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TOWARD A SUPPORTING KM MODEL OF CONCEPT GENERATION IN SMALL ARCHITECTURAL FIRMS

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ABSTRACT

Design is an activity that formulates, physically and mentally, the "environment" of human (designer and user) and the "artifact" interaction. To develop the mentioned "interaction" it is vital to understand the mechanism of the design and designers' behavior and approaches as a manageable knowledge-based outlook. According to our literature review, there is not any specific integrated model based on Knowledge Management (KM) and sharing information explaining the "Architectural Creation and Conceptualization". In this paper, it has been emphasized that architectural design is a creative process of converting knowledge and information into products and/or services (Durst et al., 2014), based on requirements into an upper level of awareness as the product concept and capturing the new knowledge as the solutions which are complete, clear, and consistent. Regardless the normative considerations, an organizational framework based on knowledge for architecture SMEs, can improve the overall performance of the architecture design enterprises. The objective of this article is to propose the need of a new approach toward "Architectural Design Process Syntax" (Yousefi, 2014) based on the developing a KM visual system/model illuminating the managerial approach in the process. The final Visual KM model could be used as a conceptual reference for architectural design process in architectural small and medium offices (SMEs). The authors have mainly followed the literature study, task analysis based on interviews and questionnaires and also visual models, as the assessment and result methodology. This article also reflects the lack of application of the key knowledge management initiatives in architecture SMEs and highlights the essential of a managerial approach toward the question by presenting some potential line of research.

KEYWORDS
Knowledge Management, Design Project, Conceptualization, Architectural firms, SMEs

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INTRODUÇÃO

When it comes to architectural design, cultural issues, customer requirements, aspects of design, social issues, functional obligations, formal concerns, philosophical theories, environmental subjects, aesthetics, human behaviors, experience of designers and many other discourses can all be considered as a source of knowledge, which should be properly managed in the process of form-making to be applied in the final design. The management of knowledge as a strategic competitive factor (Spender, 1996), represents a challenge for smaller architecture firms in particular (Durst & Edvardsson, 2012). Indeed, small architecture firms face unique KM challenges (Bashouri & Duncan, 2014), which, in turn, provides an interesting basis for developing a visual KM model framework to transform the indistinguishable architectural concepts into the actual tangible spaces.

Simon (2010, 1973) defines design as an activity to “imagine and realize” finite time things called "artifact" to satisfy human needs. Etymologically Simon’s artifact could be perceived as an "environment" in which different features could be adapted and the corresponding standards or methods would eventually be applied in accordance with the knowledge projection.

In fact, architectural design must be technically and spiritually a value production activity (Collier, 1995). Since the methodology of design is influenced by technical and managerial innovations, the meaning of it should not be reduced to a sentimentalist add-on accomplishment. Buildings, besides reflecting their utilization/application of design and technology, are manifestations of the social, political and cultural ideas (Hillier, 1996). The generalization of the "Research→Model→Design" approach is mostly credible. Applying this approach in design discipline, the term "management" in KM, reflects mostly the organizational/strategic aspects and the “knowledge” part (a human capacity acquired with time) should be reviewed and addressed as a multidisciplinary framework with a broader horizon even toward artificial intelligence and cognitive science approached by presenting some potential filed of assessment. The term “knowledge” does not simply reflect "knowing a fact" (Knight & Howes, 2003); in the design field, the traditional approach is mostly based on a problem-oriented approach that encourages the development of an artifact (Simon, 1973) but in the research, the drivers is rooted in the possible answers through the investigation of the current or past evidences in a systematic designed model (Groat & Wang, 2013). The

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"design" and "research" contain fundamental similarities and differentiations. Table 1-1 summarizes this comparison, using a number of items.

The increasing need for design organizations to secure their competitiveness has been stimulus for individuals and knowledge, and their interactions in the design process? Influence knowledge production combined with other KM related activities can ensure the organizations' long-term survival. It may also lead to business model innovation to facilitate the conversion of information and knowledge into tangible outputs, and help to restructure the unstated knowledge flow to generate the mentioned interaction between employees and spread of individual knowledge across organizational framework (Schons & Costa, 2008). As Durst and Edvardsson (2012) emphasize the areas of knowledge identification/storage/usage are still KM practices to be developed to enable the integration, dissemination, democratization of information produced by the organization.

In design, the information (as a set of elements to be collected, retrieved, processed, stored and distributed) is a relevant factor that has meaning and purpose, and thus promotes impact on their judgment or in its creator's behavior, operating as an important parameter in decisions. Knowledge in turn, is created and applied in people's minds, and intuitive, with values, experiences, insights, as part of human complexity and is communicated by manuals, documents, repositories, routines, processes, practices, standards and others. Although, information and knowledge are different properties (Tang et al., 2007), information consists of raw material for knowledge originates it. The discovery of the human brain capabilities is a key factor to understand the design activities in accordance with the "cognitive possibility" of "knowledge interchanges" (Grandori, 2001) based on the underlying assumption that knowledge is an intangible asset; the associated mechanism would eventually develop a conceptual platform for the deterministic attributes in order to support the design process enhancement. In this article we account for an architectural "knowing" which includes a human-oriented attitude contains the combination of implication, context and the creative cognitive processes. Akin (1986) considers some objectives in accordance with structuring the process of architectural design (to delineate new areas of research as a part of overall framework, to develop well-defined techniques to supplement manual methods and providing a support for teaching in the area). He established a common terminology based on the literature of knowledge acquisition and knowledge management [limited to development of these disciplines up to 80's] as an attempt of

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understanding the design task in a new Knowledge-oriented way (Figure 1-1). Akin's (1986) approach toward the human cognitive behaviors is based on using computer applications (Figure 1-2).It is an intricate task to identify and capture the main trends of collective and cognitive approaches toward the design process in architecture and the associated coding scheme and to develop a generic tool to study human design activity in design SMEs; a broad differentiation of all the studies in this field contains technical limitation since the various quantitative and qualitative methods have been applied to the existing analysis and models (Kan & Gero, 2009). In this paper, we argue that the notions of KM can be employed in the design processes as well by drawing on sophisticated analyses of knowledge and information usage analysis, architectural methodology analysis, visualization and mapping techniques, etc. This will support in intensifying creativity and innovation in smaller Architectural Design firms in a conscious way especially in the early stages of the design process.

Next, we turn to the model of the activities of individuals involved in the early phase of Design and transmit it to a knowledge-sharing structure as a simplified edifice to shape a KM model, capable of developing traceable techniques of creativity/innovation in design.

THEORETICAL BACKGROUND

Architectural design process is a methodological-scientific term which comprises design theory and methods (Tang et al., 2008; Achten, 2008). In spite of the close associations of design performance and designers' behavior, the body of knowledge and methods defines the design process as a combination of theory and method identifying the stages and disputes in the design as a knowledge-based professional activity (Dursun, 2007; Alexander, 1964). RIBA Plan of Work (2013) by the "Royal Institute of British Architects" as a standard of design and construction process in the UK covers processes from outline design to the constructed stage of the built environment, including but not limited to feasibility studies, pre-construction process the detailed construction process. Although RIBA's covering characteristics are useful for any modification, there is a controversy about the usage of RIBA plan in smaller architectural firms, since its bureaucratic/documentative spirit and hard-to-follow various tasks, shapes more a checklist perceptiveness than an approach toward managing the exchange of information and knowledge which it meant to be (Hooshyar Yousefi & Razavi, 2014).

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Table 1 - Matrix of the primary differences and shared qualities of "design" and "research".

		Aspects of Difference		
Design	Proposal for Artifact from small scale to large scale interventions	**Contribution**	Knowledge and/or Application that is Generalizable	Research
	Generative	**Leading Processes**	Analytical & Systematic	
	Future	**Sequential Focus**	Past and/or Present	
	Problem	**Drive**	Question	
		Aspects of Similarity		
Design	Systematic Design Process	**Models of Reconstructed Logic**	"Scientific" Method	Research
	Abductive Inductive Deductive	**Multiple Logics**	Abductive (Research Design/Hypothesis Formation) Inductive Deductive	
	Generator/Conjecture Model Problem/Solution	**Logics in Use**	Multiple Sequences of Logics, Dependent on Research Questions and Purposes	
	Macro/Micro and Mid-level in applied/clinical setting	**Scope**	Big/Medium/Small Theory	
	Situated Practice	**Social Context**	Situated Research	

Figure 1 - Design Knowledge System in detail (Akin, 1986).

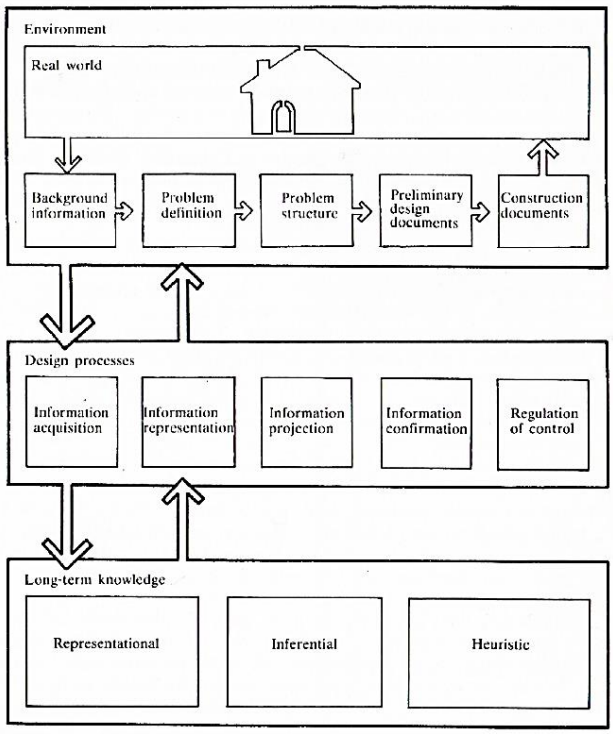
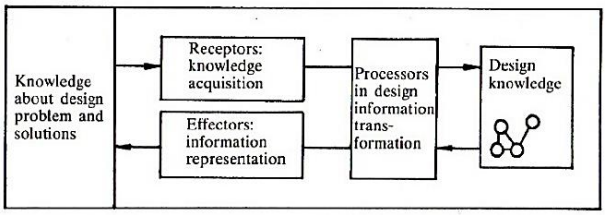


Figure 2 - Design Knowledge-Transmission System (Akin, 1986)



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Although the design activity is a complex combination of several cognitive operations (i.e., creativity, reasoning, visualization, etc.), there are very few cognitive studies that have focused on the associated professional activities. In a general view, cognition is defined as all mental activities and processes that relate knowledge and function which correspond to (Bouchard et al., 2008). Designers' cognitive activities cover all mental operations performed consciously or unconsciously by the designers in their design activities (Yousefi, 2014). For a group of scholars (e.g., Simon, 1973; Chandrasekaran, 1990; Wade, 1977; Chan, 1990) the design process is closely influenced by problem-solving issue which designers must move through different phase of "interpretation and reformulation of the problem" (Simon, 1973). In the recent three decades, the field of psychology has produced many studies on the impact of the external features of the design on the establishment of mental representations that form designers' activities grounded on a knowledge-base in order to understand the brain mechanism and develop the associated aiding model which would be eventually shaped as a "Unified Theory of Design Activities" relied on the distinction between a "space of concepts" and a "knowledge space" and allows "modeling the fundamental logic of innovation design reasoning" (Hooge et al., 2012; Hatchuel & Weil ,2003; Bonnardel, 2000). Table 2-1 contains a historical analytical representation of different views of design process from beginning of the branch till 80's.

According to Estévez (2014), there are three recognizable functions in the design activities in architectural design: speculative drawings, descriptive and prescriptive design. The "descriptive drawing" as the medium of communication is a semi-official visualization method of the general architectural expression and eventually the prescriptive one is used in the construction process. Although two last part seem more important but speculative drawings is the level which the main concepts have been shaped (Figure 3).

Dorst (2011, p.528) offers a very convenient phenomenological interpretation of the architectural conceptualization by bringing up the term "theme" as "the experience of focus, of meaning":

> **"Themes are essentially a sense-making tool, a form of capturing the underlying phenomenon one seeks to understand. They are not clearly positioned in either the problem space or the solution space; their status is unclear until it is determined where they belong."**

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Table 2 - A historical analytical representation of different views of design process from beginning of the branch till 80's. (Chokhachian, 2016)

	Design Process Theories	Design Process Defined Steps					Year
1	**AIA Basic and Supplementary Services**[1]	-	Predesign services	Schematic design Design development	-	Contract documents Bidding Administration of contract Post design service	-
2	**Thornley Student Design Process (1)**[2]	-	Accumulation of data	Isolation of general concept or form Development of form	-	Presentation of solution	1963
3	**Thornley Student Design Process (2)**	Program formulation	Investigation Assessment of design possibilities	Create Refinement and presentation	-	-	1963
4	**H. Rittle`s Summery of Design Process**[3]	Identify the problem	Collect information Analyze information	Create leap Workout solution	Test solution	Communicate and implement	1970
5	**Guenter and Corkill Systematic Approach of Architectural Design**[4]	Basic definition Preliminary program	Investigation, analysis Program abstraction	Synthesis and development Volumetric design proposal	Reevaluation and modification	-	1970
6	**R. Whitaker`s Eight-step Design Process**[5]	Recognition Definition	Preparation Analysis	Synthesis	Evaluation	Execution	1971
7	**J. C. Jones`s Design Method**[6]	Idea	Information Analysis	Synthesis	Evaluation	Optimization	1972
8	**G. T. Moore`s Design Process**[7]	Problem identification	Analysis of user needs Programming	Design synthesis	Selecting from alternatives	Implementation Post occupancy evaluation	1972
9	**M. Asimow Engineering Design Process**[8]	-	Feasibility	Preliminary design Detailed design Planning	-	-	1972
10	**RIBA Architecture Service**[9]	Inception	Feasibility	Outline proposals Schematic design Detail design	-	Production information Bills of quantity Tender action Project planning Operation on site Completion Feedback	1972
11	**Five-step Design Process**[10]	Initiation Imbalance	Preparation	Proposal making	Evaluation	Action	1979

[1] The American Institute of Architects, The Architects Handbook of Professional Practice, (Washington, DC), The American Institute of Architects, annual
[2] D. G. Thornley, "Design Method in Architecture Education", Conference on Design Methods, (New York, Macmillan), 1963, p.48
[3] H. Rittle, "Summery of Standard Descriptions of the Design Process" (unpublished student handout) Department of Architecture, The University of California, Berkeley, 1970
[4] P. A. Corkill & Robert F. Guenter, "Systematic Approach to Design" (unpublished Department of Architecture), university of Nebraska-Lincoln, 1970
[5] Richard Whitaker, "Eight-step Design Process", (unpublished), Department of Architecture, University of Wisconsin, Milwaukee, 1971
[6] J. C. Jones, Design Methods, (London, John Wiley & Sons), 1972, p.50
[7] G. T. Moore, "The Design Process" (unpublished), Department of architecture, University of Wisconsin, Milwaukee, 1974
[8] M. Asimow, "Engineering Design Process" in J.C. Jones Design methods (London, John Wiley & Son), 1972, p.24
[9] Royal Institute of British Architects, architectural Service, " in J.C. Jones Design methods (London, John Wiley & Son), 1972, p.24
[10] MacGintry, T., "Design and the Design Process," in Introduction to Architecture, ed. Tim McGinty (McGraw-Hill), 1979

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Figure 3 - The integration of descriptive and speculative approaches (Residential-Commercial Complex, 2007, Architect: BH

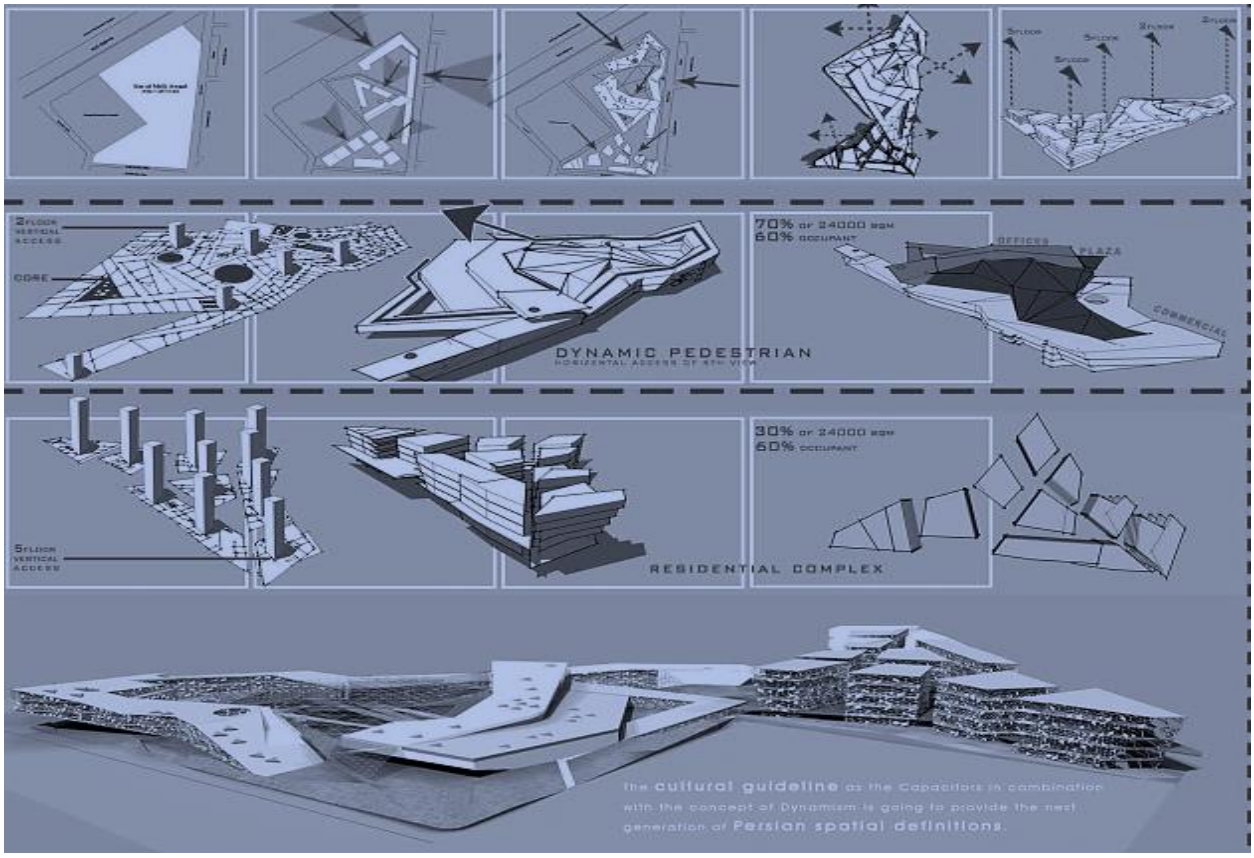

Figure 4 - The general phase model of the combination process". (Loon, 2008).

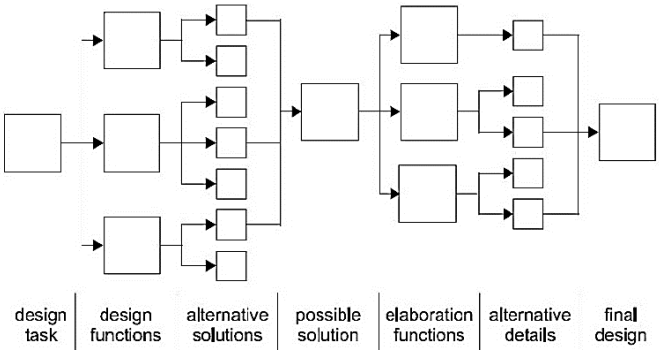

Figure 5 - Strategic and tactical approach in RIBA (2013).

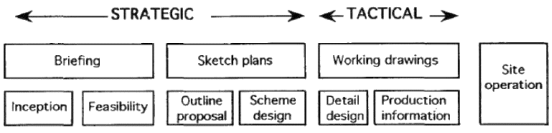

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Figure 6 - The models belong to three categories: design methodology, logic/problem solving, and folk psychology. The final line is the basic pattern of computer architectures (Gedenryd, 1998, p56).

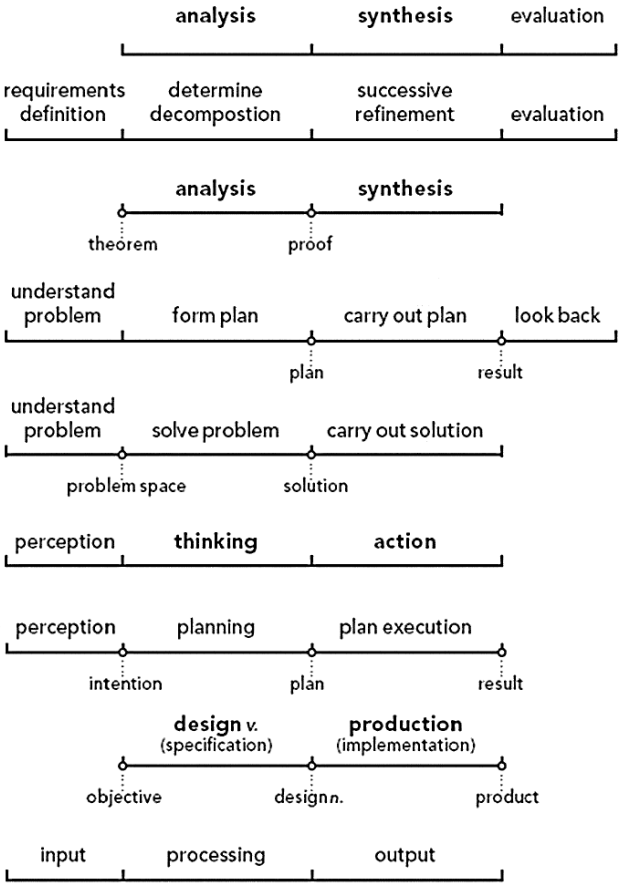
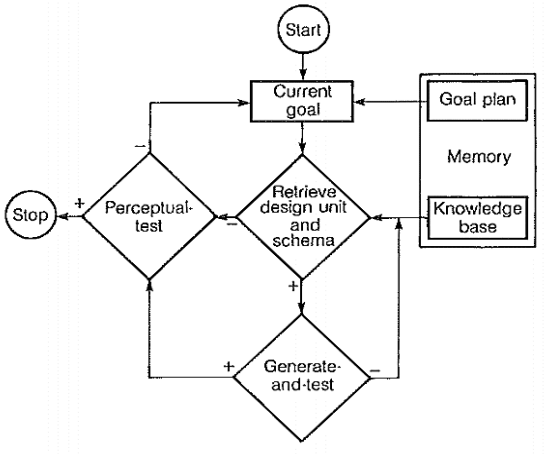


Figure 7 - General model of Knowledge-based Architectural Design process according to Chan (1990).



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Regardless to the historical origins of design "methodology", in a general assessment, it consists of three main elements: ”analyzing the problem, synthesizing a solution, and evaluating the outcome" (Jones, 1970, p. 63). Bearing in mind that during the design process, a huge “problem spaces” would technically bring a huge “solution spaces” (alternatives to be selected as the solving approaches), there are a lot of choices and ideas and plenty of decisions to be made by a combination of sub solutions in a space of sub processes (Loon, 2008; Figure 4). It eventually causes a "Phase Model" with strategic and tactical division (Figure. 5).

Gedenryd (1998) argues against the problem-solving approach and instead of defining a problem to be solved in design process, tries to define a platform for ideation and argumentation and providing a visualized model for designing through project. It is under the defining a role for stakeholders (Bowen, 2009) as co-designers or in a general clarification, considering visualization of possible solutions as reference (Figure 6).

Durst et al. (2012) studied the consequences regarding human-caused ignorance of knowledge attrition for smaller firm's financial capital and intellectual capital. The authors explored the factors affecting the performance of a knowledge based collaboration. Indeed, to identify the key knowledge factors that influence the performance of an architecture SME in the context of the design process enables the organization to identify and develop skills that will ensure "control of performance" and managing risk in a dynamic context (Rasmussen, 1997). The current situation in architecture SMEs punctuated by globalization which forces the organizations to rethink their design attitude based on the knowledge exchange inside and outside the firm (Yousefi, 2014).

DESIGN METHODOLOGY, PROBLEM, ONTOLOGY

Chan (1990) developed a cognitive prospect starting in the problem-space and the developing a set of knowledge-based operators and rules which would be applied to generate a design unit and interact with the state of designers’ Knowledge; ultimately, the design constraints and purposes would complete the problem-space. The “state of knowledge” unifies the problem-space components in order to develop the solutions and since it is associated with the designers’ knowledge (or mental activity), the model would be cognitive. According to problem-solving standpoint of Chan Model (1990), the design is divided into strategic “sequences of goals” (Daru, 1991). Chan (1990) considers the designers’ long term memory-based inclination (Bilda & Gero, 2007) as the method/goal generator/planer which in a certain state of knowledge, generates

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subdivision to be transfer to the designers' short term memory interacting with the procedure and then would be externalized by sketching. The whole procedure is based on the designer's perception of the gathered information which systematically could be tested and influence his/her short-term memory (Figure. 7). Applying the method, designers would formalized the design patterns of dealing with the goals, information and knowledge in order to generate the solutions which contributes to the knowledge base of the designer. In fact, "design methodology", intends to present a coherent step-by-step system to sustain the techniques of the associated application. In other word "architecture design methodology" extends "the sequential decision making process with a number of simultaneously-considered design decisions and objectives" (Ivashkov, 2004); it explains definite operations which are organizing design sequence by techniques such as "matrixes, flow charts or brainstorming" (Brawne, 2003, p.19).The notions of design collaboration and modelling collaborative knowledge (Robin, et al., 2007) to support a conceptual framework of design process would develop a unique architectural design managerial implications.

KNOWLEDGE MANAGEMENT AS AN ONTOLOGICAL APPROACH

The conception of ontologies, is an analytic and descriptive of concepts association (Garitselov, et al., 2012). Meta-models, as the models of the models, represent a general overall view of the whole domain and how the other models would be developed following the general set of rules (Johannes, 2009); ontology is a meta-model by itself but not necessarily a meta-model is an ontology. The sequential structure of the design procedure the prescription of knowledge exchange/flow in the architectural Conceptualization and the associated "knowledge acquisition", could be inspired by the systematic definition of "ontology" (Gruber, 1993); regardless its philosophical roots, ontology is defined as "a framework representing knowledge as a hierarchy of concepts within a domain" the common components of ontology (Fig. 8) is an inspiring example of systemic approach to the knowledge exchange during the design concept generation which is applicable to the architectural conceptualization (Figure. 9). Wade (1977) formulates/simplifies the interactions/transformations of levels of knowledge as a set of design requirements and the final form of the objects that fulfils these requirements: Suppose that "↝" represents the logical transformations that convert two levels of knowledge (as A & B), then the whole

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transformation is defined as "A⇝B". The mentioned simplification represents an over-simulated situation that both problem and solution are determined which is not common in Architectural Design.

Figure 8 - "Common components of ontology", developed by authors.

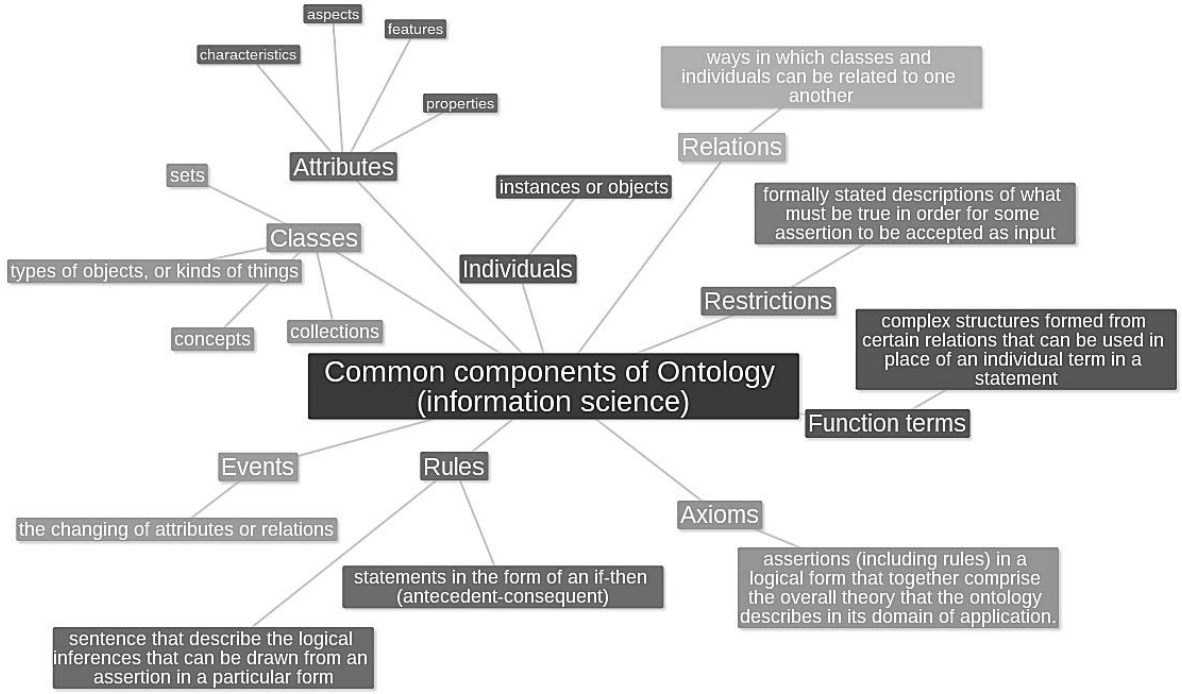

Figure 9 - Architecture student's sketch that illustrates the conceptual aspects and the knowledge exchange is completely traceable. Although it does not follow a determined procedure of reasoning, the sketching is an undetectable part of design and a very commom.

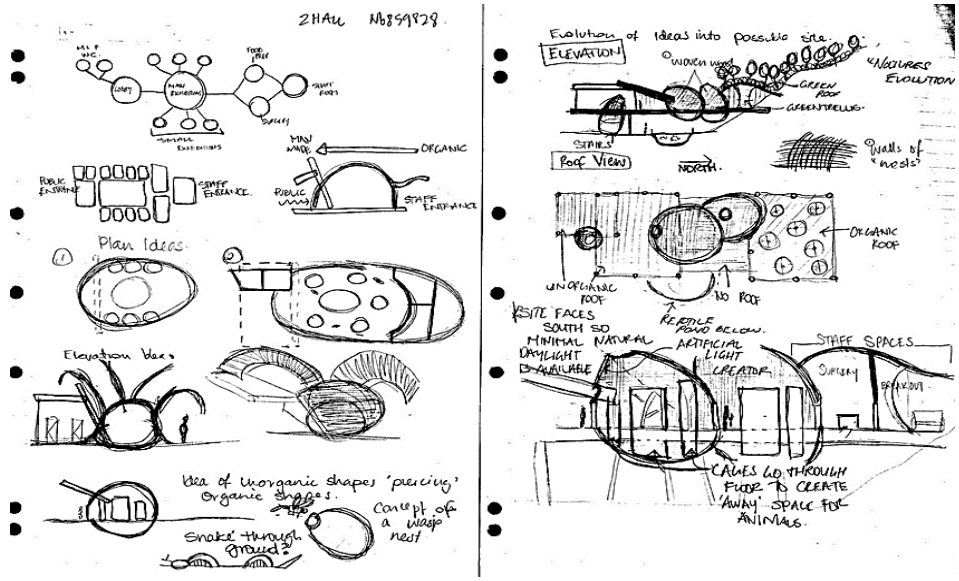

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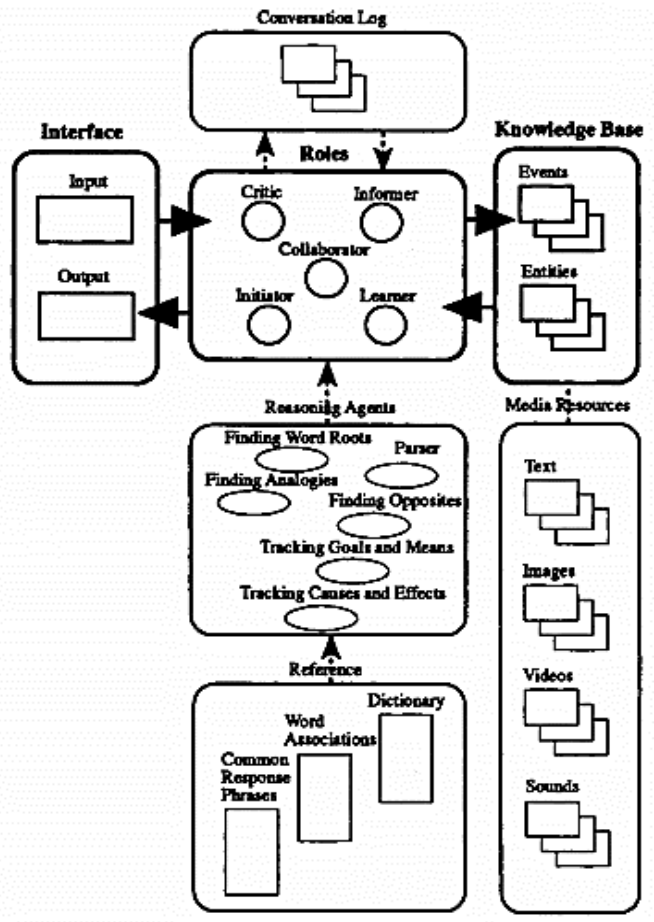
Figure 10 - Design conversation" Model/System (Lawson & Loke, 1997). Lawson/Loke model [Metamodel] (1997) has never been implemented and does not support the detailed procedural steps, but its components have been inspiring the later similar approaches



KNOWLEDGE MANAGEMENT AS A SYSTEMATIC INTEGRATED APPROACH

The common "systematic" approaches and models are rooted in both a criticism/reasoning and the transition from one phase to the other based on complexity analysis of the architectural design as a problem. The so called systematic attitude reduces the architectural design process to a list of very specific knowledge exchange rational actions to be performed by the designers in a specific order.

The knowledge based attitude should offer more dynamic reflection, not over-restricted to the constraints of systematic approach, based on the design practice itself (Segers, 2004), which represents the general required communication platform, interfaces, knowledge-base, the ontology of the procedure and the reasoning and referencing platform and the associated linkage (Figure 10).

As Gero and Kannengiesser (2006) emphasize "integrating the notion of interaction into a

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model of design optimization" is essential. In accordance with the early phase of design, the optimization of the visual aspects of the design is also a key factor (Peng & Gero, 2006). Chandrasekaran (1990) emphasizes that "the design problem is specified by (1) a set of functions (those explicitly stated by the design consumer as well as those implicitly defined by the domain) to be delivered by an artifact and a set of constraints to be satisfied and (2) a technology, that is, a repertoire of components assumed to be available and a vocabulary of relations between components" (p. xx). The model consequently is focused on inputs and outputs, "knowledge" and inference that characterize the abstract the "information" processing as "knowledge". The task of the designer would eventually be to systematically state how to design in a recursive process of repeating items in a self-similar way and possible connections between the associated components.

ARCHITECTURE SMES AND KNOWLEDGE MANAGEMENT

The traditional approach in architectural design (which is mostly valid in many architecture SMEs) contains the outline concept that the chief architects are usually the creators of the design in an artistic attitude (Marvin & Mackinder, 1982). It seems that the employment of design methodology could possibly effects the communication between staff and overall results; keeping records of design process is one of the key factors in managerial approach of decision making and employment of methodology which research and knowledge-based activity contain a significant role in the concept generation process "artistic, intuitive, adaptive, analytical, and systematic" stages (Milburn & Brown, 2003). The traditional design "modus operandi" of smaller architectural offices/individuals (Birnberg, 1992) engenders a serious lack of knowledge-oriented managerial approaches that actually identify a need for the logical adaption to new market conditions (Hooshyar & Hallhaj, 2015).

Self-employed architects and small offices with a considerable architectural design market share, face up to the problem of following the broad plans of work and regulation [such as the RIBA Plan of Work (2013)]. It is not easy to clarify any representable vision, key performance indicator, monitoring, in the manner of the architecture SMEs. The "knowledge" of an organization actually covers all the know-how, capacities and skills that are implemented there. There is therefore a need to consider knowledge in action as a dynamic subject with major conceptual influences (Durst et al., 2015a), which in accordance with the associated "Knowledge-based configuration", requires the specification of the potential

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constituent components and constraints that specify the “set of possible configurations” (Mayer et al., 2011). It would be an operational reform which in the initial level could categorized as a meta-model (Johannes, 2009). The mentioned operational reform should contain a collaborative sense in order to recruit the collective skills and the “know-how” methods and also must be capable of device-oriented set ups to preserve the mini-organizational memory and pass-on protocols/experiences to associate the maximum of available skills and mobilize a sustainable value adding procedure (Durst et al., 2015b). As Hillier (1996) discusses in his book "Space is a machine" about “what architect adds to a building”, we, the authors, believe that architects not only add the skin to the buildings, but they also go much further than the functional accomplishment, utilization and technology; they are manifesting the social, political and cultural ideas and goals (Collier, 1995). Roger Scruton (1979) emphasizes:

"Questions of value are often introduced either extraneously, through a peculiar species of moralism, or else through vague and generalized notions of "meaning" which could be applied indifferently to almost any building in any particular style. And for the most part, it is almost impossible for someone without a specialized education to express in words the beauties of architecture".

He further advocated a consideration of the architectural practice as a key contributor to what he calls “meaning” and a vernacular characteristic which architecture should be re-modified and re-arranged to achieve it; or instead of considering architecture as the "preoccupation with cultural continuity" (Scruton, 1979, p. 43 et seq.), or as Hillier (1996) put it a "preference for innovation". This definition will eventually represents the fundamental dimensions that must be covered as domain of KM, as the knowledge acquired and produced during the realization of the projects (Acs et al., 2006); and in the sense of knowledge, this approach would support the continuation of activities and all the experiences of the past specifically in SMEs, since the Knowledge capitalization could be considered as a major goal of architectural design firms, facing with the discontinuation of certain knowledge-based activities or projects (Durst, 2012). So the mentioned type of models focus on the structuring of knowledge/information bases, formed by past experiences, with the possibility of the knowledge development based on the interactive methods of contributions as the feedbacks, technical facts and documents considering the design practical solutions. KM also supports the process of knowledge creation and thereby stimulates the innovation capacity of the organization (Durst et al., 2013).

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A number of management tools would be necessary in the procedure of implementation of the Proceedings of KM (such as collecting distribution and sharing knowledge). We can also analyse that creativity through the measurement methods in association with the emergence of new knowledge through the action (Varela, 2016). The knowledge management approaches, promoting the sharing of knowledge can then also contribute. The design process as a "cognitive activity" (Gedenryd, 1998) would also define the design methodology based on "logic, rationality, abstraction, and rigorous principles". In this portrait, design is a prearranged, methodical endeavour which serves the procedure that systematically assembles data and information, sets up intentions, and presents the solution is the domain of KM. In fact, KM is thus the result of economic, organizational and strategic concerns and despite its multidisciplinary backgrounds it is driven by technology and models (Durst & Edvardsson, 2012).

ARCHITECTURAL CONCEPTUALIZATION AS A KNOWLEDGE-BASED ACTIVITY

The Conceptualization stage in architecture design process is sometimes impenetrable to be analyzed (Macmillan, et al., 2001); the key factor is the description of the activities and the related collecting data, information and dealing accordantly with the associated knowledge creation and exchange procedure. There are some previous experience (Bouchard, et al., 2009) of studying design knowledge and information gathered from designers and structurally categorized regarding the level of designers' skill following the role of knowledge exchange and dynamism of concept generation (Heylighen & Martin, 2005) in term of the imagery attitude of architects. The Heylighen and Martin (2005) approach, emphasize that "concept is an active unit" but they focused on "neuronal activation mechanism of human memory" which would not improve the progress of the Conceptualization (by so called "active unit) and eventually it develops the "interaction with the external information" and not the internal knowledge dynamism. Theoretically the current models does not allow the cognitive analysis to occur through a framework of knowledge-based reasoning and Conceptualization (Yousefi, 2014). Eventually the problems solving methods does not contain the potential of explaining the architecture concept generating phase (as well as the whole design process) and at the same time could not work as the engine/framework of a design knowledge supporting tool.

CONCLUSION

Although "design methodology" is a quite new field which mainly started since late 1950's (Fawcett, 2003) it looks already started to shift

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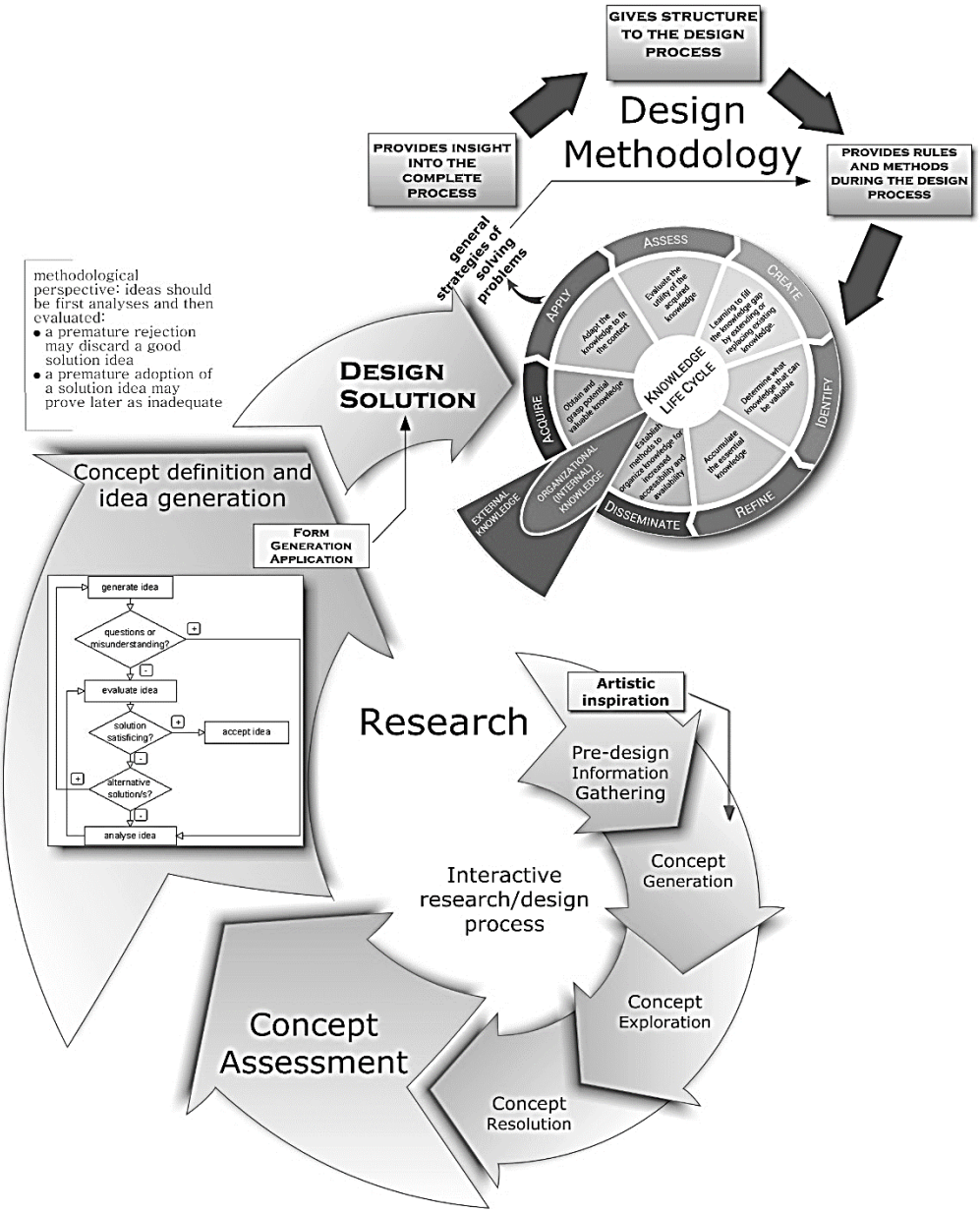
to a new branch of Knowledge based, computer aided high-performed, "form-making" (Yousefi, 2009) approach mostly applied in architecture SMEs . The design research in its early stages (Strickfaden, 2006) was based on straightforward understanding of the general descriptive approach of design and not developing a method (prescriptive) to be followed by designers. Although the scientific attitude has adapted to the design studies since the 60's, most of the so called design tools had been borrowed from the decision-making and problem-solving methodology. As Simon (1979) also emphasised, "an inventive combination of that available knowledge" could bring out the possibility for new solutions and that this attempt is not achievable in a prescriptive way (Hatchuel et al., 2013) as creativity could not be just "added" to the "problem solving theory" but it must appear as a built-in of the definition of the process itself. Regardless the normative considerations, an organizational framework based on knowledge for architecture SMEs, can improve the overall performance of the enterprise (Durst & Edvardsson, 2012). Considering the general need of an application of the key KM initiatives in architectural/design SMEs, we tried to justify the application of a KM toolbox/model in the organizational context to define the conditions for more effective enforcement of KM as a set of models or methodologies to implement information and communication processing tools to organize, enhance and enable the Architectural Design Process Syntax (Yousefi, 2009) by the captured knowledge (Durst et al., 2014). This would be achieved by developing a KM visual system/meta-model illuminating the managerial approach in the process considering the cognitive aspects in the design, to be applied as a conceptual in architecture SMEs. Schematic dissection of architecture design process must be entirely based on concept research, concept generation and concept application as three junctures to transform to the moment of truth of architectural creation (Hooshyar, 2009); this approach makes an appropriate stand for a knowledge-based creation system consideration the knowledge life cycle (Fig. 11). A visual thinking and visual modelling anchored in conceptual conduct could be considered as the leading method for the system. Mapping of the related process in this attitude is better to be applied in a visual modelling technique also (Novak & Cañas, 2008).

Figure 11 - Knowledge-based conceptualization



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