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Review of the nexus between Urban and Regional Planning and Engineering education

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BACKGROUND

The discipline of urban and regional planning teaches us about planning and managing the built environments. Planners have professional responsibility to deliver plans for most aspects of built environment such as land-use, infrastructure, transport and communication, community development and service delivery plans. This is how they make cities, towns and regions visually appealing, ecologically sustainable, socially equitable and economically productive. On the other hand, engineering disciplines, especially those are related to built-environment such as civil, construction, water and transport engineering, also deal with these issues but they focus on tools and design to implement the plans. A number of studies have been conducted on nature of interdisciplinary relationship between the planning and engineering education but none of the studies covers key issues that deserve interdisciplinary approach in addressing the built-environmental problems.

PURPOSE

The main purpose of this paper is to identify the key interdisciplinary relationships between the planning and engineering education and its implications to future curriculum review of these disciplines.

METHOD

This is purely a desktop research based on literature review from built environment planning and engineering context. First this study accomplished a contextual review about the changing international context, changing approaches in planning and engineering disciplines and the changing approaches in built-environment management; and this contextual review established the necessity of exploring the interdisciplinary relationship between planning and engineering education for future and coordinated management of challenging issues related to built environment. Second this study reviewed the interdisciplinary courses and issues between the planning and engineering education based on the available literature. Third this study provided some examples from USA and Australia and identified the practical synergies between these two disciplines. The information related to the examples is collected from internet sources available to date.

RESULTS

This review found that planning and engineering disciplines (especially urban planning and civil engineering) are closely entwined in terms of planning, designing, developing and managing our built environments. Academics from both areas should come forward to prepare and deliver some interdisciplinary courses that can address some real life challenges that need to be aware of both by the planning and engineering graduates.

CONCLUSIONS

The most obvious lesson is planning and engineering academics and professionals should work together to manage built-environment in a cooperative manner. This paper also makes appeal for further in-depth study on the same issue.

KEYWORDS:

Urban and Regional Planning, Engineering, Education, Australia

Background

Urban and Regional Planning had been established as an independent discipline in 1900s. Currently urban and regional planning is working with other disciplines such as engineering, architectural, social sciences. In this discipline the students learn both theories about urban, regional and community problems, and techniques to solve the problems. Planners are always concerned about problems that people have in their communities and they also try to provide practical solutions to these problems. Planners start with a vision of what would be ideal for a community and then apply analytical, technical and socio-political skills that help in planning a better community (van Horen, 2004).

Planners perform a variety of duties. They prepare long-term comprehensive plans to guide the future development of a region. They create detail plan and programs to develop and manage the built environment and this includes planning for parks, roads, schools, utilities, housing, shops, and other public services. Planners help decide what project should be implemented for the welfare of the society. For instances, in transport planning, planners try to identify and plan for the accessibility needs of people. Transport planning therefore takes into account the desirable social, environmental, economic outcomes and develops strategies to achieve those outcomes within a planning framework.

Planning is also a science of developing analytical framework to solve biophysical, social, economic, political and institutional problems existed within a region or urban settings **(**van Horen, 2004). Planners always try to focus on multi-disciplinary and collaborative process in problem solving. They mostly focus on strategic nature of the problem and the solution rather than producing design component of the solution.

On the other hand, engineering disciplines, especially built environment engineering also plays planning and design role in developing and maintaining built environments. For example, civil engineering is a very old discipline. In the past, civil engineers analysed real-world problems using strategies and tools that are common across engineering practices and they usually planned and designed town and infrastructure developments. Because of the era of specialisation and globalisation, now one discipline cannot serve all aspects of built environment as well as it is not economically viable and academically sound too. Hence the changing international contexts impact on the nature of most disciplines, especially the planning and engineering disciplines. These days, civil engineering deals with the design, construction and maintenance of built environments such as roads, bridges, canal, dams, sanitation facilities and buildings. On the other hand planning (urban and regional planning) discipline looks after most the planning aspects of infrastructure developments. Therefore, there is an interdisciplinary and professional relationship between those two disciplines. This paper aims to identify the key interdisciplinary relationships between the planning and engineering education and its implications to future curriculum review of these disciplines.

Methodology

This study followed a step by step contextual methodology based on literature review and observations. Here planning refers to urban and regional planning and engineering refers to built environment or civil engineering, and built-environment refers to urban environment. First this study accomplished a contextual review about the changing international context, changing approaches in planning and engineering disciplines and the changing approaches in built-environment management. This contextual review established the necessity of exploring the interdisciplinary relationship between planning and engineering education for better planning and management of built environment.

Second this study reviewed the interdisciplinary courses and issues between the planning and engineering education based on the available literature. Third this study provided some examples from USA and Australia and identified the practical synergies between these two disciplines.

This study has some limitations in scoping and exploring the main research question (i.e., what are the key interdisciplinary relationship between planning and engineering education?) because of not many studies have been published in this area or available to date and also the authors do not have any funding for doing an empirical research. That is why the study team could not manage to collect multilateral and multi sourced information to increase the paper's credibility within the academic world. All examples and the information used here were getting from online sources available to date, personal observation and experiences of the authors with some of the Australian universities. However, this paper will be a starting point of doing further in-depth research on interdisciplinary relationships between Australian planning and engineering education.

Changing International Context

Since the end of the Second World War, developments in science and technology have affected economic and industrial development in both developed and developing countries. Multiple communications, globalisation, liberalisation and decentralisation have brought a global change in flows of goods and people from one place to another. All of these factors together lead to urban population growth and a rapid growth of large and mega-cities.

The world's total population was 2.5 billion in 1950 and it is now more than 6 billion. The share of urban population in the total population is increasing over time. During the last two hundred years world urban population grew from less than 30 million to almost 3 billion (UNCHS, 2010; UNCHS, 2001). It is forecasted to be 4.1 billion in 2020, and about 5 billion in 2030 i.e., 60% of all people will live in urban centres. This rapid population changes bring huge challenges for the planners and for the engineers for managing the built environments. For example, if planners do a wrong estimation in population forecasting or identifying socio-economic dynamics, then the engineering design for today will not work for tomorrow. This is one of the reasons that we found serious traffic jams in most mega cities in the world.

International flows of goods, services, capital and information to the local level are known as globalisation (Stren 1993). The current phase of globalisation (post Second World War) is qualitatively different in terms of its scope, speed and complexity. Globalisation affects urban management in both developed and developing countries. It spreads the norms of democratic governance, transparency and accountability. It also affects the physical infrastructure of the global cities. Globalisation also creates dualistic societies and increases the gap between the 'have' and 'have nots' (Cohen 2004). The effect of globalisation on urbanisation appears to be economically dynamic but produces many problems in urban service and infrastructure delivery.

The number of mega-cities is growing faster. There are now 19 cities with 10 million or more people; 22 cities with 5 to 10 million; 370 cities with 1 to 5 million people; and 433 cities with 0.5 to 1.0 million (UNCHS, 2010; UNCHS, 2001). These global changes bring changes in the approaches of both planning and engineering education in respect of planning and managing the built environments. Both planners and engineers are currently providing specialised services to solve the growing urban and built environmental problem but they also need to provide some integrated and strategic services to the community. However, it is yet to know how these disciplines are acting to preparing their graduates in providing integrated or interdisciplinary services to the community, in order to address the changing built-environmental issues. The following discussion will provide a brief account of changing

approaches in planning and engineering education in respect of maintaining a sustainable built environment.

Changing Approaches in Planning and Engineering

Planning is a part of the political process, which identifies and decides how and to what extent resources should be distributed in society. Rationality, comprehensiveness, laws and scientific base are the basic elements of planning. The urban plans practised in both the developed and developing countries can be divided into two categories: statutory plans and performance-oriented plans.

Statutory Planning: Statutory planning is the planning system set up and specified by law or any other statutory instruments' (Davidson 1996). Statutory planning for service and infrastructure delivery includes problem identification, fact-finding, rulemaking and enforcement. Master plans, structure plans, and statutory local plans are the major types of statutory plan. The main advantages of these plans are that they can protect critical elements and avoid *ad hoc* decisions based on self-interest. The main disadvantages are that they are bureaucratic and involve inflexible routine work, with a rigid legal basis which is difficult to change over time (Davidson, 1996).

Performance-oriented planning: Need-specific and flexible plans are known as performance-oriented plans. The form of the plan is determined by the performance required rather than by prescribed statutory arrangements (van Horen et al., 2004). Basically there are two forms of performance oriented planning: action planning and strategic planning.

Action planning can be defined as short term planning within a defined area (Davidson, 1996). It mainly focuses on the issues of physical infrastructure development based on existing human and financial resources, along with community participation (Davidson, 1996). Engineers need to aware about such plan as they design infrastructure based on the needs of action plan. Strategic planning is a one kind of action planning with broad and flexible development objectives and prioritised options. Key characteristics of strategic planning are linkages to and with national policy issues, adopted multi-disciplinary problem solving approach (DAF, 2000).

Strategic planning is suitable for urban and built environment planning. Recently civil engineering practitioners have been following such type of planning. Institute of Civil Engineers in USA used the principles of strategic planning and developed a Sustainable Development Protocol in 2006, which includes sustainable development strategies and action plans. This was followed in 2009 by a civil engineering and climate change protocol that further identified priorities for action by engineers (Jennings, 2012). So they also come forward to address man-made and natural challenges by some adoption strategies instead of concentrating on designing buildings, dams and roads. Some universities such as Queensland University of Technology and University of Wisconsin started to providing degree in urban planning and built environment engineering by designing some common courses for both planning and engineering students. Therefore, their graduates are now well equipped in solving complex built-environmental problem by using interdisciplinary approach.

Changing Approaches in Built Environment Management

Here the term built environment management has used as urban management. Historically the term 'urban management' has been synonymous with that of municipal administration. During the mid-1960s to mid-1970s, municipal administration emphasised grand plans and programs, and standardised urban service delivery based on master planning principles. But this concept changed into an urban managerial approach in the early 1980s, which started to

deal with rapid urban population growth, the urban economy and local institutions (Stren, 1993). Recently this approach changed into an 'urban governance' approach, which emphasises community participation and local capacity building, institutional strengthening, public-private partnership in service delivery, efficient use of financial resources, and equity in service delivery (Minnery, 2004). The main factors leading to this change in approach were changing international contexts such as urban population growth, current mode of production, globalisation, increasing complexity and fragmentation (Werna, 1995).

The administrative approach to urban management is a traditional approach. According to this approach, urban management is defined as the interface between bureaucracy and the community (Stren, 1993). The civil servants considered themselves as development administrators and they distribute the resources among the urban dwellers. Urban elites and the bureaucrats make the decisions and plans for basic urban service delivery and infrastructure development (McGill 1998). Both planners and engineers were neglected under such approach.

Managerial approach deals with the application of good techniques, i.e., financial, organisational and master planning (Rakodi and Devas, 1993). Here both planners and engineers engaged in some extent to plan and design the service systems.The concept of 'urban governance' emerged in the 1990s (Pugh 1997). This is the concept of interaction between the government and civil society (i.e., community) and involves mechanisms to determine how power, rights and responsibilities are distributed and expressed among the stakeholders (Buehler, 2003). However, urban governance is clearly defined as the processes of urban direction-setting and implementation that incorporates the roles and responsibilities of government (the state), the private sector (the market), and civil society (the community), as well as the partnerships and conflicts amongst them (Minnery, 2004). Under this approach, planners were engaged in the development process at the very beginning and thereafter the engineers take role in design the infrastructure but they work together with an aim of sustainability of services that require for a built environment.

Nexus between the Planning and Engineering Education

As mentioned at the beginning of this paper, a number of infrastructure and services are required for developing and maintaining built-environments such as roads and transport networks, urban utilities and social infrastructures. All these developments require intensive involvement of both planners and engineers at the beginning of development. That is why some universities have been trying to develop some interdisciplinary courses that can support the need of both professionals.

Steinitz and Rogers (1970) reported an interdisciplinary education for environmental planning carried out at the Harvard Graduate School of Design. The school developed a studio course as a vehicle for synthesizing the analytical data and approaches of four different disciplines such as Landscape Architecture, Engineering, Planning and Urban Design. They aimed to developing a better method of interdisciplinary teaching which would lead to better understanding of complexities related to built-environment; however their efforts did not bring much success and was not spread over other universities (Seteinitz and Roger, 1970). The reasons of such failure were unable to bring the key and complex issues that need to be addressed through an interdisciplinary learning approach.

Lazar (1990) examined an interdisciplinary relationship between planning and engineering education, especially in the field of urban hydrology and water management. He identified that urbanisation process had profound impacts on the water quality and hydrological changes with the spatial boundary of a built environment, especially when a built environment starts facing water scarcity problem. He further identified engineering and

structural solutions could not alleviate the problem and it required the involvement of planners to planning non-structural solutions such as managing demand with some statutory and non-statutory measures. So the solution of the problem lies in the hands of co-operation between urban water planners and engineers. Therefore an appropriate mix of subject matters within the civil engineering and planning curriculum can bring sustainable solutions of such urban water supply problems.

Moudon (1997) included buildings, gardens, streets, parks and monuments as the basic elements of built-environment and he also suggested for doing interdisciplinary research to solve urban problems. Krizek and Levinson (2005) asked for a changing focus of planning pedagogy that included teaching interdisciplinary topics in an integrated and synergistic manner. They found synergies between planning and engineering education such as between land use planning and transport infrastructure development. A land use–transportation course can provides a forum to synthesize knowledge from two core disciplines, planning and engineering (Krizek and Levinson, 2005). They also found pedagogical barriers to integrating the courses were minimal but it had been suffered by resource constraints such as lack of funding, lack of faculty members, lack of motivated people to teach the class. It can be summarised here that land use and transportation systems, water supply, waste management, building social hard infrastructures are both planning and engineering components of built-environment. It needs interdisciplinary approach in designing and resourcing the course related to these issues.

In USA, some universities started to make nexus between planning and engineering education and research through sharing curriculum and courses since the last century. For example, at the University of Wisconsin, there is a coordinated degree program in civil engineering and urban planning. The College of Engineering and Applied Science with the cooperation of the Department of Urban Planning offers a Master of Science (MS) in Engineering/Master of Urban Planning (MUP) program to prepare students for positions in transportation, public works and related fields (UoW, 2012). The purpose of this coordinated program is to meet the need of planning and transportation professions for people who combine competence in both urban planning and transportation engineering because a minimum level of competence is necessary to overcome some complex challenges. Students in the program can pursue a Master of Urban Planning and a Master of Science in Engineering degree program. They make provisions of some planning and geographic information systems courses for both planning and engineering students and they also keep some courses to specialising in either planning or engineering area. However the main aim of such integration is to equip the students with both planning and engineering knowledge for problems solving for the built environment management.

However, in Australia such a nexus between planning and engineering education is occurring very slowly, and this is a new approach for some universities. According to *Building Act 1975* and *Building Regulation the Building Regulation 2006* (Qld), Disability (Access to Premises – Buildings) Standards 2010, the Building Code of Australia and AS1428.1 – 2009 and State Policy and Planning Acts, Engineers need to maintain some standard of practice in designing and maintain the built environments. Therefore the concerned engineers need to know those policy and planning acts in order to perform their (engineers) responsibilities properly; and they also need to maintain a professional relationship with the urban planners.

Most of Australian metropolitan universities have delivered both planning and engineering education. With particular observation from the State of Queensland in Australia, the University of Queensland, Queensland University of Technology, Griffith University and the University of Sunshine Coast are delivering both planning and engineering education and their degrees are accredited by the Planning Institute of Australia and Engineers Australia respectively. Other Universities in Queensland, such as University of Southern Queensland, James Cook University and CQUniversity do not have full fledged undergraduate degree in

planning but they have engineering degrees accredited by Engineers Australia. However some of the planning courses were taught in these universities as the electives courses of science, business or engineering degrees such as environmental planning, social and economic impact assessment, community engagement and conflict resolution courses were taught at CQUniversity. Most students of these courses were came from environmental science and management disciplines but not many from the engineering disciplines because the engineering students are not well aware about the benefits of these courses, for their futures roles. Now these day, engineers are not only the engineers but they also need to act as a manager. As a manager, they need some basic level of planning knowledge. However, here we are discussing bit details about the University of the Queensland (UQ) as both the authors graduated from this university and they are well aware about the relationship of the both disciplines in this university.

In the 1990s, planning discipline was belonged to the department of geography and planning within the engineering faculty; then in 2000s, this discipline were belonged to a wider department, which was known as School of Geography, Planning and Architecture but within the same faculty. Now planning discipline is within the school of geography, Planning and Environmental management under the science faculty. Also over the last twenty years, there is a change in focus in the planning discipline i.e., now the discipline is more focusing on qualitative methods and social sciences than the quantitative methods, sciences and engineering techniques. Previously the planning discipline has a direct linkage with the civil engineering, transport engineering, architecture and urban design courses. 'Introduction to Planning', a first year under graduate course at UQ, was taught for both planning and engineering students and most of the students in this course were from engineering departments. At post graduate level, some courses were also shared by the planning and engineering students such as assessment of development projects. However there is a huge scope of integration of some planning and engineering courses in this university because these days, engineers are managing large scale public infrastructure projects that requires to have some level of knowledge about planning and human factors in implementing those projects. On the other hand, planners also need to know the current scientific and engineering developments to take the rational decision about the nature and type of development that require for sustainability of the built environments.

Lessons Learned and Way Forward

Planning and engineering disciplines are closely related in terms of planning, developing and managing built-environments. Both the disciplines can be belonged to the same faculty or within the same school. In USA, most universities kept the both disciplines within a same faculty and they designed some common courses both for engineering and planning degrees, which is not much common in Australia. UQ kept the both discipline in the same faculty in early days but now they have changed their focus as well as have changed the faculty. However, Queensland University of Technology (QUT) keep the both disciplines in the same school and they make integration of curriculum between the two disciplines. This type of interdisciplinary integration is directing the planning graduates to plan what is reasonable and achievable for the sustainability of the built environment and the engineering graduates to follow their plan in terms of providing viable and appropriate design for current maintenance and future development. As both disciplines are closely related in terms of cognitive content and delivery of final products for the well being of human society, therefore there is a need for state wide review to understand synergies between the planning and engineering disciplines and the potential interdisciplinary courses that need to be taught in Australia.

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