

A FRAMEWORK UNDERSTANDING ORGANIZATIONAL CULTURE AND SUSTAINABILITY TOWARDS TECHNOLOGY ADOPTION WITH THE AID OF MANAGEMENT INFORMATION SYSTEMS IN THE TELECOMMUNICATIONS SECTOR

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Abstract

Business organizations play an influential role in championing sustainability. However, little research has been done to investigate how organizational culture and technology adoption affect an organization's capability to support sustainability. How we assess technology roadmaps integrated through a management information system depends on the data availability, level of needs vis-à-vis set goals and aspirations outlined in each organization's vision, mission, and values (VMV), driven by organizational culture and external demands. These parameters steer their mindsets on achieving them, either in a way wherein everything is considered or in a process in which anything is to be done regardless of the outcome and impact as long as they achieve the required output. This research proposes to study the intricacies of technology adoption, organizational culture, and how the process of "breaking down the Green Wall" with the aid of a management information system. An analytical framework shaped by the related literature was used, serving as a primary process for a computational model. The research examines the Interdependence of each perspective, along with the internal and external factors, including gaps that lead to the integration of business and environmental sustainability towards technology adoption.

Keywords: Agent-based modelling, Management information system, Organizational culture, Technology adoption.

1. Introduction

Organizations face the possible paradigm shift to sustainability, which requires an alignment in mindset and integration of initiatives into operations to make them successful [1]. The business sector's goal to further improve the quality of living through the migration of existing technology has increased. Implementation of technology roadmaps is already driven by business needs but possesses an impact on the environment.

Technological improvements and innovations are already driven by business needs and are directly related to globalization. Its primary goal is to produce valuable service improvements toward its existing coverage reach immediately. It is seen that these outputs impact the environment and that organizations need to manage their effects. Different strategies and processes are readily available to improve the process and minimize adverse environmental impacts, thus achieving overall sustainability. Telecommunications companies are urged to impose environmentally preferred purchasing criteria, clean energy sources, and the arrangement of taking back and recycling their bought/sold equipment.

Technological capability, technical skillsets, consciousness, personal behaviour, organizational culture, and worldview support the individual and collective perspectives, including internal competencies and conflicts. These perspectives form Interdependence with a set of competencies, contests, and gaps, further driven by external and internal factors. The development of technologies affects individual life, traditions, and habits that drive the creation or improvement of technologies [2].

Technology also serves as a platform that captures, processes, and communicates information that can be used as part of the decision-makers tool [3]. It is an omnipresent element that aids in creating opportunities supported by the technology-enabled process that affects every stage of the business. A management information system is one of the tools utilized to support management to achieve the correct information at the right time. Its principal function is to gather, process, and communicate information that can aid business strategies or models such as Management by Objectives (MBO), Critical Success Factors (CSFs), Balanced Scorecard, Knowledge Management (KM), Total Quality Management (TQM) and Business Process Re-engineering (BPR), that aims to improve business and environmental sustainability [4].

Before applying sustainability measures effectively, organizations' decision-makers must understand the underlying worldview, operating targets, social and environmental externalities [1]. They need to understand the organization's business position further and then translate these into a possible set of environmentally sustainable goals and ensure that technological requirements are not at stake. It is also empirical to ensure that end-users recognized the benefits of the technology improvement to motivate them to use it and help them accelerate the technology adoption [5]. However, the transformation would not be successful because of the absence of organizational commitment and skillset capability [6].

According to Lazlo [1], when an organization combines business performance goals with environmental responsibility and social responsibility, it is creating sustainable value; it is "breaking down the Green Wall" [1]. There is a need to further review the current organizational position and gaps in the context of their

strength, weakness, opportunities, and threats and then translate these into a possible set of sustainable goals that can keep the balance between technology adoption, business, and the environment. Corporate strategy reassessment is required to ensure a successful technology transformation aligned with the new business opportunities and directions [7]. Awareness of the technology's positive advantages should be done with the cooperation of all stakeholders that aims to develop the correct skill sets and respond to the business and consumer demands [8]. Technology awareness, evaluation, intention to adopt, behaviour, and confirmation stages are assessed to validate the adoption level of an organization or an individual [9].

The study aims to develop an analytical framework on how technology adoption is affected by organizational culture and inclination towards sustainability. There is currently no known study on the Philippine telecommunications industry relating to technology adoptions' Interdependence in achieving sustainability towards business, technology, and the environment. The emergent analytical framework can help build a process that can fulfil the stage 1 requirement in building a computational model that can simulate the possible impact of technological adoption and culture.

The study continues by initially understanding related literature that drives a paradigm shift or what is still needed to meet sustainable value creation and technology adoption. The study presents ways to transform mindset, organization cultures, and technological adoption with critical stakeholders as an essential part of business conduct through the emergent analytical framework. All levels within the organization should understand the underlying worldview, operating targets, social and environmental externalities before sustainability measures can be implemented effectively [1].

How does organizational culture, along with readily available international and local standards, policies, processes, programs, initiatives, and advocacies, affect the telecommunications industry's capability to achieve business and environmental sustainability towards technology adoption?

The following specific questions guide the study:

- i. What are the bottlenecks that hinder the organization's integration of technology adoption, business, and environmental sustainability?
- ii. How does organizational culture affect the alignment of technology adoption and sustainability?
- iii. What bottlenecks hinder the organization's integration of technology adoption, business, and environmental sustainability?
- iv. What are the organizational experiences and differences that need to be mitigated to attain technology adoption and sustainability?

2. Business and Environment Sustainability

The fast depletion of the earth's capacity to support our needs serves as widespread evidence on how global scenario for the competition of diminishing resources coupled with increasing advanced technology and rapid population [10]. Sustainable development started in the mid-1980s to bridge the gap between environmental issues with the increase in human activities' ecological

consequences and human development issues due to socio-political concerns [11]. Sustainable business practice is already a roadmap in each organization due to a wide range of social and environmental issues within their organization, society, and community [12]

Sustainability somehow cannot stand and succeed on its own without the stakeholders' support and intervention. Each stakeholder's philosophical and moral understanding of the association between humanity and nature is one of the most critical observational and philosophical issues [11]. How to keep the balance between these relationships is one of the main bottlenecks to implement sustainable development.

Numerous factors made it difficult to understand, examine, and participate in sustainable efforts despite having many policies, studies, theories, and philosophies due to the uncertainties we have encountered and continue to experience. Ciuffo, et al. [13] sees that the problem with delays coincides with how we comprehend the world, which allows us to provide clear and specific answers on what is sustainable and what is not. The systems used to measure sustainability lack clear definitions and fail to address the Interdependence between the social, economic, and environmental contexts [14]. This scenario is the primary reason why everyone should be aligned and well educated in fully understanding the concept of sustainability.

2.1. Attitude towards sustainability

Individual competencies and attitudes are human factors that affect the development process and sustainability [15]. Understanding the factors that influence attitudes towards sustainability is necessary, allowing both policies and initiatives within the organization. Filho [16] described the factors that affect individual attitudes:

Table 1. Factors that affect individual attitudes.

Attitudes	Implications
Knowledge	It provides how sustainability is defined, including its implications
Background	Individual training often influences how an individual's level of acceptance of sustainability
Experience	The degree of exposure to environmental and social affairs make it easier for an individual to understand the role of sustainability
Perception	The holistic view of the different external elements helps to have a broader appreciation of sustainability
Values	An individual's values can dictate if how they often determine whether his/her attitudes are beneficial or not

2.1.1. Factors affecting attitude towards sustainability

Bonnet's frame of mind concept asserts that sustainability has many dependencies and factors besides their attitude towards the environment. He also cited. An essential feature of his view is "that it locates the essence of sustainability like human consciousness itself and thus differs both from conventional anthropocentrism and eco-centrism" [17]. Bonnet's view centres on human consciousness, 'intrinsic valuing of persons,' and how they co-exist with nature as the master goal to balance humanity and nature.

The study also acknowledges several significant contributions, particularly of Wilber [18]. His integral theory focuses primarily on how integral vision and practice can attain personal transformation and acknowledge the four most important Kosmos dimensions: the individuals' interior and exterior and their collective factors. He directly differentiates the individual and collective subjective domain, cultural values inter-subjective domain, and objective domain of the physical world of the individual and the society they dwell in [18].

He affirms that unsustainability stems from the overreliance on Western thought that focuses on the materialistic view. A chronological synthesis of human evolution came from his comprehensive comparative study, called the 'integral vision' [18]. The integral vision is represented in four quadrants, as shown in Fig. 1. Quadrant 1 shows the balance between the individuals subjective/internal (I) and is shared by its organization's culture (We). The right-hand quadrants show the individual's objective/external world (It) and society they dwell in (Its).

The first quadrant illustrates the individual's refining stage that touches their internal awareness and experiences. This state leads to a particular mindset based on their beliefs, purpose, assumptions, and values. It also contains different levels, streams, states, and categories of consciousness. The second quadrant illustrates the Interdependence of individual behaviours and the objective world, its individual view in objective and empirical, "scientific" fashion. The internal developmental stage is represented in the third quadrant, which constitutes the organizational culture based on its core foundation, understanding, values, and beliefs. Lastly, the fourth quadrant focuses on the collective exterior similar to system sciences, social systems, techno-economic structures, and environmental networks.

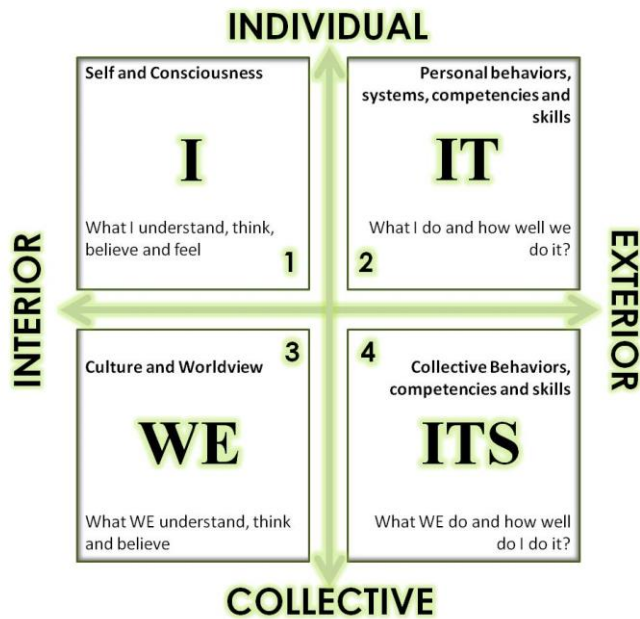


Fig. 1. All quadrants, all levels adapted from Wilber [18].

This model is used to plot the management and employee's perspective with the organization that can be considered a holistic overview and serves as a sequential roadmap of the individual evolution towards technology adoption and sustainability.

2.2. Sustainable value creation

An organization's milestones in attaining sustainability by Laszlo's qualitative study can serve as a basis and provide the indicators that need to be considered [1]. His study was committed to the principles of sustainability. Sustainable value, according to Laszlo, is the product of the integrated sustainability strategy whereby the business-main purpose is to create value for both shareholders and stakeholders [1]. It is a lasting value based on economic, environmental, and social performance. Laszlo's model shows how marketplace opportunities for stakeholder satisfaction converge with new ethics to make a substantial and compelling case.

The case studies highlighted cultural transformation, risk of strategic conditions, sustainability branding with customers, and business challenges and financial pressures faced by internal sustainability champions. Laszlo's key findings relate to the paradigm shift and personal transformation shift that focuses from shareholder thinking to a stakeholder management mindset. His model was derived from his qualitative studies that focus on business organizations' commitment to sustainability principles and traces the journey of a hypothetical CEO named Michael Watts. Watts starts with a fragmented business approach where its primary focus happens within the organization's goals. As the years pass, Watts has several important realizations and makes essential changes in the organization. One is that his company must endeavour to "tear down the Green Wall." [1]. Laszlo describes this process as bridging the demarcation between business and environmental performance [1]. Laszlo's CEO introduces his new vision for an integrated sustainability strategy as shown in Fig. 2.

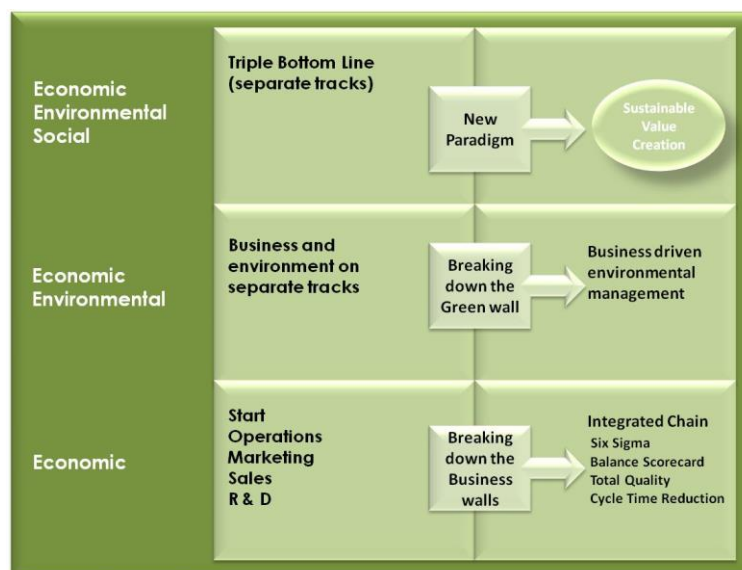


Fig. 2. Integrated bottom line model adapted from Laszlo [1].

Thus, from a profit-centered approach, Lazlo's CEO succeeded in steering his company towards an optimized business process to improve quality, minimize defects and ensure customer satisfaction. He put environmental performance at the same level as business performance. Later, he added social performance. This addition ensured that their core business would have a minimal negative environmental impact. In the end, Watt's organization transformed into one that balances profit with its environmental and social impact.

2.3. Personal transformation

The introduction and creation of new technologies pave the way for some promises of changing human life either through improve human performances, computational machines, and different processes to interact with the environment and apply calculations to process information that creates a new platform for social interaction [19].

There is no single statement that can cover the connections between science, technology, and environmental issues [20]. Technology has generated different ethical challenges in the Interdependence of human and environmental interaction. The shift towards green thinking, cleaner production, and sustainability is now being employed in different corporate sectors in varying degrees, depending on the internal and external driving forces that eventually affect their decision-making.

The majority of the business sectors realized that they needed to pause and reflect on the growing need to balance the environment and technology. Green technology was developed and used to protect the environment and conserve natural resources. This concept is a must in today's scenario to achieve environmental sustainability and lead sustainable life [21].

Lazlo has created a model that represents a quick but detailed glimpse of how traditional business has evolved from its moral development from "me" to "us" and to "all of us" way of thinking [1]. It shows the evolution from a fragmented business approach to an organization that balances social and environmental issues to meet its business targets.

The idea of personal transformation that tackles the four factors in achieving transformation was also introduced by Wilber [18].

2.4. Management information system

A management information system is an organized approach to retrieving, storing, analysing, processing, and communicating gathered data to internal stakeholders and management to achieve set goals and aspirations that affect business and environmental sustainability [3]. It also maximizes technology capabilities to support different organizational hierarchies, business, and environmental stakeholders.

David and Olson defined a management information system as an integrated information system that creates or supports models used by organizations [22]. An information system is a set of components that collect, retrieve, process, store and distribute data on time [23]. The management utilizes the data to align organizational direction with their culture and goals, affecting the business, technology, and environment.

Timely and accurate information supported by facts and Fig. 3 in the desired format aids management in defining policies, procedures, and methods. It is a vital organizational resource that serves as a tool for business decisions and helps define or strengthen organization culture by further understanding its employees. Employees are the most valuable resource that drives the organization's culture and technology adoption.

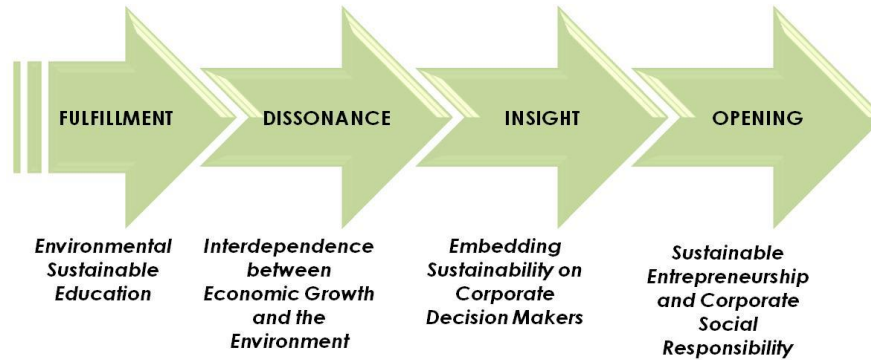


Fig. 3. Four factors that facilitate personal transformation adapted from Wilber [18].

The technology ensures that information is efficiently processed and conveyed to stakeholders. The organizational analysis utilizes this information that aims to understand the business ecosystem. The organizational analysis's main goal focuses on knowing or understanding technology trends, the environment, and all stakeholders within the organization with the help of an information system.

An information system is an enabler to attain a paradigm shift, change direction, assess current organizational culture, or gear the company towards technology adoption. It is a set of hardware, software, and a database used for data processing, visualizing complex issues, and controlling different organizational activities. The system collects unstructured data from defined sources which are loaded and retrieved for processing. The internal structure, resources, and data are analysed to identify the characteristics of the proposed system and understand the interaction to design a set of policies and parameters. It interacts with each stakeholder: employees, customers, competition, regulatory, and other internal or external factors. The raw and processed data is stored in a database and formatted either in management, regulatory, or general format.

A database is the main repository of collected data designed to achieve planned data requirements logically related and described in the identified parameters. The information can be accessed and updated within each data warehouse and automatically shared or analysed depending on the set rules and guidelines.

2.5. Agent-based modeling

Agent-based models (ABMs) are important tools used in the analysis of policies by helping in the exploration of emergent outputs that can aid interdisciplinary decision-making [24]. Green Technology policies are hinged with four main pillars: Energy, which promotes efficient utilization; the environment that aims to

minimize environmental impact, Economy that targets to enhance economic development through the use of technology; and Social that aspires to improve quality of living [21].

Different processes and tools are used to observe different phenomena, such as new social norms formation, often using a reductionism approach called equation-based modeling (EBM). This tool has had historical application in the field of mobile technology adoption, where studies are classified as either statistical regression-based studies [25] or (MCDM) Multi-Criteria Decision Making [26].

Identifying major criteria that affect the adoption of telecommunication services frequently used MCDM were [27] used the analytical hierarchy process (AHP). The study identified four major factors (1) economic, (2) relational, (3) knowledge, and (4) convenience. Another study was conducted in [28] that studied the significant influencers on mobile service. That study discussed five factors; social, habits, technology, ease of use, and usefulness. The last two factors exhibited that they played a vital role in the adoption process [28].

A complex adaptive system (CAS) has helped overcome the deficiencies and limitations of the reductionism approach. Agent-based modeling (ABM) is the most sought methodology for CAS and has seen increased application among academia and industry [29]. It is a research method representing social processes applied in a simulation program that can distinguish regressions and ethnography [30]. It has been developed to validate and verify multiple ranges of academic phenomena [31]. ABM's application includes the utilization of services of sustainable ecosystems [32], economic sciences [11], and environmental technologies [33]. The emergence of information systems and the use of big data also significantly impacted the application of ABM [34]. Statistical analysis can support different studies based on multiple numerical simulations [35]. There is available off-the-shelf software that is capable of modeling and simulating a system. Anylogic is software that is applied in a discrete system and an agent-based simulation system that represents multiple subjects and can be integrated with a Geographic information system [36].

However, based on available literature and applications, no study has been conducted on the technology adoption, culture, business, and sustainability integrated by readily available tools, concepts, theories and are applied to an ABM model in the Philippine Telecommunications industry. The prime purpose of this study is to create a textual model of ABM, which is the first part of its iterative phases, and identify how it can be integrated into a management information system.

3. Research Method

Quantitative methods have been found insufficient by leadership scholars in answering cultural inquiries and explaining phenomena happening in their focused subjects. This approach paved the way for qualitative research, which is "a form of systematic empirical inquiry into meaning" [37]. This research type aligns with the agreed rules of qualitative research communities, which define systematic as planned, ordered, and the public. At the same time, it is also grounded in the world of experience. As per Denzin and Lincoln, qualitative researchers based their studies on natural settings. They try to interpret different occurrences on how people translate or present them to them [38].

The two research types are distinguished by Evered and Louis [39] into two standpoints: quantitative studies often support "inquiry from outside," while whereas qualitative are "inquiry from inside." They differ based on how the researcher is engaged, the type of contact with subjects, and involvement in the physical setting. The traditional "outside" quantitative research intends to isolate the phenomenon, reduce the level of complexity in the analysis, and test previously derived hypotheses. On the contrary, the "inside" qualitative approach seeks a holistic picture from historically unique situations that emphasize habitual meanings and uses an inductive mode to let the data speak.

Grounded theory and Agent-Based Modeling are utilized to meet the research goal. The primary reason for justifying Grounded Theory's use is its commitment to lessening the researcher's bias (Glaser, 1992; Glaser & Strauss, 1967; Strauss & Corbin, 1990). It lessens the researcher's preconceived notions brought by internal knowledge and experience since findings can emerge from the collected data. The credibility of the generated theory can then be ensured. It is assumed that this methodology can respond to subjective and objective inquiries that investigate the organizational cultural understanding and practices and explain the sustainable environmental actions within the targeted subjects. Using this theory can fulfil this process and produce a systematic step-by-step procedure, concepts, and guidelines for further studies in the business sector.

On the other hand, agent-based modeling (ABM) is a computational model that looks into systems of several interdependent agents. This type of modeling is used in many domains, including the formation of social norms [40]. As discussed by Wilensky, the method involve the following three building blocks [41]:

- i. Agents - these are the basic computational units of ABM characterized by properties, habits, or behaviours. The internal or external states of the agent's properties can be changed by its behaviours, which are rules-based on how it can act or decide [42].
- ii. Environment - this setting requires that conditions around the agents interact within the model. It is an environment where an artificial social life unfolds [42]
- iii. Rules of behaviours - The rules enable agents to interact within themselves and their environment [42].

ABM covers three sequential and repetitive phases; Design, implementation and evaluation, and output analysis [41]. For this study, the authors focus on the designing phase.

The designing phase's main purpose is to create a primary process which is the textual model of ABM. The textual model serves as the conceptual model, which is documented in natural language and includes all the rules of agent's behaviour and properties, environment, and how agents interact with each other.

3. Results and Discussion

The discussed theories of Filho [16], Wilber[18], and Laszlo[1] integrated with the organization's Vision, Mission, Values (VMV), internal and external factors have arrived at an integrated framework.

On the first research question - "What are the bottlenecks that hinder the organization's integration of technology adoption, business, and environmental

sustainability?" the literature shows that a clear understanding of the company's programs both in the perspective of technology adoption and sustainability can help the employees value the impact, rationale, benefits, and achieved output of such programs. Focusing primarily on the organization's day-to-day operations can result in reactive compliance to policies and regulations due to a lack of evident appreciation of the programs. Knowledge enrichment aligns the management, employees, and other stakeholders to a specific direction towards adoption and sustainability. Effective laws, monitoring, and institutional system ensure smooth and seamless implementation of programs. These policies provide an opening to individuals and organizations to become conscious of their actions and performance. Internal and external knowledge within the organization directed to the technology adoption and sustainability mainly affects individual understanding and collective mindset.

On the second research question - "How does organizational culture affect the alignment of technology adoption and sustainability?" the framework shows how organizational culture affects technology adoption and sustainability. Experiences honed through awareness, learning, education, continuous involvement within the organization can lay down the holistic direction of the organization. The culture serves as the main driving force that sustains an organization. This aspect can be related to Kotter and Heskett's [43] definition in a more profound or less noticeable level regarding shared values within the organization, which continue even when the employee membership changes. Organizational new employees automatically adapt their behaviour patterns or encourage their fellow employees on a more noticeable level. The organizational culture can evolve due to the various influencing factors such as the organization's environment, socialization process, leadership, and management practices [44]. The value and importance of individual actions and initiatives should not be neglected. Kincheloe and Weil's [45] statement can be related to this instance: "people are not abstract individuals who live as fragments, in isolation from one another [but] become who they are and change who they are as a result of their connections to the social sphere". These individual tries to effect changes through the attempt to influence, resist, and change the systems they are embedded within based on their own belief, understanding, and values infused by the organization or its culture.

On the third research question - "What are the factors that can affect individual understanding and collective mindset towards?" crafted policies that are currently missing or are not fully implemented within the organization bring about a lack of engagement of employees. Therefore, the people do not know what to do, do not see the benefits of acting, anticipate difficulties associated with action, or feel it is easier to continue their current actions. Low organizational consciousness and awareness, ineffective communication and cascade, employee's mindset and thinking, and transparent management stand based on their involvement served as bottlenecks in integrating technology and sustainability within the organization.

On the last research question - "What are the organizational experiences and differences that need to be mitigated to attain technology adoption and sustainability?" It was initially established that different notions within the organization should be mitigated. Some employees may view the company as geared more towards profitability and less on the environment. A balance between monetary, technology, and the environment is integral to corporate strategy and management decision-making. Integration of technology strategy vis-à-vis sustainability initiatives, particularly on budget allocation, directs a concrete plan to

support proper waste disposal, utilize resources, and systematically organize things. It is also believed that there should be a Technology and Sustainability Champions to the accountable or lead group that can influence and mobilize the organization towards adoption and change in mindset.

The concepts were fit together to represent the Corporate Cycle which relates to the individual and collective perspective towards sustainability concerning organizational culture and technology adoption. It encompasses a holistic approach of the organization's responsibility for the environment and society and the actions needed to shift the virtuous basis of action from intellectual questions of right and wrong to the point of whether they are doing it sustainably and creating sustainable value. Figure 4 illustrates the framework towards the organizational technology adaptation.

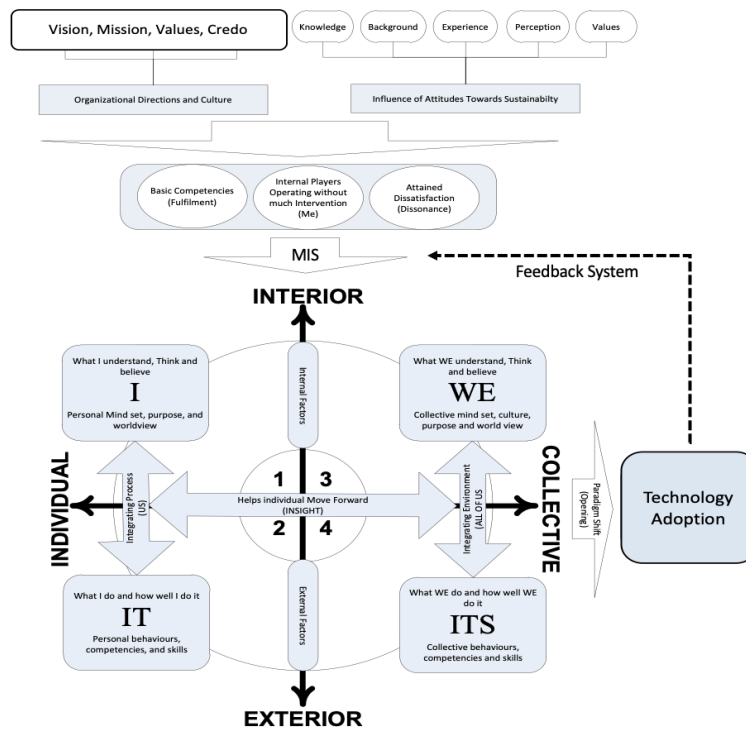


Fig. 4. Organizational framework towards technology adoption.

4. Conclusions

This study met its main objectives and developed a framework segmented into four central portions (1) culture; (2) integration towards sustainability; (3) its interdependence, and; (4) technology adoption.

In the final framework, Interdependence is represented by four squares inside the circle (What I understand and I do / What We understand and What We do), Internal and External Factors, Individual and Organizational Gaps, Competence, and Conflict. These perspectives are influenced by internal factors, namely, business direction, internal policies and business process, and external factors such as existing government laws and regulations, international standards, and community programs.

The integration process takes place on the individual and organizational levels. Integration occurs when gaps in identified competencies and organizational conflicts are resolved. The integration can help the individual and the organization achieve business and environmental sustainability towards technology adoption.

When all factors fall into place, integration towards environmental sustainability is achieved. At this point, through the integration of environmental and business performance, the company, together with employees, may be said to be "breaking down the Green Wall" [1].

The Knowledge enrichment that aligns internal stakeholders affects the mindset towards technology adoption and environmental sustainability. Figure. 5. shows a clear understanding of the current program's impact, rationale, and benefits is needed. The embedded mindset is that management should start and lead these initiatives to be successful. The management information system integrated within the organization's data source can aid in creating effective law, monitoring, and institutional system supported by management can ensure alignment across the organization.

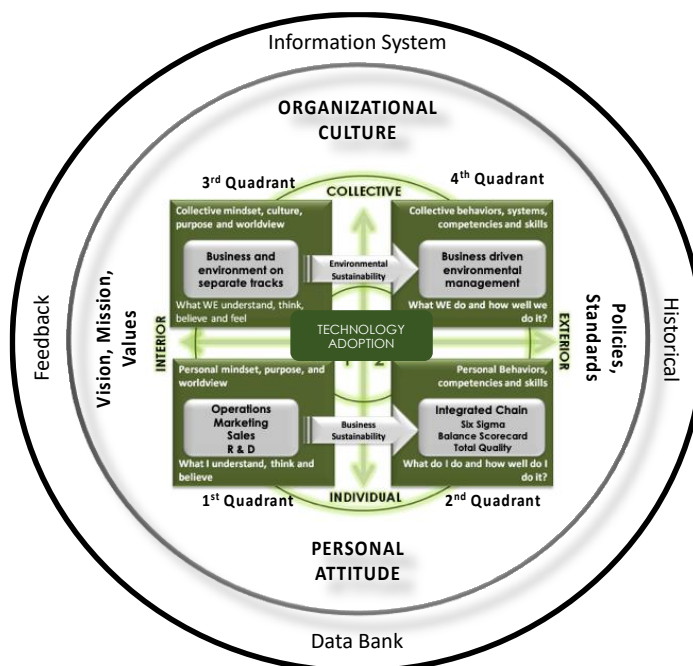


Fig. 5. Framework in understanding organizational culture, its interdependence with sustainability and integration towards technology adoption.

The need to improve the active involvement of management and employees can help ensure the integration of technology adoption and sustainability initiatives within the organization. One of the significant barriers is employees not knowing what to do beyond their current task and thinking it is inconvenient, time-consuming, not enjoyable, and not remarkable to do individual initiatives. Increasing consciousness, establishing awareness, effective communication, and a

clear management stand can encourage everyone's active involvement. Through this, everyone can be in sync and can move forward towards a common aspiration.

The different preconceived notions within the organization need to be mitigated to attain environmental sustainability. Employees still see that the company is geared towards profitability and less on the environment. Organization values should align with the business directions. A balance between monetary and the environment should be an essential part of the organization's strategy and management decision-making. Creating a cost assessment that looks beyond business boundaries, considering environmental protection, and allocating the budget should be done. Their perception that information is not being delivered to them appropriately should be addressed by proper information dissemination, designing the surroundings to induce the employees to act, and creating a lead group that can influence and mobilize the organization towards environmental sustainability. The lead group or technology and environmental champion with a pro-environmental attitude can inspire and motivate employees using accurate and timely information from the organization's databank.

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