proficiency Testing	Competence
(CCC-01)	OK Ma'am, we conduct drills in response to a fire or earthquake that might happen.	• Trainings – fire drill, earthquake drill	
(CCC-04)	I am also the Safety Officer of the laboratory….We are also equipped in case an earthquake occurs	• Equipped in case an earthquake occurs	
(BBB-01)	First, individual staff in the laboratory should know their responsibility by doing awareness/ orientation about their job prior to officially engaging work in the laboratory	• On-the-job awareness/orientation	Awareness
(CCC-02)	Maybe the trainings, also such as the OSH training, environment health and safety training and personnel on-the-job training. These are some of the resilient practices that we do.	• Work orientation	
(CCC-02)	Maybe the trainings, also such as the OSH training, environment health and safety training and personnel on-the-job training. These are some of the resilient practices that we do.	• OHS Training • EHS Training	Training
(CCC-04)	I am also the Safety Officer of the laboratory, and I am part of the Spillage Control Team. We also have our fire safety training, what do we do in case there is fire and chemical spill training as a response to chemical spillage.	• Fire safety training • Chemical spill training	

Table 4

Laboratory resilience practices – People (during a disruption)

Respondent	Descriptive quotes	Concise version of quotes	Theoretical Category
(CCC-01)	Of course, we have teamwork, unity, and cooperation in solving problems.	• Teamwork • Unity • Cooperation in solving problems.	Collegiality
(BBB-01)	Lastly, all staff in the laboratory should be cooperative/participate in all the policies /action taken in the laboratory for it to be successful so does the office/organization it belongs to. The laboratory operations will be successful if each individual will be cooperative so as to accomplish the set target.	• Cooperation and participation laboratory policies • Cooperation to achieve targets.	
(CCC-02)	As resilience is how to adapt to a challenge or situation so you need to practice adapting, including that with others, that you seek for help.) (Well, probably, though at times challenging but I am taking this lightly so as not to be stressful. It is better to handle stressful situations lightly so that you can do your work easier and be more efficient.)	• Asking for help if there are challenges. • Positive mindset – handling stressful situations lightly. • Doing work lightly to be more efficient	Emotional strength
(BBB-01)	Patience and frequently checking for every staff what they need and challenges they are encountering in their work and make an immediate action.	• Patience	

(CCC-03)	Assessing my actions toward an encountered difficulty, gathering, and analyzing remediation options and implementing the chosen corrective action. I help relay regulations in an assertive manner, as objective as possible.	• Action assessment towards difficulty • Relay regulations in an assertive yet objective manner	
(BBB-02)	1) Build strong teamwork which allows each employee to utilize their full potential. In this way each member will get the job right. 2) I cope by believing that it is the stepping stone which potentially lead us to better version of ourselves. I learned that recognizing the contribution of every individual will help the organization to put each strength of employee in the situation, which in turn, motivates them to work even harder.	• Strong teamwork to utilize full potential of employee and getting the job right. • Cope by believing that it is the stepping stone which potentially leads us to a better version of ourselves. • Help the organization to put each strength of employee in the situation.	
(BBB-01)	Need supervision and guidance for them to be able to be on track despite of the challenges.	• Supervision and guidance to be on track despite challenges.	
(BBB-02)	I learned that recognizing the contribution of every individual will help the organization to put each strength of employee in the situation, which in turn, motivates them to work even harder. I believe that as Supervisor, I need to build harmonize	• Recognition of the contribution of each individual • Listening to member's insights and perspectives.	Psychological safety

	relationship by listening to every insight and perspective of every member make mutual solutions that are beneficial to all.		
(CCC-05)	Careful deliberation and fair distribution of workloads to personnel.	• Careful deliberation	
(BBB-04)	What is essential is keeping everyone well informed about what is happening to help reduce anxiety and uncertainty.	• Keeping everyone well informed to help reduce anxiety and uncertainty.	
(CCC-02)	You need to ask for help so that the load will be lighter.	• Asking for help if there are challenges.	
(CCC-05)	and fair distribution of workloads to personnel. As a Laboratory Aide, time and work management, making sure to focus on what needs to be done first.	• Fair distribution of role/ workloads to personnel. • Time and work management	
(BBB-04)	The organization must employ work redistribution to other staff but ensuring that the workload is still manageable.	• Work redistribution • Workload management	Resourcefulness
(BBB-01)	Fast track of hiring of personnel, proper coordination in other division/unit …and frequently checking for every staff what they need and challenges they are encountering in their work and make an immediate action.	• Fast track personnel hiring • Supervision and guidance to be on track despite challenges. • Immediate action	
(BBB-04)	Also, the immediate hiring of replacement employees is being done.	• Immediate hiring of replacement employees.	
(BBB-03)	For example, …and flexi time was also encouraged especially during the COVID-19 pandemic. Proper adjustments to still do our duties and responsibilities.	• Flexible working time • Proper adjustments	Spontaneity

Table 5

Laboratory resilience practices – People (after a disruption)

Respondent	Descriptive quotes	Concise version of quotes	Theoretical Category
(CCC-04)	"Consistently present-willingness to help, teamwork, and multitasking."	Consistently present-willingness to help, teamwork, and multitasking.	Flexibility
(CCC-03)	"I have learned to balance all my workloads, do multi-tasking."	• Learned to balance workloads • Do multitasking.	
(CCC-02)	*"As resilience is how to adapt to a challenge or situation so you need to practice adapting,.."*	• *As resilience is how to adapt to a challenge or situation so you need to practice adapting,..*	Adaptability
(BBB-04)	"Laboratory resilience acts as a cornerstone for organizational resilience by ensuring the functionality and adaptability of the unit." "Laboratory resilience contributes to the organization resilience by ensuring that it can recover from any challenging circumstances…"	• Ensuring the functionality and adaptability of the unit • Ensuring that the organization recover from any challenging circumstances.	
(BBB-03)	"The laboratory adapts to the changing times."	• Adapts to the changing times.	

Table 6

Laboratory resilience practices – Process reliability

Respondent	Descriptive quotes	Concise version of quotes	Theoretical Category
(AAA-01)	"As early as the 4th Quarter of 2019 when I was assigned at the Central Luzon and as a former laboratory personnel, during the early years of my career, I have empowered the Laboratory Head to look into the laboratory infrastructure comprising of the scientific methods, protocols, quality assurance and quality control, certified reference materials, equipment calibration, competency and proficiency testing, data privacy and integrity, and the physical environment." "We have established the Laboratory Safety Manual and Occupational Health and Safety (OHS) programs to prevent the occupational health and safety (OHS) risks that might compromise the safety, well-being, and mental health of our personnel." "Just recently, we did a process failure mode and effect analysis to identify and provide corrective and preventive actions to potential failures in all facets of laboratory processes and the entire laboratory infrastructure."	Scientific methods and protocols Quality assurance & quality control Equipment Calibration Laboratory Safety Manual Occupational Health and Safety Programs Failure Mode and Effect Analysis	Methods
(CCC-01)	*It is also important that equipment is calibrated to be used in the laboratory analysis to produce accurate results.*	• Calibration of equipment • COVID-19 prevention	

(CCC-02)	*(I am practicing resilience at work for example, environmental monitoring such as when it is raining, checking for roof leaks, if chemicals in the storage area get wet when it is raining, these are some of the work practices that we are doing.*	• Environmental monitoring • Work practice
(CCC-04)	*(So, to speak, a Data Controller is resilient if he can control the data securely, without leakage. How I was able to do that? Everything is procedure-based, the way these are carried out.) "Yes Ma'am. In fact, I am also monitoring the wastewater generated at the laboratory and when the storage tanks are already full, I promptly report to my Immediate Supervisor that we need to have it hauled by an accredited treater to prevent them from overflowing. I am also handling the transfer of the waste from the laboratory to the Ground Floor following the safety protocols. The hazardous wastes are contained, locked securely, and provided with labels"*	• Procedure-based • Laboratory upkeep and cleanliness • Monitoring of wastewater • Hauling of laboratory wastewater to treatment facility • Safety protocol on waste management – with spill containment, labeled, and with secured storage.
(CCC-03)	"..gathering and analyzing remediation options and implementing the chosen corrective action.	• Gathering and analyzing remediation options • Implementing chosen corrective actions
(BBB-04)	"As a Safety Officer, it is important to the organization that the safety policies are being implemented. Also, regular training of Emergency Response Team is important for them to be ready and to help prevent the occurrence of injuries."	• Implementation of safety policies • Emergency Response Team (ERT) • Injury prevention

(AAA-01)	"As early as the 4th Quarter of 2019 when I was assigned at the Central Luzon and as a former laboratory personnel, during the early years of my career, I have empowered the Laboratory Head to look into the laboratory infrastructure comprising of the scientific methods, protocols, quality assurance and quality control, certified reference materials, equipment calibration, competency and proficiency testing, data privacy and integrity, and the physical environment."	• Data Privacy and Integrity	
(CCC-04)	(So, to speak, a Data Controller is resilient if he can control the data securely, without leakage. How I was able to do that? Everything is procedure-based, the way these are carried out.) "Yes Ma'am. In fact, I am also monitoring the wastewater generated at the laboratory and when the storage tanks are already full, I promptly report to my Immediate Supervisor that we need to have it hauled by an accredited treater to prevent them from overflowing.	• Control of data • Data security, no leakage • Traceability of data – where it originated • Reporting to Immediate Supervisor on tank levels for wastewater	Data/ Information Communication
(BBB-01)	Fast track of hiring of personnel, proper coordination in other division/unit	• Proper coordination with other divisions/units	
(CCC-03)	"Proper communication with my colleagues so that the operation in the laboratory can continue even without our superiors."	• Proper communication to ensure continuity of operations even without superiors.	
(BBB-03)	For example, we have open online communication even pre-pandemic time for the laboratory staff where announcements and information exchanges are communicated, remote video meeting …especially during the COVID-19 pandemic.	• Open online communication even pre-pandemic time	

(AAA-01)	"As early as the 4th Quarter of 2019 when I was assigned at the Central Luzon and as a former laboratory personnel, during the early years of my career, I have empowered the Laboratory Head to look into the laboratory infrastructure comprising of the scientific methods, protocols, quality assurance and quality control, certified reference materials, equipment calibration, competency and proficiency testing, data privacy and integrity, and the physical environment."	• Certified Reference Materials	Equipment
(CCC-02)	We also check for physical damage on equipment, if they are maintained properly, or if they are calibrated)	• Equipment maintenance and calibration	
(CCC-04)	We also monitor our spill kits and fire extinguishers. We are also equipped in case an earthquake occurs.)	• Availability and monitoring of spill kits and fire extinguishers • Spill containment	
(BBB-03)	Due to the resignations of analysts and limited permanent positions, it was my dream to have advanced equipment that needed fewer people for the lab to function efficiently even before the pandemic. Try to be ready and prepared for the future.	• Advance equipment	

Table 7

What laboratory resilience practices accomplish in promoting organizational resilience and public service continuity

Respondent	Descriptive quotes	Theoretical categories	Themes
CCC - 01	Smooth operations	Efficient operations	Public service continuity
CCC - 01	Operate with speed, accuracy, and efficiency.	Efficient operations	
CCC-03	Immediate problem solving for continuity of laboratory operations	Uninterrupted operations	
CCC-05	Smooth operations	Efficient operations	
BBB-04	Resilience helps ensure continuity of laboratory operations in the face of unexpected events.	Uninterrupted operations	
BBB-03	To be able to deliver services without interruption.	Uninterrupted operations	
AAA-01	Sustainability of products, services, and processes	Operational resilience	Institutional resilience
CCC - 01	Highlights the importance of the role of Laboratory Analyst on public service.	Personnel Engagement	
CCC - 02	Resilience helps improve the laboratory beyond its limitations.	Adaptive capacity	
CCC - 02	Resilience enables personnel to explore outside their work's comfort zones	Adaptive capacity	
CCC - 02	Focuses on improvement, not just for laboratory, but other divisions/sections.	Operational resilience	
BBB-01	The laboratory operations will be successful if each individual will be cooperative so as to accomplish targets.	Personnel Engagement	
BBB-02	Level of laboratory resilience is directly proportional to the operation of the laboratory.	Operational resilience	
BBB-04	Laboratory resilience acts as cornerstone for organizational resilience	Operational resilience	
BBB-04	Its ability to adapt to disruptions.	Adaptive capacity	
BBB-03	Ready and prepared for the future.	Operational resilience	

BBB-03	Calmness in the face of challenges	Personnel Engagement	Institutional resilience
BBB-03	Take time to properly plan how to address challenges.	Operational resilience	
BBB-03	People encouragement for work engagement to adapt despite challenges.	Personnel Engagement	
BBB-03	Overcoming future challenges that the laboratory with strong Management support	Operational resilience	
AAA-01	Strive for coherence, integrity, and confidence to aid in the implementation of environmental policies.	Purpose and commitment	Credibility and reputation
AAA-01	Underpin and enhance environmental soundness.	Purpose and commitment	
CCC - 02	Better feedback for laboratory (becomes more recognized)	Feedback and recognition	
CCC-04	Resilient laboratory – delivering the needed services for clients.	Feedback and recognition	
CCC-04	Efficient public service.	Purpose and commitment	
BBB-01	Success of the laboratory is success of the organization of the organization it belongs to.	Feedback and recognition	

Table 8

Challenges/disruptions

Facilities	▪ Fire ▪ Earthquake ▪ Leak ▪ Chemical Spill ▪ Physical damage of equipment ▪ COVID-19 pandemic ▪ Unnecessary things ▪ Hazardous wastes ▪ Health emergencies
Personnel	▪ Lack of awareness/training on how to use the fire extinguishers. ▪ Non-awareness regarding COVID-19 ▪ Incident is traumatic. ▪ Resignation of staff/Laboratory Analysts ▪ Lack/shortage of manpower. ▪ Laboratory Head on leave ▪ No proper turn-over of workloads ▪ Absence of next in line due to health problems ▪ Sudden resignation
Management	▪ Lack of recognition and appreciation for those who drives harder and further for the organization. ▪ Limited permanent positions ▪ Management Support
Data/information	▪ Data leakage ▪ Data security
Supply chain	▪ Trade disruptions ▪ Uncalibrated equipment

Chapter V

RESULTS AND DISCUSSION

Based on the analysis of the responses from the semi-structured interview and written questionnaires, the following findings have emerged to address the research questions.

Resilience as defined by laboratory personnel

Resilience has emerged as a crucial feature, especially in laboratory settings where staff members must face disruptions without sacrificing service quality. Although systemic definitions of resilience are frequently used, knowing how frontline laboratory personnel define it offers a grounded understanding of its practical aspects. According to the responses, resilience is categorized into four (4) domains based on the timing of a disruption or challenge:

1) Risk Management – Anticipatory

Under this domain includes preparedness and the capacity to foresee future threats and crises, emphasizing the necessity for equilibrium between bureaucratic regulations and innovative strategies. According to laboratory team members, resilience is the capacity to anticipate and adjust to potential threats and difficulties in the future rather than waiting for a crisis to occur. This anticipatory form of resilience emphasized readiness, responsibility, and balance in a front-line institutional setting.

This is evident in the response statement of (AAA-01) that resilience is *"preparing for*

future crises and disruptions." Thus, being resilient entails being able to recognize possible threats and putting in place systems that can adapt to them. This proactive mindset functions similarly to a risk management strategy, where resilience involves anticipating the future rather than merely recovering from a negative event.

He believed that resilience, in his capacity as Regional Director, entailed being accountable and transparent about the use of public resources. This demonstrated that resilience involves more than just strength; it also involves public trust and sound governance. *"There must be assurance that public resources are used responsibly and transparently,"* he stated. Resilience and institutional accountability are linked in this statement, which is consistent with good governance principles. *“Finding dynamic equilibrium in the face of new realities”* reflects adaptive capacity, the ability to maintain core functions while responding to emerging changes.

As evidenced by AAA-01's focus on *"balance between bureaucratic rules and innovative strategies,"* he perceived resilience as a delicate balance between structure and flexibility. He is engaged in the reflexive organization of foresight, expected of a responsible leader, orienting to both bureaucratic mandates and informal, on-the-ground know-how. According to these concepts, resilience is a way of thinking about uncertainty that encompasses being prepared, having moral responsibility, and being adaptable rather than as a fixed quality for the institution’s leaders and employees.

(b) **Response** refers to the actions taken at the onset of a disruption, involving recognition of the risk landscape dynamics, assurance of efficient resource utilization, and stress management, all essential for providing mission-critical laboratory services.

Respondents described resilience in various ways: as an acknowledgment of *"ever-changing and increasingly complicated disruptors"* (AAA-01), as the assurance that laboratory services can *"manage stress and emotional well-being"* (BBB-04), and as *"being able to function properly … even though we face challenges"* (BBB-03).

Such responses: "*Bounce back from difficulty"* (CCC-03), *"Function properly despite challenges"* (BBB-03), and *"Survive despite challenges"* (BBB-01) connotate a reflexive posture. These are more than just definitions; they are performative statements that reaffirm the laboratory personnel's identity as resilient individual, drawing from their own experiences.

During a disruption, what is framed as a "response" is not a set of pre-scripted actions but rather the outcome of recognizing and articulating emergent contingencies. Laboratory personnel collaboratively determine what counts as a "risk," who is responsible, and what actions should be prioritized. The way they manage stress and allocate resources is not a pre-given function, they are visible in the routine coordination of tasks, assessments, and reassurances that make their actions accountable to others and to the mission of the laboratory and the entire institution. From the way laboratory personnel describe organizational resilience, their responses imply an unspoken shared norm that resilience is good and necessary.

c) Resumption/Restoration entails recovery, rebound, and the reestablishment of stability following a disruption. Team members of the laboratory described resilience as the ability to recover, resume, and restore function after a disruption. This perspective reflects a foundational understanding of resilience as the capacity to return

to normal operations (business as usual) following a disruption brought about by threats/challenges.

They have highlighted expressions such as: *“Recover from shocks”* (AAA-01), *“katatagan (stability)* (CCC-01)” *“capacity to quickly recover from difficulties” “katatagan (stability) of an organization”* (CCC-04), *“ability to bounce back from a difficulty”* (CCC-03). According to these laboratory key personnel, organizational and personal recovery processes are linked to resilience. The focus on *"bounce back"* and *"quickly recover"* suggests timeliness and efficiency, implying that resilience is more than just surviving but also about reducing downtime and resuming functionality even at a minimum as soon as possible. The frequent use of the Tagalog word "katatagan," which means stability or constancy, further emphasizes the cultural aspect of resilience. It shows that, in addition to recovery, keeping composure and operational consistency in the face of difficulties is valued.

According to this definition, resilience is a dynamic process of restoration with the aim of restoring or even improving upon pre-disruption conditions rather than a static attribute. To navigate and recover from crises, it requires both the psychological fortitude of individuals and the structural stability of organizations.

(d) **Refine** refers to a laboratory's ability not only to endure disruptions but also to emerge stronger by adapting positively and transforming through the experience.

It involves the idea of *“adapting from shocks”* (AAA-01) and reflects both personal and organizational resilience, such as *“how a person adapts to a certain situation or like challenges”* (CCC-02), and *“how an organization stands firmly against the grind”* (BBB-02). This concept implies a commitment to *“instill strong practices”*

(BBB-02) that promote *"strength and adaptability"* (CCC-05), ensuring *"survival despite many challenges"* (BBB-01) and the *ability to "adapt positively"* (BBB-04) in the face of adversity. The participants gave explanations of what resilience means based on their roles and tasks. *(CCC-02) talked about "adaptation", CCC-03 shared about "bouncing back and survival" (BBB-01) while (BBB-02) mentioned "standing firmly and instilling strong practices."*

In what was coded as "refinement," laboratory members learn and transform through reflective sense-making and not only through formal mechanisms. They tell stories such as the COVID-19 pandemic, a small fire in the previous location of the laboratory highlighting "what happened", "what went well", and "what we will do differently." These interpretations worked to the advantage of laboratory personnel such that they can visibly and practically conceive and treat disruptions as an avenue for them to rethink mundane tasks and recalibrate standards.

"Resilience is good governance and leadership" as framed by (AAA-01) where he does not just define resilience but **Resolve** emerged as a theme to describe leadership credibility and accountability where he further emphasized through his statements such as *"assurance that public resources… are used responsibly and transparently"* and *"strike a balance between bureaucratic rules and innovative strategies."* highlighting his view of resilience as central to the stewardship and legitimacy of the institution.

Respondents have not given abstract or academic definitions. They have done something with their words and have expressed their roles, responsibilities, and institutional culture.

Resilience is defined, not as a static attribute that the laboratory or laboratory personnel have, but rather, it is a continuing, locally produced accomplishment. Laboratory staff make sense of and enact "resilience" through practical reasoning, conversational exchanges, and accountability practices that unfold across time (before, during, after, and post disruption) in response to perceived or actual unforeseen events.

In sum, what is called "resilience" as defined by laboratory personnel emerges not as a formal category, but as a sense of continuity that is interactionally achieved and responsiveness which were made visible in the ordinary actions, descriptions, and reasoning of laboratory personnel.

Resolve represents a moral and professional orientation to disruption, composed of four interlinked domains: a) Risk Management, b) Response, c) Resumption/Restoration and d) Refinement.

Laboratory team members did not present these as formal phases, but through their explanations, it became clear that these domains represent how they practically make sense of responsibility, manage uncertainty, and uphold the mission of the laboratory.

Their responses are not just definition; they enact resilience. They resonate that they have a shared institutional ethic – that to be resilient is to foster resolve and to have a common orientation towards responsibility, responsiveness, and continuity even amidst adversities.

Laboratory Resilience Practices

Three (3) major themes were revealed: (A) Leadership, (B) People, and (C) Process Reliability.

(A) Leadership: Leadership is the cornerstone of resilience where behavior and structure in the laboratory are anchored to, and guided by commitment, values, and systems.

(B) **People:** Availability, behavior, and competence are the attributes that have been revealed contributory to personnel resilience.

(C) Process Reliability: Laboratory practices which cover methods, data, systems, and equipment management to achieve process reliability complement leadership and personnel resilience enabling continuity of operations.

A. Leadership

Leadership is evident in their institutional values of setting good examples with the ones that they are regulating (the industries within Central Luzon) with respect to their compliance obligations to protect the public and other stakeholders. Values such as empowerment, being proactive, safety, and a well-established rapport within an integrated management system set the tone for resilience in the laboratory. Laboratory personnel articulates and practices laboratory resilience which are deeply rooted in leadership arising from three (3) categories: commitment, values, systems:

1) **Commitment** is evident with the institution having a *"laboratory infrastructure"* and their practices to *"to set good examples with the industries that we are regulating …by complying with the permits, licenses, and clearances"* as echoed by AAA-01.

This expression of commitment is part of the laboratory members' practical reasoning and approaches to uphold professionalism, accountability, and public service in the organization. When AAA-01 mentioned that the laboratory infrastructure and their practice of *"setting good examples"* by complying with regulatory requirements, is not merely a policy statement but an accountable action. This is a way of showing others (those that they regulate) that their Office is a legitimate, responsible authority. How they comply with the same mandates that they impose serves both as a method and as evidence of their rightful place within a moral and procedural order.

This was cascaded top down in the statement of BBB-01 that *"individual staff in the laboratory should know and keep it in their mind and by heart their responsibility"*, and that *"working in the government focuses more on public service and not in individual interest."* These descriptive quotes reflect how the laboratory personnel perform their role with a sense of duty revealing their institutional ethos. This was also emphasized by the Safety Officer (BBB-04) that *"As a Safety Officer, it is important (and we safety officers embodies) to be proactive and to ensure the safety of everyone involved."* The idea that safety officers must "embody" safety reflects how the Safety Officer role is enacted in everyday practice and visible behaviors.

2) Values

As AAA-01 says, *"and as a former laboratory personnel during the early years of my career, I have empowered the Laboratory Head to look into the laboratory infrastructure."* This illustrates how he is using his past work experience to support his current decision. AAA-01 builds resilience by giving them the power to share tasks and

maintain stability over time. *"Listening to every insight and perspective of every member... mutual solutions that are beneficial to all,"* as (BBB-02) said. (BBB-02) emphasizes that leadership is a process of working together, listening, and building consensus to create authority. These small actions show how laboratory leaders build credibility and encourage resilience by valuing the point of view of laboratory personnel under her supervision. This strategy encourages inclusivity and improves adaptability, allowing the laboratory to respond more effectively to disruptions.

This shows relational resilience, which is the ability of a team to work well together even when things are tough. Recognizing and using each person's strengths creates a sense of belonging and motivation. Team members work together to solve problems and help the organization bounce back after failures through shared responsibility and inclusive leadership.

*"*To set good examples with the industries that we are regulating, *we manage the environmental aspects and impacts of our operations."* This underscores the laboratory's proactive approach to environmental stewardship. The institution proactively exemplifies that regulatory compliance and operational sustainability are integral to its primary goal, rather than awaiting external pressure.

This not only cultivates adaptive resilience by reducing risk exposure but also enhances the laboratory's reputational resilience, thus encouraging public trust and credibility among stakeholders such as industries and the community.

Empowering leadership, recognition of each team member's contributions, and being a role model in terms of environmental compliance - are practices rooted in their established norms. Laboratory personnel make sense of resilience not just through technical competence but through value-driven actions deeply rooted in people-centered and ethical practices which are part of their routine behavior and decision-

making. This ensures that the laboratory is continuously evolving, grounded ethically, and socially cohesive to withstand disruptions.

3) Systems

AAA-01 shares that *"Holistic Management System... Risk Management... SWOT analysis of the Bureau covers that of the laboratory."* This theme reflects how formal systems like IMS (Integrated Management Systems) serve as strategic tools. In practice, laboratory personnel adhere to their Laboratory Quality Manual aligned to the established and implemented Integrated Management System. The data reveals the unseen resilient practices and strategies centered on leadership. These results demonstrate that resilience is not merely a top-down initiative but a socially sustained achievement that is upheld by the laboratory team members who are a part of the institutional setting.

B. People: Availability, Behavior, and Competence

Laboratory resilience before a disruption is anticipatory in nature by doing potential problem analysis and risk assessment, figuring out the needs and challenges of staff, and preparedness to manage emergency situations or operational interruptions. Equipping laboratory personnel with knowledge and skills is also vital in dealing with the potential effects of the threats and challenges that have been and will be experienced by laboratory personnel.

1) Before disruption

a) Anticipatory Action / Preparedness emerged from the quotes *"Patience and frequently checking for every staff what they need and challenges they are encountering in their work and make an immediate action."* (BBB-01) and *"By thinking of possible problems, we might encounter (risk assessment) and formulating possible solutions to address them."* (CCC-05).

Laboratory personnel proactively identify risks and respond promptly to prevent or minimize such risks. These are evident in their routine actions such as checking equipment for physical damage, monitoring chemical storage during rain, or advancing calibration requests which are concrete ways to produce a resilient environment and maintain a culture of readiness and support. These are echoed in these quotes: *"Environmental monitoring such as when it is raining, checking for roof leaks, if chemicals in the storage area get wet…"* (CCC-02) These practical checks are locally organized practices that are continually reinterpreted and reproduced in the laboratory.

b) Competence

Laboratory resilient practices codified under the theme: Competence includes gauging the adequacy and effectiveness of the established emergency plans and programs that are done regularly by laboratory personnel.

Examples are quotes from (CCC-01) *"We conduct drills in response to a fire or earthquake that might happen.",* (CCC-04) *"We are also equipped in case an earthquake occurs."*, *"We also have our fire safety training… and chemical spill training…"* Staff are regularly trained and participate in emergency simulations, ensuring they know what to do in high-stress situations and shares a common understanding of readiness should an unforeseen event occurs.

c) Awareness

At the laboratory, awareness is not simply a given attribute but a practical day-to-day accomplishment such as orientations, training, and simulations. Participants described how laboratory staff come to *"know their responsibility"* not just through formal instruction, but through embedded practices on-the-job training, OSH seminars, and environmental safety briefings (e.g., BBB-01, CCC-02). These activities are routine methods for cultivating and reaffirming mutual understanding of roles, safety norms, and collective accountability. In doing so, awareness is automatically reinforced in how these laboratory personnel communicate, respond to, and perform their work tasks, particularly under stressful situations or disruption.

For example, the use of "OSH training" or "orientation" operates as a way participants demonstrate that resilience is not just reactive and these practices reduce ambiguity, distribute responsibility, and allow the laboratory to maintain order even in the face of disruptions.

d) Training

The provided statements *"Trainings… such as the OSH training, environment health and safety training, and personnel on-the-job training…"* (CCC-02) and *"We also have our fire safety training, what do we do in case there is fire and chemical spill training as a response to chemical spillage."* (CCC-04) highlight institutional and individual practices related to occupational health and safety (OHS) and emergency preparedness, emphasizing resilience-building within a workplace environment. Training is viewed as an investment in resilience, ensuring staff are equipped with up-to-date skills and knowledge.

2) During disruption

Collegiality, emotional strength, psychological safety, resourcefulness, and spontaneity are the attributes that have emerged while laboratory personnel practices resilience at the onset while flexibility and adaptability become evident as they transform and adapt to the changing times after a disruption.

Unexpected disruptions, such as workforce shortages, logistical failures, or pandemics, often challenge laboratory operations. These disruptions assess not only the technical capabilities of a laboratory but also the organizational and human capacity to adapt, sustain performance, and recover.

a) Collegiality

The coded data consistently emphasizes teamwork, unity, and collaboration, as participants indicate that cooperative behavior and active engagement are crucial for implementing laboratory policies and managing disruptions.

Statements such as *"We have teamwork, unity, and cooperation in problem-solving"* (CCC-01) and *"The laboratory operations will be successful if each individual will cooperate in order to achieve the established goal."* reflect a common belief that a resilient laboratory culture is built on the foundation of collective endeavor. This collegiality was considered essential for maintaining organizational coherence during crises, achieving objectives, and resolving problems. Resilience becomes a collective endeavor when individuals align with the team's objectives, rather than an individual one.

b) Emotional Strength

Emotional resilience emerged as another key component. Respondents cited a variety of personal strategies, including maintaining a positive attitude, handling stress lightly, and seeking help during an unforeseen event. (CCC-02) explained that *"It is better to handle stressful situations lightly so that you can do your work easier and be more efficient."* while (BBB-02) cited that *"I cope by believing that it is the stepping stone which potentially lead us to better version of ourselves."*

These attitudes demonstrate a powerful emotional coping mechanism that allows laboratory professionals to function efficiently in the face of uncertainty.

"Patience and frequently checking for every staff member's needs and challenges in their work and making an immediate action" says (BBB-01) and *"Assessing my actions toward an encountered difficulty…"* shared by (CCC-03) manifests their ability to regulate emotions and maintain focus, which contributes to their personal and laboratory resilience.

c) Psychological Safety

As shared by BBB-01 that *"…frequently checking for every staff what they need and challenges they are encountering in their work and make an immediate action."* while BBB-02 said that *"I learned that recognizing the contribution of every individual."* She also mentioned that "…*I need to build harmonize relationship by listening to every insight and perspective of every member make mutual solutions that are beneficial to all."*

These statements revealed a strong sense of support within the laboratory. These laboratory heads emphasized the value of supervision, guidance, and recognition of

the individual contributions of their staff and the importance of a sense of support for their team members to keep them motivated. BBB-04 also expressed that "*What is essential is keeping everyone well informed about what is happening to help reduce anxiety and uncertainty."*

This technique of inclusive discussion promotes psychological safety by allowing employees to express concerns, provide solutions, and stay involved during crises. Maintaining an open communication and mutual respect are crucial for morale and operational stability.

d) Resourcefulness

Another category that has emerged is resourcefulness where staff recognized the ability to seek help as cited by (CCC-02) *"You need to ask for help so that the load will be lighter."* Similarly, to ease burdens during challenging times, they are also practicing workload management and fair task re-distribution as expressed by (CCC-05) these statements - *"and fair distribution of workloads to personnel."* and (BBB-04) *"The organization must employ work redistribution to other staff but ensuring that the workload is still manageable."*

These resilience practices foster a culture of mutual support. Laboratory team members recognize that seeking for help and redistributing tasks ease burdens during challenging times. This not only prevents burnout but also ensures continuity of operations.

e) Spontaneity

As (BBB-04) narrated that *"the immediate hiring of replacement of employees is being done"* and (BBB-03) *"and flexi time was also encouraged during the COVID-19 pandemic"* and *"proper adjustments to still do our duties and responsibilities",* it can

be noted that they have practices which are spontaneous and flexible in managing disruptions.

These responses explain the need for the laboratory to remain structurally alert, and these practices of flexibility can set the difference between continuity and breakdown.

Laboratory resilience practices during disruption are a variety of human and organizational practices. The codified data surfaced five interdependent themes: collegiality, emotional strength, psychological safety, resourcefulness, and spontaneity. Together, these elements create a strong framework for restoration and recovery. Enhancing resilience in laboratory environments entails fostering interpersonal relationships, advocating supportive leadership, facilitating operational adaptability, and supporting individual coping strategies.

3) After disruption

Following a disruption, laboratory staff identified these practices that facilitated with recovery and continuity. Flexibility in real-time role performance and adaptability over time through individual and institutional transformation were found to be two (2) separate but connected themes.

a) Flexibility

One participant (CCC-03) talked about *"multitasking"* and *"balancing all my workloads,"* which shows that she can switch between roles and tasks quickly in response to unanticipated demands. This demonstrates her flexibility, which is said to be highly relational and important for maintaining laboratory operations. Without necessarily needing formal training or systemic redesign, these statements

demonstrate how they coordinate their actions to manage the unforeseen circumstances at the laboratory while still making sense to their peers.

In contrast to being physically present, being "consistently present" (CCC-04), is a silent but essential aspect of flexibility and is a type of psychological availability that enabled him to react quickly to operational pressures by showing up and remaining involved. Phrases like *"teamwork"* and *"willingness to help"* highlighted a work environment that encouraged collaboration, unofficial support, and a readiness to go above and beyond one's official role (CCC-04).

b) Adaptability

According to (CCC-02), adaptation is an active process: *"As resilience is how to adapt to a challenge or situation, so you need to practice adapting..."*, implying that resilience is not only reactive but also developed through deliberate and collective learning. As a result, CCC-02 was able to actively modify his work procedures to fit new circumstances.

The laboratory is not isolated from institutional resilience practices, as stated by (BBB-04), which states that *"laboratory resilience acts as a cornerstone for organizational resilience by ensuring the functionality and adaptability of the unit,"* and *"laboratory resilience ensures that the organization can bounce back from any difficult situation, which adds to the organization's resilience."*(BBB-03) described the laboratory's ability to *"adapt to the changing times,"* implying both an immediate recovery and a strategic alignment with changing expectations and demands.

This demonstrates how adaptation is a complex phenomenon: while institutional learning and process evolution ensure long-term resilience, staff coping is

facilitated by individual cognitive flexibility. When combined, they allow the laboratory to withstand disruption and adjust accordingly.

Flexibility and adaptability are deeply intertwined. While flexibility was tied to moment-to-moment responsiveness, adaptability was described in terms of longer-term adjustments and mindset shifts. Flexibility allows the laboratory to operate with continuity when conventional approaches are inadequate while adaptability refers to the recalibration of mindsets and transformation of systems over time.

C. Process Reliability

Process reliability is a key theme that was revealed in this study on laboratory resilience specifically in settings where accuracy and continuity are crucial. In the laboratory, it is shown through standardized procedures, secure information systems, and systematic resource management. This section examines the laboratory's ability to maintain operations in both normal and disrupted conditions by utilizing institutional protocols, risk mitigation strategies, and routine practices.

1. Methods

One of the contributing factors that the laboratory personnel rely on to ensure process reliability are the established methods, policies, and procedures as mentioned in the following responses:

(AAA-01) stated *"to look into… scientific methods, protocols, quality assurance and quality control, certified reference materials, equipment calibration…"* which was supported by (CCC-02) when he expressed that *"It is also important that equipment is calibrated to be used in the laboratory analysis to produce accurate results."*

(AAA-01) also mentioned *that "We have established the Laboratory Safety Manual and Occupational Health and Safety (OHS) programs to prevent the occupational health and safety (OHS) risks" and "…we did a process failure mode and effect analysis to identify and provide corrective and preventive actions to potential failures in all facets of laboratory processes".*

These were supported by (CCC-02) when he stated that *"I am practicing resilience at work for example, environmental monitoring such as when it is raining, checking for roof leaks, if chemicals in the storage area get wet when it is raining, these are some of the work practices that we are doing."* Documents such as the Laboratory Safety Manual and OHS Programs serve as resources for laboratory personnel in the implementation of resilient practices. These are combined with the process risk assessment such as the Failure Mode and Effect Analysis (FMEA), to identify failure modes and effects and address the root causes that might cause errors and disruptions in delivering their services. This proactive approach supports accuracy of results and continuity of operations, especially when facing unforeseen events or interruptions.

With reliable processes built on written documents, laboratory personnel are confident that they are well equipped in managing disruptions brought about by the identified risks as supported by the following responses: *"Also, regular training of Emergency Response Team is important for them to be ready and to help prevent the occurrence of injuries." (BBB-04)* and *"We also monitor our spill kits and fire extinguishers. We are also equipped in case an earthquake occurs.," added (CCC-04).*

2) Data/Information/Communication

There are also established methods on data privacy and security which is pivotal when it comes to protecting the results of laboratory analysis. This has been shared by AAA-01 that *"As early as the 4th Quarter of 2019 when I was assigned at the Central Luzon… I have empowered the Laboratory Head to look into the laboratory infrastructure comprising of the … data privacy and integrity …"* on a strategic note and was reinforced by (CCC-04) when he said that *"A Data Controller is resilient if he can control the data securely, without leakage…Everything is procedure-based."*

Resilience encompasses not only physical systems but also the IT system to ensure the confidentiality, integrity, and accessibility of laboratory records. By adhering to procedure-based measures and data protection, the institute prevents data loss, tampering, or ambiguity ensuring that judgments can be made accurately whether on a routine basis or even during disruptions.

Routine practices such as communicating with superiors on laboratory waste management also reflect everyday resilience as echoed by (CCC-04) in these statements: *"I am also monitoring the wastewater generated at the laboratory... we need to have it hauled by an accredited treater to prevent them from overflowing."*

Responsible management of these wastes as framed by (CCC-04) that "The hazardous wastes are contained, locked securely, and provided with labels." ensures compliance, reduces environmental impacts, and prevents service disruptions, attributed to spills/leaks, and other regulatory repercussions. There are respondents, (CCC-03), who shared that *"Proper communication with my colleagues so that the operation in the laboratory can continue even without our superiors."*. Similarly, (BBB-03) also shared that *"We have open online communication even pre-pandemic time for the laboratory staff where announcements and information exchanges are*

communicated..." (BBB-03) and (BBB-01) *"Fast track of hiring of personnel, proper coordination in other division/unit."* (BBB-01) surfacing that they prioritize decentralized decision-making and transparent communication. By promoting internal dialogue and information security, they can sustain their operations independently yet with strong support from leadership.

3) Equipment

Planning for equipment upgrades demonstrates a proactive approach to potential human resource outages or future demands, enabling sustainable laboratory operations. This emerged in the responses from (AAA-01) *"I have empowered the laboratory head to look into…certified reference materials, equipment calibration."*

(BBB-03) aspirations in her response that *"It was my dream to have advanced equipment that needed fewer people for the lab to function efficiently even before the pandemic. Try to be ready and prepared for the future."* (BBB-03) is a resilient forward-looking goal that will enable them to adapt to the evolving needs of their customers.

The responses demonstrate how laboratory personnel integrate resilience with emphasis on process reliability into their daily routines, ranging from emergency preparedness to data security. They foster a culture of resilience that promotes accountability, adaptability, and continuity, regardless of the uncertain circumstances, by adhering to protocols, managing waste, and maintaining open communication.

What Laboratory Resilience Practices Accomplish in Promoting Organizational Resilience and Public Service Continuity

These responses underline that a resilient laboratory guarantees the uninterrupted provision of public services in an efficient and timely manner despite the presence of challenges:

Public Service Continuity

Efficient operations

This results in maintaining high quality performance, efficient operations, and stability as echoed in the statements of the following key members of the laboratory: *"Operate with speed, accuracy, and efficiency." which leads to "Smooth operations." (CCC-01 and CCC-05)*

In this context, resilience serves as a safeguard for essential functions upon which the public relies, including environmental monitoring and regulatory compliance. Consequently, public service continuity is not merely an outcome but a driving purpose behind resilience strategies, particularly in laboratories responsible for producing science-based outputs to aid policy and public welfare.

Uninterrupted operations

(BBB-04) shared that "*Resilience helps ensure continuity of laboratory operations in the face of unexpected events"* which can help in "*Immediate problem solving for continuity of laboratory operations." (CCC-03)* "*To be able to deliver services without interruption"* (BBB-03).

Institutional Resilience

Personnel Engagement

The human side of resilience emerged as a powerful foundation of continuity. Individual roles and collective cooperation, according to laboratory professionals, are essential for attaining operational goals as framed by (BBB-01) that *“The laboratory operations will be successful if each individual is cooperative so as to accomplish targets”*.

Such remarks demonstrate a shared accountability framework that enables employees to participate meaningfully in everyday operations. Notably, emotional resilience emerged as a considerable influence. Personnel emphasized *"calmness in the face of challenges"* and the value of *"People encouragement for work engagement to adapt despite challenges"* (BBB-03).

These responses support the notion that resilience is psychological rather than just structural, and that it is based on a culture of support and mutual drive. The role of the Laboratory Analyst was especially recognized for its contribution to public service: *"Highlights the importance of the role of Laboratory Analyst on public service"* (CCC-01).

This demonstrates that public service continuity is more than just an administrative goal; it is a personal commitment shared by frontline laboratory employees.

Operational Resilience

Laboratory resilience forms the backbone of a broader organizational resilience as (BBB-04) articulated that *"Laboratory resilience acts as cornerstone for organizational resilience"* and supported by (BBB-02) in her statement that the *“Level of laboratory*

resilience is directly proportional to the operation of the laboratory." which highlights that there is a linkage between operational and institutional resilience.

The need for a well-studied long-term strategies and readiness has been the focus of what BBB-03 reflects on: *"Take time to properly plan how to address challenges.", "Ready and prepared for the future."*, and *"Overcoming future challenges...with strong Management support"* which proves that what makes sense to them is resilience built on a calculated foresight and not on reactive approaches alone.

Furthermore, respondents emphasized a commitment to sustainability not only in laboratory operations but also across organizational functions with these illustrative quotes: *"Focuses on improvement, not just for the laboratory, but other divisions/sections"* (CCC-02) resulting to *"Sustainability of products, services, and processes."* (AAA-01)

This illustrates that operational resilience in the laboratory serves as a paradigm for interdepartmental collaboration, cascading resilience practices across the institution.

Adaptive Capacity

The ability of the laboratory to respond to unforeseen events is rooted in its adaptive capacity as (CCC-02) identified resilience as a means that *"helps improve the laboratory beyond its limitations"* (CCC-02). Adaptability is closely related to flexibility and innovation – attributes which surpasses technical compliance towards positive transformation.

(CCC-02) narrated that Resilience enables personnel *to "explore outside their work's comfort zones"* (CCC-02). This shows that adaptation promotes professional development and dynamic learning environments in the laboratory. Resilience for the

laboratory was further broadened by one participant as *"its ability to adapt to disruptions"* (BBB-04), which encompasses both strategic agility and systemic responsiveness.

Adaptive capacity is therefore viewed both as an individual characteristic and a collective trait that enable the laboratory to survive disruptions but also in its transformation contributory to institutional resilience.

Credibility and Reputation

Purpose and Commitment

Their institutional credibility is intricately linked to its laboratory resilience, especially in adhering to environmental mandates. Statements like *“Strive for coherence, integrity, and confidence to facilitate the implementation of environmental policies”* (AAA-01) and *“Underpin and enhance environmental soundness”* and *“efficient public service”* (CCC-04) demonstrate a dedication to public trust and scientific accountability.

Participants believe that a reputable laboratory enhances governmental transparency and legitimacy. This aligns with public sector goals towards fairness, consistency, and evidence-based governance.

Feedback and Recognition

Resilience fosters enhanced visibility and recognition. Participants emphasized that *“Better feedback for laboratory (becomes more recognized)”* (CCC-02) and *“Resilient laboratory – delivering the needed services for clients.” (CCC-04)* enhance institutional reputation.

Significantly, recognition was perceived not as an individual reward but as a collective accomplishment: *"Success of the laboratory is success of the organization it belongs to." (BBB-01).* This underpins a comprehensive concept of resilience, wherein individual and team efforts combined to uplift the institution.

The findings indicate that the laboratory, when confronted with unforeseen events and interruptions, demonstrates resilience through its committed workforce, practices, adaptive capacity, and value-driven leadership, resulting in efficient and sustained operations. The laboratory's resilience, along with the purpose and commitment, fosters organizational resilience and ensures continuity of public service, thereby contributing to a resilient and reputable institution.

Discussion

This research revealed how the laboratory personnel develop and maintain resilience through localized, everyday activities within their unique institutional and socioenvironmental contexts. The findings of this study coincide with the studies conducted by Williams et al. (2017) and Sutcliffe & Vogus (2003), all contributing to the understanding of resilience as a developing, context-dependent process particularly in crisis-prone contexts such as environmental governance in the Philippines.

Global Risk Landscape and Public Service Continuity. This research was undertaken in a locale and context of a high-risk environment, as the Philippines consistently ranks at the top of the World Risk Index (UNU-EHS, 2022). The findings on the resilience practices of the institution which spans from risk management to refinement, reflect the organizational need to sustain its operations effectively even

under exposure to threats and vulnerabilities. The laboratory's proactive practices establish how government laboratories are responding to this global urgency with local adaptive capability and transformation ensuring continuity of mission-critical services.

Resilience as a Dynamic and Temporal Process. The four (4) intertwined areas that surfaced from this research – Risk Management, Response, Resumption/Restoration, and Refinement mirror the dynamic, time-based nature of resilience defined by Duchek (2020), who introduced that resilience unfolds through phases of anticipation, coping, and adaptation. With the same notion, Sutcliffe and Vogues (2003) highlighted that organizations that are resilient can anticipate, absorb, and learn from disruptions. This resonates with how the personnel, not just respond to disruptive events, but prepare, endure, and transform through routine practices.

Personnel Resilience as a Cognitive and Emotional Capacity. The individual and team-level aspects of resilience emerged from the practices exhibited by laboratory personnel such as their collegiality, emotional strength, psychological safety, resourcefulness, and spontaneity. These accounts as seen in the laboratory personnel resonate with what has been examined by Xiao and Cao (2017) and Gerschberger et al. (2023) that group resilience is strengthened through social connections, emotional security, and mutual responsibility.

Multi-Level Resilience and Transitioning Capabilities. Based on the results of this study, laboratory resilience is centered on People (Availability-Behavioral-Competence) (Individual), Process Reliability (functional/operational) and Leadership (strategic resilience). This is supported by the work of Hepfer & Lawrence (2022) as

they described different types of resilience, each demonstrating distinct but complementary approaches. The results further support the idea of "level transition," as proposed by Xiao & Cao (2017), according to which individual resilience (e.g. collegiality, emotional strength, psychological safety, resourcefulness, and spontaneity) scales into operational resilience and ultimately aids in organizational learning.

The concept of resilience by Lengnick-Hall (2011), which comprises of contextual, behavioral, and cognitive skills at interrelated organizational levels is also being reinforced by this study when there are adjustments/innovations in the routine processes at the laboratory such as flexibility in the shift schedules to manage operations given resource constraints which enhances institutional capacity.

Process Reliability and Operational Resilience. Laboratory resilience, as seen through process standardization, risk assessment protocols, and system maintenance, aligns with operational resilience frameworks described by Hepfer and Lawrence (2022) and Agkun and Keskin (2014). Their research highlights that structured systems, reliable procedures, and adaptive resource management are foundational to ensuring service continuity. The laboratory's use of FMEA, ISO-aligned manuals, and data privacy safeguards exemplify how resilience is enacted not only by people but also through systems that buffer against functional breakdowns.

Functional Resilience and Organizational Culture. The idea of "functional resilience" according to Hepfer and Lawrence (2022) is rooted on interpersonal routines, embedded systems, and the capacity to continue critical functions even in the face of unanticipated events which is demonstrated in this research by the lived

practices of laboratory personnel where teamwork, open communication, trust, mutual respect, and a strong internal support system.

Laboratory Resilience and R&D Innovation. The integration of resilience in innovation is another notable connection; resilience in R&D contexts like laboratories does not only entail bouncing back but sustaining innovation under constraint. (Lv et al., 2018; Dziadkowiec, 2021). The findings of Clercq & Pereira (2019), which show that employees' creativity and resilience are enhanced in high-stress and high-demand environments, are consistent with the experiences of the institution's laboratory personnel.

This supports the notion that pressure and adversity can serve as catalysts for innovation and adaptation. These results align with Santoro et al. (2021), who demonstrated that appreciating employee resilience directly enhances organizational performance. The institution's laboratory resilience through creative work redistribution, adaptive scheduling, and informal reflective practices are all drivers of adaptive innovation.

Laboratory Resilience and Knowledge Sharing. The emphasis on knowledge continuity and learning culture in the institution as have been highlighted in the *laboratory practices that are people-related such as the training and competence* is aligned with the results of Si-hua Chen (2016) and Xiao & Cao (2017), which underscored how resilience at the individual and team levels is enhanced by shared vision, cooperative awareness, and openness to learning. Particularly, informal mentorship and peer-to-peer instruction emerged in the data as adaptive strategies during personnel turnover or resource constraints. This is congruent with what has

been described by Ducheck (2020) on resilience capacities that organizations with robust knowledge bases are more prepared in anticipating, coping with, and adapting to disruptions.

Resilient Leadership as an Enabler of Continuity. The role of leadership in fostering laboratory resilience — through commitment, value-driven decisions, and integrated systems — strongly resonates with the existing research of Lombardi et al. (2021) on the interconnectedness of innovation with resilient leadership wherein active involvement and systematic preparedness resulted in a significant impact in addressing disruptions. Both these top-down directives and ground-level initiative improve the institution's long-term capacity for innovation and recovery as echoed by Richtnér & Löfsten (2014)**.** Laboratory leaders were seen to balance bureaucratic obligations with innovative practices, echoing Gilbert et al.'s (2012) emphasis on the importance of leadership adaptability and foresight during institutional disruptions.

Resilience in Public Sector Laboratories: A Contextual Contribution. This study is a substantial contribution to the literature, as it addresses the scarcity of research on laboratory resilience in the Philippine public sector. The laboratory personnel and administrative staff of the institution showed resilience under resource constraints, overcoming bureaucratic obstacles and environmental unpredictability through bottom-up initiatives and team problem-solving, in contrast to private sector laboratories in the UK that benefited from strong university-industry links and well-funded infrastructure (Ulrichsen, 2021; Arranz et al., 2022). This research presents grounded practices from a government environmental laboratory and demonstrates how resilience is socially produced, locally interpreted, and sustained not through top-

down policies alone but through everyday reasoning, relationships, and accountability — a perspective consistent with ethnomethodological and interpretive resilience literature (Trace, 2016; Tasic et al., 2019).

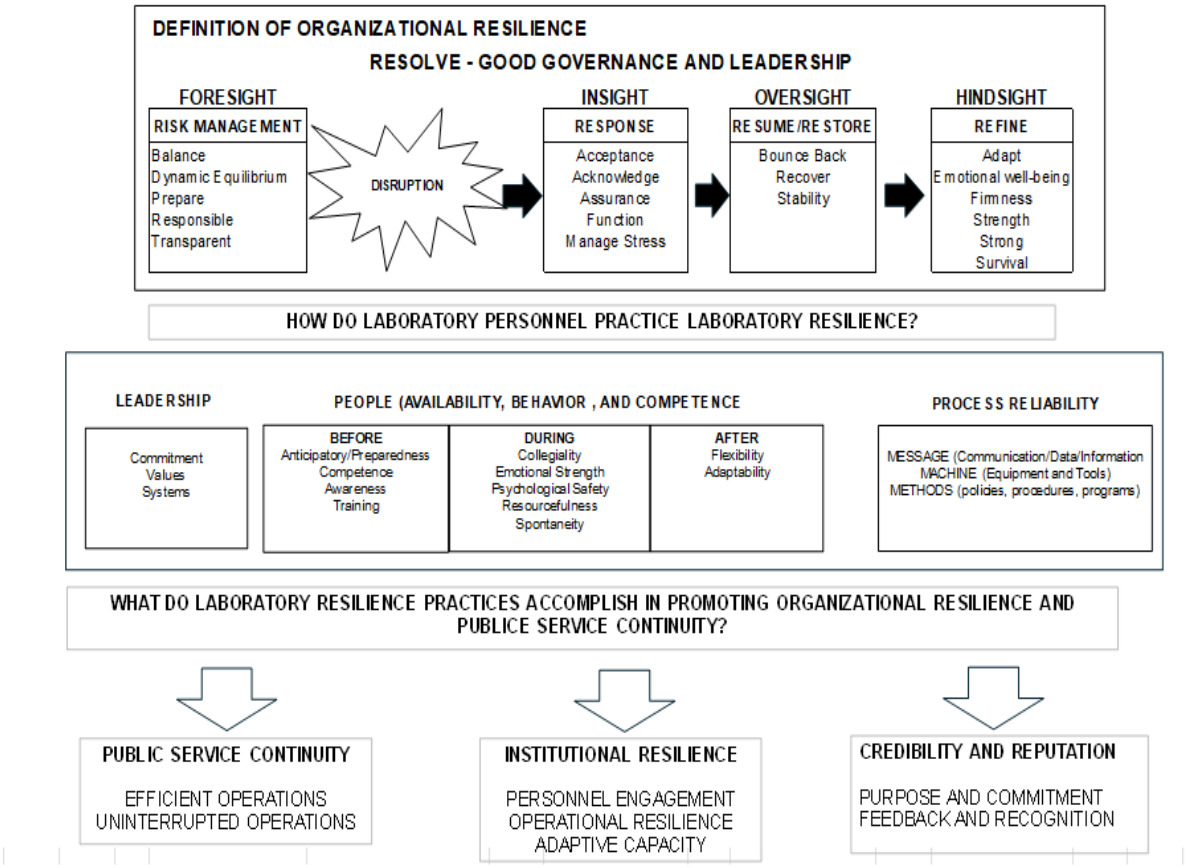
Resilience as Situated Practice: Ethnomethodological Insights. The participants responses revealed that resilience is not a fixed capacity but rather a practical accomplishment that they have collaboratively achieved through their interactions, innovation, and laboratory routines. This is consistent with Duchek's (2020) emphasis on resilience as a dynamic process that draws on anticipating, coping, and adaptive abilities. Laboratory personnel demonstrated the ability to realign resources, sustain work continuity despite logistical limitations, and co-create informal knowledge-sharing methods. This is associated with the ethnomethodological perspective when resilience is evident through the laboratory routines and the situated sense-making practices of laboratory team members described. This is closely aligned with the study of Arranz et.al. (2022) that the resilience of a laboratory culture is grounded on a "pillar of in-person communication, expertise sharing, coherent social and professional relationships".

By demonstrating a context-sensitive explanation of laboratory resilience and how these dynamics unfold in an untapped resource-challenged government research and service laboratory, fundamental concepts of organizational resilience have been enriched. Every day, embodied resilience that might otherwise go unnoticed in macro-level resilience frameworks was effectively brought to light by the ethnomethodological approach.

Proposed Framework: How Laboratory Resilience Practices Accomplish and Promote Organizational Resilience in Public Service

The researcher proposes the following framework on Laboratory Resilience: Enabler for Organizational Resilience and Public Service Continuity:

Figure 1. Proposed Framework: How Laboratory Resilience Practices Accomplish and Promote Organizational Resilience in Public Service.



This proposed framework, comprising four interlinked domains - Risk Management, Response, Recovery, and Refinement - offers a process-oriented approach to understanding resilience as it unfolds across time and institutional levels. The routine actions of laboratory personnel demonstrate that resilience is not only technical in nature, but also cognitive, emotional, and moral. It is achieved through shared responsibility, proactive leadership, training, and a culture of foresight and reflection. The integration of the Foresight-Insight-Oversight-Hindsight perspectives within the model deepens the understanding of how resilience is articulated before, during, and after disruptions.

Ultimately, laboratory resilience contributes directly to organizational resilience by enabling uninterrupted, responsive, and credible service delivery. These practices affirm the laboratory's role in sustaining regulatory functions and public trust, particularly in the face of environmental risks, limited resources, and systemic challenges commonly encountered in the Philippine public sector.

Chapter VI

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

This research examined how laboratory personnel at the regional laboratory define and practice resilience and how these practices enable institutional resilience and public service continuity. Using an ethnomethodological approach, the research surfaced four temporal dimensions of resilience—risk management (before), response (during), resumption/restoration (after), and refinement (post) anchored in leadership's resolve. These domains illustrate resilience in routine, relational, and reflexive actions across disruption timelines.

Three core themes were revealed as domains of laboratory resilience:

1. **Leadership** – Characterized by commitment, values, and systems, leadership of the institution models ethical governance, empowers teams, promotes inclusivity, and reinforces structured management systems.
2. **People** – Laboratory personnel demonstrate resilience through anticipatory actions, competence, emotional strength, psychological safety, collegiality, adaptability, and training. These practices reflect an embodied commitment to operational continuity.
3. **Process Reliability** – Encompassing methods, data management, communication, and equipment, the laboratory ensures reliability through standardized protocols (e.g., FMEA, ISO), risk assessments, and proactive resource planning.

These dimensions foster **institutional resilience** through:

- **Public Service Continuity** – Maintaining uninterrupted, efficient operations.
- **Personnel Engagement** – Fostering cooperation, emotional strength, and shared responsibility.
- **Adaptive Capacity** – Enabling continuous learning, strategic foresight, and transformation.
- **Credibility and Reputation** – Strengthening public trust through compliance, feedback mechanisms, and ethical service delivery.

This study supported the idea that resilience is a socially constructed and interactionally accomplished practice rather than a static attribute. It is embedded in the everyday work of personnel and reinforced through leadership, collaborative routines, and adaptive strategies.

Conclusion

This study concludes that resilience within the institution's laboratory is a situated, socially enacted, and ethically grounded practice. Rather than a static organizational trait, resilience is produced and sustained through daily activities, interpersonal coordination, and strategic leadership rooted in public accountability.

Recommendations

Develop an Institutional Laboratory Resilience Framework

Operationalize the four identified temporal domains—risk management, response, recovery, and refinement into laboratory policies, standard operating procedures, and disaster risk management plans.

Enhance Ethical and Systemic Leadership

Implement leadership training programs focused on foresight, inclusive decision-making, and accountability aligned with environmental governance and public service continuity mandates.

Support People-Centered Resilience Practices

Formalize initiatives to promote mental health, adaptive capacity, professional recognition, and cooperative work cultures across laboratory functions.

Reinforce Process Reliability and Infrastructure Readiness

Institutionalize regular calibration, safety training, risk analysis (e.g., Failure Mode and Effect Analysis), and document control as core resilience-building mechanisms.

Align Laboratory Resilience with National Mandates

Integrate findings into the agency's PSCP in compliance with R.A. 10121 (Disaster Risk Reduction and Management Act of 2010) and Civil Service Commission Memorandum Circular No. 2, Series of 2021.

Foster Regional and Inter-Agency Learning Communities

Establish cross-regional knowledge-sharing platforms among public laboratories to exchange good practices, co-develop resilience frameworks, and enhance sector-wide preparedness.

Implications of the Research

1. Theoretical Implications

Development of a Contextual Theory of Laboratory Resilience

The study introduces a grounded conceptualization of laboratory resilience as a processual and interactional phenomenon, rather than a static attribute. It challenges top-down perspective by situating resilience within the day-to-day routines, decisions, and meanings constructed by laboratory personnel.

Temporal Structuring of Resilience

The proposed four-phase temporal model—risk management, response, recovery, and refinement—offers a novel framework for examining how resilience is experienced across time. This temporal framing can inform future research designs, monitoring tools, and conceptual frameworks for organizational resilience.

Contributions to Ethnomethodology in Organizational Research

By applying ethnomethodology to a public service laboratory, the research shows how resilience is socially produced through routine interactions, role performance, and practical reasoning. This expands the methodological reach of resilience research into micro-sociological domains.

2. Institutional Implications

Laboratory Personnel as Agents of Organizational Resilience

The study affirms that resilience is co-constructed at the operational level by laboratory personnel who adapt, improvise, and support one another in times of disruption. Their ability to sustain continuity, emotional stability, and professional accountability is central to institutional survival.

Leadership as an Enabler of Ethical Governance

Leadership emerged not only as a structural function but as a moral commitment demonstrated through role modeling, transparency, and responsiveness. These practices are essential in nurturing trust, accountability, and resilience in public institutions.

Process Reliability as a Strategic Resource

Institutional reliance on process consistency – policies, procedures, calibration routines, failure mode analysis, and data integrity—was shown to be vital for resilience. These technical practices function as stabilizing mechanisms that ensure both safety and service continuity during disruptions.

Post-Disruption Learning and Organizational Adaptation

The “refinement” domain of resilience highlights that disruptions can be productive as they create opportunities for institutional learning, review of systems, and transformational improvement.

3. Policy Implications

Enhancement of Public Service Continuity Plans (PSCPs)

The findings provide empirically grounded insights to refine PSCPs in compliance with RA 10121 (Philippine Disaster Risk Reduction and Management Act) and CSC Memorandum Circular No. 2, Series of 2021. The temporal and thematic frameworks offer a structured way to integrate laboratory resilience into government continuity planning.

Justification for Institutional Investments in Resilience

Evidence from this study supports budget proposals and legislative priorities that advocate for improvements in laboratory infrastructure, staffing, information systems, and emergency protocols in public laboratories.

Alignment with National Disaster Risk Reduction Strategies

By showing how resilience operates at the micro-level, this study underscores the value of integrating operational laboratories into national and regional risk management and adaptation frameworks.

Inclusion of Laboratory Resilience in Sectoral Policies

The proposed framework developed can inform sectoral guidelines or administrative issuances by DENR, DOST, DOH, DOLE or similar agencies, specifically recognizing laboratories as critical service units.

4. Practice Implications

Formalization of Resilience-Oriented Leadership Practices

Leadership training and development must incorporate modules on ethical decision-making, disaster foresight, team dynamics, and emotional intelligence to prepare laboratory leaders for disruptive events.

Continuous Training and Psychological Preparedness

Laboratories should institutionalize regular drills, team debriefings, mental health support, and skills-based training to maintain both functional and emotional readiness of staff.

Strengthening Internal Communication and Role Clarity

Practice resilience through routine transparent communication, clear role distribution, and collaborative problem-solving, especially during and after disruptions.

Integration of Risk Management into Routine Operations

Tools like Failure Mode and Effect Analysis (FMEA), checklists, calibration logs, and real-time reporting systems should be embedded into daily laboratory operations to preempt disruptions and enhance system reliability.

Replication Across Regional Laboratories

Regional laboratories and similar institutions may use this case as a model for training, benchmarking, or peer-to-peer learning across regional and national laboratory.

Future Research Directions

Comparative Studies Across Regional Laboratories

Future research can adopt a multi-site comparative approach to examine how laboratory resilience practices differ across regional laboratories or other agencies with laboratory mandates.

Integration of External Stakeholder Perspectives

Studies involving regulators, clients, and community beneficiaries could help triangulate internal resilience practices with public trust and service effectiveness.

Longitudinal Exploration of Resilience Trajectories

A longitudinal study may provide deeper insight into how laboratory resilience evolves over time, especially in response to recurring or layered disruptions.

Quantitative Validation of the Temporal-Process Model

The four-domain model (risk management, response, recovery, refinement) may be operationalized into survey tools or metrics to measure laboratory resilience across institutions.

Digital and Technological Resilience in Public Laboratories

Future studies could explore how emerging digital systems contribute to or challenge laboratory resilience.

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APPENDICES

APPENDICES

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INTERVIEW QUESTIONNAIRE

INTERVIEW QUESTIONNAIRE

The primary objective of the interview is to identify how the laboratory personnel practices laboratory resilience and to examine in what ways these practices promote organizational (institutional) resilience (public service continuity).

OPENING

1) Participant's introduction – getting to know one another.
2) Brief overview of the study.
3) Information for the interviewee that the data is collected for the purpose of academic research.
4) Interviewee is assured of ethical considerations and confidentiality.
5) Consent to audio record the interview.

DEMOGRAPHICS

1) Name of institution
2) Research area
3) Interviewee information
    - Name:
    - Title:/Department/Position:
    - Role Description and responsibilities:
    - Years working in the organization:
    - Educational background:

RESEARCH QUESTIONS:

How do you practice laboratory resilience and in what way does it promote organizational (institutional) resilience?

QUESTIONS:

1) What is your definition of resilience?
2) How do you practice laboratory resilience and in what way does it promote organizational resilience (public service continuity)?
3) What are the significant challenges/disruptions that the organization faced recently?
4) How do you cope with these challenges? What have you learned from these events?
5) What is important about your role as _____when managing disruptions? What personal attributes are particularly helpful for you when facing challenges?
6) How does resilience affect how the laboratory is operated?
7) What are your improvement strategies on resilience to ensure public service continuity?

CLOSING

- Thank the interviewee.
- What have I not asked?
- Request for interviewee's availability for follow-up interview (in case there are clarifications)