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GREEN INFRASTRUCTURE TRANSITIONAL MANAGEMENT SPHERE ANALYSIS OF POLICIES AND REGULATIONS IN KUALA LUMPUR, MALAYSIA

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Abstract

Kuala Lumpur (KL) is experiencing rapid development leading to urban green space fragmentation. Green infrastructure (GI) could be the answer to the fragmented green space issue. Nevertheless, how policies and legislations contribute to the spatial establishment of GI in KL remains unclear. Thus, the policies and regulations governing GI establishment in KL were examined in this study. A total of 77 records associated with policies and regulations that may contribute to GI spatially were reviewed. In order to evaluate the efficacy of the chosen articles, the transition management sphere analysis was applied. The study discovered that Malaysia is still lacking in GI policies and regulations. Furthermore, this study also highlighted different challenges and opportunities during optimising GI implementation in spatial design. The finding can be a reference for future policy and regulation establishment.

***Keywords**:* Green space, green network, planning, transition management sphere analysis

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INTRODUCTION

As urbanisation increases, natural ecosystems and green spaces disappear, causing biodiversity loss (United Nations, 2019). Since 1990, almost 1.3 million kilometres of forests, mainly in tropical regions, have been destroyed (United Nations, 2019). Rasli et al. (2019) discovered that insufficient policy accelerated urban expansion and fragmented green areas in Kuala Lumpur (KL). The establishment of urban corridors may help reduce the impact of urban-induced forest fragmentation (Danjaji & Ariffin, 2017). Therefore, establishing green infrastructure (GI) may be a viable option.

The definitions of GI vary significantly depending on the focus of the document and researchers' work (Mell, 2016). To begin with, GI can be interpreted as strategic network planning of natural, semi-natural, and artificial spaces to conserve natural ecosystems that provide ecosystem services that benefit humans in rural or urban areas. The primary roles of GI are to preserve and link parks and other green areas for ecosystem services. Besides, GI protects and connects natural regions to promote biodiversity and mitigates habitat fragmentation by conserving flora, wildlife, natural processes, and ecosystems (Benedict & McMahon, 2006). Thus, the spatial arrangement of patches, corridors, and matrices comprising a landscape is essential in determining how functional flows and movement occur within the landscape (Forman, 1995) that supports a crucial ecological process, hence contributing to a sustainable landscape (Ahern, 1995; Shi & Qin, 2018). Uy and Nakagoshi (2008) denoted that linked green areas have higher ecological benefits than isolated green spaces.

Crammond & Carey (2017) stated that the policy is found in various forms of documents, discussions, and actions reported and observed formally and informally. Policies and procedures can lead to specific protocols, regulations, or developed standards (Stewart, 2014). Karuppannan et al. (2014) suggested that comprehensive acts, policies, and guidelines are necessary for urban wildlife protection. Hence, the following research question is addressed in this study: Do the policy and regulation contribute to KL's GI establishment via transition management sphere analysis? Although Malaysia has a green spaces policy and regulation, assessing if the policy and regulation are adequate to maintain and contribute to GI establishment via transition management sphere analysis is necessary.

STUDY METHOD

First, the related policies and regulations were identified by selecting articles related to GI. Table 1 lists the relevant documents: policies, plans, acts, guidelines, and non-governmental organisations (NGOs) plans or reports that contribute to GI planning and establishment. As GI-related documents were limited, this research also included draft reports.

Table 1: Type of policies and regulations

Level	**Policies and Regulations**
National	11th Malaysia Plan, National Landscape Policy, National Housing Policy, National Policy on Biological Diversity 2016-2025, National Green Technology Policy 2009, National Agro-Food Policy, National Forestry Policy, National Policy on Climate Change, National Sports Policy, National Tourism Policy 2020-2030, Low Carbon Cities Framework, Green Earth Programme, National Community Programme, Smart City Framework, National Urban Policy 2, National Physical Pan 3, National Urban Community Garden Policy, National Policy on the Environment
Structure & Local Plans	KL Structure Plan 2020, KL City Plan, KL Low Carbon Society Blueprint 2030, Strategic Plan KL 2010-2020, Draft KL Development Control Plan 2008, Draft KL Structure Plan 2040
Guidelines	Urban Stormwater Management Manual for Malaysia, Planning KL Guideline for Building Setback in Landed Housing (Bungalow, Semi detach or Terrace), KL Planning Guideline for Low-Density Housing Development (Bukit Tunku, Taman Duta, Bukit Persekutuan Dan Bukit Damansara), KL Planning Guideline for Submission of Planning Approval Document Digitally, Planning Guideline for Green Neighbourhood, Planning Guideline for Identification of Brownfield Development, Planning Guideline for Healthy Walkable City, Planning Guideline for Community Facilities, Planning Guideline for Theme Park, Planning Guideline for Golf, Planning Guideline For Preservation and Development of Environmental Sensitive Area, Planning Guideline For Housing, Planning Guideline Rooftop Garden, Draft Planning Guideline for Open Space & Recreation, Planning Guideline for Carpark, Planning Guideline for Old Folks Physical, Planning Guideline Erosion and Sediment Control in Malaysia, Landscape Masterplan Manual, National Landscape Guideline, Wayleave for Electricity Supply Line, Planning Guideline for Commercial Area, Planning Guideline for Transport Oriented Development, Planning Guideline for Strata Community Scheme, Planning Guideline for Mix Used (Vertical) in Commercial Zone, Planning Guideline for Infrastructure & Utility, Planning Guideline for Utility Infrastructure,
Acts	Act 172 Town & Country Planning Act 1976, Act 171 Local Government Act 1976, Act 133, Street, Drainage & Building Act 1976, Act 313 National Forestry Act 1984, Act 716 Wildlife Conservation Act 2010, Act 226 National Park Act 1980, Act 267 Federal Territory (Planning) Act 1982, Act 645 National Heritage Act 2005, Act 418 Water Act 1920, Act 56 National Land Code 1965
NGOs Plans/Reports	Landscape Architect Agenda, Green Transformation Programme – Think City, MyCrest, Green Building Index

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The study was analysed and synthesised using the thematic approach Braun and Clarke (2006). Figure 1 shows the study flow that applies theoretical thematic analysis using Atlas.ti to code GI and transition management spheres.

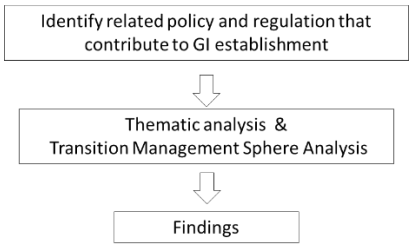

Figure 1: Study flow

Firstly, identification of related policies and regulations. Second, the coding process was undertaken according to the code group and theme ideas presented in Table 2. Saldana (2015) defined a code as a term or phrase summarising a language-based or visual data segment. The coding was done according to the title of sections or subsections containing ideas or themes, as shown in Table 2. According to Loorbach and Rotmans (2010), the general concept of transition management sphere analysis is four distinct forms of governance behaviour that can be explained in Table 2. During the analysis phase, the codes were linked together and explained. Code co-occurrences and Sankey diagrams from Atlas.ti were used to explain the relationship between the findings.

Table 2: List of code groups and ideas for themes

Code group	**Ideas for themes**
Green infrastructure	Green infrastructure
Patch - hub/space	Green space, park, national park etc.
Corridor - network	River, pedestrian, railway etc.
Component	Tree, green building, hardscape etc.
Ambiguous	Environment, landscape, natural resources etc.
Strategic: Practices at the level of a societal system that considers a long-term perspective is related to the structuring of a dynamic societal issue and the creation of alternate futures	Vision, objectives, goals, targets, green space definitions
Tactical: Operations at the level of subsystems linked to the creation and breakdown of system structures	Supporting strategies alliances, engagement, institutions, regulation, physical infrastructures, financial infrastructures, integration with other influential policies, principles, measures

Operational: Activities relating to short-term and day-to-day choices and behaviour. At this stage, actors either reconstruct system structures or opt to restructure or modify them	Instruments and delivery mechanisms, responsibility, timing and funding, resources for implementation, technical skills, action plan
Reflexive: Activities related to the assessment of the current condition at different stages and their interrelation of a misfit by structured evaluation, research, social problems are continually reformulated and updated	Monitoring, evaluation, processes, indicators and targets, peer-to-peer policy learning

**Note.* Adapted from Friese et al. (2018) and Bush (2020)

FINDINGS AND DISCUSSION

Green Infrastructure with Policy and Regulation

Figure 2 represents a Sankey diagram that shows the disparity across the policies and regulations with GI. Most of the policies and regulations contributed to patch (n = 285), followed by corridor (n = 101), component (n = 94), ambiguous (n = 43), and finally GI (n = 6). The next section will address how policies and regulations contribute to GI establishment.

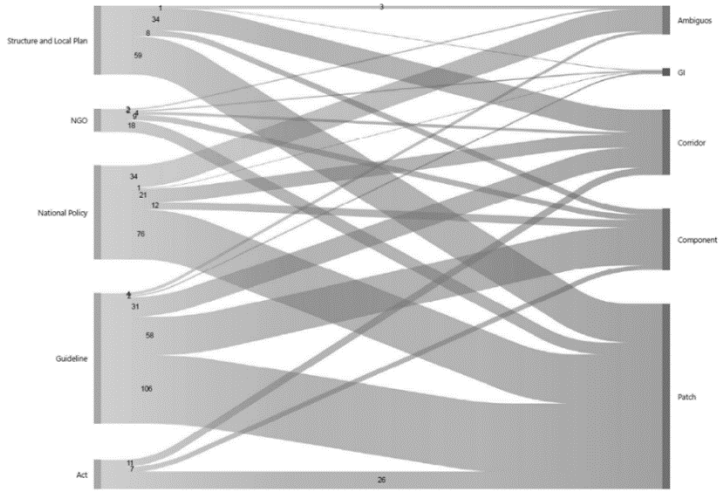

Figure 2: Contributions of the policies and regulations towards GI

National Policy and Green Infrastructure

The national-level policy contributes mostly to patch (n = 76), followed by corridor (n = 21), component (n = 12) and GI (n = 1). At the national level, the National Landscape Policy (NLP) defines GI as a network of open spaces, green areas, parks, wetlands, natural habitats, and natural landscapes for ecosystem

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preservation. Therefore, the definition is compatible with the landscape ecology principle by having a patch and corridor to protect the ecosystem. Although GI is mentioned in Kuala Lumpur City Plan 2020 (KLCP 2020), it focuses more on green technology and stormwater. Thus, clearly, GI is not covered in the Malaysia acts, structures, and local plans. Nevertheless, a progressive effort is ongoing to connect the green area and blue corridor as urban ecological nodes in KL structural and local plan. National policy (n = 34) has the most ambiguous codes, such as environment, natural resources, or landscape. Although national policy uses ambiguous terms, other national plans can still adhere to it. Nonetheless, having specific terms such as GI for top-down application and execution for detailed policy and regulation is better.

In National Urban Policy 2 (NUP 2) Objective 5.5, the government strives to increase the size, quality, and quantity of open space by acknowledging agency responsible and achievement indicators. Furthermore, NUP 2 defined green space as an area covered by natural plants or planted. The definition of green space provides more opportunities than open space to establish GI. Nevertheless, no specific act protects green spaces, except for the act that covers forest reserve and open space. On the other hand, in NPP 3, a greenfield is defined as an area with forest and productive agricultural area that also includes a green network in the urban area. Nonetheless, no consensus is available in the concept of green space whether to include only public places or private green areas (Nor Akmar et al., 2011). Therefore, the exact definition of green space and GI elements should be proposed in future.

Guidelines and Green Infrastructure

Unfortunately, no specific guideline is available for GI in Malaysia. Nevertheless, the available guideline covers patch, corridor and elements of GI. Guidelines provided most of the contribution to GI establishment (n = 201), followed by the national policy (n = 144), structures and local plans (n = 105), acts (n = 44), NGO guidelines (n = 35) and GI (n = 2). Patch (n = 106) and component (n = 58) is prioritised by the guideline more than corridor (n = 31). These findings demonstrate that Malaysia has numerous guidelines for GI that support the national policy, structure, and local plans.

PLANMalaysia has produced significant guidelines to preserve and conserve the environment. For example, the Draft Planning Standard Guideline for Open Space and Recreation by PLANMalaysia derives its power from Act 172. It provides seven hierarchies of open space: national park, regional park, town park, local park, neighbourhood park, playfield, and play lot. Besides, the guideline sets a 10% for open spaces for any development application in peninsular Malaysia. In line with the Draft Kuala Lumpur Structure Plan 2040 (Draft KLSP 2040), Kuala Lumpur City Hall (KLCH) constantly updates and provides more specific guidelines, such as management of shading tree

guidelines, that suits KL locally in terms of supporting other planning guidelines by PLANMalaysia. Nonetheless, GI does not solely depend on green space as it also needs corridors and the elements in the patch itself. Hence, a need for a specific GI guideline exists.

Acts and Green Infrastructure

No act covers GI as a holistic entity in Malaysia. The act only mentioned patch (n = 26), corridor (n = 11), and component (n = 7). Hence, how can GI connectivity be established if no such act exists? Thus, the GI act can be proposed to protect GI as a holistic entity instead of preserving only part or parcel of green spaces. Moreover, there are differences in execution in different local authorities. As for KL, the open spaces policy under the Federal Territory Act 1982 (Act 267) is almost similar to Act 172 except for some addition. Act 267 comprise more details regarding the commissioner's power and tree girth size. The difference is due to subsection 35G in Act 172. The local planning authority may amend or revoke a tree preservation order, including granting planning permission under subsection 22(3) regarding an area where a Tree Preservation Order (TPO) is for the time being in force.

Nevertheless, most experts believe that Malaysia's TPO execution is still inadequate and ineffective (Hasan et al., 2016). Mohamed Sukri et al. (2019) found that most construction industry respondents have not read the TPO (Act 172) document. Furthermore, Kanniah (2017) mentioned that monitoring the existence and disappearance of trees is difficult as less comprehensive inventory information is available on the existing trees.

Local Government Act 1976 (Act 171) provides local authority responsible for land planning and development control, including open space. In Act 172, the local government is responsible for planning and managing public space that covers any open space, parking place, garden, recreation, and pleasure ground or square. Street, Drainage, and Building Act 1974 (Act 133) help local governments to perform their functions under Act 171. The act covers streets with any road, square, footway, passage, or service road. Conclusively, Act 172, 171, 267 and 133 can contribute to GI establishment in the urban area by protecting open spaces and trees with proper amendment and execution.

As for a corridor, the Waters Act 1920 (Act 148) defines a river as a tributary of a river and any other stream or natural watercourse. The National Heritage Act of 2005 (Act 645) included provisions for the protection and preservation of national heritage, which includes natural heritage such as rivers. Thus, rivers with heritage significance can be part of the GI corridor with the protection of this act. Nevertheless, the acts also depend on the execution of the related plan and guidelines of the corresponding agency and local authority.

Nonetheless, a discrepancy exists in the National Forestry Act 1984 (Act 313). For instance, economic growth takes precedence when economic

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development and environmental protection clash. Cutting down trees is permissible if the land is to be used for a more economically valuable purpose than the forest's current use (Kanniah, 2017). The National Land Code authorises public authorities to revoke reserved and protected public parks and recreational areas (Kanniah, 2017). Thus, policymakers should be aware of this issue and amend these sections. As observed, the act in Malaysia is primarily concerned with patches. Hence, according to the landscape ecology principle, a holistic GI act should encompass patches and corridors to ensure sustainable development.

Structure, Local Plan and Green Infrastructure

Structure and local plan discuss primarily on patch (n = 55), followed by corridor (n = 33), component (n = 8), ambiguous (n = 3), and finally GI (n = 1). The KL city aspires to be a world-class city. Thus, KL tries to support this vision by having strategic, tactical, operational and reflexive measures. In order to achieve the vision, KLCH developed its open space hierarchy based on PLANMalaysia open space planning guideline. Besides, KLCH protects green space by conserving Environmental Sensitive Areas, forests, civic spaces, neighbourhood areas, and green networks. In addition, KLCH also protects more green spaces by creating creative policies such as imposing green roofs and derelict land utilisation. Spaces underneath elevated KL highways can be incorporated as part of GI (Mohamed Anuar & Abdullah, 2020). In summary, KLCH is performing a great job in planning the policy of patches. However, there is a need for more policies and guidelines on GI.

On the other hand, the Kuala Lumpur Low Carbon Society Blueprint 2030 (KLLCSB 2030) suggested improving existing policies by-laws and existing open space policy. In this case, open space in KL is constantly improving from time to time. For instance, in the Draft KLSP 2040, the open space hierarchy includes pocket parks and linear corridors. Furthermore, Draft KLSP 2040 supports GI establishment by having a green and blue network that connects the green area and blue corridor as urban ecological nodes. Other potential GI elements that can contribute to GI establishment must be assessed to establish GI.

Non-Governmental Organisations (NGOs) Guidelines and Reports

Although NGOs pay less attention to GI, patch (n = 18), component (n = 9), corridor (n = 4) and GI (n = 2), NGOs are known to support government initiatives. Norhanis et al. (2012) stated that the crucial environmental protection aspects in Green Building Index (GBI) are to conserve and maximise existing natural areas to promote habitat maintenance and restoration. Although GBI has provided eight contexts, vertical greenery is only found in the historic building part. Despite the fact that GBI rates mainly on the building, this applaudable achievement might be a role model for GI planning. Hence, a GI index that is governed by NGOs is suggested. Nor Akmar et al. (2011) posited that although

public sectors, such as federal and municipal levels, continue to guide policy and management, private actors (corporations and NGOs) have become increasingly prominent in green space governance.

Furthermore, corporate social responsibility (CSR) projects such as Adopt-A-Park Programme has become an innovative approach by the KLCH (Abdullah et al., 2020), while Landscape Malaysia planted 19,000 trees in KL (Kanniah, 2017). The Landscape Architect Agenda by the Institute of Landscape Architects Malaysia (ILAM) emphasises enhancing a conducive housing environment by creating blue-green infrastructure. Furthermore, Think City created a Green Transformation Programme that encourages green roofs and vertical greenery in the historic core of KL. Thus, NGOs play a crucial role in the knowledge transfer and implementation of GI.

Green Infrastructure and Transition Management Sphere Analysis

The Sankey diagram in Figure 3 provides an overview of GI and transition management spheres. The transition management spheres that contributes the most to GI is tactical (n = 317), followed by operational (n = 205), strategic (n = 138), and finally reflexive (n = 84). As expected, patch (n = 402) is the most crucial element of Malaysia policy and regulation, followed by corridor (n = 148), component (n = 124), ambiguous (n = 61), and lastly, GI (n = 9).

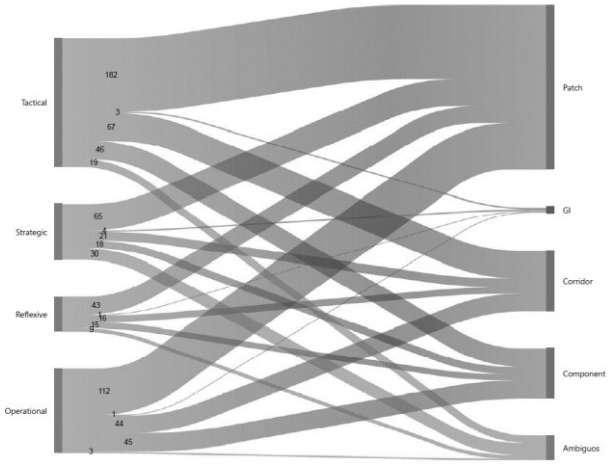

Figure 3: Contributions of transition management sphere towards GI

In NLP, Thrust 3 explain how strategic, tactical, operational, and reflexive spheres create functional and sustainable GI. For example, the implementing agency is allocated in Strategy 3.1. In terms of the reflexive measure, providing adequate quality GI to international standards might not be sufficient. Hence, a GI index or indicator might provide better monitoring. Moreover, the most

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beautiful garden nation index was proposed to measure landscape quality in development areas.

Operationally, the quality of planning officers should be strengthened, with a focus on staff competence, procedures, and public relations ability (Mohd et al., 2011). Furthermore, technical departments need extra time to provide their comments (Mohd et al., 2011). Lack of sufficient information and competent experts in developing policies may create doubts about the validity of the policies (Mohd et al., 2009). For example, awareness campaigns, public dialogues, and in-house training are essential to publicise the TPO (Act 172), TPO Guidelines and TPO Rules (Sukri et al., 2020). The National Landscape Guideline provides a holistic guideline operationally, whereas the Landscape Masterplan Manual issues planning guidelines for local municipalities. Draft KLSP 2040 also mentioned operational measures on establishing public and private partnerships public trust for green areas.

In terms of reflexive measures, Draft KLSP 2040 proposed Kuala Lumpur Urban Observatory (KLUO) to monitor urban sustainability. Besides, KLUO also provides technical input and reporting on the sustainability status of KL. Moreover, the city biodiversity index was proposed in Draft KLSP 2020 for habitat monitoring purposes in the reflexive sphere. Nevertheless, indicators alone will not guarantee better reflective practices unless an assessment by a particular organisation supports the indicators (Bush, 2020). Thus, an organisation in charge of the monitoring should be set up. Another reason for reflexive shortcoming is the organisation's fear of failure and short timelines for evaluating the performance of installations and innovations (Bush, 2020). Hence, Malaysian policymakers should be aware of these shortcomings and learn how to manage them.

The monitoring framework should consider issues such as coordination, institutional responsibilities and links, indicators, and timeframes to create a system for evaluating performance versus goals (Yaakup et al., 2009). In this respect, the policies are part of an integrated government effort that creates a coordinated public policy framework (Marzukhi et al., 2012). The legislative framework should provide for the development process requirements, monitoring, and enforcement (Othman et al., 2014). The refinement and enhancement of the Malaysian Urban-Rural National Indicators Network on Sustainable Development (MURNInets) would provide a more realistic assessment of Malaysia's progress towards sustainable development (Shamsuddin, 2013). Thus, GI may be included as an indicator in MURNInets.

Overall, the national level policy should have GI planning policy supported by structural and local plans, guidelines, NGOs, and acts with logical monitoring and enforcement. According to Kanniah (2017), a unit should be established to coordinate the monitoring and administration of public and private green spaces in KL for a more rapid and effective service delivery process.

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CONCLUSION

The study highlighted that the Malaysian government intends to protect the environment. Unfortunately, Malaysia's policies are still lacking in GI establishment as most of the policies contribute to patches. Resultantly, the limitations may cause the fragmentation of green areas. Strategically, the policy should be included at the national level to ensure that other policies and regulations can adhere to it through tactical, operational, and reflexive measures. Moreover, GI reflexive measures must be established and executed to monitor and update the GI status continuously.

In this case, KLCH developed an impressive policy in adhering to the national policies in terms of green spaces planning. Besides, KLCH even created detailed guidelines for tactical, operational, and reflexive purposes. Nonetheless, improvements can be made by developing a GI policy. Finally, the policy and regulation need to be improved to plan and establish GI. The government and NGOs should collaborate to address these issues. Gaps in strategic, tactical, operational, and reflexive spheres should be addressed accordingly to produce a holistic plan. Finally, the policy and regulation need to be improved in order to plan and establish GI. The government and NGOs should collaborate to address these issues. Any gaps in strategic, tactical, operational, and reflexive spheres should be addressed accordingly to have a holistic plan. Policy planning to safeguard GI from changes requires long-term protection goals, quantifiable policy objectives, and practical and adaptive policy instruments to detect and mitigate predicted effects on ecosystem services (McWilliam et al., 2015).

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