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A SYSTEM OF SYSTEMS APPROACH TO MANAGING COASTAL CITIES: PROSPECTS FOR ENHANCING SUSTAINABLE TOURISM AND DISASTER RISK MANAGEMENT IN THE PHILIPPINES

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Abstract

This paper introduces the challenge of addressing interrelated development issues contextualized to the tourism economy and natural ecosystems in the Philippines with high vulnerability to natural disasters. This is aligned with the emphasis in the Sustainable Development Goals (SDG) and other global commitments advocating institutional paradigm shifts for achieving interrelated targets to protect lives, livelihoods, and generally development gains at both national and local levels. In light of the foregoing, the paper offers a System of Systems (SOS) approach, derived from the wide body of knowledge on Systems Theory, in understanding complex and inter-related issues that coastal cities face. Based on this understanding, to demonstrate its applicability, SOS is applied in two areas, namely, sustainable tourism and disaster risk management. The paper discusses and concludes with a way forward for institutionalizing systems theory application in city management for enhancing governance by improving evidence gathering and strengthening institutional feedback mechanisms.

Keywords: system of systems approach, systems theory, sustainable tourism, urban disaster risk management, coastal city governance

1. INTRODUCTION

Cities have developed along coastlines over time, primarily for trade, defense, transportation and food gaining advantage from their location. Coastal cities are also usually attractive tourist destinations and economy booster due to their unique natural flora and fauna that are distinct to coastal environments. However, the growth of cities most often adversely affects its natural environment due to conflicts with infrastructure, services and local livelihoods. The interrelations of the economic importance of tourism with pristine natural ecosystems makes it a challenging component in developing and implementing policies and strategies at regional, national, provincial and local levels.

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Coastal zones present a complex range of interrelated challenges from major economic contributions through tourism that need to be balanced with the fragility of the natural ecosystems and vulnerability to natural disasters. This is further catalyzed by global connectivity, demand for travel to pristine areas and increasing incomes with willingness to spend. Government departments fall short and sometimes fail to see these interrelations, leading to poor quality of services and deteriorating living environment. Underscored by the SDGs and the global commitments, institutional mechanisms that help to address the connectedness of such issues, will enable coastal managers, administrators and other stakeholders in strategy and policy formulation, infrastructure planning and implementation to build resilience within their governance processes. This will help sustain growing urban stress, maintain the ecosystem, balance the economy and mitigate risks from natural disasters and global pandemics.

As measured by the share of Tourism Direct Gross Value Added (TDGVA) to the Gross Domestic Product (GDP), the contribution of tourism industries to the Philippine economy was estimated at 12.7 percent in 2018[3]. The TDGVA amounted to PhP 2.2 trillion in 2018, higher by 14.3 percent compared to previous year's record of PhP 1.9 trillion (Philippine Statistics Authority, PSA, 2019). The Philippines coastline is 36,289 km long with land area of 298,170 square (sq) kilometers (kms); the sea area (measured as territorial waters up to 12 nautical miles) is 1,830 sq kms; coastal population is 62percent of the total population of 104.9 million; ocean economy[4] is US$11.9 billion (7 percent of GDP, gross value added - GVA, 2015, in constant prices); employment in the ocean economy is 2.15 million (5.5percent of total employment); the estimated value of coastal and marine ecosystems is US$17 billion; marine protected area as (percentage of territorial waters) is 6 percent; the Philippines ranks 62 on the Ocean Health Index (OHI), at 165 among 221 countries and territories[5]; Gross domestic product (GDP, in constant 2010 US$ prices) is US$ 303.4 billion; coastal and marine tourism contributes 25 percent to the ocean economy with

[3] TDGVA is the indicator to measure the value added of different industries in relation to tourism activities of both inbound and domestic visitors in the country.

[4] Ocean Economy (2016) comprises coastal and marine tourism-25 percent, fisheries and aquaculture-20 percent, mining and quarrying -7 percent, manufacturing-19 percent, construction-1 percent, electricity, gas, water supply-11 percent, construction-1 percent, ports and shipping-12 percent, financial intermediation (maritime insurance)-1 percent, real estate, renting and business activities-0 percent, public administration and defense-4 percent, education (PEMSEA, GEF, UNDP, 2018)

[5] Independent groups conduct assessments in regions, countries, states, and communities using the Index approach to measure ocean health. These assessments are useful to managers in policy implementation and decision making as they integrating local information and priorities. The assessment process is consultative and gathers stakeholders from various backgrounds (scientific, civil society, government, private sector, and NGOs) to better understand local demands and priorities, interrelations between multiple activities, and collaboratively establish management targets. OHI-Science.org is the primary resource for Ocean Health Index (OHI) scientific information, tools, and instruction and provides access to free available data, methods and information on completed and ongoing OHI assessments. These resources can be used by anyone to lead independent OHI+ assessments.

around US$3 billion in value added, with about 900,000 employed in this sector (PEMSEA, GEF, UNDP, 2018). More than 50 percent of Philippine municipalities and almost all major cities are coastal, and 62 percent of the population lives in the coastal zone (DENR, DILG, USAID, DA-BFAR, 2001).

The Philippines is highly vulnerable to natural hazards, in particular, typhoons, storm surges and rising sea levels. These are attributed to its geographic location in Southeast Asia. It is ranked third worldwide among countries with the highest risk according to the World Risk Report 2018, with an index value of 25.14 percent[6]. Since 1990, the Philippines has been encountered 565 disaster events which caused an estimated $US 23 billion in damages. Additionally, 85.2 percent of the sources of the country's production are susceptible to disasters, 50.3 percent of the total land area is economically at risk, about 60 percent of total land area is exposed to multiple hazards, and 74 percent of the population is vulnerable. Further, as the islands are located within the "Ring of Fire" between the Eurasian and Pacific tectonic plates, earthquakes, fires and volcanoes pose equally serious risks (UNDRR, ADPC, 2019).

The UNDRR projected that the country loses about 7.5 percent of its gross savings from multiple hazards every year. This is equivalent to around 69.1 percent and 10.4 percent of the government's social expenditure and total reserves, respectively. In absolute terms, the country's average annual loss from earthquakes, wind, storm surge, floods, volcanic eruptions, and other natural hazards is pegged at US$ 7.9 billion (UNISDR, 2015). It has been estimated that disasters can drastically cut the country's ability to reduce extreme poverty by 2030 from 65 percent to 35 percent (ESCAP, 2019).

While tourism contributes significantly to economic growth, the sector is threatened by unplanned developments and inadequately regulated tourism activities leading to environment deterioration of the land and sea, exacerbated by climate change and risks from disasters, detrimental to tourism itself. The major causes of pollution in the Philippine coastal waters include: domestic sewage and solid waste from cities, coastlines lined with resorts, hotels and promoters of tourism activities; oil and fuel leaks from ships; mine waste and sediments from quarrying and mining in coastal and upland areas, most of which also flows to the sea through streams, rivers, canals and shoreline areas; agricultural chemicals, industrial organic and toxic waste which, although often treated or restricted, is frequently dumped into rivers and the seas (DENR, DILG, USAID, DA-BFAR,

[6] "The World Risk Report is published annually since 2011 by Bündnis Entwicklung Hilft. Since 2017, the Institute for Law of Peace and Armed Conflict (IFHV) at Ruhr University Bochum is responsible for the scientific management and calculation of the World Risk Index. As a member of the Network on Humanitarian Action (NOHA), the IFHV ensures the international consolidation of the index in science, and jointly pursues the goal of maintaining and increasing the utility of the World Risk Report as an instrument for decision-makers in politics and society" (Day, et al., 2019).

2001). Pressures are exacerbated due to growing population, directly increasing waste generation; desludging of septic tanks; clogged waterways; plastic waste and marine debris; unregulated development and urban sprawl resulting in pollution, habitat conversion, erosion and sedimentation. There are 10,052 materials recovery facilities covering 24 percent of total coastal barangays; 140 sanitary landfills covering 19 percent of local government units (6,878 illegal dumpsites have been closed); few local government units have established wastewater systems; only 8 of the 17 regions have 10-Year solid waste management (SWM) plans (PEMSEA, GEF, UNDP, 2018).

Further challenges are due to the adverse impacts on the natural productivity of these eco-fragile areas due to conflicts in resource use; high population growth rate and poverty; illegal activities; pollution; food security; biodiversity conservation; growing informal urban settlements exacerbating the proliferation of substandard materials and poor construction, increasing the vulnerability to earthquakes, flooding and the probability of water and sanitation related diseases caused by poor drainage systems and lack of sanitation (See: DENR, DILG, USAID, DA-BFAR, 2001; UNDRR, ADPC, 2019).

Expansion of coastal settlements with indiscriminate conversion of land to agriculture and aquaculture purposes has contributed to the severe depletion of mangrove ecosystems, which are considered the most effective natural buffers of typhoons, coastal flooding and storm surges. The hydro-meteorological events including typhoons and floods, accounted for over 80percent of the natural disasters in the Philippines during the last half-century (UNDRR, ADPC, 2019). In 2013, Typhoon Haiyan (also known as Typhoon Yolanda), one of the severest disasters to strike the Philippines, impacted 26 million people and with about 8,000 fatalities. Approximately 70 percent of the Philippine population is threatened by rising sea levels, forcing people to relocate. The severity and frequency of natural disasters is exacerbated by climate change (Center for Excellence in Disaster Management and Humanitarian Assistance, 2018).

Policy and institutional gaps add to the challenge. These range from conflicting local policies and coastal management laws between competing and neighboring local government units (LGUs); conflicts between national government infrastructure programs and local coastal management initiatives; differences in the jurisdictional interpretation among agencies concerned with coastal management at national and local levels; inadequate resources for coastal management by LGUs together with political and /or land conflicts between proximal LGUs; and inadequate mechanisms and support for community participation (DENR, DILG, USAID, DA-BFAR, 2001).

The sustenance of the unique and sensitive ecosystem with its natural assets[7] (UN Statistics Division of

[7] Natural assets of the natural environment. These consist of biological assets (produced or wild), land and water areas with their ecosystems, subsoil assets and air (UN Statistics Division of Economic and Social Information and Policy Analysis, 2001).

Economic and Social Information and Policy Analysis, 2001) that make coastal areas both attractive and a large contributor to revenue generation is threatened by enormous coastal pollution and environmental degradation, which is exacerbated by climate change induced impacts and risks from natural disasters. Natural assets typically include pristine beaches and shorelines, living coral reefs, fauna and flora, estuaries, lagoons, coastal systems, including mangroves, dunes, marine ecosystems and other local natural habitats, wetlands, surface and ground water resources. Often drastic actions are required to counteract the damage to these regions. Recently, on April 26, 2018, the pristine island of Boracay in the Philippines was ordered to be closed by The President's Proclamation No. 475 under a state of calamity with effective mobilization of funds to save one of the country's most famous beaches from irreversible environmental damage (NEDA, 2018).

In light of the foregoing, this paper discusses Systems theory as a potential administrative and decision-making approach to improve tourism governance by balancing and addressing economic needs. Its application to public administration as a system to respond to such complexities is supported by research literature, ranging from policy formulation and implementation to clarifying roles and responsibilities within departments. Based on this understanding, the paper aims to offer a System of Systems (SOS) approach in analyzing and enhancing tourism governance and management of natural assets of coastal cities. To illustrate its applicability, in particular, in the context of unanticipated shocks such as the current COVID-19 pandemic, the case of Iriga City is discussed. The paper concludes with a way forward for institutionalizing systems theory application in city management by improving evidence gathering and strengthening feedback mechanisms.

2. LITERATURE REVIEW AND DISCUSSION

1) Systems Theory and Public Administration

Systems theory is described as an interdisciplinary theory describing the complexity of systems in nature, society, and science. It provides a framework to understand and describe a group of objects that work together to produce a result (Environment and Ecology, 2020). The systems approach gives prominence to interrelationships and not the elements of the system. It is from these dynamic interrelationships that new properties of the system emerge (See: About Systems Engineering, n.d.; Ibid.). A review of the application of Systems Theory in governance, policy analysis, and public administration reveals the following:

a. Ensuring effective governance demands a holistic approach which can be facilitated with the systems theory application.

Anil B. Deolalikar, Shikhaand Jha, and Pilipinas F. Quising (Eds., 2015) notes three main characteristics of governance. These are: (i) it spans government, the private sector and civil socie; (ii) it is a process and not a product, encompassing decisions made based on complex relationships between various actors with different goals, interests and priorities; and (iii) it is multi-dimensional which includes,

rule of law, government effectiveness, voice and accountability, political instability and violence and the regulatory burden. Mark Bevir (2013) notes that shortfalls in governance are due to the inadequacy to address causes and effects and interlinkages of issues due to inadequacies in knowledge and technical capacity. This is exacerbated by the interrelations between different departments, because of the way the departmental functions and roles of personnel are defined and executed (See: Deolalikar, Jha, & Quising (Eds.), 2015; Bevir, 2013). Governance can therefore be defined as the exercise of leadership with accountability, resulting in an inclusive practice of efficiently establishing and implementing institutional rules and processes to manage resources, incentivize and build capabilities in organizations and societies to justly strive towards improved quality of life and well-being. In this context, organizations provide the decision-making dimensions of governance to institutions, constituting legislative, administrative and judicial processes.

b. Systems theory application facilitates the interpretation of policy by scoping and segmenting issues and problems and developing implementable solutions.

Jenny Stewart and Russell Ayres (2001) inform that the systems approach offers policy makers a fresh set of analytical perspectives. It suggests that policy design is as much a matter of choosing structures and relationships, as of selecting analytical tools and methods for informed decision making. Segmenting issues and problems helps policy makers and organizations to identify, prioritize, focus and analyze the segmented aspects. Solutions can thereafter be developed through policy interventions or other incentives that influence citizens or market behavior. Policy makers are thus enabled to make practical choices through incremental changes. The following examples illustrate these challenges:

(i) Environmental management recognizes interconnectedness at the core of eco-systems. Stewart and Aiyers note that policy makers have perceived fragmented approaches to regulation, i.e., those that address land, air and water issues separately cannot adequately protect ecosystem health. For example, in New York State, the problem of administrative fragmentation was addressed by the issuance of the Environmental Quality Review Act, which required each agency to take a holistic approach towards its permitting activities. Under this mandate, the New York Department of Environment Conservation attached conditions related to air quality and wildlife protection to an application seeking water quality certification for a shopping mall. Thus, rather than coordinating each agencies activities at a "super agency" level, systemic connections were written into the decision making process at the agency level.

(ii) The New Zealand Resource Management Act (1991) adopted and mandated an integrated resource management as a systemic process by gathering conflict resolution and negotiating processes into a "permitting

structure". This replaced the earlier sectoral and agency fragmentation between land use, forestry, pollution, traffic, water and air and included sustainability objectives through integrated approaches for decision making for development applications by administrative agencies at the regional and local levels (Ibid.).

(iii) Inter connections between industry and environmental policy are two areas which are most often seen as opposing and irreconcilable, due to different political incentives. Policy makers have over recent years been required to converge environmental and economic issues in response to pressures from citizens, largely middle class urban dwellers (Ibid.).

c. The word "system" is often also used to describe the assembly of organizations, such as health systems or research systems or environment and urban management.

These systems by their nature are linked in the form of flows (money, peoples and products) where the output of one system affects the policy variables and indicators of the other systems. Policy makers in modern governments are challenged and confronted with such interdependent problems. Systems analysis in policy making is usually equated with the building of systemic models, to enable informed decision-making. Systems approaches can also be usefully employed to generate specific analytical and implementation strategies for policy recommendations (Ibid.).

d. Systems thinking helps to analyze failures.

Many policy decisions fail to achieve their targets e.g., employment generation, industrial development programs and environment campaigns. Key reasons for failure is the lack of understanding of the interconnectedness of issues within the system as well as the interrelations with other systems. Additionally, the implications of the un-anticipated changes in one part affecting the other and / or policy advisors falling short of facilitating convergence between various administrative and political actors which ultimately result in sub-optimal choices leading to poor quality results. This often results from policy makers facing shortfalls due to their own limitations in understanding conflicts arising from contradictory outputs from various other systems (Ibid.).

e. The systems approach helps to understand trade-offs in achieving the 17 Sustainable Development Goals (SDGs).

Edward B. Barbier and Joanne C. Burgess (2017) note that the systems approach helps to appreciate the important tradeoffs in attempting to attain the SDGs simultaneously, further that achieving the SDG goals and targets requires policy integration. This involves the management of cross-cutting issues that cross the boundaries of "established policy fields" beyond the institutional responsibilities of individual departments (Vereinte Nationen, 2018). The SDGs demand policy makers to take such strides in policy making and implementation by deriving innovative institutional mechanisms. Further, citizens would only benefit when SDGs are localized

and contextualized through practical solutions targeted for communities.

By and large, policy makers are confronted with not only complex problems, but interdependent complex problems, wherein the "environment" of the administrative and governance system has a major impact on the output of the system. The environment can be external or a result of the output of another system. Policy makers need to design a system or adapt to one which factors both these scenarios and takes these into account in order to get the desired output. Systemic policy related connections can be integrated into the decision-making process at the agency level itself, rather than creating a "super agency" to respond to the needs of the environment by coordinating activities within multiple systems (Ibid.).

Organizations and administrative units as part of the public administration framework are clearly interdependent and interrelated besides functioning as individual elements of the system. This is emphasized by the systems theory approach. This paper expands this approach to interrelationships within systems such as between city administration, urban planning, environment management and economic or industrial policy implementation. From these dynamic interrelations and linkages, new properties of the system are derived leading to the formation of the System of Systems (SoS) approach.

2) A System of Systems (SOS) Approach for Sustainable Tourism

a. SoS and Coastal Cities

Sonia Chand Sandhu, Kelkar Vedanti, and Sankaran, Vaideeswaran (2019) exemplify that coastal cities inherently reside within complex eco-systems which comprise a dynamic interface of the land, marine (ocean/sea) and coastal sub-system as shown in Figure 1[8]. These can be described as:

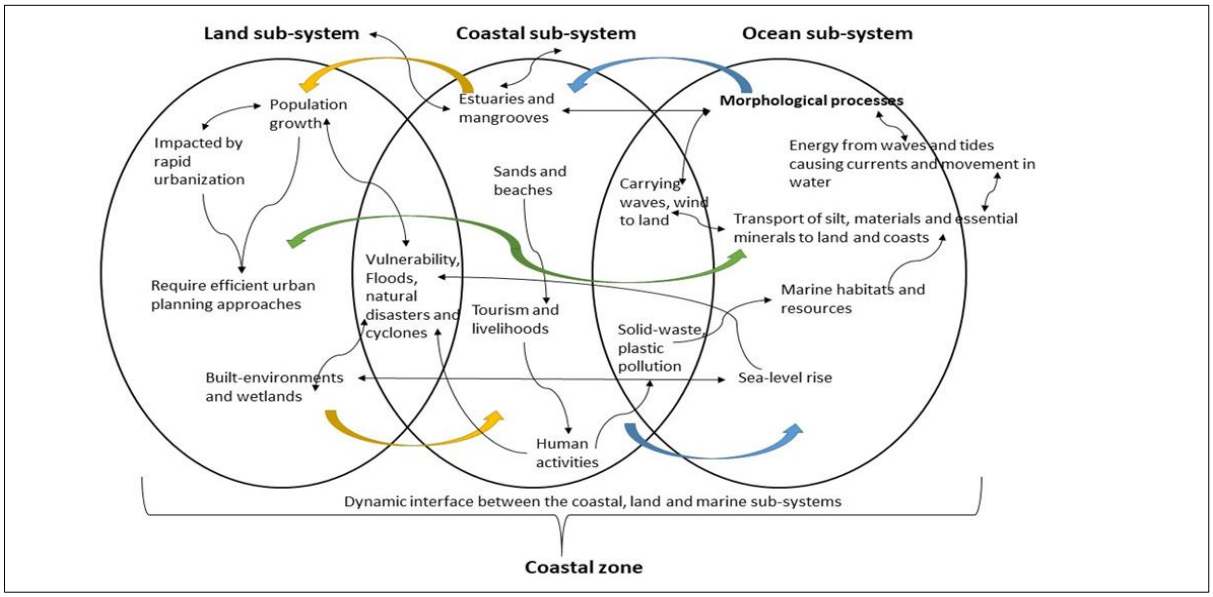
(i) natural processes which include naturally occurring atmospheric and geologic interactions including variations induced by climate change, covering the atmosphere, lithosphere, hydrosphere, including abiotic, biotic, and chemical processes;
(ii) user and administrative processes and functions comprising natural resource use and its management; and
(iii) infrastructure functions and processes to fulfill citizens' needs, and how these are provided, administered and managed. This directly and / or indirectly impacts natural processes and the user functions (i and ii), resulting in environment stress and institutional conflicts (Ibid.).

Except for the natural processes (i), the user and administrative processes and the infrastructure functions (ii and iii) require human intervention based on the social and economic demands

[8] "The marine sub-system is characterized by varying water depth and sediment movement, waves, tides and marine habitats such as coral reefs. The coastal sub-system includes the beach, foreshore and natural coastal protection systems such as mangroves and dunes. The land sub-system is adjacent to the coast and is mainly characterized by its topography, ground and surface water resources, habitats such as wetlands and the built environment. The coastal zone is dynamic as it undergoes continuous interactions between the waves, wind and the land causing erosion of rocks and movement and deposition of sediments. This further causes the movement and transport of materials such as silt, sand and organic matter" (Sandhu, Kelkar, & Vaideeshwaran, 2019).

and need. Figure 1 also shows the inter-linkages of these three processes within the three physical/natural subsystems (land, coast and ocean) in a coastal zone. Therefore, the complexity posed to coastal city managers, both spatially and administratively, is evident. Adding to this complexity is the vulnerability to natural disasters, more so due to human pressures and impacts from infrastructure and services such as ports, harbors, industrial activities, fisheries, agriculture, and tourism. For effective governance of coastal cities, an appreciation of this complexity is required to identify issues and address each challenge to reach a desired outcome demanded by stakeholders, primarily citizens.

Figure 1: The Coastal Eco-system with Sub-system interdependencies and Interrelations: a conceptual representation



Source: *Sandhu, Kelkar, & Vaideeshwaran, 2019.*

The systems theory analysis can help segment such complex multiple systems and sub-systems to: (i) identify the type of system and its composition of sub-systems, (ii) understand the elements of each sub-system and (iii) their interrelations. Typically, a system can be viewed as a monolithic system or a SoS. "A monolithic system is a set of different elements which are interconnected to perform a unique function that would not deliver the same result if performed by the individual elements" (Mostafavi, 2017). The SoS combines different systems and performs a function which would not deliver the same result if performed by a single system with its individual elements. Thus the SoS is a combination of systems with "operational independence" from its individual components (Ibid.)**.** Based on this understanding, coastal zones are characterized to a SoS. This provides the "theoretical lens" to facilitate an assessment of the complexity of human and infrastructure sub-systems within the natural system of the coastal zone (See: Ibid.; Sandhu, Kelkar, & Vaideeshwaran, 2019).

Tom S. Hopkins, et al. (2012) illustrate further application which is evidenced through the methodology for sustainable integrated coastal zone management using a tested Systems Approach Framework (SAF). This was developed and tested at 18 coastal study sites in the European region[9], and recognized by Land - Ocean Interactions in the Coastal Zone as a project that converged social and ecological aspects of coastal systems. It can be locally adapted to different coastal systems, issues, stakeholders, and countries. The results demonstrated its validity for transboundary settings and systems as well (See: Sandhu, Kelkar, & Vaideeshwaran, 2019; Newton, 2012).

The SAF experiments identified three themes associated with policy effectiveness: (i) appreciating the degree of connectivity between multiple coastal-zone issues to inform planning and policy formulation, (ii) understanding the system dependence of these issues to avoid conflicts from human activities, and (iii) a balanced consideration of public needs. These themes do not provide ready solutions because whether or not similar issues arise in different coastal zones, they cannot always be resolved in a similar manner due to contextual differences among coastal zones in composition, pattern, and function. Weaknesses in effectiveness in the handling of an issue may be due to ambiguity and / or transparency in policy implementation or weak enforcement due to ineffective governance mechanisms (Hopkins et al., 2012).

b. SoS and Sustainable Tourism Management

Aser B. Javier and Dulce B. Elazigue (2011) analyze tourism in the Philippines such as one that primarily includes activities related to ecotourism[10]; health, wellness and retirement; meetings, incentives, conventions and exhibitions; adventure, sports; leisure; and cultural heritage. These activities are planned and implemented through eco-tourism strategies and local tourism development plans. The local government units (LGUs) are the administrative units, which are responsible for their implementation, mandated by respective government orders. These form the basis of the withinputs of the three systems that emerge from the three pillars of city management, environment protection and climate change risks and tourism. The related government orders and mandates are discussed as follows:

i. Republic Act No. 7160 of 1991: The Local Government Code (Section 17) requires LGU's to ensure that required services and facilities for tourism development and promotion are available. This includes procuring equipment,

[9] The SAF was a part of the European Union (EU) FP6-funded project, Science and Policy Integration for Coastal System Assessment (SPICOSA; http://www.spicosa.eu/). The 18 study sites represent a wide variety of European coastal systems, including transitional waters such as lagoons, deltas, and estuaries, along the coasts of the European regional seas, from the shores of the Black Sea to the fjords of Norway. This increases the applicability of the SAF beyond its tested locations.

[10] Ecotourism is defined as "travel undertaken to witness the unique natural or ecological quality of particular sites or regions, including the provision of services to facilitate such travel"(UN Statistics Division of Economic and Social Information and Policy Analysis, 2001)

ensuring regulation and supervision of businesses, and providing security. LGUs, as a corporate entity (Section 15) are also empowered with full autonomy (Section 22) for the management of their economic enterprises. The Local Development Councils (LDCs) at the provincial, city, and municipal level (Section 109) are mandated to develop socioeconomic development plans and policies; public investment programs and; provide incentives to encourage local investments. The LDCs also appraise and prioritize socioeconomic development programs and projects through the approval of local development plans which are submitted to the regional development council. These are incorporated into the regional development plan and submitted to the National Economic and Development Authority (Ibid.).

ii. Republic Act No. 9593, The Tourism Act of 2009 is implemented by both the national and local governments: Local tourism development planning is done by the LGUs, in consultation with stakeholders. This involves the participation of local communities, indigenous peoples, non - government organizations (NGOs) and the private sector. The management of local tourism projects and initiatives and the establishment of tourism enterprise zones is to be undertaken in partnership with the private sector and building capacity of LGUs in this regard is emphasized. The Local Government Code mandates the preparation and implementation of a tourism development plan, the enforcement of standards and the collection of statistical data for tourism purposes. The objective of the plan is to develop sustainable tourism by integrating zoning, land use, and infrastructure development and ensuring application of standards for tourism enterprises, heritage and environmental protection. (Section 37) (Ibid.).

iii. Institutional arrangements: The Department of Tourism (DOT) is the main government agency for planning, programming, coordinating, implementing and regulating the tourism industry. This includes both the development and promotion of tourism activities. DOT provides technical assistance to the LGUs in the development of tourism destinations, setting standards and regulatory enforcement; preparation, implementation and monitoring of local tourism development plans, gathering of statistical data, and enforcement of tourism laws and regulations. It also monitors the LGUs' for compliance with national standards for the licensing of tourism enterprises and for ensuring the proper coordination, integration, prioritization and implementation of local tourism development plans (Ibid.).

- LGUs coordinate with DOT on a number of activities: These include integration and coordination of local and national plans for tourism development; approvals for appointing a qualified tourism officer in every province,

city or municipality where tourism is significant; compliance (private sector industries and other tourism stakeholders) with rules and regulations for the operation of all tourism enterprises, including with the national standard for licensing, accreditation and classification of tourism enterprises; establishment of tourist information and assistance centers at strategic locations; monitoring and reporting of resources to the DOT on the status of tourism plans and programs, tourist arrivals, and tourism enterprises; issuance of timely advisories on the safety of travel to particular places and; incentives by LGUs for tourism enterprises such as , reductions in applicable real estate taxes and waivers of fees and charges (Ibid.).

iv. Executive Order No. 111 and the National Ecotourism Strategy: This was issued on 17 June 1999 to establish the guidelines for ecotourism development in the Philippines, and create a National Ecotourism Development Council for policy making and a review mechanism for the approval of ecotourism projects. Prior to this EO, a joint Department of Natural Resources (DENR)-DOT Memorandum Circular No. 98-02 provided the guidelines for ecotourism development in the Philippines. In this regard, the Ecotourism Steering Committee was created which includes a representative from the concerned LGU. Pursuant to EO111, the National Ecotourism Strategy (NES) was completed in April 2002 to promote an integrated approach for the protection of natural resources while simultaneously generating economic opportunities for local communities. This was prepared through a series of regional stakeholders' consultation and national planning workshops that emphasized a bottom-up and top-down approach for capturing ideas, information and experiences in developing the country's ecotourism sites (Ibid.).

v. The Disaster Risk Reduction Management (DRRM) Act 2010 and the Climate Change Act of 2009 explicitly indicate environmental protection provisions to be monitored by the National Disaster Risk Reduction and Management Council (NDRRMC) and Department of Interior and Local Government (DILG), Department of Environmental and Natural Resources (DENR) and their offices. Risk reduction is cascaded from the national to the local level starting with the NDRRMC as the highest decision-maker which includes members from different departments and government agencies. At the local level disaster risk reduction and management offices (LDRRMOs) or Barangay DRRM Committees (BDRRMCS) within LGUs are responsible for risk governance. These were formed in 2014 through a Joint Memorandum Circular between the NDRRMC, DILG, and the Department of Budget and Management, and Civil Service Commission (JMC No. 2014-1). Capacity building

of the LGUs for disaster preparedness is actively promoted through joint trainings and projects under the Local Government Academy (LGA) together with community involvement within the local DRRM (at the Barangay level) through community based organizations (CBOs) and private sector operators who are the key stakeholders of the DILG. Programs to translate policies into actions have been formulated and implemented, including sector-specific programs on coastal resource management, forest development, protection and rehabilitation, the Ridge to Reef Framework of Development and localized policies, such as the Agno River Basin Inter-Regional Watershed Management Program in Ilocos (UNDRR, ADPC, 2019). Hazard forecasting and sea level monitoring is done by the National Mapping and Resource Information Authority (NAMRIA) stations reporting to DENR and the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA)[11] respectively. The Nationwide Operational Assessment of Hazards (NOAH) program under the Department of Science and Technology (DOST), provide early warning with a six-hour lead time to vulnerable communities against impending floods.

The mandates and responsibilities of the LGU's, DOT and DENR, as described above, through the various Executive Orders, address the demands from each of their systems to achieve a common goal but there are areas of overlap in their roles and responsibilities which lead to governance shortfalls (Ibid.).

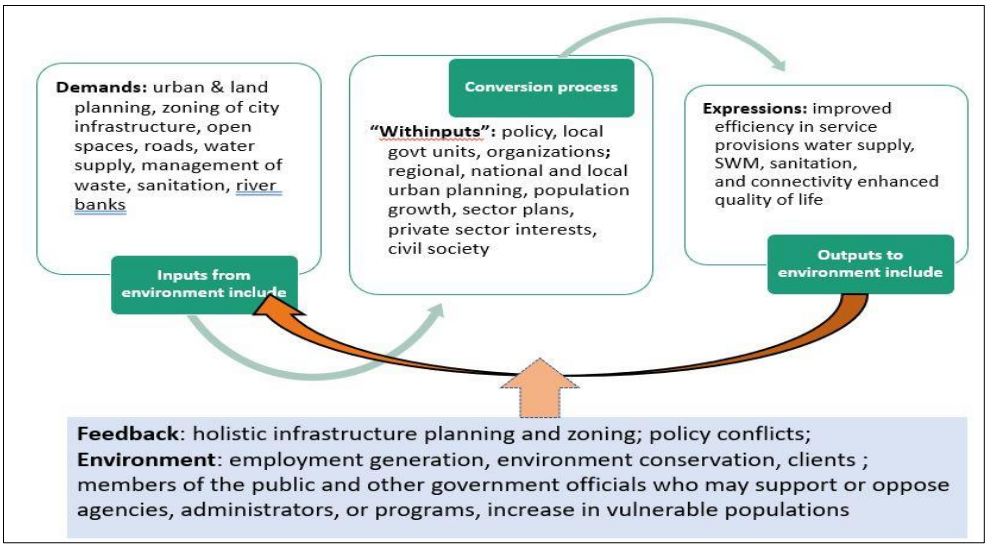
Guided by systems theory (Sharkansky, 1978), the conversion process/with inputs for each system includes the processes within the respective departments, policies at regional, national and local level that influence the inputs to result in an output. It is seen that the withinputs of each system is governed mainly by the administrative landscape of local governance, which includes the mandates of the Executive Orders along with the impact and influence of local business environment, training and resources available to the LGU. The outputs are a mix of tangible services which can be measured and residuals which (most often) are difficult to assess and / or cannot be measured. These outputs when measured from the feedback loops can identify the weaknesses or any emerging issues in the particular system, guiding the need for further data as evidence. These lead back to strengthening the input processes of each pillar and its system and / or may lead to the emergence of a new system.

[11] As of 2015, there are 74 seismic stations for earthquake monitoring, 36 tsunami detection stations, 6 volcano observatories and 10 tsunami early warning systems, and 19 National Mapping and Resource Information Authority (NAMRIA) sea level monitoring stations under DENR. The Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) has over 1000 automated weather stations and water level sensors, with information provided for public access on their respective websites (UNDRR, ADPC, 2019)

Pillar I: City Management System: Local Government Unit (LGU)

Applying SoS (Figure 2), the demands include urban planning, including land use and zoning of city infrastructure for all service provisions of open spaces, roads, water supply, management of waste, sanitation, and management of river banks (in cases where rivers flow through cities).

Figure 2: Systems theory application exemplifying local governance through the city management system



Source: *Author, Adapted from (Sharkansky, 1978)*

The conversion process and with inputs that influence the demands and performance of outputs include the organization, empowerment of the LGUs with respect to the implementation of regional, national and local urban planning policies and sector development plans, implications of population growth, private sector interests (equity and partnerships) and civil society engagement.

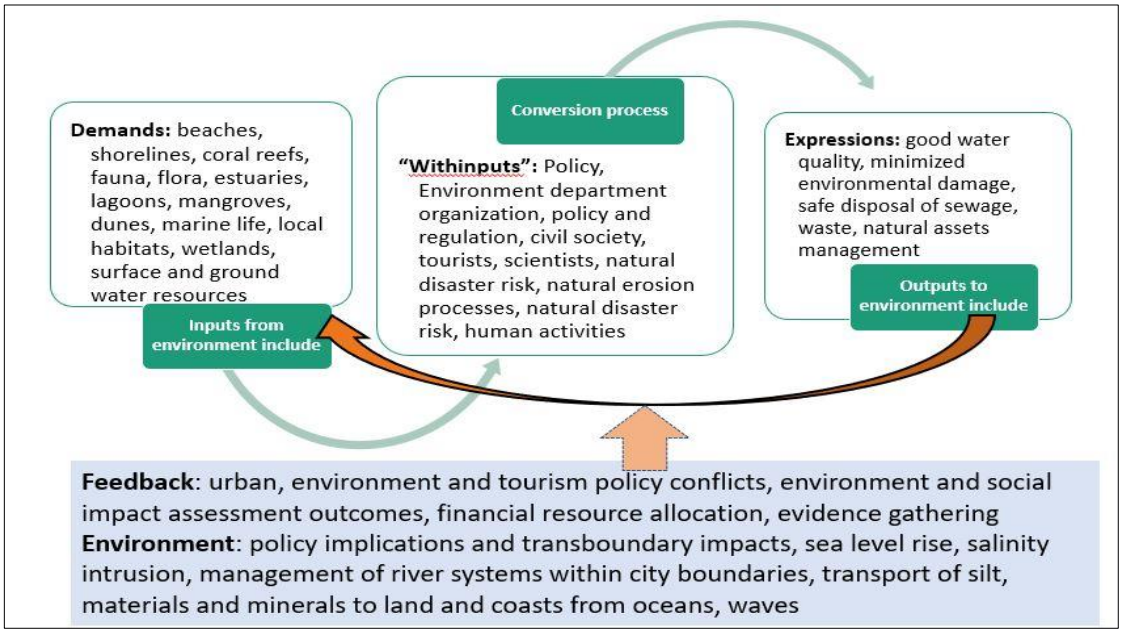
The outputs include an improved efficiency in service provisions with potable water supply, solid waste and sanitation management, connectivity and mobility between the city and generally an enhanced quality of life for citizens which broadly encompasses environment, social and economic outcomes.

The feedback mechanisms identify the need for holistic infrastructure planning and zoning; identification of policy conflicts that adversely impact the performance of outputs - these may include conflicts between land use zoning, leading to possible increases in vulnerable populations and destruction of natural assets such as mangroves and fragile corals on which tourism values are dependent. This may, in turn affect employment generation and environment conservation efforts.

Pillar II: Environment Protection and Disaster Risk Management

As shown in Figure 3 below, the demands are for pristine beaches and shorelines, living coral reefs, fauna and flora, estuaries, lagoons, coastal systems, including mangroves, dunes, marine ecosystems and other local natural habitats, wetlands, surface and ground water resources.

Figure 3: Systems theory application exemplifying cross sectoral challenges of environment protection and disaster risk management



Source: Author, Adapted from (Sharkansky, 1978)

The conversion process and with inputs applies policy, that influence the performance of outputs of the department of environment and natural resources (DENR) and related monitoring agencies (Part III, Section B, para a-e) including those responsible for disaster risk governance (Part III, Section B, para e). These include the mandates of their department /organization, policy/s and regulations, civil society influences, tourists safety, scientific information from environment, social impacts and disaster risk assessments, natural erosion processes, and human activities among others.

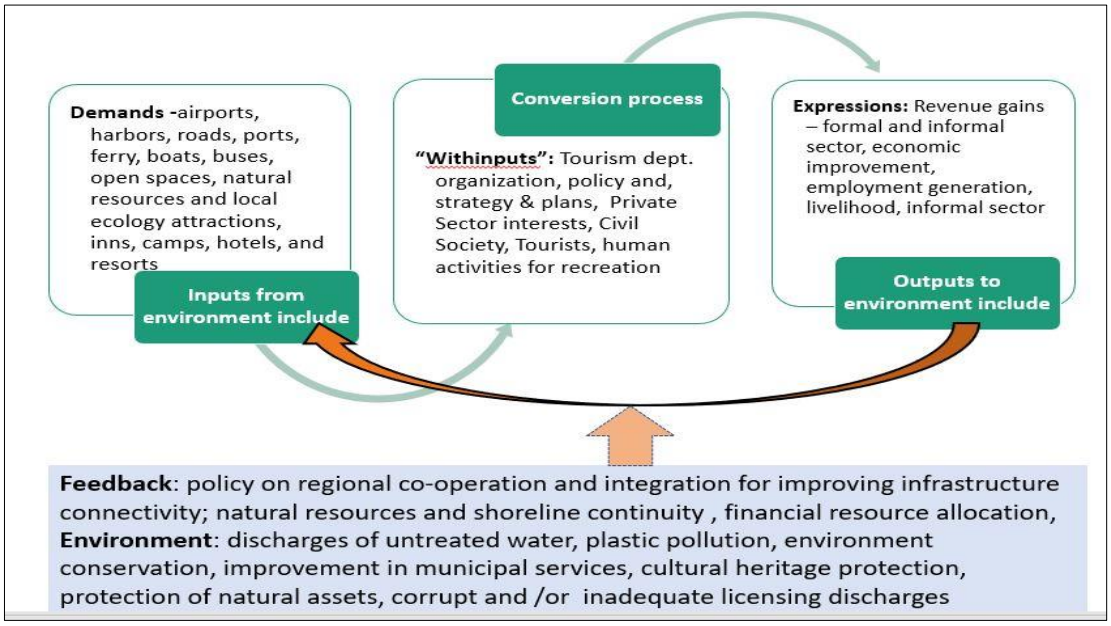
The outputs encompass good water quality, minimized environmental damage, safe disposal of sewage, waste, management of all ecological natural assets. Feedback mechanisms identify policy conflicts between urban land use, environment protection and tourism; identify warning signs from NOAH, NAMRIA and PAGASA; inadequate use of environment and social impact assessment and disaster risk assessment outcomes and/ non-compliance with environment regulation and standards; shortfalls in financial resource allocation and evidence gathering for policy implications and assessments of transboundary impacts on natural resources, sea level rise, salinity intrusion, management of river banks and/ systems within city boundaries, transport of silt, materials and minerals to land and coasts from oceans and waves. Environment bears the consequences of climate change facing extensive, most often, irreversible damage to the land system inversely affecting tourism.

Pillar III: Sustainable Tourism Management

The demands include provision of tourism related infrastructure such as airports, harbors, roads, ports, ferry

systems, local boats, bus terminus, open spaces, natural resources and local ecological based attractions, inns, camps, hotels, and resorts. The conversion process with inputs include the organization and skills of the department of tourism, implementation of national policy, development of local tourism plans, private sector interests, civil society interventions, tourists behavior, and other recreational human activities.

Figure 4: Systems theory application exemplifying implementation of tourism policy and multi stakeholder engagement



Source: Author, Adapted from (Sharkansky, I., 1978)

The outputs include revenue gains from the formal and informal sector for economic benefits to the city including from the informal sector, employment generation, and local livelihood improvement. Feedback mechanisms identify the need for strengthening policy on regional co-operation and integration for improving infrastructure connectivity between cities for optimizing tourism potential; sustainable maintenance of natural resources and shoreline continuity; financial resource allocation; discharges of untreated water, plastic pollution, environment conservation, improvement in municipal services, cultural heritage protection, protection of natural assets, corrupt and / inadequate licensing.

A desired result for a coastal city would be to achieve well planned and administered resilient infrastructure to support a sustainable tourism economy based on effective management of its natural assets[12]. Individual systems of each pillar (as described above) clearly deliver only partial results towards this outcome as the output of one system may not address the demand of the other system. For example, the output

[12] Natural assets are defined as assets of the natural environment. These consist of biological assets (produced or wild), land and water areas with their ecosystems, subsoil assets and air (UN Statistics Division of Economic and Social Information and Policy Analysis, 2001).

of the city management system may create a modern and efficient sewage collection and disposal network, which may still fail to address demand of the environment system, due to its proximity to a natural asset, thereby increasing the vulnerability of the eco-system. Thus, individually the different outputs of the systems can be contrary or counterproductive towards the expected outputs of the other systems. This is underscored by the dynamism of the coastal zone shown in Figure 3, which highlights the various systems at work with their inter - relationships which policy makers and administrators need to be mindful during decision making. Deficiencies arising out of the inter-dependencies of various systems and sub - systems are apparent within Public Administration operating under its mandated guidelines. This leads to a deficiency in outcome vis a vis demand from the system or sub-system due to the limitations in the with inputs or implementation of the mandates and responsibilities of LGU's per their respective Executive Orders. The SOS identifies these weak elements, recognizes deficiencies in outcome/s through the feedback mechanisms and addresses this shortcoming.

c. SoS and Urban Disaster Risk Management

Urban resilience is the capacity of cities to absorb, adapt, to shocks and stresses and prepare for future ones on economic, social, institutional and environmental aspects, while maintaining their functions of a city. The scale and impact of shocks and stresses grows with the continued growth of urban areas and populations. Stresses may range from structural changes due to industrial shifts (e.g. relocation or closure of a city's key firms), economic crises (such as the global financial crisis of 2007/08 and the European debt crisis of 2009), in and out migration of populations, natural disasters (i.e. earthquakes, floods and hurricanes), disruption of energy supplies, and / or leadership and political changes. The scale of these shocks and stresses vary with the size and location of cities such as its country, region, urban area, city, community or household. These lead to varying but significant social, environmental, economic implications and institutional consequences. Complimentary approaches that cover all these aspects are required for building resilience to reduce the risk of disasters with efforts to sustain livelihoods. In all cases, local action needs to be supported by national policy frameworks. This approach is guided by The Sendai Framework which assures a primary role to national level agencies in disaster risk reduction strategies, directing these to develop plans and allocate resources to drive resilience activities across multiple institutional levels. "Systems thinking", confirms the inter-connection between the multiple elements of the system as "cities are adaptive, socio-technical systems comprising various elements which, when combined, have qualities that may not be present individually. Changes within this system are both systemic and dynamic, wherein changes in in one element may induce changes in another element of the system and respond to feedback loops respectively (Figueiredo, Honiden, & Schumann, 2018).

To illustrate the application of SoS in DRM, we use the case of Iriga City in its response to the COVID-19 pandemic, as declared by the World Health Organization (WHO) on 11 March, 2020 (Elflein, 2020). Thereafter, the National Government of the Philippines issued Executive Order No.020-B, Series of 2020, further amending EO 020, issued on 22 March, 2020 for enhanced quarantine and curfew (UPRI, 2020). The LGUs rely upon national directives for policy and decision-making and pursuant to this, the Department of Interior and Local Government (DILG) issued a memo per circular no 2020-077 on 24 April 2020, rationalizing the establishment of the LGU Task Force against COVID-19 (DILG, 2020). With the declaration of code red alert, sub level 2 in the Country and the declaration of an Enhanced Community Quarantine (ECQ) for the entire Luzon area, the City Government of Iriga[13], under the leadership of Mayor Madelaine Yorobe Alfelor, responded with the activation of its Incident Management Team (IMT) to assess the city's capacity to address issues related with COVID-19. The Iriga City Task Force COVID-19 (TF COVID-19) was created with the objective of quickly creating awareness and advocating preventive measures against COVID-19. The IMT and the TF COVID-19 conducted situational analysis to assess the current status of issues in the city. A series of orientation workshops were conducted for identifying and planning actions and interventions together with specific roles and responsibilities necessary to address the concerns affecting COVID-19. Thereafter, regular meetings and conferences are held on a real time, daily basis to assess, monitor and determine further courses of action (City Government of Iriga, 2020).

The LGU implemented protocols for sanitation, disinfection, and decontamination as good practices for prevention and containment of COVID-19. To ensure that residents stay indoors during the enhanced community quarantine (ECQ) the LGU, through the Department of Agriculture launched the "Vegetable on Wheels" program to ensure access to basic goods to Barangays. This project led to the establishment of satellite markets in the Barangays or the "Saudan sa Barangay. Given that the ECQ enforced by the national government due to the threat of coronavirus disease 2019 (COVID-19), requires strict home confinement, suspension of work and public transportation, workers' incomes are temporarily affected for all households. The LGU procured and distributed relief goods to help Irigueños affected by the quarantine.

The LGU is always the first responder in any disaster, including in the COVID-19 situation. The City Government of Iriga chose to implement proactive efforts in the management, response and prevention of COVID-19. The LGU evolved and adapted with the changing national government protocols, ensuring that the interventions remained aligned with the needs of the

[13] Iriga, City, is a 4th class city in the province of Camarines Sur, Philippines, with a population of 111,757 as per the 2015 census. It is located about 400 kilometres south-east of Manila, and about 33 kilometres south of Naga City. Located at the heart of Bicol Economic Growth Corridor and one of the fastest growing cities in the region. It has evolved into an eco-tourism, agro-economic and educational hub with two big universities in the city.

constituents. To ensure efficient and effective utilization of personnel resources and other logistical support, various Administrative Orders, Memorandum Orders, Advisories and Information, Education and Communication (IEC) campaign and materials were issued by the City Mayor. This covered the health emergency response team, public mass gathering restrictions and self-quarantine rules (City Government of Iriga, 2020).

The first response of the Iriga LGU was to create a Task Force that included heads of operations, logistics, administration and finance, communications and security departments. To implement the mandate of the National Executive order for ECQ meant that any decision taken would impact the population and the different departments of the city such as law and order, finance and logistics. The initial steps taken by the LGU after setting up the Task Force as listed in points above highlighted the interlinking and interdependence of the various departments. This is more pronounced in an event of unanticipated shock as the Covid - 19 Pandemic. However, the steps taken by the LGU was to create a "Super Agency" (refer Part B (ii) b) to coordinate and manage the interconnectedness of the departments. Further, due to the lack of a formal system to address the emerging interdependencies which were pronounced due to COVID-19, the Task Force was created to increase effectiveness of implementing the executive or policy directives issued.

The SoS through its feedback mechanism appreciates the inter-dependence of various departments and elicits the desired response from all departments for effective implementation of executive and policy directives. The second response of Iriga city, after creating the IMT and the TF, was to establish procedures, responsibilities, training and outreach to deal with the unanticipated shock to the system. This response is addressed through the with input of the disaster management system (explained below in section D), keeping in perspective the feedback from the other systems. This aims to improve effectiveness of the actions as the feedback will reduce response time towards further actions. Instead of attempting to coordinate each department activity at a "super agency level" the SoS helps in writing these systemic connections into the decision making process at the department level (refer paper section Part B (ii) b) (Stewart & Ayres, 2001). By connecting the various departments through feedback loops, it has the potential to preclude the creation of a special purpose task force to handle a shock event like the Covid-19 Pandemic.

Applying the SoS approach helps to build resilience which in turn leads to preparedness for dealing with the shocks to the status quo of the city and / or the region. Shocks, such as the current (March 2020 onwards), is from a health pandemic, but these can also be ecological such as earthquakes, volcano eruptions, financial like mass unemployment due to recession, market meltdown or any other. The SoS allows for the with inputs in the conversion process to sustain such shocks. In an unanticipated situation there would be an immediate feedback towards the demand and inputs, as the planned output would be significantly affected due to the shock to the system.

Taking forward the pillared approach (discussed in sections above) and application of (Sharkansky, 1978), the shock to the system can be addressed by creating an important vertical pillar within the SoS on disaster management. The interrelated pillars would include: (i) city management system; (ii) environment and social protection system; (iii) tourism system and; (iv) the disaster management system. This pillar (iv) can comprise the following elements:

The demands include creation of buffer stocks of food and essentials; creating (maintaining) infrastructure for critical needs such as roads, power and water supply; maintaining natural assets and coastal ecology as a nature based solutions for absorbing shocks and minimizing damage from a natural disaster (as applicable). The conversion process with inputs include the empowerment of the LGUs for prioritized decision making; translation and implementation of national policy actions at local level (as was done by Iriga city), organization or re-organization or re-deployment of staff resources; training vis a vis new approaches to managing urban resilience, disaster management, implementation plan for logistics and distribution of aid. Typically, resilience needs to be embedded in the system through this element of conversion by imbibing the following capabilities within the system: reflection and learning; robustness to limit failure; resourcefulness for reallocation and repurposing resources; flexibility to plan alternative strategies; avoiding redundancy; inclusion with consultation and communication mechanisms; and integrated with systems and sub-systems working together (Figueiredo, Honiden, & Schumann, 2018). This would help shift from short-term post-disaster responses to a more proactive and complete process of prevention, response, consultation and monitoring that is itself a continuous loop (Ibid.).

The outputs include efficient logistics for aid distribution, continued operations of critical infrastructure such as access to medical aid, hospitals, delivery of basic service provisions with potable water supply, power, solid waste and sanitation, maintenance of connectivity between the city for medical aid, evacuation and / or supply movement as the case maybe and; disbursement of economic aid and other desired outcomes. The feedback mechanisms play a critical role and need to be more flexible and instantaneous as the nature of the shock could be unique and different. For example, in the case of a health system shock like the current (March 2020) COVID - 19 outbreak, one important feedback is for establishing social distancing norms; availability of bank accounts for citizens for direct distribution of aid; warehouses for buffer food stocks and storage of relief goods. In the case of coastal cities, an immediate key Impact would be to evacuate stranded tourists to prevent overburdening the infrastructure among others matters. The gathering of true information and data is crucial for informed decision making and feedback mechanisms are the conduits for this. In this regard, as an example, The ENDCOV program designed by the University of the Philippines Resilience Institute (UPRI), Pandemic Response Team is designed to help the government and LGUs. This, however, relies on the

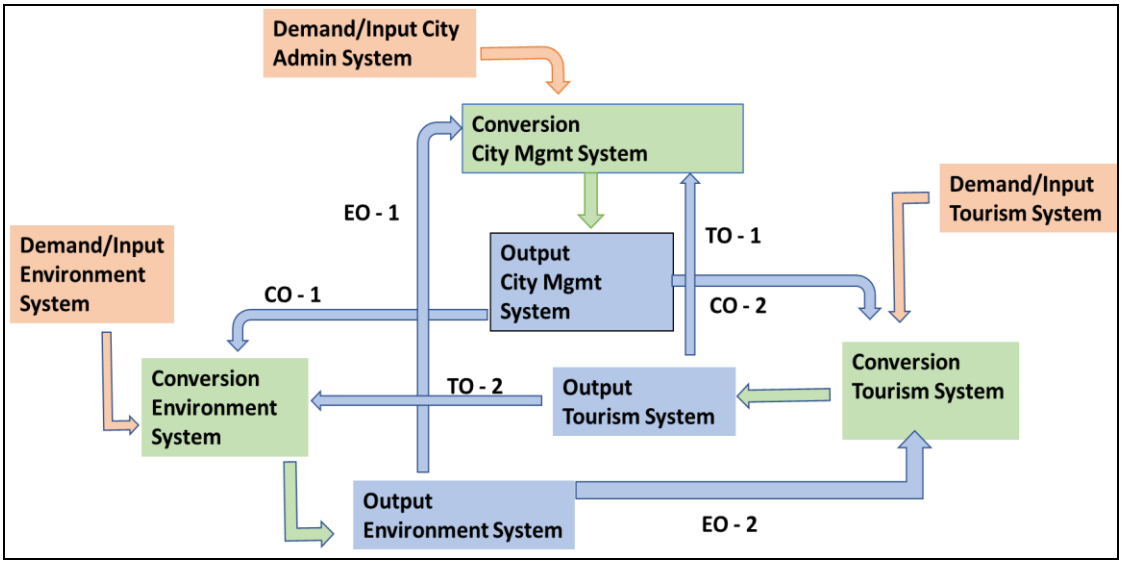
quality of official reports, testing accuracy, monitoring, and true accounts of fatalities, among others, delivered on a daily basis for input to the "endcov.ph dashboard". Gathering near real-time data, makes it easier to project the rate of spread and identify locations of hotspots and outbreaks on a daily basis, thus helping national and local officials make informed decisions whether to extend, lift, or relax community quarantines (UPRI, Pandemic Response Team, 2020).

3. **CONCLUSIONS AND WAY FORWARD**

The SoS approach is cross-cutting and fosters holistic and integrated thinking. It goes beyond independent initiatives, highlights the importance of interactions between different systems, and emphasizes their synergies to optimize value of interventions. It helps to segment and analyze multiple, complex and overlapping issues contextualized to the development perspective and stakeholder interests. This may range from compliance with regulation, design of a program or a project, needs and demands of citizens, resource allocation, technology application to name a few. Systems theory is characterized by feedback mechanisms which help to identify weak links and address problems that arise during design and implementation. This is done cyclically and re-iteratively by pegging each issue to the relevant department, even if it did not originate from that particular department or from within its jurisdictional area. These approaches help to resolve "who does what and how" enabling better governance.

The SOS approach presented in this paper equips coastal city managers with the tools to improve city governance towards the desired result by addressing interrelations within each system and its sub-system and bringing convergence and integration in decision making between departments. Continuous functioning of feedback mechanisms between outputs and conversion processes between the three pillars adds value to the decision maker by highlighting timely and evidence based information to address gaps and weaknesses in the desired result. For each system, it uses feedback mechanisms that identify and measure weaknesses in outputs and (feedback) towards inputs of the simultaneously functioning systems which affect the desired result. The feedback mechanisms are valuable in identifying the weak links or any new emerging issues and / or due to unanticipated shocks which may lead to partial achievement of the result.

Figure 5: The SOS based governance system for coastal cities with feedback loops for improved management of inter-sector issues of cities, tourism, and environment



Notes: CO-City Outputs; EO-Environment and disaster risk outputs; TO-Tourism outputs

Source: Author

This approach helps to identify collection of evidence and quantifiable data that measures the output of the system and compares it against the demand. The evidence and data so obtained will facilitate more informed decision making by addressing fragmentation of policy decisions; conflicts between strategic and operational priorities between sectors; shortfalls in policy implementation and technical design of interventions, management capability and financial allocations; non-compliance of regulations and standards; and stakeholder interests; inputs from scientific studies to preempt unanticipated risks and / any other need or demand. This system can also be used to highlight good practices that can be fed back into the conversion process for replication. These would lead back to the inputs to reiteratively bring incremental changes to the outputs until the desired result is achieved. These aspects can then be fed back to the relevant conversion process/es to be addressed either through a change in plan, revisions rules and procedures to be enacted for the concerned administrative units, modification in policy or design of intervention, change in stakeholder input, resource re-allocation or any other with input. The SOS will thus forge continuous and incremental change for enhancing the quality of outputs and optimizing synergies between departments, thus building institutional resilience.

The study derived from System Theory, an approach that can be applied for enhancing understanding and management of complex issues that pervade coastal cities. It laid down the conceptual foundations of the SoS framework that will need more case applications in future studies. It aims to complement current academic and practical discourses on urban management, particularly the intersections of sustainable tourism and disaster risk reduction.

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