Built Environment Information Platform

A conceptual introduction

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***Abstract*—The built environment and its components require a continuous and uninterrupted flow of information in between its various players. In this paper a conceptual framework is proposed describing the role of these players as well as the nature of the links in between them. The authors introduce a new term, a conceptual framework which can be used as a platform called BENIP (Built ENvironment Information Platform).**

Keywords—BENIP; built environment; informaton platform

I. INTRODUCTION

In the past half century there has been a great deal of discussion about the position of individual and teamwork and their role in science [1]; in relation to this it has been repeatedly argued that the era of lonely experts is over [2], [3], [4], [5], [6], [7], [8]. On the other hand, there is an increasing share of interdisciplinary topics spanning over several specialties giving a boost in the progress of research activities [9]. Furthermore, according to Barabási [10] based on the currently valid network models our world is small enough for people to connect with each other through relatively limited number of steps. This concept was originally laid out by Karinthy saying that "any two people can be connected in a maximum of six steps" [11]. This was later scientifically phrased by Milgram [12] and proved by Guare who also introduced the idea of six degrees of separation. Based on this thought our world is indeed small and can be considered highly connected, not to mention how much data is gathered in the world every day [14].

Based on the above it seems logical that the information gathered in relation to the built environment should not be handled separately but could be mutually used for the benefit of all sectors. The question may arise: why the built environment as a whole? The answer is simple, everything surrounding us humans is part of it.

In this paper we introduce a new term called Built ENvironment Information Platform (BENIP). This concept aims to reveal the links in between the various domains of our built environment.

II. DEFINITION OF BUILT ENVIRONMENT

A simplistic definition by [15] says that the built environment is covered by the domains of outdoor spaces and buildings; transportation; and housing. According to [16] the built environment is more like a scalenature topic introduced at meso, micro, and macro scales. The built environment starts as a ma-terial or component form and grows into buildings, areas, cities, and finally a man-made environment of earth. [17] offers a broader view according to which he built environment 1) is everything humanly made, arranged, or maintained; 2) fulfills human purposes (needs, wants, and values); 3) mediate the overall environment; 4) comes with results that affect the environmental context. [17] categorizes it into seven scales: products, interiors, structures, landscapes, cities, regions, and earth. In their study [18] the built environment scales are grouped into "Material", "Building", "Area", and "City". "Material" comprises all types of material and components while "Building" includes all types of structures, residential, non-residential, and infrastructure. "Area" represents the industrial parks and non-industrial areas that are smaller than cities but larger than facilities, and finally "City" includes both cities and large regions (see Fig. 1).

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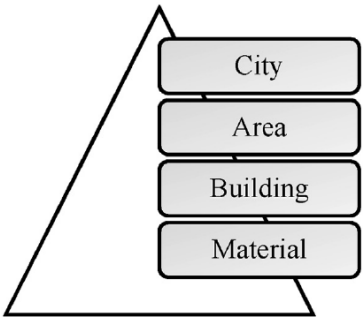

Fig. 1. Built environment scales [18]

[19] conceptualizes the built environment as a social-ecological system paying attention to two issues, the impact of spatial relationships and concepts of time. In their framework (see Fig. 2) where the natural and social overlap is in the built environment, which encompasses the fast changing, short-term processes – like design and management systems – within the constraints imposed by the features of long-lived buildings and infrastructure systems and the underlying land use patterns. Essentially the time rings for built environments provide a more systemic and graduated perspective on how time is valued (norms) and how elements of the built environment and ecosphere interact and influence each other. In Fig. 2. for built environments, the material and cultural realms are combined, with the fast pace of the social processes (design, assessment, contracting, management) balanced by the longer-term influences of buildings and landscapes.

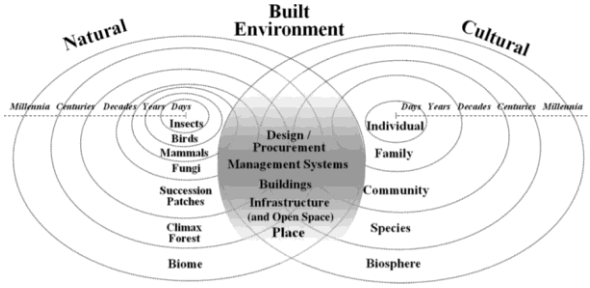

Fig. 2. Built environment as a social-ecological system [19]

III. Flow Of Information Between Research Areas

Based on what is drafted in the introduction, the continuously increasing amount of information as well as the connection between the specific disciplines it can be stated that there is no coordinated and sustainable design for the built environment without smooth information transfer. This is well illustrated by Wanga et.al [20] in Fig. 3, where the flow of information, the link between various domains as well as the strength of connection are visible.

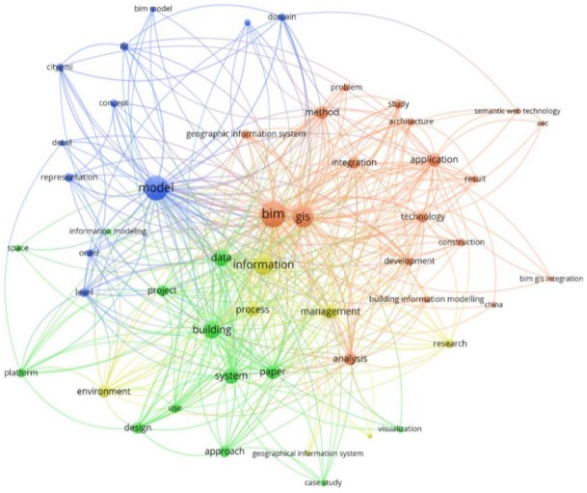

Fig. 3. Word co-occurrence network [20]

This figure clearly summarizes what we can experience every day in this highly connected world. However, it masks the reasons and benefits hiding behind these numerous links. BENIP gives a meaning to these links.

If we focus closely on the built environment and its three associated disciplines we can arrive at the conclusion that it is needed to describe the cooperation in between architecture, civil engineering and transport sciences. Based on our experiences this can be illustrated by the following figure (Fig. 4).

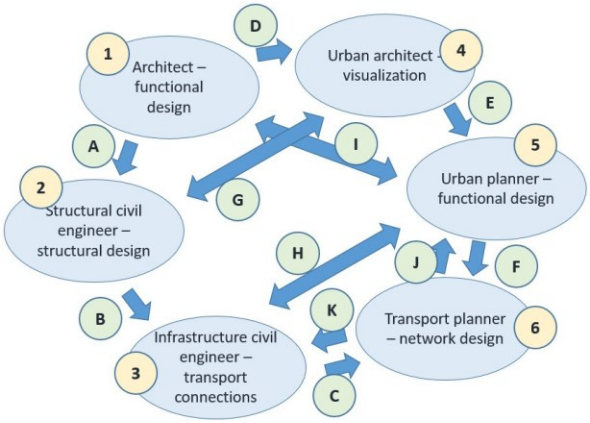

Fig. 4. Core of the BENIP logic

The various players and their relationship are described in detail in the following two sections.

IV. BENIP Players

As figure 4 shows in the BENIP circle there are at least six groups of players. It could be a major question, what is the order of the players. There is no order regarding importance. There is order just from the viewpoint of the explanation. Do we understand the story bottom up or from top to bottom. Now we would like to show it bottom up, so we starting from the

small details to reach at the end the full picture. Therefore is architect the first player to understand, but first means here to the most important.

1) Architect

The architect is the master in the birth of the building, the designer who provides building spaces with function. As a result of his work the function and the form of the building are born.

2) Structural Civil Engineer

The structural civil engineer provides the building envisioned by the architect with a frame. As a result of his job the structure of the building is created, which eventually influences its look and its general impression.

3) Infrastructure Civil Engineer

The infrastructure civil engineer provides the individual buildings with transport connection, they are responsible for designing the network around the buildings, thus extending individual buildings into a built environment.

4) Urban Architect

This player formulates the atmosphere and the harmony of buildings, or as we might also call it, the city visualization. Furthermore, he does not only create a visualization but a living space as well.

5) Urban Planner

This player launches the circulation of blood in the city, defines the location and weight of individual functions. This is the player who induces life in between spots in the urban fabric. As a result, the functional arial units of cities are born.

6) Transport Planner

They are responsible for regulating flows in the urban network by providing more or less space for transport. As a result of their work the network connecting the functions of individual buildings can become sustainable and environmentally friendly.

V. BENIP RELATIONSHIPS

Under this section the relationship in between the above players is explained. These links can be either one- or two-directional, however, even opposing-competing links can exist.

A. The architect delivers the building features based on a **functional design** to the structural civil engineer.
B. The **physical location** of the buildings envisioned by the structural engineer will be the information based on which the infrastructure civil engineers work.
C. **Characteristics of the infrastructure** will provide the framework for the infrastructure civil engineer.
D. The **building design plan** based on the functional design provides a basis for the urban architect.
E. The **city visualization and atmosphere** made by the urban architect influences the urban planner's functional design to a great extent.
F. The **functional layout** created by the urban planner serves as a basis for the transport planner's work.
G. The **city visualization and atmosphere** made by the urban architect will react on the structural design of buildings and vice versa, thus here a mutual understanding is needed.
H. The **functional layout** created by the urban planner as well as the **characteristics of infrastructure** mutually influence each other requiring a close cooperation.
I. **Characteristics and location of the functional arial units** stem from the **individual functions** created by the architect. The starting point for the architect is the functional arial unit.
J. The transport planner connects the functional arial units by their use, thus **transport connections** react on the operation of functional clusters.
K. The transport planner is responsible for flow regulation and has to indicate if the **requirements against transport connections** exceed their features making them unable to ensure an appropriate connection.

Overall the six players and the eleven links in between them provide the basis for the appropriate flow of information in relation to the built environment. This, however, demands a common language. This common language is the uniform and standard description of information. This is not always self-evident and simple as described by Horváth et al. through a transport related example. This case reveals how complicated it is to harmonize the methods of various disciplines. A well-known example is also BIM (Building Information Model), which is nowadays an accepted communication platform in the fields of architecture and structural design.

What the authors propose with BENIP is not a further expansion of BIM with the description of settlements and transport systems, but a new and complex language which is capable of including the content of BIM, GIS as well as other data.

VI. CONCLUSIONS

In our connected world the cooperation of different disciplines and specialties is essential. The data driven society needs more and more information. These phenomena lead to the situation that even the work of the specialists needs more and more connected environment. The answer for this challenge is the newly formed term: BENIP - Built ENvironment Information Platform. It provides a framework that handles all the relevant information of the built environment from BIM to GIS in one single system. CogInfoCom unifying both engineering and human-oriented

perspectives can give more room to reach progress in developing this platform further. [22][22] [23]

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