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Name: Nayaab Khan

Supervisor: Elena Marie Ensenado

Specialisation: Urban Environment, Sustainability & Climate change

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Summary

The role of ecosystem services (ES) in urban planning is crucial for the wellbeing of human beings. Despite increasing interest in urban greening, urban sprawl has led to the degradation of natural areas. This issue is evident in developing countries like Pakistan, where rapid urban expansion has caused significant environmental damage. Islamabad, the capital city of Pakistan, has experienced a notable decline in green spaces due to unplanned urban growth, leading to habitat loss and ecological disruption, and loss of ES. Urban green open spaces play a vital role in making cities sustainable and liveable, hence, the lack of integration of ES knowledge in planning, especially of urban green open spaces, exacerbates environmental issues along with affecting the overall wellbeing of humans. Thus, there is a for improved understanding and application of ES concepts to promote sustainable urban development.

This research aims to explore how urban planners' knowledge of ES influences their planning decisions for urban green open spaces. The study evaluates the extent of ES knowledge among urban planners and investigates the types of decisions made concerning the inclusion of ES. It also identifies the perceived barriers to integrating ES into the planning processes.

The research used a mixed method approach, combining both quantitative and qualitative data collection and analysis methods, conducting a survey of 49 respondents and 7 expert interviews. The survey and interviews aim to assess the level of knowledge of ES, the planning decisions regarding the inclusion of ES, and the perceived barriers to integration. The data was analysed using statistical and content analysis. The data analysis showed that the awareness of urban planners regarding ES is just below moderate, while the understanding of individual characteristics of ES is higher. However, ES integration into planning for urban green open spaces is only moderate and typically occurs in later stages of planning. The most commonly integrated are cultural ES. Key barriers identified include weak policy and legislation and insufficient resources. While most significant were newfound barriers, client awareness and willingness, and the political environment. Even though planners recognize the importance of ES and its knowledge, these barriers hinder the effective integration of ES into urban green open space planning.

The research highlights the importance of informed decision making in urban planning, emphasizing the importance of addressing the recognized barriers, by relevant stakeholders, along with improved ES knowledge in planners. For future research, a more qualitative approach for a deeper analysis, by comparing planning documents with current findings is recommended.

Keywords

Ecosystem Services, Urban Green spaces, Urban planning, Planning decisions, Barrier

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Abbreviations

ES	Ecosystem Services
MEA	Millenium Ecosystem Assessment
TEEB	The Economics of Ecosystems and Biodiversity
UHI	Urban Heat Island
CDA	Capital Development Authority

Chapter 1 – Introduction

1.1 Background

Although cities may not relate much to the concept of Ecosystem services, they have gradually started to consider themselves not only as consumers but also as the producers of these services, hence moving away from the perspective of not being associated with the concept. (Geneletti et al., 2020)

Ecosystem services (ES) are the “benefits that people derive from functioning ecosystems” (Costanza et al., 2017). They play a vital role in providing essential services to humans. Since ES are generated by biodiversity, its decline negatively impacts the services they offer. ES have been further placed into four categories. Provisioning services, which are obtained from the ecosystem in material forms like food, water, and raw materials. Regulation of ecosystems also provides benefits like air quality maintenance, urban heat Island mitigation, noise reduction, etc. Intangible benefits provided in the form of tourism, cultural values, aesthetics, and human well-being are known as cultural ES and lastly supporting services, such as biodiversity maintenance, and the provision of oxygen are essential for aiding to provision of other services (MEA, 2005), hence ES are crucial for the population living in Urban areas. (Niemelä et al., 2010)

In reality, urban areas are increasingly putting immense pressure on the environment along with becoming harmful and difficult to manage. Therefore, it would not be unreasonable to deal with these problems starting from the cities. Since urban design is considered as a field committed to amplifying the physical nature and quality of the city by providing quality services to its citizens, the very foundation of the discipline might need to be re-evaluated. The ecological systems in urban areas are vital for human sustenance in the cities. Sometimes the services provided by green areas, like clean air, reduced temperatures, etc, which unknowingly are being utilised by the citizens, go unnoticed. (Weber et al., 2006).

The part urban green spaces play in making cities sustainable and liveable has been acknowledged as a fundamental starting point. (Dhingra & Chattopadhyay, 2016). The growth of urban areas, which alters both cities and their surroundings, poses various challenges for preserving urban green spaces, resulting in loss of ES, meanwhile also impacting their availability, thus effecting human health and overall well-being. (Tzoulas, 2007). As the numbers grow, more people are facing the consequences such as loss of ecosystems and their services, biodiversity, and extreme weather events caused by climate change. (IPCC, 2019).

To enhance urban ES, green infrastructure, which consists of planned vegetated land cover within urban areas or referred to as urban green spaces, also called urban green open spaces (UGOS) (Kumar & Rajak, 2023), such as parks, planting strips and other natural areas, can be utilized. (Elderbrock et al., 2020). Efficient allocation of green spaces within a city is crucial for achieving sustainable objectives effectively. Urban green spaces are essential in urban planning, making significant contributions to reducing urban heat and providing various social, physical, and environmental benefits. (Anguluri & Narayanan 2017).

To recognize the benefits of nature in urban areas is not a recent development in urban planning. (Geneletti et al., 2020). Urban planning has numerous ways it affects the urban ES (Cortinovis 2018). To ensure the benefits provided by ES are maintained and amplified, it is important to make urban planning decisions aware of ES and understand how these actions can affect their provision. (Geneletti et al., 2020).

1.2 Problem Statement

Theories related to science and policy state that knowledge plays a crucial role in influencing decisions. Understanding the value of ES could therefore serve as a guiding principle on how decision-makers acknowledge and comprehend problems. (Posner et al., 2016). In real life, knowledge of ES has proven to enhance decision-making processes across many levels by increasing the awareness of stakeholders. (Cortinovis & Geneletti, 2018).

The quality of urban areas depends on the planning and preservation of green spaces (Senik & Uzun, 2022). Urban planners often depend on green infrastructure and spaces, to create more sustainable cities, and it's essential to plan and manage them effectively. Therefore, such planning and management efforts should be supported by sufficient information. (Campagnaro et al., 2019).

Planning decisions regarding land use in cities dictate the availability of ES that are essential for the wellbeing of the urban population. (Cortinovis & Geneletti, 2018). As Policy makers and practitioners are in control of the major decisions regarding the future of planning and availability of ES, it is important to recognize their level of understanding of the concept to make informed decisions. It is unlikely for planners to integrate ES if they are unaware of the value they deliver, as awareness and knowledge are essential preconditions to mainstream ES in the planning process (Cowling et al. 2008), and how it could be achieved. (La Rosa, D, 2019). The gap comes from a lack of understanding this knowledge, if present, should be translated into planning, management, and policy. (Mngumi, 2020). Urban ES are hardly a part of urban planning and there is an absence of knowledge in planners of standards for the productivity of ecosystems. (Song et al., 2020), hence there is still limited integration. (Graca et al., 2017).

In developing countries, urban green spaces are imperative. (Ramaiah & Avtar, 2019). Although there is growing interest in urban greening, research indicates that urban sprawl has significantly reduced natural and green areas. Some cities successfully preserve or expand their green spaces, but the majority face degradation and destruction. (Baycan-Levent & Nijkamp, 2009). Natural systems are crucial for cities and their residents but are usually overlooked by planners as they do not consider the environmental and ecological role green space systems play. (Wang, 2009), leading to unsustainable development practices and adverse environmental impacts.

Globally, developing countries are experiencing rapid urban expansion (Manzoor et al., 2019). As is the case with Pakistan, where built-up growth is 3.5 times higher than the urban population growth (NAP, 2023), impacting the city's natural habitats, biodiversity, land cover, and ES that foster human well-being. (Elmqvist et al., 2013). This unplanned growth causes problems for planning, and cities in Pakistan have expanded to meet the demands of commercialization and other factors, which has led to harmful impacts on the environment (Ahmad & Anjum, 2011).

Case Study: Islamabad, Pakistan

Cities usually expand over the cultural landscape that produces ES and biodiversity (Elmqvist et al., 2013), thus the decline in Urban green open spaces or ES in Islamabad, which includes reportedly a 9 percent decrease in forest cover, has not only affected the natural environment but also recreational opportunities and has been the main cause for increased UHI and decrease in air quality (Hassan et al. 2016). Islamabad, the capital city of Pakistan, is a modern, planned city located at the base of the Margalla Hills. It has favorable climate, green spaces, protected areas, and access to healthcare and education, due to which a population boom has led to urban expansion, replacing natural land with urban infrastructure, causing habitat loss and ecological disruption. As a consequence, Islamabad's crop and grasslands, and forests have been converted into housing, markets, roads, and parking lots, making it one of Pakistan's fastest growing cities. (Asif, 2023). Urban growth is a major factor that

contributes to deforestation and land use conversion (Elmqvist et al., 2013), which can be witnessed in the Land use cover documentation of Islamabad.

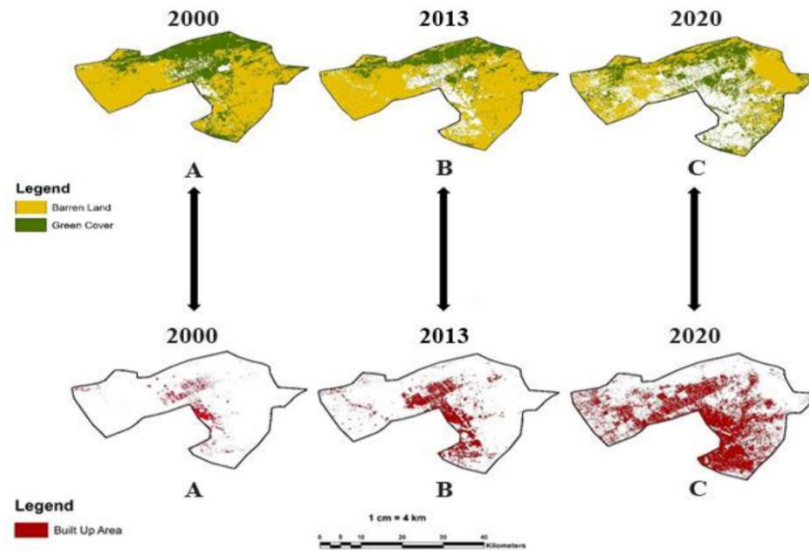


Figure 1. Land use map of Islamabad (Aslam et al., 2020)

As shown in the figure, the built-up area in Islamabad has increased immensely, putting severe pressure on the green cover. The continuous build-up of constructed areas has resulted in loss of biodiversity and natural habitat. (Aslam et al., 2020).

Additionally, limited knowledge of ES in planning for Urban green open spaces can also be applied to the city of Islamabad. According to UN-Habitat (2023), the expansion of cities in Pakistan at large has been without proper planning which has led to environmental problems. This issue is further escalated due to below par urban design and the absence of technical capacities. There also seems to be a significant gap in research on ES in the city of Islamabad and study on its individual characteristics. Due to lack of sufficient research about green spaces, the use of ES is hardly involved in planning decisions. (Ciliers 2015 et al. in Song et al. 2020) and planners and policymakers seldom lack knowledge when planning (Kabsiche, 2015 in Song et al., 2020). Although not widely adopted in planning, the ES approach can promote sustainable urban development. There is a need for more information and an improved understanding of the concept. (Niemelä et al., 2010)

1.3 Relevance of Research

This study addresses the critical role of ES knowledge in urban planning, particularly regarding urban green open spaces. Specifically, by assessing the level of knowledge among urban planners and examining how well ES considerations are integrated into planning processes. It aims to highlight the importance of informed decision making. The knowledge is often of critical value for managing ecosystems. (MEA 2005). The perceived barriers to integrating ES in planning can provide insights for improving the planning processes and other disciplines related to it, creating a suitable environment for the practice. The experience of planners can shed light on the practical use of ES in planning, considering the political, social, and institutional complexities involved. (Scott et al., 2018)

Top of Form

Bottom of Form

Previous research presumes that the identification of knowledge of ES in stakeholders may improve urban planning but is usually not clear in the case of local contexts. This gap was addressed by carrying out a survey of practitioners and stakeholders to inquire how their perception regarding green infrastructure influences their practice. (Molesh et al.,2022). Similar research could be applied to the

city of Islamabad, in terms of knowledge of ES provided by open Urban green open spaces and their role in planning

1.4 Research Objectives

The objective of this research is to investigate the influence of ES knowledge on planning decisions amongst urban planners concerning urban green open spaces. Specifically, to assess the level of ES knowledge in urban planners. Additionally, to examine the types of planning decisions taken regarding inclusion of ES in urban green open spaces and identify the perceived barriers to integration of ES in such planning processes.

1.4 Research Questions

Main Question: *“To what extent does knowledge of ES amongst Urban planners influence planning decisions of Urban green open spaces?”*

Sub Questions:

- 1)What is the level of knowledge of ES amongst Urban planners?
- 2)What planning decisions for urban green open spaces have been made?
- 3)What are the perceived barriers to integration of Es in planning for Urban open green Spaces?

Chapter 2 – Literature Review

2.1 Introduction

This chapter is focused on the notable literature related to the concept of ES and the significance of knowledge, specifically conceptual knowledge, in Planning for UGOS. It starts by explaining the concept of ES, knowledge, the planning aspects for urban green open spaces and the relationship between the three in theory. Further, it goes on to introduce the barriers to integration of ES from literature, which aids in introducing the variables based on which it has been assessed. The chapter ends with a conceptual framework combining the main themes of the research into independent and dependent variables

2.1.1 Ecosystem Services

Societies essentially depend on natural ecosystems (‘nature’), which benefit them and support human wellbeing and existence. (MEA, 2005). Millenium Ecosystem services (MEA) 2005, defines Ecosystems as a dynamic system where “plants, animals, microorganisms, and the non-living environment interact as a functional unit”, varying in proportions. It states that humans an important part of these ecosystems.

The concept of ES as articulated by the MEA in 2005, refers to the various advantages that people derive from ecosystems. Originally, with the intention of calling attention to direct and indirect advantages that humans gain from nature, the term ‘ecosystem services’ has a range of definitions based on various views on their association to human wellbeing. (Daily, 1997). The concept was advanced upon to bring the focus towards the benefits generated by ecosystems and increased awareness on conserving biodiversity. (Elmqvist et al., 2013))

The (MEA) signified the urgency for further research in the field, then identified and categorized ecosystem services provided by natural ecosystems. These ES include provisioning services, such as food, water, which are directly obtained from ecosystems. Regulating services, such as climate regulation, water purification, flood control which help to maintain ecosystem balance. Supporting services, such as soil formation, nutrient cycling, and cultural services such as recreation, aesthetics, and spiritual connection contribute to the cultural and social fabric of the society. The MEA highlighted the significance of these services in promoting sustainable development. The ecosystems that provide these services, are crucial for human wellbeing. (ICUN, 2011). Multiple organisations have classified ES, the most prominent being MEA and TEEB (The Economics of Ecosystems and Biodiversity), where the latter mainly shed a light on the economic side of ES. The classification of ES done by the MEA and TEEB are similar, with one exception as TEEB labels supporting services also as “Habitat services”.

Provisioning Services	Regulating Services	Cultural services
<i>Products obtained from ecosystems e.g.</i>	<i>Benefit obtained from regulation of ecosystem processes e.g.</i>	<i>Non-material benefits obtained from ecosystems e.g.</i>
<ul style="list-style-type: none"> • Food • Fresh water • Fuel wood • Fiber • Biochemicals • Genetic resources 	<ul style="list-style-type: none"> • Climate regulation • Disease regulation • Water regulation • Water purification • Pollination 	<ul style="list-style-type: none"> • Spiritual and religious • Recreation and ecotourism • Aesthetic • Inspirational • Educational • Sense of place • Cultural heritage
Supporting Services <i>Services necessary for the production of all other ecosystem services e.g.,</i>		
<ul style="list-style-type: none"> • Soil formation 	<ul style="list-style-type: none"> • Nutrient cycling 	<ul style="list-style-type: none"> • Primary production

Figure 2. Classification of ES (MEA, 2005 in Sarkar & Das, 2016)

Additionally, The MEA 2005, categorizes ecosystems into different categories like forest, Marine, Wetland, Urban etc. It defines Urban as built environments with high human density. ES are particularly relevant to urban settings. Along with improving quality of life, these services significantly contribute to urban resilience, enhancing the ability of cities to cope with environmental and socio-economic aspects. (Elmqvist et al., 2013)

2.1.2 Urban green open spaces & ES

Urban green spaces are mainly natural environments composed of elements like soil, water, plants etc., that are close to an urban built environment. In contrast, built environments involve human intervention which alters the landscapes and potentially disturbs the natural processes. Open spaces, on the other hand, experience minimal intervention, hence, preserving their natural qualities which allows ecosystems to function and maintain their ecological values. (Maruani & Cohen, 2007). While public open spaces usually include all areas that are accessible by public, whether green or civic, urban green spaces generally refer to any public or private open spaces in urban areas that are vegetation covered for most of the part. Hence, Urban open spaces that are accessible to public and are covered with vegetation can be termed as Urban green open spaces. (Kumar and Rajak, 2023).

Urban green open spaces contribute significantly to the city, it's ecosystems and residents. Green spaces have an important role in providing ES by maintaining sustainability of ecosystems. (Song et al., 2020). It is widely acknowledged that urban green open spaces help reduce the impact of urbanization on land (Semeraro et al, 2021). They comprise of trees in parks and on roads, forests, nature conservation areas, parks, gardens, road belt green spaces (Song et al, 2020) (Semeraro et al, 2021). In urban planning. Urban ES are referred to both physical structures and elements of nature. (Elmqvist, 2013). Urban green open spaces, being an integral part of urban ecosystems, offer essential ES (Song et al., 2020). Some ES specific to Urban green spaces are identified in literature as follows:

Table 1. ES specific to urban green spaces.

Provisioning	Food & Raw materials
Regulating	Local Climate & Air Quality Regulation, Carbon sequestration & Storage, Noise Regulation, Moderation of Extreme Events, Wastewater treatment, Microclimate Regulation, Urban Heat Island mitigation, soil fertility
Cultural	Recreation, Mental & Physical Health, Tourism, Aesthetic, Spiritual connection, and Sense of Place, Cultural diversity
Supporting	Habitat for species, Production of oxygen, biodiversity, pollination

Source: (Green Surge, 2017) ;(Margaritis & Kang, 2017); (Elmqvist et al., 2013)

Ecosystem services provided by various green spaces have different capacities as they are context specific, based on their size and type. (Taratalos 2006 in Song et al., 2020). A city without ES is neither attractive nor alive. The United Nations has recognised that urban green spaces are essential for human wellbeing (UN-DESA, 2019).

2.1.3 Knowledge of ES

According to Cowling et al (2008), before ES can be effectively integrated into planning processes, it's crucial to have awareness, understanding, and the necessary organizational and institutional capacity in place. Much of the research does not incorporate the knowledge and views of decision makers and

planners, who are the main actors making decisions in each specific context. (Mascarenhas et al., 2014). Ecosystem services remain a fragmented field and there is still not much clarity in how to integrate the concept of ecosystem services into decision making and planning. (de Groot et al. 2010 in Mascarenhas et al., 2014). In a recent review, Mc Kenzie et al. (2014), describes through case studies that Ecosystem services knowledge can be used conceptually for promoting awareness and dialogue. “According to theories of the science-policy interface, knowledge has an important role in shaping decision” (Posner et al., 2016). Efforts to incorporate ES knowledge into policy rest on basic assumptions that this knowledge will improve decisions and result in improved environmental and human well-being outcomes, (Posner et al, 2016).

The different modes of ES knowledge namely; conceptual, strategic, instrumental are defined by McKenzie et al. (2014) as conceptual knowledge being the learning process which “broadens and deepens understanding, shapes thinking, and enables people to develop new beliefs and values”, strategic knowledge as “to support and promote a specific intervention or policy option, or justify previously held beliefs and values” and Instrumental knowledge as continuity of knowledge from “scientists to rational decision makers who make observable decisions on technical grounds”. This classification aids in thinking about how this concept may, by various stakeholders, improve understanding and communication while applying information related to ES in decision making. (Beery et al, 2015).

McKenzie et al (2014), provided a further framework the provides five pathways coming under these classifications, that increase the impact of knowledge at each stage. This framework was further developed by Posner et al (2016), shown in Fig 1, as, “coproduction of knowledge (pathway 1), conceptual use (pathway 2), strategic use (pathway 3), instrumental use (pathway 4), and outcomes for human well-being, biodiversity, and ecosystems (pathway 5)”.

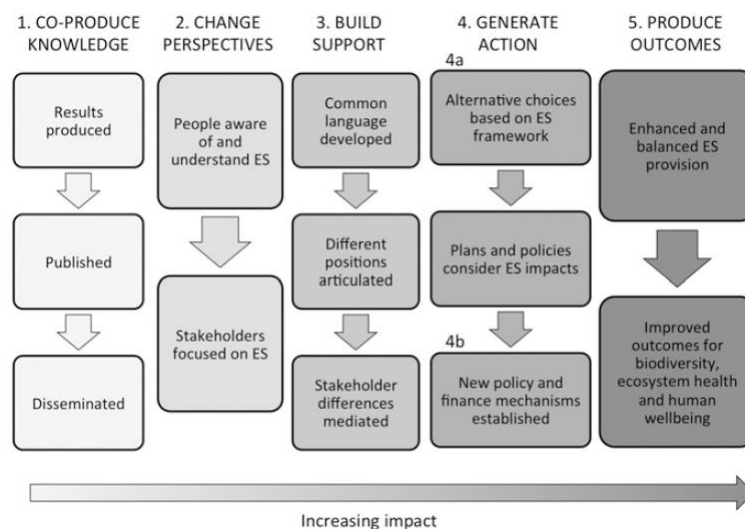


Figure 3. Evaluation framework for ES Knowledge by Posner et al., (2016)

The framework depicts how knowledge of ES can lead to impact. Different pathways are represented which indicate varying levels of success in making informed decisions. The impact increases as it moves from left to right and top to bottom. Pathway 1 represents generating the ES outputs and research findings that are shared and published. Pathway 2 represents the impact of ES information on the awareness, understanding, beliefs and attitudes of decision makers and stakeholders. Pathway 3 is important in building support and creating a common ground by using related ES language amongst different stakeholders and decision makers, during the process of choosing suitable policies and other options. Pathway 4 depicts the influence ES information has on actions and behaviours of decision makers e.g. policies, funding and decisions related to projects. Pathway 5 focuses on outcomes such as creation of new policies and other measurable improvements in ES provision, biodiversity and human wellbeing.

While focusing on conceptual knowledge, pathway 2 (Shape minds) can be focused on to assess if Ecosystem knowledge has an impact in the early stages of decision making. It aims to observe if knowledge has the capacity to point decision makers to make decisions oriented towards conservation. During the process, importance and impact of conceptual knowledge of Ecosystem services can be evaluated as a resource for decision making. Here it focuses mainly on pathway 2, when ES knowledge helps shape the minds of decision makers and planners by raising awareness and providing an ES focus for stakeholders. (Posner et al., 2016).

The success of the ES concept in connecting society and nature, and its influence on decision making, depends mainly on how well the conceptual knowledge about it is put into practice. Understanding the importance and value of ecosystem services is crucial for implementing the ES concept effectively. This understanding forms the basis for strategic and practical applications of ES knowledge in decision making processes. The idea is that by understanding the concepts behind ES, people can change their way of thinking and make better decisions. Conceptual knowledge often comes before practical use, as it helps build awareness and understanding, which are essential for making informed decisions. (Beery et al, 2015).

To lay foundation for effective implementation of ES, conceptual knowledge should be used and should be a continuous process throughout. (McKenzie et al, 2014 in Beery et al, 2015). Hence, knowledge about the ES could be valuable as an early step in shaping the problem identification of decision makers. (Posner et al., 2016). In a study done on Portuguese planners by Mascarenhas et al., (2014) to understand their level of knowledge, planners were given a questionnaire survey, to understand the perceptions of regional spatial planners in Portugal regarding ES and how they are incorporated into spatial plans. They were asked to rate on a scale of 1-5 how well they knew the concept of ES. Additionally, the planners were also asked to rate how aware they were of the different defining concepts of ES like the MEA and TEEB. The research concluded that the concept is well known among the planners. It was observed that the major initiative like MEA and TEEB did not play a notable role in mainstreaming ES concept among planners. Further research is required to explore other influences such as organizational involvement, academic contributions, awareness campaigns and other related channels of information. Additionally, based on previous research, there may be a disconnect between planners' perception and actual integration of ES in regional planning. This indicates a need for further research to understand these gaps and emphasizes the importance of using mixed methods for research.

2.1.4 Planning for Urban green open spaces

Urban green open spaces such as parks, public gardens, and trees along roads play an important role in urban planning, with urban plans containing specific guidelines that create balance between these natural elements and built structures. (Semeraro et al., 2021). Planning decisions also help shape various physical characteristics, as well as institutional and managerial structures within the city e.g., property classifications, accessibility, which are crucial in determining who can access and benefit from urban ecosystem services. (Barbosa et al. 2007 in Geneletti et al., 2020). Benefits of provision of urban green open spaces are essential for sustainable development. This suggests that there's a necessity to describe and categorize the benefits of these spaces in a manner that encourages their greater integration into planning processes. (Janson, 2014). Urban planners face crucial decisions, like the pressures of cost, restrictive land use, and uncertain public support, as well as limited land area with which to provide urban ES (Mathews et al., 2015 in Elderbrock et al.,2020). In such decisions, it is crucial to take perspectives of stakeholders such as policymakers, managers and residents. (Elderbrock et al.,2020).

To address the integration of ES, Elderbrock et al. (2020) examined currently present ES in the study area for research and reached out to diverse stakeholders to understand their priorities for the present ES. To integrate stakeholders' priorities in decision making, the study considered a set of questions that planners could use when making decisions regarding vegetated land cover driven by urban ES considerations. The planning considerations that planners might want to consider while making decisions include i) "What Urban ES are Available from the Landscape?", this entails as climatic

conditions and land vary from area to area, what types of ES are provided by the land being planned for. ii) “What Land Cover Types Thrive in This Location?”, the existing climate, land use and soil types of the area might limit the types of cover planned for the area, hence suitable vegetation types etc. need to be studied. iii) “What are the Urban ES Priorities of Multiple Stakeholder Groups?”, it is important to analyse through the perspective of landscape managers, residents, and different stakeholders. iv) “Which Urban ES can be Quantified According to Land Cover Type?”, quantification of ES is considered to make informed decisions between different alternatives. Air quality might be quantified as opposed to habitat species; these kinds of resources might result in giving priority to quantifiable vs unquantifiable ES and v) “What barriers or constraints exist?”, multiple barriers could exist to hinder green infrastructure development such as funds, maintenance, different stakeholder objectives, lack of social support and other concerns. (Elderbrock et al., 2020). This helped the research in illustrating how certain methods used to acknowledge such queries such as surveys, land cover analysis, urban ES quantification and others can aid in developing a clear path for urban green space development.

2.1.5 Planning aspects for Urban green open spaces

Planning for open spaces focuses on protecting them from extensive development interventions. These spaces provide leisure and recreation. Recreation in addition offers many benefits. They enhance the scenic character by greening urban areas, provide psychological benefits through contact with nature, reduce stress, and improve social interactions and equality. These spaces also serve educational and scientific purposes by providing diverse environments for learning and research, and they improve attitudes towards human-nature relationship. Open spaces also function to conserve natural values of land. Intervention in these natural spaces might damage these natural resources (Chavas, 2000 in Maruani & Cohen, 2007), which offer essential ecological and environmental services, such as protecting natural processes, conserving biodiversity, maintaining air and water quality, and enhancing the local microclimate, all of which are vital for supporting life. (Maruani & Cohen, 2007)

As there is growing recognition of the importance of urban green open spaces which influences planning decisions, it has resulted in the development of diverse approaches and planning methods, based on different priorities and functions. A comparison of two approaches to planning is provided: demand and supply. The demand approach prioritizes accessibility of the users, visibility, and connectivity, while providing recreational activities and facilities that cater to different groups and their needs. In contrast, the supply approach emphasizes the preservation of natural values and ecological processes, defining spaces by natural features, and promoting minimal intervention with limited activities and low maintenance, to achieve conservation goals. (Maruani & Cohen, 2007). These approaches reflect the differentiated goals in open space planning, each with its own set of principles.

Planning aspect	Examples of guiding planning principles	
	Demand approach	Supply approach
Site selection	Proximity to users Accessibility (e.g. mild topography, no obstructions) Visibility Relation to other open spaces	Presence of high-quality natural values Uniqueness of natural values Sensitivity or vulnerability of natural values Visual quality Integrity of ecosystem Vital ecological processes
Quantitative measures	Size of each open space unit Total amount of open spaces	Preferably defined by natural features or ecosystem boundaries (e.g. drainage basin)
Types of activities	A variety of recreational activities Activities fit for different groups Suitability to special needs and preferences	Limited outdoor recreation (e.g. hiking) Activities compatible with conservation goals
Site design	Design for intensive use High maintenance Wide selection of facilities	Minimal intervention Limited access Few facilities Low maintenance

Figure 3. Guiding planning principles by Maruani & Cohen (2007)

2.1.6 Perceived Barriers to Integration in Planning decisions

To get a complete picture of the use of ES in planning, there may be other barriers that could hinder inclusion along with lack of knowledge. Sitas et al., (2013), conducted a study in Eden, South Africa, to analyse in depth the challenges and opportunities related to implementation of ES in landscape planning and policy. The Qualitative analysis of views of multiple stakeholders and content analysis Identified multiple challenges to implement ES. The most prevalent barriers include

i) “Confusion concerning the concept of ES”, where individuals from different sectors, and even some within the environmental sector, show confusion regarding certain aspects. This confusion relates to understanding the relationship between biodiversity and ES and their valuation.

ii) “Insufficient resources” are another challenge. Stakeholders across various sectors, including municipalities and governmental or non-governmental agencies, face significant challenges due to scarce financial, human, and informational resources. Only a few of the municipalities studied had dedicated environmental management staff, and where these positions existed, they often remained unfilled due to limited budget. Limited human and financial capacity often restricts the implementation of tasks and activities related to ES. This lack of resources also affects the ability to implement, monitor, and enforce environmental laws and regulations. Additionally, stakeholders have highlighted challenges related to insufficient and non-existent information on ecosystem services, which also limits informed decision making.

iii) “Environment versus development tension”, where many stakeholders perceive each other as belonging to two opposing groups, who are seen as anti-development and pro-development, where latter are perceived as anti-environment. Environmental concerns raised during planning processes are sometimes viewed as hindering development. Additionally, the biodiversity and environmental sectors are seen by some as restricting access to land and opportunities for local development.

iv) “Weak alignment of policies and legislation”, where stakeholders perceive a weak alignment between current legislation and policies, particularly between national, provincial, and local planning processes. Although planning is supposed be aligned across various levels, integration of ES knowledge into policies is seen as pointless due to poor connections. Environmental issues are usually excluded in local planning, mainly because municipalities are working in silos. There is a lack of centralized information, which results in uninformed decisions. Usually, stakeholders rely on past practices and outdated frameworks, which limits the integration of new scientific knowledge into decision making processes.

v) “Minimal proactive planning”, where it is perceived that proactive planning, particularly for risk reduction, is lacking. It is commonly believed that planning primarily involves reacting to crises, while little importance is given to preventing disasters. Few existing plans prioritize minimizing disaster risks, especially those related to the environment. Document analysis confirms that disaster management plans focus on response and recovery, rather than proactive risk reduction.

Additionally, a problem that adds to this gap is the inadequacy of research to guide the decisions for urban planning. (Derkzen et al., 2015). Furthermore, only a few studies focus on analysing urban ecosystems in detail, such as examining the differences in type and function of existing urban green spaces. Significant knowledge gaps remain, especially for cities, including a lack of studies to understand the dynamics of urban ES, for both past and future. (Haase et al., 2014)

2.1.7 Inter relation between ES, Knowledge, Planning decisions and Perceived barriers

Planning and managing open green spaces can be a challenge, especially in cities. (Mager & Kiese, 2018), and urban planning decisions significantly impact the amount and distribution of ES. The provision of ES by urban green open spaces usually relates to specific characteristics such as their

composition. (Galdino et al., 2022). However, planners understanding of ES remains limited, and further research is required to explore their experiences with ES. Scientists have mainly studied the integration of ES into planning practices through two methods. The first method involves interviewing key individuals such as practitioners, policymakers, and stakeholders to understand their perception of ES, while the second includes analyses of data and documents. The interviews, in the first method, typically reveal the perceived benefits and challenges of using ES in planning. (Cortivovis, 2015). The perceptions of these individuals tend to reveal the political, social, and institutional complexities involved in practical use of ES in planning. (Scott et al., 2018). Integrating ES information into decision making faces numerous obstacles, ranging from organization level problems to broader challenges such as misaligned legislation and other barriers explained in section 1.7.

Furthermore, to ensure the effective integration of knowledge of ES into urban planning, it's crucial to understand the benefits of these services and green spaces. Urban green open spaces, including parks, gardens, forests and the services provided by them depend on their individual qualities and how well these qualities are integrated into the urban context. Landscape characteristics, such as natural vegetation play an important role in providing specific benefits like stress relief. Factors like the size, location, and content of green spaces influence the actual delivery of ES and the associated benefits and values. (Jansson, 2014). Identification of the benefits nature provides, and understanding their values can benefit planners and managers, also educators to move towards creating a sustainable city. Lack of information about how decisions affect the environment can result in loss of ES. Hence, they need to be considered into city planning. (TEEB, 2011).

2.2 Conceptual Framework

Based on literature the literature reviewed, the main concepts on which the framework is constructed on are knowledge of ES, planning of urban green open spaces and barriers to Integration. The knowledge of ES will be assessed by awareness, understanding and importance of ES. The integration of ES into planning will be based on four planning aspects, following the operationalization, and their further indicators. Likewise perceived barriers will be assessed based on 3 sub variables, their indicators. Independent Variable in the framework is the knowledge of planners, while the dependent variable is planning decisions.

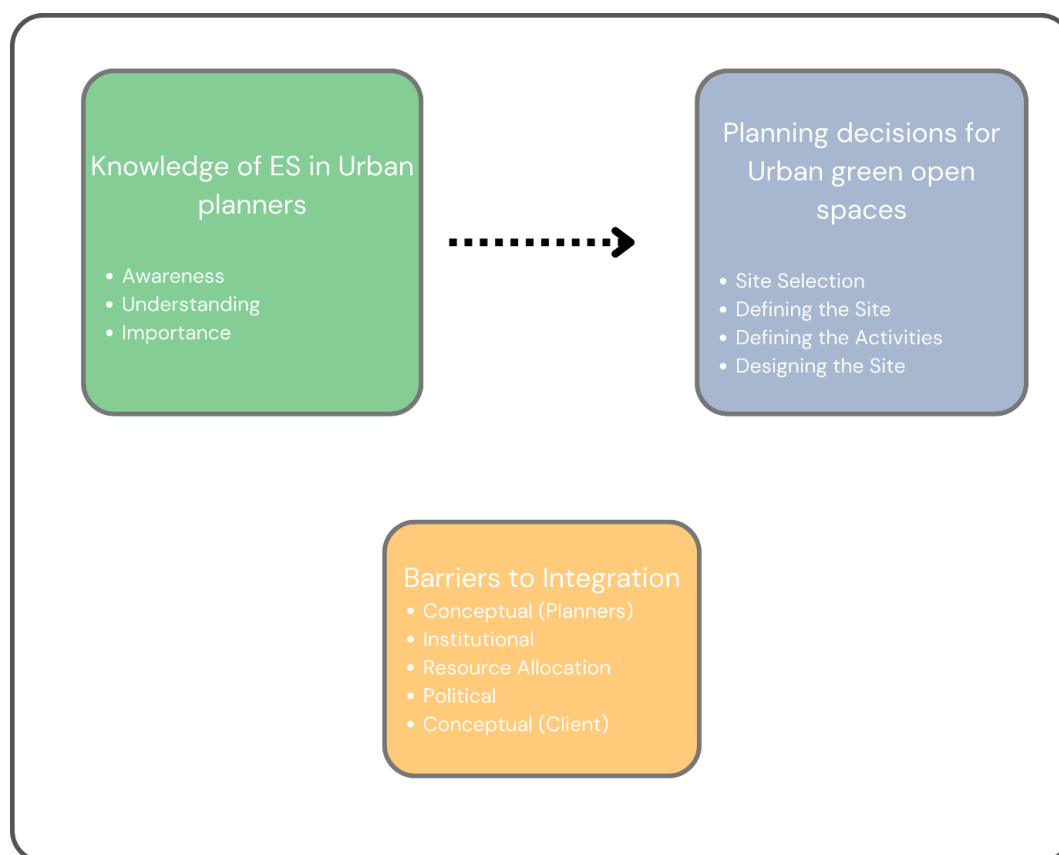


Figure 4. Conceptual framework (Source: Author)

Chapter 3 - Research design and methodology

3.1 Research Strategy

A research strategy provides an overview of the essential components of a study and outlines the approach for conducting the research. It can employ various methods for data collection. (Van Theil, 2014). For this research, the objective is to assess the knowledge of Urban planners of ES in Islamabad, Pakistan. Variables extracted from a thorough literature review are used to assess the level of knowledge, along with decisions taken regarding planning of urban green open spaces and perceived barriers to integration as the research gathered self-reported, ordinal scale data on variables identified in the literature as key elements. (Posner et al., 2016) A case study area was chosen, as it helps in studying the situation in depth, along with gathering extensive details of the case. (Van Theil, 2014). As data is collected using a combination of methods it strengthens its capacity to uncover a diverse range of social, cultural, and political factors potentially related to the subject of interest, which may not have been previously identified. (Bhattacharjee, 2012)

A questionnaire survey was designed and conducted to understand the views and perceptions of urban planners in Islamabad. The survey method was chosen as it is extremely efficient to answer the questions that involve a large number of units of study and a large number of variables. Additionally, due to work overload, fewer human resources, and limited time, planners find it difficult to take time for interviews. (Mascarenhas et al., 2014). The survey was designed to have close-ended questions, and several open-ended questions, as surveys can be used to collect information as well as to gather data on people's opinions or attitudes about a specific subject. Their large scale and high level of standardization make surveys an efficient data collection method, and the data obtained can be easily generalized, providing a high level of external validity. (Van Theil, 2014).

As Case studies and semi structured interviews are among the best-suited methods for assessing how knowledge is used in decisions. (McKenzie et al., 2014), a further qualitative research strategy was selected for this study because the goal is to also gain a contextual understanding at a micro level of the case. Therefore, the research employed a qualitative approach since it offers a comprehensive view of the complexities involved in the implementation of ES in real world settings. Relying only on a quantitative approach would likely fail to grasp the detailed nature of the opportunities and challenges in mainstreaming ES, which might lead to a loss of richness of the data. (Sitas et al., 2013) Both methods aim to collect similar information, with the interview gathering a little more subjective knowledge and perceptions, building on the current variables. Participants were deliberately chosen from key departments (Sitas et al., 2014), that are involved in urban planning. Initial sampling was purposive, targeting urban planners. Additional participants were recruited through referrals from the initial respondents. (Creswell, 2014). Participants from varying institutional backgrounds were approached, to get a wider perspective. Conclusively, the research has focused on a particular case to get an in-depth view of the findings. The methods applied are further described in detail in the chapter later.

3.2 Operationalization

The main variables with respect to this research are defined as:

- i) Knowledge of Ecosystem Services: Knowledge of ecosystem services based on awareness and level of understanding in planners and decision makers.
- ii) Urban green open spaces: Urban areas mainly covered by vegetation that are accessible to the public

iii) Ecosystem Services: “The benefits people obtain from ecosystems.” (MEA,2005). These include provisioning, regulating, cultural and supporting/habitat.

iv) Planning aspects for planning of Urban green open spaces: Refers to the aspects in which Es integration is to be considered by the planners. These are site selection, defining the site, defining activities and designing the site. The indicators to assess these variables can be explained according to literature as:

- Available Ecosystem Services: Types of ES available
- Land cover types: The area's climate, land use, and soil types. Necessitating a study of suitable vegetation.
- Stakeholder perspective: Taking perspective/opinion of stakeholders like landscape managers, resident and others.
- Presence & vulnerability of natural values: Sensitivity towards existing nature and biodiversity
- Integrity of Ecosystems: Ensuring stability & function of ecosystems and services provided by them.
- Visual quality: Visual and aesthetic quality
- Defining natural features: Prominent natural features of the land
- Defining types of activities: What types of activities were defined by the design e.g. recreational.
- Site design (Minimal intervention): The level of intervention while designing the site, how much the landscape was altered.

v) Barriers to integration: Challenges to implement ES in planning, which come under conceptual, institutional, resource allocation. The indicators of these perceived barriers are explained in literature as:

- Confusion related to the concept: Planners and other professionals lack in depth understanding of the concept
- Insufficient resources: Financial, human or informational resources and insufficient or non-existent.
- Environment/development tension: Environment concerns during planning process considered to be obstructing opportunities and development & vice versa
- Weak legislation and policies: Weak alignment between national, provincial, and local planning, with environmental information and poor communication. Fragmented information and lack of centralized knowledge hinder effective decision making and application of new knowledge.
- Minimal proactive planning: Lack of available research guidance of Ecosystem services for Urban planning

Table 2. Operationalization of variables and indicators

Sub Question	Variable	Sub variable	Indicator	Unit	Data Type	Data Collection
What is the level of knowledge of ES amongst urban planners?	Knowledge of planners	Awareness, Understanding, Importance	<p>Level of awareness (Individual), Level of awareness (Other professionals), Understanding of ES(Individual). Importance of ES(Individual)</p> <p>i)Provisioning: Food, Raw Material, water ii) Regulating : Air Quality maintenance , Climate regulation, Soil fertility, Urban Heat Island (UHI) mitigation, Pollination, Extreme weather event moderation , Noise regulation, Carbon sequestration & Storage, iii) Cultural : Recreation & Tourism , Aesthetic Values, Cultural heritage Values, Sense of Place, Cultural Diversity, Spiritual & Religious Values , Physical & Mental Health , Wellbeing iv) Supporting : Nutrient, Biodiversity maintenance & protection, production of oxygen, pollination</p>	Likert scale 1-5, subjective	Qualitative & Quantitative	Primary: Interviews & Survey
Q2. 2)What planning decisions for urban green open spaces have been made?	Planning Aspects	i) Site selection ii) Defining the site iii) Defining activities iv) Designing the site	i) Available Ecosystem Services ii) Land cover types iii) Stakeholder perspective iv) Integrity of Ecosystems v) Visual quality vi) Presence & vulnerability of natural values vii) Defining natural features viii) Defining types of activities ix) Site design (Minimal intervention)	Likert scale 1-5, subjective	Quantitative & Qualitative	Primary: Interviews & Survey
Q3. What are the perceived barriers to integration of Es in planning for Urban open green Spaces?	Barriers to include ES in planning for urban open green spaces.	Conceptual, Institutional, Resource Allocation	i) Confusion related to the concept ii) Insufficient resources iii) Environment/development tension iv) Weak legislation and policies v) Minimal proactive planning	Likert scale 1-5, subjective	Quantitative & Qualitative	Primary: Interviews & Survey

3.3 Sample Selection

Including all potential units of study in research is rarely feasible, necessitating a selection known as a sample. By creating a non-probability sample, the researcher intentionally selects specific study units. Purposive sampling is used to choose participants based on criteria that helps address the research question, making it suitable for qualitative data collection. (Van Theil, 2014). This research found non-probability sampling as a suitable choice since the sample size is less than 100.

The sample for this research was selected as professionals in the urban planning practice. These professionals, also known as town planners in the context of Islamabad, have been part of urban planning in the city on various levels. This sample consisted of Urban planners who work in the private, Government, and Academic institutions and Capital Development Authority (CDA), Islamabad. The official number of urban planners from Islamabad registered with the Pakistan Council of Architects and Planners (PCATP) is currently 72.13 Experts were reached out for interviews, out of which 7 replied with a positive response. These participants were reached out based on their respective positions in the field and work experience. The table below illustrates the details of the 7 interviewees.

Table 3. Interview Respondents

Code	Quota	Respondents' description	Source
G1	CDA Official	Director general of Planning	Interview
G2	CDA Official	Assistant director Planning	Interview
TP 1	Private	Senior Urban planner working with various organizations.	Interview
TP 2	Private	Urban planner working with various organizations.	Interview
TP 3	Private	Urban planner working with various organization.	Interview
TP 4	Private	Urban planner working with various organization.	Interview
A1	Private, Academia	Senior Urban planner with experience in planning, teaching and research.	Interview

For quantitative analysis, 52 professionals who are urban planners responded to the survey. Out of the 52, 3(5.8 %) had not specifically worked on urban green open spaces, hence only 49 surveys were used for the analysis. Questionnaires were distributed by connecting with urban planners through multiple channels. They were reached out by connecting with mutual professionals and social media platforms such as LinkedIn and Twitter. Snowball sampling was applied as a second method of sampling, where you begin by identifying a few respondents who meet the criteria for inclusion in your study, and then ask them to recommend others they know who also fit your selection criteria to collect further useful information. (Bhattacharjee, 2012). For this study, the urban planners forwarded the questionnaires to their respective colleagues and known planners. This method helped in getting responses from 52 respondents, out of which 49 were useable. The response rate is 72.2%. The sample was representative of the current planning practice in Islamabad. Additionally, to increase the likelihood of receiving a higher number of completed questionnaires from the selected sample, follow up messages were sent respectfully to confirm that the respondents had received the questionnaires and felt encouraged to complete and forward them.

3.4 Data collection methods

For this research, two methods of data collection were carried out, namely qualitative and quantitative. Both methods were used to collect primary data. As mentioned in section 1.1, questionnaires and an interview guide was developed based on the variables and indicators, illustrated in the operationalization extracted from literature, to answer the research questions. (Van theil, 2014).

A questionnaire was sent out to the planners that was created on Google Forms. Most questions were closed-ended with pre-coded response options, as they can be quickly administered and easily coded and analysed. (Kelley et al. 2003 in Mascarenhas et al., 2014). The questions were framed in a manner that answered the research questions. It started by introducing a brief description and background of the study, the targeted population, and the expected time to complete the survey. The first section asked the respondents about their background in terms of years of experience and the institutions they work at. The next section inquired about the knowledge of ES, moving on to planning decisions made during the process, and finally the perceived barriers. Beginning with simple questions initially helped familiarize respondents with the research. (Thiel, 2014). The questionnaire included a mix of multiple-choice questions (MCQs) and used a scoring method, based on the Likert scale. The scale is based on a five- or seven-point scale, ranging from "strongly disagree" to "strongly agree." Unlike binary items, they provide more detailed responses, including the option to express neutrality. (Bhattacharjee, 2012). A scale of 1-5 was used, with 1 weighing the lowest and 5 the highest. Two open-ended questions were provided to gather information that is not currently part of the research.

The questionnaires were supplemented with interviews to get the views of a broader set of stakeholders (McKenzie et al., 2014). Expert interviews were conducted for a qualitative study. A semi-structured interview was carried out, where a set of questions was prepared earlier based on the themes to be discussed from the operationalization. (Van Thiel, 2014). The interview aimed at collecting data on individual experiences regarding the perception, knowledge, and application of ES in urban planning. (Thompson et al., 2024). Twelve open-ended questions were developed, which covered the same variables as the survey. The questions were built upon or removed during the interviews, depending on the respondents' answers and the way the conversation was developing. (Van Thiel, 2014). All interviews started with a brief introduction of the research topic and were recorded after getting permission from the interviewees. The respondents were given a choice to give the interview in English or Urdu i.e. the local language. Two respondents opted to give it in Urdu. While preparing the interview guide, it was kept in mind to keep the questions from being too interrogative. The interview guide did not contain background questions, as the experts were reached out based on their credentials. Out of the 13 planners who were reached out for the interview, 7 agreed to be a part of it. Due to time constraints and convenience, some potential respondents prefer questionnaire surveys, (Bhattacharjee, 2012), which is the case for this research.

3.5 Data analysis

The quantitative data collected through questionnaires, Descriptive statistics were conducted for the three sub-questions, summarizing the data quantitatively in MS Excel after collection. The sub variables knowledge, understanding and importance were converted into numerical values based on the Likert scoring of 1-5, since they were a string variable in the original questionnaire summary e.g. not important-very important etc. The data for the main research question was analysed with the help of Stata, widely used for data analysis. Pearson correlation was run to answer the main research question. It was divided according to the four planning aspects. Each aspect was considered as the dependent variable one by one, correlated with multiple independent variables of awareness and understanding and importance given to ES by urban planners. It is to evaluate if the relationship between knowledge and integration in planning is positive or negative, further, to find out where it falls from negligible to very strong.

The qualitative data was in the first stage after collecting was transcribed through the software called Transkriptor. Two of the interviews conducted in Urdu were first translated, and then transcribed. All

content was re-evaluated to confirm there was no misheard text. The text was then transferred to MS word, and then to Atlas ti, a tool that is highly regarded for qualitative analysis. All 7 interviews were coded by primarily mix method coding. where eventually all codes were moved under the codes in accordance with the variables from the operationalization. Code analysis of the main 3 variables knowledge, planning and barriers was done to see the occurrence of prevalent themes. Code analysis table was further used to answer the main research question, looking at the frequencies of codes.

3.6 Reliability and Validity

Research validity can be ensured by carefully selecting the research strategy and methods to address the question logically and transparently. Internal validity refers to accurately measuring the effect it is intended to, while external validity is the capacity to apply the study's results beyond the study itself. (Thiel, 2014)

Testing the questionnaire is an important phase of the research. A pilot study can significantly enhance the questionnaire's reliability and validity, as the researcher can have a small group of potential respondents complete the questionnaire and provide feedback. (Van theil, 2014). Thus, the understanding and clarity of questionnaires was assessed by conducting a pilot study among four urban planners and required modifications were made such as adding an explanation of the barriers. Properly operationalizing the variables and accurately formulating the questionnaire items is particularly important for ensuring internal validity (Van Theil, 2014), which was applied to this research. However, along with the non-responsiveness, the reliability and validity of the responses cannot be certain. This could be due to the respondents being aware of them being part of a research or meeting the research expectations, which can also happen for anonymous questionnaires. To address this, triangulation can be used. (Timney Bailey, 1992 in Van Theil, 2014), which was done by using different methods, such as interviews. This method is also applied when the units of study are small, especially in case study research. By taking the multiple method approach, as much information was collected as possible, getting a response from 77.7% of the sample, and increasing the validity of the data. (Van Theil, 2014)

For qualitative research, the more structured an interview is, the more reliable and valid the findings. In a semi-structured interview, which is the case for this research, the questions are closely aligned and structured with the operationalization, hence increasing validity and reliability. Similarly, a population with various backgrounds of planners such as private, government academia etc, although the same profession, ensured representativeness and contributed to triangulation. (Van Theil, 2014).

Case study research typically has low external validity because its findings are context-specific and not easily generalizable. To address the low internal validity and reliability as well, triangulation is used. The cross-verification of data from multiple sources, is an effective way to enhance reliability and validity. (Van-Thiel, 2014)

To otherwise enhance the reliability, it is important to document data sources. (Van Theil, 2014). The research was kept transparent throughout the process, with audio recordings of the interviews, and the transcribed data.

To follow ethical principles, respondents were informed their participation was voluntary and anonymous for the questionnaires and would only be used for research. (Posner et al., 2016). The interviewees were asked for consent before recording the interview along with consent to use the data for scientific research.

3.7 Limitations

Some limitations to the research include a short time span, which did not allow to gather and analyse planning documents as secondary data and triangulate the research further. Hence, these studies focus on self-reported perceptions and opinions rather than directly assessing the implementation of the ES concept in planning practices, but these findings can provide valuable insights into the potential methods through which this integration might occur. (Cortinovic, C., & Geneletti, D, 2018).

Additionally, bias of the planners might be present, since they try to keep reputation of their own and the organizations they work for positive.

4. Chapter 4 – Data presentation & Analysis

4.1 Respondent Profiles

Of the 49 responses analysed, only 47 people responded to the question of how many years of experience do they have. Out of which, the majority at 26 (53.4%) had a professional background of 5 to 9 years. Followed by 14 (29.8 %) people with an experience of 0 to 4 years. 6 (12.8%) professionals have an experience of 10 to 14 years and finally 1 (2.1%) professional with 14 – 18 years of experience.

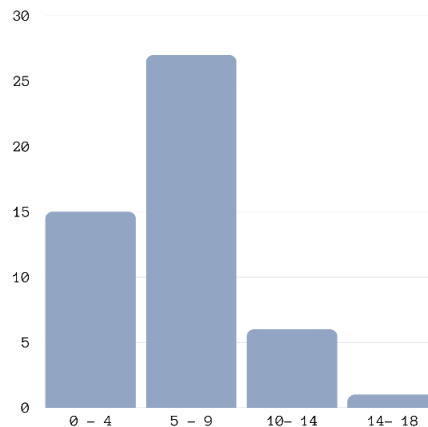


Figure 5. Years of experience (Source : Author)

Of the 49 people responding to the question of about the current organization they work at, 31(63.2 %) planners work at private institutions, with 6 (12.8 %) working in Government Institutions, while only 1 (2.0 %) working in Academic institutions. The remaining professionals work in multiple institutions with 1(2.0%) working in a Think tank along with and academia. See Fig. 5 for Institutional background.

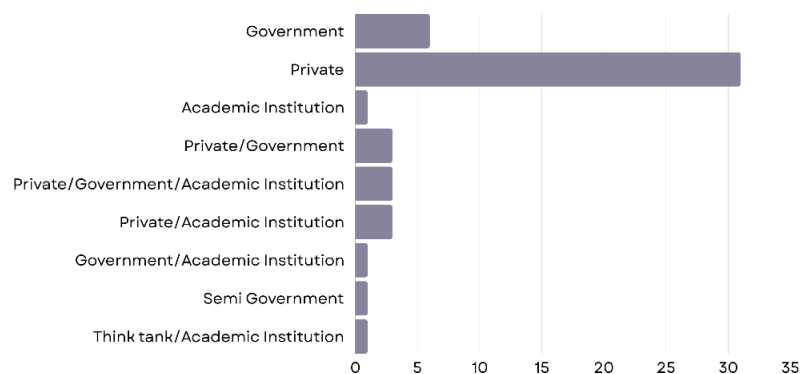


Figure 6. Institutional background (Source : Author)

To assess the knowledge of ES in Urban planners, they were asked to describe their level of awareness, understanding and how important do they consider these services. The same variables are analysed from the interviews conducted.

4.2 What is the level of knowledge of ES amongst Urban planners?

4.2.1 Awareness

Form the 49 responses in the questionnaire, 17(34.7 %) planners described their level of awareness s being slightly aware and 14(28.6) % described it as moderately aware. The remaining described it seen in Fig.7.

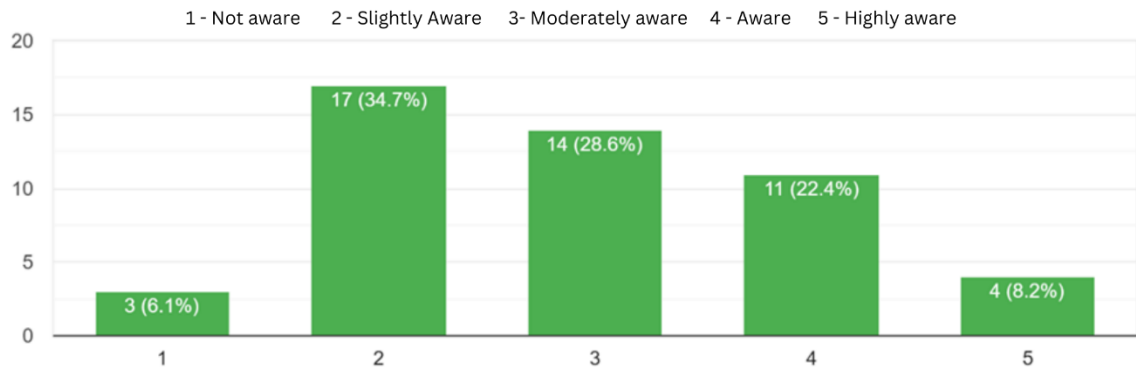


Figure 7. Level of awareness (Source : Author)

The questionnaire also asked the planners to define the term ecosystem services according to their understanding, for which there were 25 responses. The responses were analyzed individually 20 out of the 25 respondents defined the term in a correct manner, grasping the basic concept of ES.

“Ecosystem services are contributions of ecosystems to human well-being and have an impact on our survival and quality of life.” Respondent

From the interviews, the Experts were only asked to describe their level of the concepts awareness and understanding, without defining, to refrain from sounding interrogative. Expert TP1 briefed that he looked up the concept after they were contacted for the interview. On asking the same question, another Expert stated that the concept of ES is relatively new, saying

“Actually, the concept or the topic of ecosystem services is relatively new in context of developing countries like Pakistan and a very limited number of researchers are there who are currently working on studying this aspect from the perspective of urban planning. In future, maybe in the coming 10 years, we will see a boom or a trend of studying this aspect from different perspective but right now it is in very initial stages” – TP 4

Two of the experts believed they were aware of some characteristics of the concept. On the other hand, Expert (TP3) mentioned the concept of ES is very limited in their case.

The remaining interviewees refrained from explicitly explaining their level of awareness, with one exception, defining the term ES as

“Well, to my understanding, ecosystem services mean benefit that people take from the ecosystem which may be food, fuel, medicine and it also includes environmental consideration like air pollution and etc.” G1

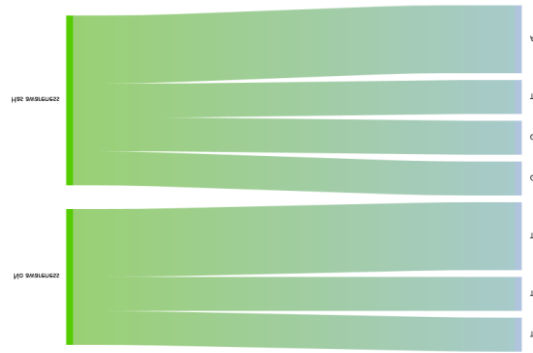


Figure 8. Level of awareness extracted from Atlas ti. (Source : Author)

Fig. 8 shows more experts were not aware of the concept as opposed to being aware.

When asked about rating the knowledge of other professionals, 21 (42.9%) planners consider them to be slightly aware, while the remaining can be seen in Fig. 9.

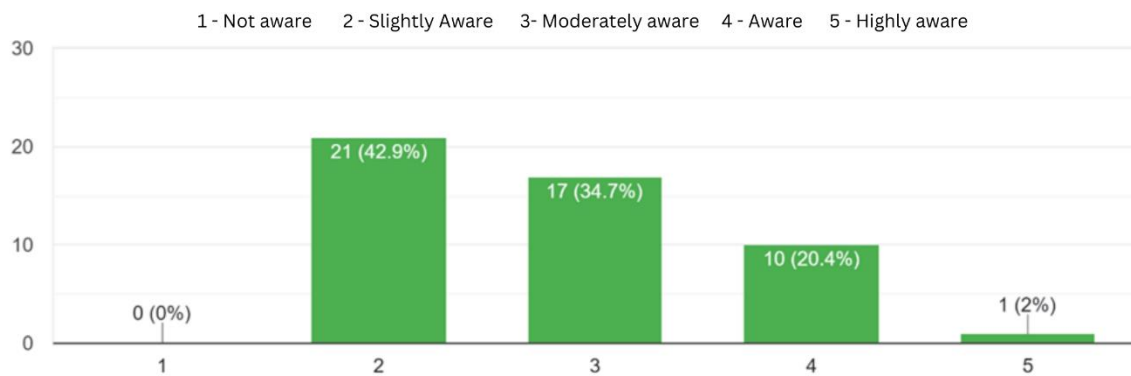


Figure 9. Level of awareness – Other professionals (Source : Author)

The experts in the field, when interviewed, were of the same opinion.

According to one,

“So, right now, I wouldn't say that there is much awareness about it amongst the designers or my fellow designers. Or even in the municipality” – TP2

Another town planner was of the same opinion, stating it is an alien concept and only 10 to 20 percent of people would be aware of the term in the current circumstances. (TP1). Expert (A1) believed the limited awareness because the planners are concerned with many other aspects of planning.

On the other hand, one expert observed,

“Well, I think urban planners are well aware of the term ecosystem nowadays considering Pakistan is one of the most affected countries from global warming. So yeah, we have the idea of what we have to do” – G1

The analysis shows, as seen in Fig. 10 more planners in the current practice are unaware of ES that being aware, with 3 experts believing both cases are true depending on the circumstances. As TP1 explained

“..I would still say that once you look at the practices, some of them would be actually using this concept without knowing it. So since everyone, any sane designer when they're designing, they do consider all of these things.”- TP 1

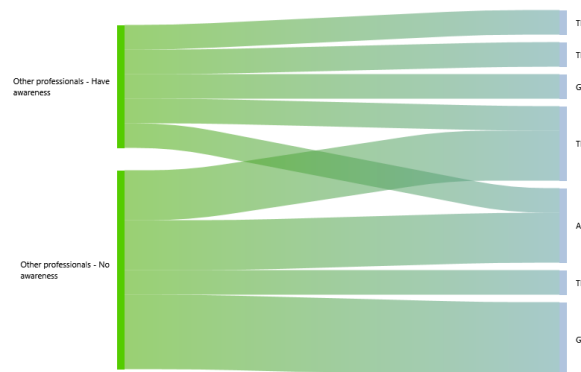


Figure 10. Level of awareness of other professionals extracted from Atlas ti. (Source : Author)

The results show a high number of survey respondents, 34.7 %, described themselves as being slightly aware, and 42.9% described it as them being slightly aware as well. Similarly, experts in both cases believe a greater number of planners have no awareness of the concept.

4.2.2 Understanding

The professionals were asked to rate their level of understanding of the multiple ES.

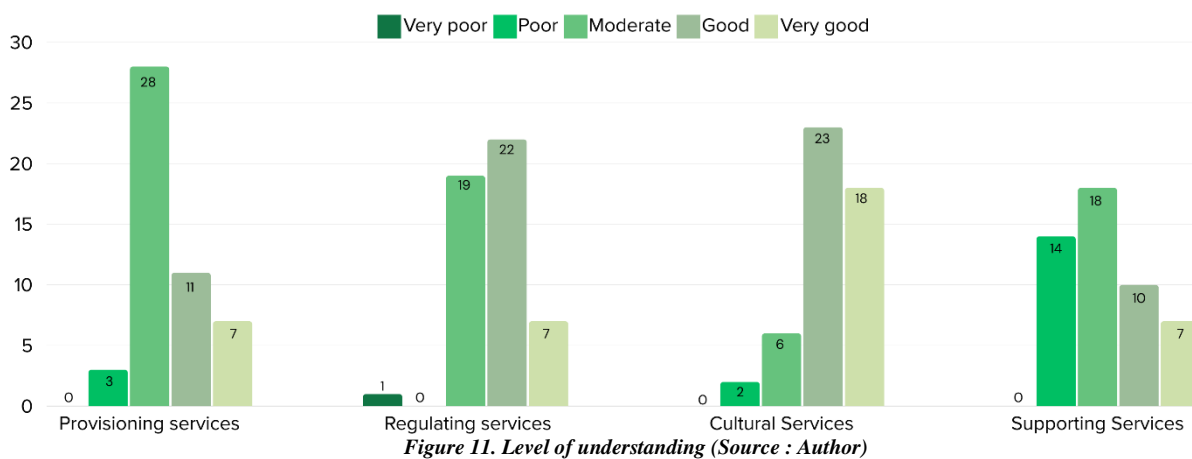


Figure 11. Level of understanding (Source : Author)

Through the questionnaire, they were asked to rate their understanding based on individual services, to understand their knowledge on a deeper level. Fig. 11 shows 28(57.1%) planners understand the benefits of provisioning services on a moderate level, with 3(6.1%) considering it poor, and the remaining rate it good to very good. 22(44.8%) rate their understanding of regulating services it good, 19 (38.7%) rated moderate, with only 1 (2.0 %) with a very poor understanding and the remaining considering it very good. For cultural services, planners, 23(46.9%) rate it good with 18 (36.7%) rating it very good, the remaining have a poor to moderate understanding. Lastly, for supporting services, 18 (36.7%) rate it moderate, 14(28.5%) have a poor understanding and the remaining have good to very good understanding of the benefits of ES.

The interviews were also analyzed to judge the understanding level, their personal and in the practice currently, although experts did not give a clear answer to the question to describe their understanding. While answering the question of understanding, they mentioned the scope of the planning community was limited.

“...most of the planning community thinks on a very limited scope” G2

Although, one perceived that other sustainable practices related to sustainability might be understood as compared to ES.

“Just like we have green rooftops or green infrastructure or blue infrastructure, wetlands, something like that. But the other aspects are not as much understood, or they are not aware of other solutions that are involved in context of ecosystem services”. – G2

Further adding their own understanding was a little better. They understood the importance of the ecosystem and it’s contributions to human wellbeing. (G2)

During the interview, it was realized the experts understand the basic concept of ES if not completely aware. One of them stated that planners were concerned with the quality of green spaces.

“..And then shortly after that, we have so much green area. But that green space is not usable. That is the reason why planners are more concerned that whatever green spaces you are going to be leaving, it should be usable by the public.....so I talk about urban ecosystem, most or less, okay, green spaces, good environment, good air quality”. – A1

Another planner stated while talking about a site they worked on, showing an understanding of the benefits. They mentioned the plantation site would create a dense forest for people to walk in and create an ecosystem for migratory birds. (TP2). They believed the concept is being used by a few, without the use of the technical term. Overall, it can be witnessed that the understanding of the individual benefits of ES is higher than that of the concept termed as ES. The approach to the concept might be different, but the outcomes are similar. (A1)

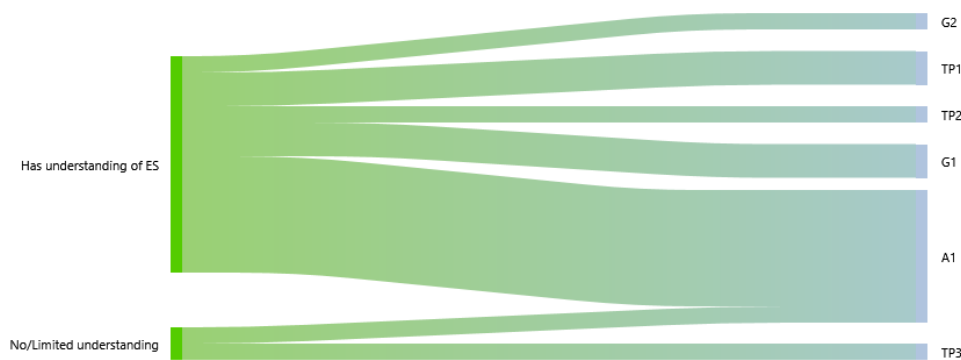


Figure 12. Level of understanding extracted from Atlas ti. (Source : Author)

Fig. 12 shows that 5 out of 7 experts understood the basic concept. While Expert A1 explained giving an example, where he mentioned his knowledge about biodiversity was present, but he has no understanding of how to conserve it, hence limited understanding. 1 expert had no understanding of the concept, while the remaining 1 interview analysis found no suitable reference to understanding.

4.2.3 Importance

When asked about their opinion about the importance of these services. Fig. 13 shows provisioning services, where 24 (48.9%) consider them as Important, with 18 (36.7%) chose very important and the remaining chose moderately important. For regulating services, 36 (73.4%) consider them as very important, which in comparison to other services is the highest. The remaining deem them as moderately important to important. Cultural services are important to 24(48.9%), 21(42.8%) consider them very important while 2 (4.0%) consider them slightly important and moderately important. Lastly, supporting services were important to 24(48.9%), very important to 17(34.6%) and moderately important to the rest.

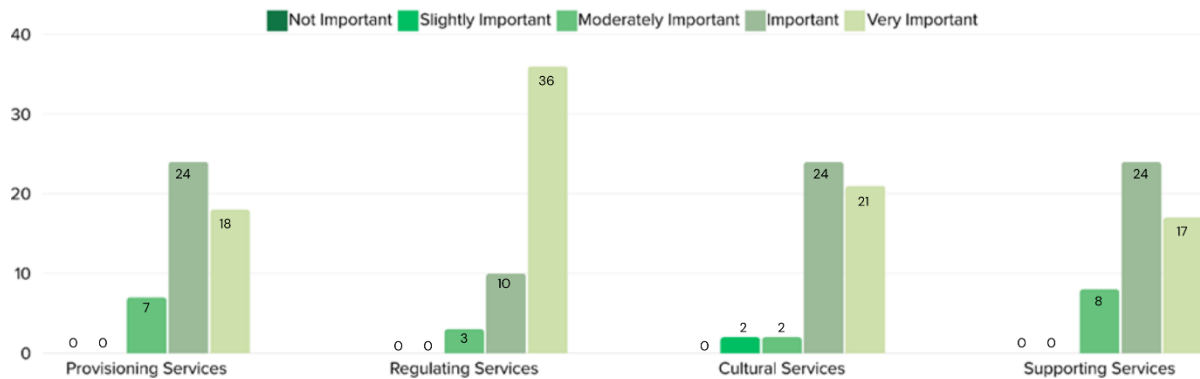


Figure 13. Importance of ES (Source : Author)

Importance of ES was not inquired from the experts, although the interviews were analysed for their perceptions. One of the experts stated ES are important for the success of a project.

“As soon as you drift apart from that, in any aspect, if you don't give importance to humans, if you don't give importance to the plants, if you don't give importance to whatever the context was, the urban project is bound to somehow not live up to its expectations”. TPI

Likewise, they perceived green spaces without providing benefits to the population ineffectual.

The planners were also asked about the importance of knowledge of ES in planners. 23(46.9%) considered it important and 20(40.8%) as very important. The remaining considered it moderately important or less.

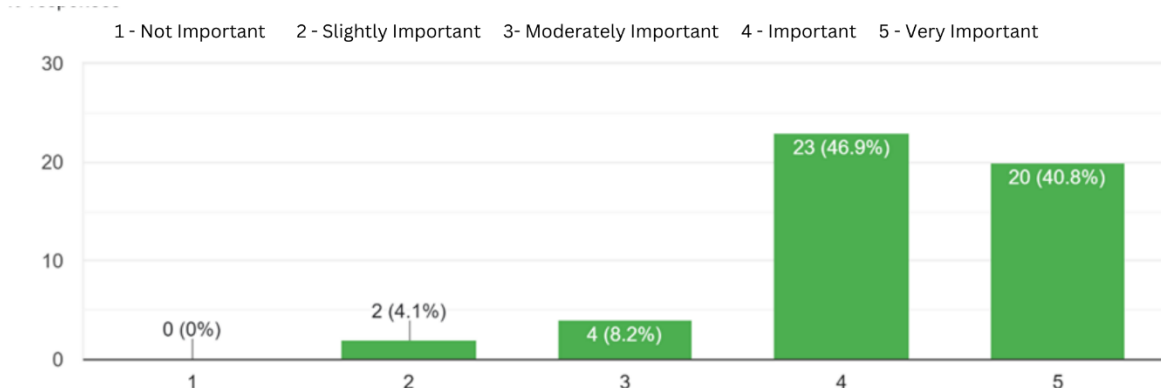


Figure 14. Importance of knowledge in Planners (Source : Author)

The same perception could be witnessed in the interviews. It is considered an important element because until people are aware of the term and the benefits provided, the concept will not be adopted. (G2). All experts considered knowledge of ES as important in urban planners.

As soon as everyone knows about this concept, as soon as everyone actively talks about it, it is bound to improve everything. So, yes, knowledge is absolutely important. And I think you're doing a good job if we can somehow publish your paper somewhere. It could help everyone..”TP1

One of the experts felt that understanding the application was more important than the term;

“So knowledge about terminology is important, but I would say that characteristics or the application, that is more important for the planners” A1

On the other hand, according to one expert, deeming knowledge as important stated strong implementation laws would have more value than knowledge of planners. (TP4)

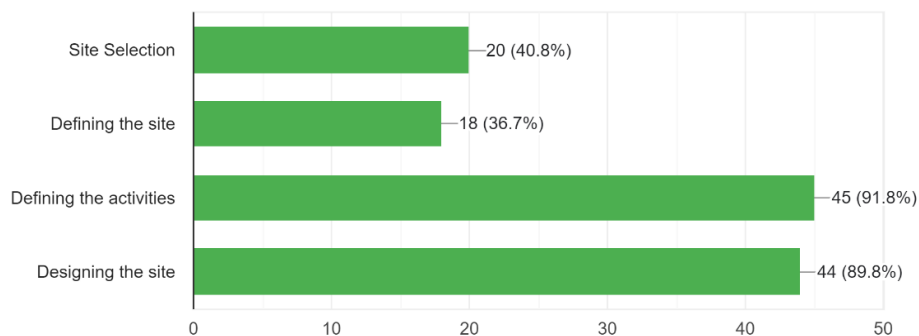
4.2.4 Summary

It was observed that the awareness levels across the survey and the interviews remain similar. The average awareness among the planners is 2.9 i.e., just below moderate. As for the collective understanding of the benefits of ES, the average is 3.5, i.e., between moderate and good. The interview analysis revealed similar results, with most experts not aware of ES but familiar with a few individual benefits and services of ecosystems. Understanding of benefits of Cultural services is the most significant, with 23(46.9%) considering it good and 18 (36.7%) at very good. However, the survey shows a higher than moderate understanding of supporting services on average, at 3.2, but the experts did not mention any benefits related to supporting services. On average, at 2.4, the understanding of other professionals is just below moderate. The interviews also portray a greater understanding of other professional of individual aspects of the concept.

From the interview analysis, experts were found mentioning how ES are important in planning. From the survey it is just below important at with an average of 4.6, of all the responses. Additionally, experts unanimously believe knowledge of ES is important in planners. Similarly, respondents place it at 4.3 on average, just below highly important.

4.3 What planning decisions for Urban green open spaces have been made?

On answering the questions related to planning decisions, the planners were initially asked according to the individual aspects of planning. Planners have worked on aspects of planning, with majority working on the last two stages while defining the activities and designing the site. One of the reasons for this is urban planners are given with the defined site, as experts TP1 and TP3 stated, they are provided with land and its defined boundaries. This decision is rarely left with the urban planners.



15. Planning aspect planners have worked on (Source : Author)

Figure

Looking at the aspects individually, the results in Fig. 15 show ES were majorly considered in the later aspects of planning, while defining the activities and designing the site. For site selection, 21 (42.8%) did not consider ES, 4 (8.1%) considered it extensively while the remaining remained between slightly to moderately. While defining the site, 15(30.65%) did not consider ES at all, 14 (28.5%) regarded ES slightly and the rest chose between moderately and extensively.



Figure 16. Consideration of ES based on individual aspects (Source : Author)

While defining the activities, we see a major trend shift, with 20(40%) regarding ES considerably and 16(32.6 %) moderately, see fig. 16 for the remaining. Similar results can be seen while designing the site, 23(46.9%) considerably using ES and 13(26.5%) extensively. The remaining chose slightly and moderately again with 0% not using at all.

As an extension of the previous question, planners were asked about the individual the indicators of planning aspects to assess the level of integration.

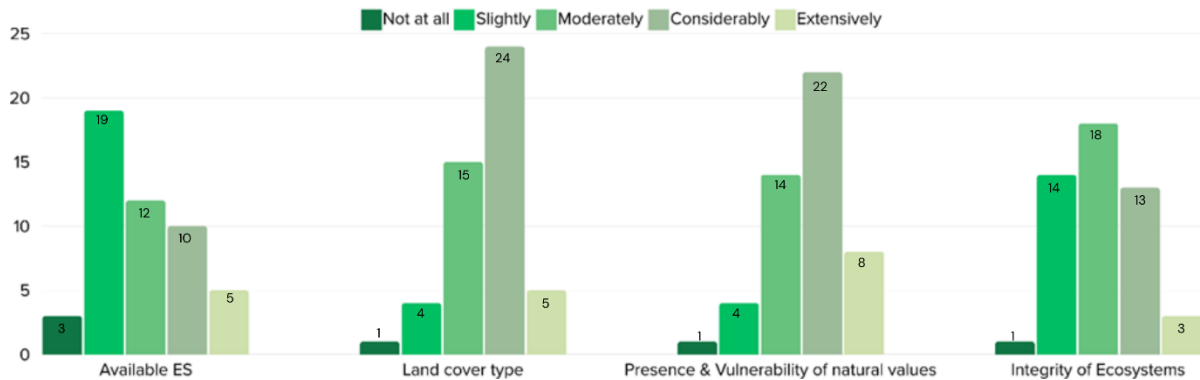


Figure 17. Consideration of ES indicators. (Source : Author)

Fig. 17 illustrates if they considered existing available ES on the site, to which 19(38.7%) respondents say they slightly did, with the remaining mainly between moderately and extensively. 24(49.2 %) considerably considered Land cover types. 22(44.8%) regarded the presence and vulnerability of natural values. Integrity of ES in moderately considered by 18(36.7 %) planners. See fig. 17 for the complete data.

During the interviews, the topic of integration of ES in planning was also explored. From the analysis, it could be seen that few ES on individual levels were integrated. Like vegetation, flora fauna, and

different landscape features. Likewise, many experts gave insights on how they integrate different characteristics, like noise pollution as well.

“For that, I can say that once the land is provided, I'm sure most of the designers are considering it. For instance, in our practice, we do consider the fact that if there's any flora, any vegetation, which is some years old, many years old, or even decades old, we make sure that that is being utilized. So that adds to the overall design as well, in urban design, they add to the beauty of it as well.” TP1

They gave a general idea how they approach planning of urban green open spaces. They try to consider as much as the requirements, or the client allows. They try to create a situation to cater to all stake holders. Depending on the client, they try to create a “win-win” situation. (TP3)

On the other hand, they also realize that the inclusion of ES factors is very surface level, focusing on only a few factors, mainly visual.

“but the oxygen levels to be honest we haven't seen”: TP4

“...since our designs are mostly, so the land is provided, we design it as for the people and we have to understand the context in a way.” TP1

“But to the extent of carbon neutrality and these concepts, there is no such consideration given right now” G2

When inquired about more specifically about biodiversity and habitat protection, the responses were similar. They believe biodiversity and habitat are not given their due importance, owing to many factors.

“.. our projects are basically where the land is already provided. So the urban fabric is a little superficial, unfortunately in our city.” TP1

The view is that the green spaces do not serve this purpose when designed.

“They're supposed to provide relief and comfort and a space of refuge for the citizens or the residents living around that green space. That's not happening like that. It's the other way around. You would go to these parks and see expensive coffee shops. And you would say that... So, eventually, it only serves a certain demographic.... The current planning or I would say planning practice is based on a very capitalist model... And providing green spaces or responding to the local ecology would be the last thing as a businessman.” TP2

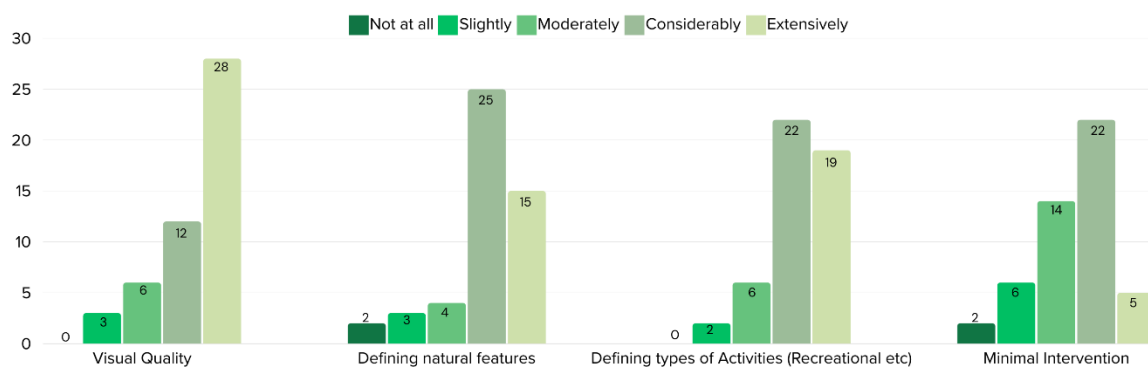


Figure 18. Consideration of ES indicators. (Source : Author)

A major shift can be seen in Fig. 18 with 28(57.1%) extensively considering visual quality. Defining natural features were given consideration by 25(51%) and extensively by 15(30.6%) planners. While for defining types of activities, 22(44.8%) considerably regarded ES and 19(38.7%) extensively. Lastly, 22(44.8 %) said they did minimal intervention while designing and urban green open space and 14(28.5%) did moderately.

As a clear trend of variables coming under cultural services given the most importance is evident in the survey, as compared to Fig. 17. The experts' interviews indicated a similar output. Planners feel aesthetics or cultural services are given more importance.

"..you know how I talked about in the start of the cultural things. So, we do cultural part of it basically is the most prioritized, because this is how people will be using this space." TP1

When asked if aesthetics are given more importance, all experts unanimously agreed this is the case.

"Definitely, yes. We are more concerned right now towards the overall outlook of the project as compared to the environmental benefits it is giving to it.. It is basically there as a design component or a landscaping component, not from the particular environment perspective. They usually do this for the aesthetics, maybe, or visual appeal, sort of.." G2

Likewise, to make the place attractive to fulfill the requirements of the client and user, it becomes challenging to focus on other ES. The client expects the planner to create visually appealing and functional spaces. Mostly inclusion of ES depends on the guidelines given by the client.

"That's actually up to the sponsor. If he wants to develop just a green land parcel or to establish a play area or anything else for the community that is to be living there." G2

Despite the planners understanding the importance of ES, integration is limited. There is a lot of gap that needs to be filled and there is a lot of room for improvement.

"The green spaces, which weren't designed considering all of these things like the ecosystem thing that you mentioned, nature will take its course for sure. So as urban designers, you need to be wary of that. As soon as you get wary of that, I'm sure you will take decisions which will last for long, which will be sustainable, which will be for the well-being of the human as well as the ecosystem itself." TP1

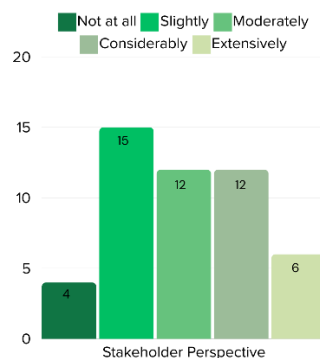


Figure 19. Consideration of ES indicator – Stakeholder perspective. (Source : Author)

Fig. 19 shows 15(30.6%) slightly considered stakeholder perspectives, but 12(24.2%) considerably and similarly 12(24.2%) extensively considered stakeholder perspective. It cannot be concluded from the

survey results what percent of community, other experts and others are considered. While the experts mentioned the types of stakeholders included in decision making.

The experts shared their current practices include different stakeholder perspectives depending on the projects. Mainly other experts are referred to while designing, e.g. landscape or horticulture experts.

“Landscape experts give their own opinions and we make sure that we get an insight on what the residents want as well.” G1

On the other hand, one expert also believed the experts do not have enough representation.

“And even if you talk about these relevant persons, the persons who know, for example, environmentalists, who know about this stuff like the species and everything, they don't have representation in master plans or in development agencies or authorities” A1

As for the residents, only one expert expressed that they involve community or residents in the process, stating they consider public participation high in Islamabad, but it does not fulfill the objective, since:

“but in the end, the decision is usually, rest with the development authority, that they are going to design a design and they have their checklists” A1

Otherwise, generally experts agreed community participation is not a practice currently.

“Sadly, it isn't because, you see, the problem is that development, the process of development, of any kind of development, it does not involve any participatory process.”- TP2

4.3.1 Summary

From the collective data, it is observed that integration of ES in different planning aspects for Urban green open spaces is considerably done while defining the activities and designing the site mostly as shown in Fig. 16. A clear pattern of importance given to cultural services can be noticed from the survey, comparing Fig. 17 and Fig. 18. Based on this pattern, it can also be concluded that land cover at average of 3.6, are just below considerable consideration and similarly presence of natural features with an average of 3.6, are given more importance as they can be more easily visually assessed, as compared to availability of ES with an average on 2.8 and keeping the integrity of ecosystems, similarly 2.9 just below moderate consideration. The experts also collectively believe aesthetics and other visual factors are a priority. Although landscape features and local vegetation are considered, they are usually dependent on their visual characteristics. According to the experts, community participation is minimum, but expert stakeholders, in most cases, are taken on board during the planning process

4.4 What are the perceived barriers to integration of ES in planning for Urban green open spaces?

The survey responses show the planners collectively perceived there were many barriers to integration of ES along with and other than knowledge. The survey respondents were given a list of barriers, extracted from existing literature, and asked mention additional barriers they might have faced. Where as during the expert interviews, an open ended question was asked, the barriers were not listed but used as a prompt in two of the interviews to get more details.

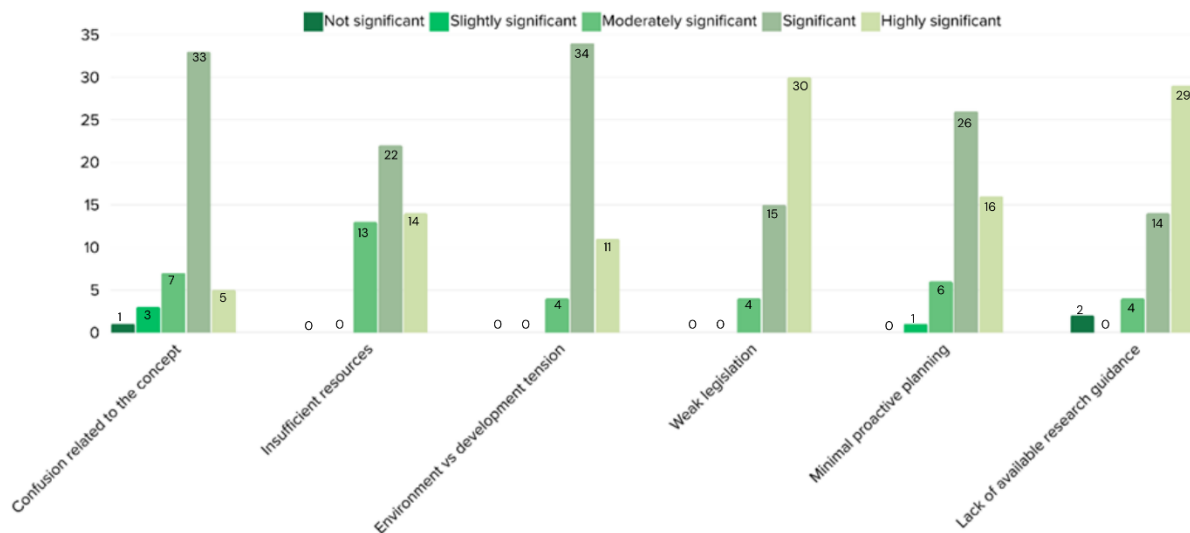


Figure 20. Barriers to integration (Source : Author)

4.4.1 Confusion related to the concept

As seen in in Fig. 20 above, 33 (67.3%) believe confusion related to the concept is a significant barrier, while 5 (10.2%) believe it's highly significant, the remaining between not to moderately significant. Similar responses were seen during the interview, it was noted that the concepts can be too technical sometimes and there is lack of training.

“So that is the limitation of partially of the planner, because we have, we are conserving so many things. But we don't know exactly, we don't have a training for that.... new approaches, terminologies, methodologies are coming so rapidly and advancing so rapidly. And we are trying to unify different concepts. But different disciplines use the same thing in different words. That's how the terminology, the definition becomes messed up. And we don't know what is the operational definition.” A1

4.4.2 Insufficient resources

In Fig. 20, 22(44.8%) think insufficient resources are a significant barrier, 14 (28.5%) believe they are highly significant while according the rest they are moderately significant, in terms of financial, human capital and information

“Resources are the basic issue for the developing countries. In any one, like, there is lack of technical resource available in the authority or in the organization that are making these policies “ G2

Financial issues are the most perceived,

“Well, the major barriers are financial constraints since looking at the economy of Pakistan, it's not that good” G1

It is believed even if the understanding is there, the need to save money overshadows the consideration for ES.

“Overall, the effect it has on the environment, they are given knowledge of it, but in their concerns, either they have to save their money or give money, or they have low budget.” TP3

4.4.3 Environment vs Development tensions

Fig. 20 shows 34 (69.3%) planners believe environment vs development is a significant issue. 11 (22.4%) believe it is highly significant and the remaining moderately significant. Through interview analyses it could be witnessed that all experts believed it was a significant barrier as well. The development aspect seems to be given more importance than the environment, thus inefficient spaces are being planned.

“They are supposed to provide that food supply, dairy, poultry, but they are not actually. Right now, they are just big lots of green land, fancy villa in the center and that's not serving its purpose”. TP2

An additional factor that came up often was the percentage of green space as compared to built space. Many believe it is a major factor in the development of urban green open spaces.

“Its biggest impact is that we have not controlled this ratio. If we have not maintained green areas along with the built-up area, this has also been affected, air has been affected and all these things happen....if 10% of the space is green space out of 100, then how can they control the ecosystem? That is not possible. So, visually, they can control it aesthetically and visually to some extent, but they cannot control the ecosystem because of the scale of the park “ TP3

4.4.4 Weak Legislation

Fig. 20 shows 30 (61.3%) planners believe weak legislation is a highly significant barrier, which is the highest as compared to others, as shown in Graph 4. 15(30.6%) believe it's significant and the rest believe it is moderately significant. Weak policies and legislation were the most prevalent barriers in the interviews as well. They are believed to be inefficient and outdated.

The unfortunate part is that I think, for the most part, the policies were written back in the 80s. ..World has changed a lot. Every day, like, cities are becoming more walkable, cities are becoming more greener, cities are becoming more environment friendly. So, when the, probably in the 80s, the thinking of the world was different.” TP 1

Lack of coordination is also a huge challenge, that effects the decisions related to urban green open spaces.

“... first is the coordination is very weak. I mean the, let's say, Ministry of Climate and Disaster and the physical planning agencies like CDA, they should work together on these things. But right now, it is like National Adaptation has been prepared by Ministry of Climate, but at the end, no input from the developing authorities is there.” G2

4.4.5 Minimal proactive planning

It can be seen in Fig.20, 26 (53.0%) consider it a significant barrier, 16(32.6%) find it highly significant while the rest believe it's slightly to moderately significant. Interview analyses show a few experts believe we require an approach that focuses of proactive planning.

“it's not a big concern for governments because so it's usually what we do is like, we go for a reaction-oriented approach...” A1

And believe Urban open green space planning should be treated as other disciplines.

“Just like we have the parameters for physical planning and the parameters for the architecture. So, why not for this.” G2

4.4.6 Lack of available research

Finally, Fig. 20 shows a high number of planners, 29 (59.1%), believe it is a highly significant barrier. 14 (28.5 %) thinks it's significant. 2(4.0%) planners look at it as not significant. Experts did not specifically cite this as a barrier, but believed the terminology plays an important role in a planning process.

“So that has been an issue that the same terminology is being recognized or being inferred differently or interpreted differently. So that is the main challenge” A1

4.4.7 Political Environment

Analysis of the interviews resulted in the development of new barriers, that were not already listed as indicators. A widely accepted point of view that became apparent was decision by planners are affected by the political environment. Many stated that the final decisions are mostly dependent on the higher level, in a private or a government setup, hence citing it as a top-down approach. (TP4) Another planner stated it is a complicated environment and decisions are based on many factors.

“in urban planning, I would say is more or less very much influenced by political, I would say, it is politicized, like how to develop a land, where to develop a land, where to lay a park, where to design a park, the site selection, which you call it is very much influenced by these concerns” A1

Further adding it's a process where decision is not in hands of the planners mostly

“kind of a thing, which politicians or different agencies or institutions think that it's their job to make decisions”- A1

Another opinion was in countries like Pakistan, due to economic instability, environment and climate concerns a less of a priority. Environmental concerns usually are not a priority since more pressing issues like political and economic instability are present. Overall, the view is decisions are dependent on higher institutions and there is limited decision-making power in the hands of the planner.

4.4.8 Client awareness and willingness

Another prevalent perception that became apparent was the planners believe the conceptual knowledge of the clients, residents, developer or officials is not sufficient.

“...that they don't have knowledge of biodiversity, they don't have awareness, so they are not considering this thing. They are only visually seeing how good this park is for the society members, whether there's a place to play or not.” TP3

All experts unanimously strongly believed unless the client, that include civilians, developers and government authorities, are made aware or forced to follow by laws, it would be close to impossible to integrate concepts like ES into planning.

“So, unless we do not educate people about the importance of such spaces, we will not be able to see the results” G2

The survey respondents had similar perceptions, where while answering the question of any other barriers they might have come across, 16 out of the 19 respondents mention awareness and willingness of the client was a major barrier.

“Conceptual knowledge of people on Islamabad and clients is very less. They usually look at it with an economic lens” Respondent

4.4.9 Summary

The results show the already listed indicators were all considered significant by the planners, with weak policy and legislation and lack of available research for urban planners as the most prevalent. Many additional barriers were identified, amongst which political environment and the awareness and willingness of the client were most apparent.

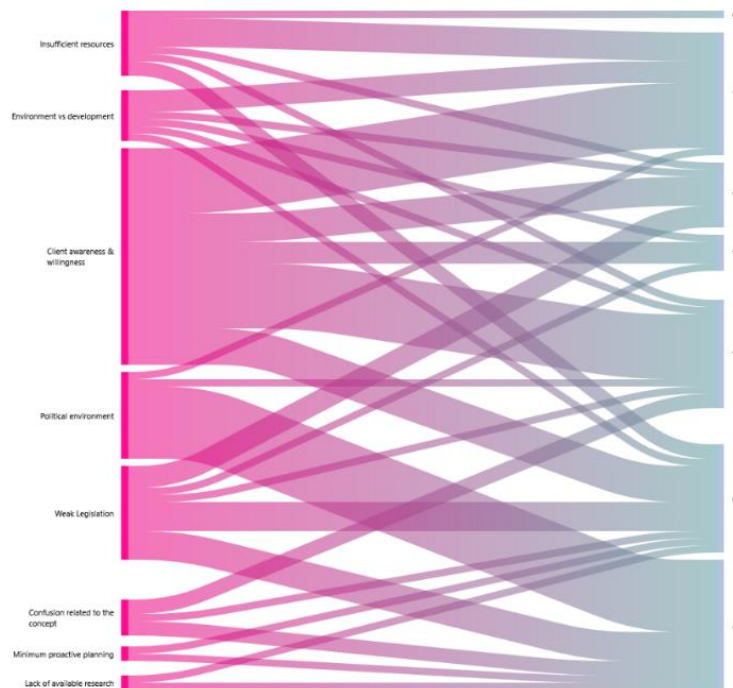


Figure 21. Occurrence of codes for barriers extracted from Atlas. Ti (Source: author)

The Sankey graph, Fig. 21, shows similar results as the survey, Weak policies are highly significant, while lack of available research has low occurrence as compared to the survey. The major finding is that two of the most prevalent barriers, in interviews and surveys, were not part of the variables. Client awareness and willingness and political environment are the biggest concerns for planner at the moment.

4.5 To what extent does knowledge of ES amongst Urban planners influence planning decisions for Urban green open spaces?

Pearson correlation was performed to measure how correlation coefficients indicate the strength and direction of the relationship between variables. The r value for interpretation is 0.00–0.10 Negligible

correlation, 0.10–0.39 Weak correlation, 0.40–0.69 Moderate correlation, 0.70–0.89 Strong correlation, 0.90–1.00 Very strong correlation. (Schober et al., 2018). See Annex 3 for correlation table.

4.5.1 Site Selection

As per the results of the correlation test performed, level of awareness of ES has a weak influence on planning decision regarding inclusion of ES in site selection with a correlation value i.e. $r=0.38$.

Level of understanding of provisioning services indicates a weak correlation with site selection at $r=0.37$. Similarly, understanding of regulating services and supporting services is weak, with $r=0.17$ and $r=0.39$, respectively. Understanding of Cultural services has an r value of -0.25 , indicating a weak negative correlation, which means the two variables will move in inverse directions if any changes occur.

Results for level of importance given to ES by the planners show a weak influence on provisioning services and site selection, with $r=0.24$ and similarly weak influence of importance of supporting services with $r=0.25$. Level of importance of regulating and cultural services is indicated has a weak negative influence on considering ES during site selection, with $r=-0.10$ and $r=-0.15$, respectively.

4.5.2 Defining the Site

Results for correlation test indicate awareness of ES has a weak influence on the process of defining the site with $r=0.37$.

Level of understanding of provisioning services has a moderate influence of site defining, with $r=0.47$, similarly, understanding of supporting services also has a moderate influence, with $r=0.58$. Understanding of regulating services has a weak influence on the process of defining the site, with $r=0.31$. Level of understanding of cultural services has a weak negative influence on defining the site, with $r=-0.12$. this indicates the variables have an inverse relationship.

Level of importance of provisioning services has a weak influence on site design, $r=0.17$. importance of regulating services has a negligible negative influence with $r=-0.09$ and a negligible negative influence of importance of cultural services is indicated, with $r=-0.04$. Level of importance of supporting services has a moderate influence on inclusion of ES while defining the site, with $r=0.44$.

4.5.3 Defining the activities

Correlation test results show the level of awareness of ES has a moderate correlation, with $r=0.44$, on decision making while defining the activities for urban green open spaces.

Level of understanding of provisioning and regulating services has an identical moderate influence on defining the activities, with $r=0.43$. Level of understanding of cultural services has a weak correlation, with $r=0.16$. understanding of supporting services has a moderate influence with $r=0.42$.

Level of Importance of provisioning and supporting services have a moderate influence, with $r=0.43$ and $r=0.40$, respectively. Importance of regulating services has a weak influence and defining the activities, with $r=0.17$. Lastly, level of importance of cultural services has a negligible influence on decision making while defining the activities, with $r=0.06$.

4.5.4 Designing the Site

Level of awareness shows a moderate on influence on decision making regarding inclusion of ES while designing the site, with $r=0.45$.

Level of understanding of provisioning services, regulating services and supporting services has a moderate influence on decision making while designing the site, with $r=0.56$, $r=0.59$ and $r=0.41$, respectively. Understanding of cultural services has weak influence with $r=0.33$.

Level of importance of provisioning and regulating services has a moderate influence with $r=0.50$ and $r=0.53$, respectively. Level of importance of cultural services has a weak influence, with $r=0.17$. Lastly, Importance of supporting services has a moderate influence on the process of designing the site, with $r=0.64$.

4.5.5 Summary

Awareness, understanding and importance have a positive weak or less than weak influence on decision making regarding ES during site selection. With the exception of understanding of cultural services and importance of cultural services, both having a weak negative influence on the site selection process.

Similarly, Influence of awareness is positively weak on decision making processes while defining the site. Understanding of provisioning and supporting have a positive moderate influence and understanding of regulating has a weak positive influence. Importance of regulating and cultural services, along with understanding of cultural services, all have a negative influence.

For defining the activities, awareness has a positive moderate influence. Understanding of provisioning, regulating, supporting and level of importance of provisioning and supporting services have a moderate positive influence as well. No negative influence was indicated of the selected variables on defining the activities.

Awareness has a positive moderate influence on the decision-making process regarding consideration of ES during the site for urban green open spaces. Understanding of cultural services has a positive weak influence, along with level of importance of cultural services. all remaining variables have a positive moderate influence. No negative correlation was indicated in the influence of selected variables on site design.

The aspects of site selection and defining the site have mainly weak positive correlation with selected variable, with two exceptions. The two later aspects defining activities and designing the site are in moderate positive relationship with the selected variables, except few exceptions in the latter. No negative correlation is indicated in the last two planning aspects

4.5.6 Expert Interview Analysis

	8: TP4	9: A1	10: G1	11: G2	12: TP1	13: TP2	14: TP3	Totals
Consider ES Important		1 2.22%			1 2.22%	5 11.11%		7 15.56%
Considered ES	1 2.22%	1 2.22%	2 4.44%		2 4.44%	3 6.67%	2 4.44%	11 24.44%
Did not consider ES	1 2.22%			2 4.44%				3 6.67%
Has awareness		2 4.44%	1 2.22%	1 2.22%	1 2.22%			5 11.11%
Has understanding of ES		7 15.56%	2 4.44%	1 2.22%	2 4.44%	1 2.22%		13 28.89%
No awareness	2 4.44%					1 2.22%	1 2.22%	4 8.89%
No/Limited understanding		1 2.22%					1 2.22%	2 4.44%

Figure 22. Code document analysis table extracted from Atlas ti. (Source : Author)

The code document analysis of expert interviews indicates various types of relationship between knowledge of ES and consideration of ES during planning decisions, related to urban green open spaces.

Fig. 22 shows, awareness (11.11%) has less table relation frequency than understanding, while analysing indicators of which is due greater understanding (28.89%) of planners of individual characteristics of ES as compared to the concept of ES as a whole, as illustrated in section 4.2. A higher number of experts stated they considered ES (24.44%) while making planning decisions, than not considering ES at 6.67%. As shown in section 4.3, this could be due to integration of mainly cultural services, hence the higher number of ES integration. The experts in some cases communicated ES were considered and not considered, depending on the type of the project, as can be seen for expert TP1, TP4 and TP3.

Few opposing relationships can be witnessed in the code document analysis table, Fig. 22. Expert TP3 illustrated no awareness and understanding of the concept, including no evidence of them giving importance to ES was found during the analysis. When asked about consideration of ES, they stated inclusion of the services while planning,

“So, we definitely consider the vegetation, flora, fauna and the context in the design aspect”- TP3

Further adding they consider other types of ES as well. As for Expert A1, high understanding of concept was exhibited, but the consideration for ES was insignificant. Similar is the case for Expert G2, where understanding and awareness of ES is present, but consideration was not given to ES in planning.

“..these concepts, there is no such consideration given right now “ – G2

As seen for expert TP1 and G1, their awareness, understanding and importance given to ES translated into their planning decisions.

Yes, we do. Ecosystem is given its due consideration. = G1

TP1 further solidified the finding that mainly cultural services are given consideration.

“..we do cultural part of it basically is the most prioritized, because this is how people will be using this space.” TP1

Similarly, TP2 considered ES highly important and exhibited understanding of the concept, which translated into their planning decision as well. From the analysis, it can be witnessed that although ES were given consideration, it was less in relation to their respective understanding of the concept.

During the analysis, it was established that planning decisions were not only based on the knowledge of the planners. Experts stated many elements to which their decisions were bound to, as detailed in section 4.3. Confusion related to the concept was not a prevalent theme, as opposed to other factors their decisions based on. As illustrated in Fig. 23, many barriers were come across during the interview analysis.

	8: TP4	9: A1	10: G1	11: G2	12: TP1	13: TP2	14: TP3	Totals
Client awareness & willingness	4 5.00%			5 6.25%	3 3.75%	9 11.25%	9 11.25%	30 37.50%
Confusion related to the concept		2 2.50%		1 1.25%		2 2.50%		5 6.25%
Environment vs development	1 1.25%			1 1.25%	1 1.25%	1 1.25%	3 3.75%	7 8.75%
Insufficient resources	1 1.25%		1 1.25%	2 2.50%		1 1.25%	4 5.00%	9 11.25%
Lack of available research		1 1.25%		1 1.25%				2 2.50%
Minimum proactive planning		1 1.25%		1 1.25%				2 2.50%
Political environment		10 12.50%				1 1.25%	1 1.25%	12 15.00%
Weak Legislation	3 3.75%	4 5.00%		4 5.00%	1 1.25%	1 1.25%		13 16.25%

Figure 23. Code document analysis table extracted from Atlas ti. (Source : Author)

Conceptual confusion of the planners has substantially low frequency, of 6.25%, other than lack of available research and minimum proactive planning. Expert A1 stated, it is not the sole reason

“So that is the limitation of partially of the planner, because we have, we are conserving so many things. But we don't know exactly, we don't have a training for that. “ A1

Experts associated their planning decisions with various barriers, with client awareness and willingness (37.50%) and weak legislation (16.25%), which are substantially high than confusion related to the concept.

“I feel like the biggest challenge is the lack of knowledge, I would say, of the people taking the decision. Not the designers here..the most important stakeholder, which is the client. – TP1

4.5.7 Summary

Although knowledge of ES translates into planning consideration of urban green open spaces, there are many elements the decisions must be based on. Fig. 22, illustrates a variety of relationships between knowledge and planning decisions. Three experts illustrated an opposing relationship between their knowledge of ES and its consideration in planning decisions. The frequency of ES considered in planning is higher, mainly due to the focus on cultural services. The analyses translated into other barriers being more prevalent than the confusion related to the concept, which has one of the lowest frequencies. The main barriers highlighted, in Fig. 23, were weak legislation and client awareness and willingness.

5. Chapter 5 - Conclusions

The research results show planners in Islamabad have below moderate awareness of the ES concept, but their understanding of the individual characteristics is higher. They mostly considered cultural services in later stages of planning. Although knowledge affects their planning decisions, it is observed they are also influenced by other elements. The detailed conclusion of this research is given by answering the research questions below;

What is the level of knowledge of ES amongst Urban planners?

Through the survey and interviews to assess the level of knowledge, it is indicated from the average results that the awareness level of planners in Islamabad is just below moderate, and their understanding level is between moderate to good. Cultural services and its characteristics prevail in term of awareness and understanding in the planners. While there is moderate understating of the concept of ES, it can be seen that the level of understanding of individual characteristics is higher comparatively. The results share a similar patten with previous research e.g., Thompson, et al. (2024) which found that knowledge on ES among planners is insubstantial. As for the importance of ES, planners deem them very important, with provisioning services at a higher rate. This shows a positive indication towards improvement in the future development as it is unlikely for planners to integrate ES if they are unaware of the value of their integration, as awareness and knowledge are essential preconditions to mainstream ES in the planning process (Cowling et al. 2008). Many other studies have shown that planners still often have limited knowledge when setting planning objectives (Song et al., 2020).

To what extent have urban planners included ES in planning for urban green open spaces?

Most of the planners have worked on defining site activities and designing the site. As observed in the expert interviews as well, the land and defined site are already provided to the planners with specific guidelines and requirements, hence, most ES integrated, if at all were at the later stages of planning. It is evident that most focus is on cultural services and the visual characteristics related to it. The previous research done by Cortinovis and Geneletti (2017) observed similar predictable findings that pertains to recreation as a primary focus of urban planners, as it is since the early start of the discipline, every plan in the sample addressed recreation and was consistent with analyses of urban plans from other cities worldwide. Although, another research found that planners and practitioners find it challenging to connect the familiar issue of recreation with the new concepts of cultural ES. (Mascarenhas et al.,2014) Other Individual ES, mainly regulating, were also included by the planners like noise regulation and extreme weather moderation. This could be a result of them being key topics of discussion on urban resilience and sustainability, and more likely to grab attention of other stakeholders. (Cortinovis & Geneletti, 2017).

The experts believe planning process also has a top-down approach, as discussed in section 4.4, with leaving minimum decision-making power in the hands of the planner. Urban ES are hardly a part of urban planning and there is absence of knowledge in planners of standards for productivity of ecosystems. (Song et al., 2020), hence there is still limited integration into urban planning (Graca et al., 2017).

What are the perceived barriers to integration of Es in planning for Urban green open Spaces?

Although there has been an increased focus on the value of ES in planning, it still remains debated. Numerous challenges are present in effectively integrating the ES concept into current planning processes and decision making. (Groot et al, 2010)

Results show there are many perceived barriers to integration of ES other than knowledge. The most apparent are weak legislation and policies and lack of available research guidance on ES in urban planning. La Rosa (2018), concluded in research on urban planning in Italy, that insufficient guidelines on how to incorporate ES in the planning process in limited at the moment and planners who intend to include ES have no precedents for what should be considered. Improving these guidelines would encourage inclusion of ES in planning. In the same study, it is indicated the improving laws and regulations on national and regional levels might improve the future chances of inclusion of ES by local planners, hence improving the overall planning context. Despite decentralized policies in Pakistan, the local municipal government lack the capacity to independently tackle urban problems, which limits their ability implement sustainable urban planning & design. (UNDP, 2023)

The additional barriers, Client awareness and willingness and Political environment, were realised after the analysis. A precedent study for client awareness is not present, as planning processes in Pakistan are contextual and do not follow the general planning guidelines followed globally.

To what extent does knowledge of ES in Urban planners influence planning of Urban open green spaces?

Integrating ES knowledge into urban plans is an important strategy, and incorporating ES indicates their quality. (Cortinovis & Geneletti, 2017). The research studies influence of this knowledge on the decision-making processes. All indicators for knowledge, except knowledge of other professional, were correlated with the planning aspects. The statistical analysis illustrated of the four planning aspects, the awareness of ES has a weak positive influence on decision making during the process of site selection and defining the sites. For the later two aspects, a positive moderate influence can be observed. The reason for this difference is illustrated in section 4.2, as majority planners make planning decisions during the latter two aspects. Level of understanding of individual ES has a moderate positive influence on the process of defining the activities and designing the site. Except the level of understanding of cultural services has a weak positive influence on defining activities and site design.

The qualitative analysis illustrates similar results, where knowledge, mainly understanding of ES, according to table relation frequency is 28.89% and consideration of ES is at 24.44%. Although consideration is lower than understanding, it depicts a positive influence of knowledge of ES on planning decisions. The vital finding of this analysis was identification of barriers or other elements influencing such decisions and knowledge is not the only factor affecting decision making. The confusion related to the concept frequented on a very low scale as compared to other elements. It is observed that the decline in ecosystems and their ability to provide these services not only entails a better a understanding, it also requires this knowledge to be incorporated into wider governance and institutional frameworks. (TEEB, 2011).

Hence, looking at the analysis results, it is evident that even if there is knowledge, its utilization is shaped by the interconnected legal, budgetary, social, and institutional environments in which they operate. (Thompson et al., 2023).

5.1 Revised Conceptual framework

The research concludes, that although knowledge is a variable affecting the planning decisions, it is not standalone, as shown in the conceptual framework in Chapter 2. The findings of sub-question 3 and the main question illustrate the influence of barriers on the planning decisions, while two new barriers were identified, adding to the originally put variables extracted from the literature. Hence, both, knowledge of ES and barriers to integration are independent variables affecting the planning decisions of urban green open spaces. The conceptual framework below shows the revised proposed framework, with two sub variables added to the barriers i.e., client awareness and willingness (conceptual, client) and political barriers, as identified in the research.

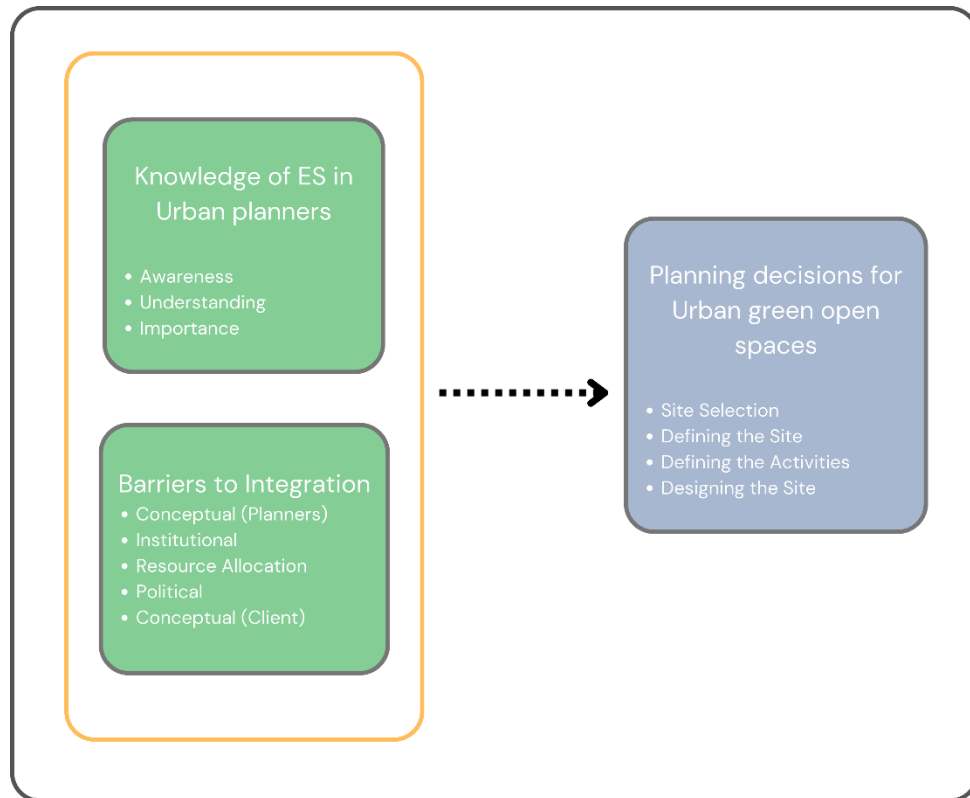


Figure 24. Revised Conceptual framework (Source : Author)

5.2 Recommendations

This research was carried out to assess the current knowledge, integration, and barriers to including ES in Urban Planning. It gives us an interesting overview of the current practices and perceptions of the planners. In the future, it would be helpful to base this research on a more qualitative strategy, for more in-depth analysis. Further analysing planning documents and comparing them with this study would enhance the quality of the findings, based on evidence. It would also be interesting to conduct future research about the knowledge of planners based on this study, and do a comparative analysis with this research, preferably with training and education programs carried out in between. To improve planning, it would be suggested to introduce research guidance for planners and other stakeholders, especially related to urban green open space planning. Recognition of ES provided by these spaces would result in improved and informed decisions, hence improving the quality of spaces.

Based on the barriers, the most significant was client awareness and willingness. A similar study could be conducted from the perspective of the client and the public, improving the database for ES knowledge, and giving direction for future research. This approach could also be applied to other cities in Pakistan and might help to develop tools and frameworks based on their respective findings and sharing data and improving city-to-city learning

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Annex 1

Questionnaire link:

<https://forms.gle/DdvDKcfdFeWMsYXJ7>

Link to Interview Transcripts:

<https://drive.google.com/drive/folders/10jYQ4Sc4a22Zkhy8BqhzM2TzSDT95zJg?usp=sharing>

Link to survey data:

[Knowldge 1.xlsx](#)

Interview Guide:

Introduction

- Q1) How would you describe your understanding of the concept of Ecosystem services?
- Q2) In your opinion, how would you describe the level of awareness regarding the concept of ES amongst urban planners in the city of Islamabad?
- Q3) Looking at the level of awareness, how would the describe the level of understanding of this concept amongst the planners?
- Q4) In your professional practice, do you consider Ecosystem services while selecting the site and defining the site for an urban open green space? For example, considering the available ecosystems and types of land cover of the site such as current vegetation?
- Q5) Would you say the planning process, that you carry out and that is practiced in Islamabad, is sensitive towards the existing nature and biodiversity of the urban open green spaces?
- Q6) Do you believe consideration is given to sustaining and preserving the present ecosystems in this process also?
- Q7) Does this process of planning urban open green spaces consider knowledge and perspective of other stakeholders? For example, landscape experts, residents etc.
- Q8) During the later stages, while defining the activities and designing the site, have you considered Ecosystem services (Air Quality, UHI mitigation, Climate regulation, Extreme weather moderation, Tourism, Aesthetics, Noise regulation, production of Oxygen, physical and mental wellbeing etc) provided by urban open green spaces?
- Q9) In your opinion, are visually defining factors (Aesthetics,) given more consideration than, for example, keeping the integrity of the ecosystem (Biodiversity, Habitat)?
- Q10) What would you consider an important aspect of the planning process to effectively integrate ecosystem services in Urban open green space planning? For example, defining the site, designing the site etc.
- Q11) Do you believe Knowledge is an important factor in effective integration of Ecosystem Services in Planning?
- Q12) What do you perceive are the barriers/Challenges, in your experience, in integrating ecosystem services into planning? (Prompt: Confusion related to the concept, Insufficient resources, Environment/development tension, Weak legislation and policies, Minimal proactive planning.)

Annex 2

Code document analysis extracted from Atlas ti.

Name	Grounded	Density	Groups	Created by
▸ ○ □ Barriers to integration	71	0		Nayaab Khan
▸ ○ □ Integration	49	0		Nayaab Khan
▸ ○ □ Knowledge	54	0		Nayaab Khan
● ◇ Consider ES Important	7	0		Nayaab Khan
● ◇ Has awareness	5	0		Nayaab Khan
● ◇ Has understanding of...	13	0		Nayaab Khan
● ◇ Knowledge - Importa...	10	0		Nayaab Khan
● ◇ No awareness	4	0		Nayaab Khan
● ◇ No/Limited understa...	2	0		Nayaab Khan
● ◇ Other professionals -...	5	0		Nayaab Khan
● ◇ Other professionals -...	8	0		Nayaab Khan

Figure 1. Coding for Knowledge extracted from Atlas. i (Source : Author)

Name	Grounded	Density	Groups	Created by	Modified by
▸ ○ □ Integration	49	0		Nayaab Khan	Nayaab Khan
● ◇ Considered ES	11	0		Nayaab Khan	Nayaab Khan
● ◇ Did not consider ES	3	0		Nayaab Khan	Nayaab Khan
● ◇ Important aspect for...	11	0		Nayaab Khan	Nayaab Khan
● ◇ No stakeholder Persp...	3	0		Nayaab Khan	Nayaab Khan
● ◇ R2 - Aesthetics given...	8	0		Nayaab Khan	Nayaab Khan
● ◇ R2 - minimal interven...	1	0		Nayaab Khan	Nayaab Khan
● ◇ R2 - presence and vu...	4	0		Nayaab Khan	Nayaab Khan
● ◇ R2 - stakeholder pers...	8	0		Nayaab Khan	Nayaab Khan

Figure 2. Coding for Planning decesion extracted from Atlas. i (Source : Author)

Name	Grounded	Density	Groups	Created by	Modified by
▸ ○ □ Barriers to integration	71	0		Nayaab Khan	Nayaab Khan
● ◇ Client awareness & w...	30	0		Nayaab Khan	Nayaab Khan
● ◇ Confusion related to...	5	0		Nayaab Khan	Nayaab Khan
● ◇ Environment vs devel...	7	0		Nayaab Khan	Nayaab Khan
● ◇ Insufficient resources	9	0		Nayaab Khan	Nayaab Khan
● ◇ Lack of available rese...	2	0		Nayaab Khan	Nayaab Khan
● ◇ Minimum proactive p...	2	0		Nayaab Khan	Nayaab Khan
● ◇ Others	5	0		Nayaab Khan	Nayaab Khan
● ◇ Political environment	12	0		Nayaab Khan	Nayaab Khan
● ◇ Weak Legislation	13	0		Nayaab Khan	Nayaab Khan

Figure 3. Coding for Barriers to Integration extracted from Atlas. ti (Source : Author)

Annex 3

Pairwise correlations - Site Selection

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1) Awareness	1.000									
(2) UnderstandingP~g	0.326* (0.022)	1.000								
(3) UnderstandingR~g	0.359* (0.011)	0.567* (0.000)	1.000							
(4) UnderstandingC~l	0.088 (0.546)	0.268 (0.063)	0.407* (0.004)	1.000						
(5) UnderstandingS~g	0.471* (0.001)	0.712* (0.000)	0.643* (0.000)	0.265 (0.066)	1.000					
(6) ImportanceProv~g	0.308* (0.031)	0.262 (0.068)	0.205 (0.158)	0.046 (0.755)	0.261 (0.070)	1.000				
(7) ImportanceRegu~g	0.023 (0.877)	0.137 (0.347)	0.270 (0.060)	0.380* (0.007)	0.009 (0.950)	0.442* (0.001)	1.000			
(8) ImportanceCult~l	-0.211 (0.146)	0.025 (0.864)	0.110 (0.451)	0.071 (0.628)	0.025 (0.863)	-0.143 (0.327)	0.235 (0.103)	1.000		
(9) ImportanceSupp~g	0.353* (0.013)	0.510* (0.000)	0.404* (0.004)	0.169 (0.245)	0.532* (0.000)	0.479* (0.001)	0.452* (0.001)	0.111 (0.448)	1.000	
(10) Site Selection	0.379* (0.007)	0.372* (0.009)	0.170 (0.242)	-0.248 (0.086)	0.390* (0.006)	0.244 (0.091)	-0.096 (0.513)	-0.146 (0.318)	0.251 (0.082)	1.000

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Pairwise correlations – Defining the Site

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1) Awareness	1.000									
(2) UnderstandingP~g	0.326* (0.022)	1.000								
(3) UnderstandingR~g	0.359* (0.011)	0.567* (0.000)	1.000							
(4) UnderstandingC~l	0.088 (0.546)	0.268 (0.063)	0.407* (0.004)	1.000						
(5) UnderstandingS~g	0.471* (0.001)	0.712* (0.000)	0.643* (0.000)	0.265 (0.066)	1.000					
(6) ImportanceProv~g	0.308* (0.031)	0.262 (0.068)	0.205 (0.158)	0.046 (0.755)	0.261 (0.070)	1.000				
(7) ImportanceRegu~g	0.023 (0.877)	0.137 (0.347)	0.270 (0.060)	0.380* (0.007)	0.009 (0.950)	0.442* (0.001)	1.000			
(8) ImportanceCult~l	-0.211 (0.146)	0.025 (0.864)	0.110 (0.451)	0.071 (0.628)	0.025 (0.863)	-0.143 (0.327)	0.235 (0.103)	1.000		
(9) ImportanceSupp~g	0.353* (0.013)	0.510* (0.000)	0.404* (0.004)	0.169 (0.245)	0.532* (0.000)	0.479* (0.001)	0.452* (0.001)	0.111 (0.448)	1.000	
(10) DefiningtheSite	0.371* (0.009)	0.468* (0.001)	0.307* (0.032)	-0.123 (0.402)	0.581* (0.000)	0.174 (0.232)	-0.094 (0.519)	-0.045 (0.761)	0.445* (0.001)	1.000

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Pairwise correlations – Defining the activities

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1) Awareness	1.000									
(2) UnderstandingP~g	0.326* (0.022)	1.000								
(3) UnderstandingR~g	0.359* (0.011)	0.567* (0.000)	1.000							
(4) UnderstandingC~l	0.088 (0.546)	0.268 (0.063)	0.407* (0.004)	1.000						
(5) UnderstandingS~g	0.471* (0.001)	0.712* (0.000)	0.643* (0.000)	0.265 (0.066)	1.000					
(6) ImportanceProv~g	0.308* (0.031)	0.262 (0.068)	0.205 (0.158)	0.046 (0.755)	0.261 (0.070)	1.000				
(7) ImportanceRegu~g	0.023 (0.877)	0.137 (0.347)	0.270 (0.060)	0.380* (0.007)	0.009 (0.950)	0.442* (0.001)	1.000			
(8) ImportanceCult~l	-0.211 (0.146)	0.025 (0.864)	0.110 (0.451)	0.071 (0.628)	0.025 (0.863)	-0.143 (0.327)	0.235 (0.103)	1.000		
(9) ImportanceSupp~g	0.353* (0.013)	0.510* (0.000)	0.404* (0.004)	0.169 (0.245)	0.532* (0.000)	0.479* (0.001)	0.452* (0.001)	0.111 (0.448)	1.000	
(10) Definingtheac~s	0.439* (0.002)	0.431* (0.002)	0.433* (0.002)	0.163 (0.263)	0.423* (0.002)	0.432* (0.002)	0.166 (0.254)	0.059 (0.686)	0.403* (0.004)	1.000

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Pairwise correlations – Designing the Site

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1) Awareness	1.000									
(2) UnderstandingP~g	0.326* (0.022)	1.000								
(3) UnderstandingR~g	0.359* (0.011)	0.567* (0.000)	1.000							
(4) UnderstandingC~l	0.088 (0.546)	0.268 (0.063)	0.407* (0.004)	1.000						
(5) UnderstandingS~g	0.471* (0.001)	0.712* (0.000)	0.643* (0.000)	0.265 (0.066)	1.000					
(6) ImportanceProv~g	0.308* (0.031)	0.262 (0.068)	0.205 (0.158)	0.046 (0.755)	0.261 (0.070)	1.000				
(7) ImportanceRegu~g	0.023 (0.877)	0.137 (0.347)	0.270 (0.060)	0.380* (0.007)	0.009 (0.950)	0.442* (0.001)	1.000			
(8) ImportanceCult~l	-0.211 (0.146)	0.025 (0.864)	0.110 (0.451)	0.071 (0.628)	0.025 (0.863)	-0.143 (0.327)	0.235 (0.103)	1.000		
(9) ImportanceSupp~g	0.353* (0.013)	0.510* (0.000)	0.404* (0.004)	0.169 (0.245)	0.532* (0.000)	0.479* (0.001)	0.452* (0.001)	0.111 (0.448)	1.000	
(10) Designingthes~e	0.447* (0.001)	0.559* (0.000)	0.590* (0.000)	0.330* (0.021)	0.411* (0.003)	0.502* (0.000)	0.534* (0.000)	0.171 (0.241)	0.636* (0.000)	1.000

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

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