Environmentally oriented research and programming in architecture and urbanism

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This paper addresses environmental issues and keywords which are increasingly being incorporated in the field of research and architectural programming. From an environmental standpoint, new prospects, topics and themes, have been steadily emerging, engendering broad debate worldwide, about application potentials and options. Such issues and concerns ought to be introduced into the ongoing research efforts and further considered in the newly extended conception of programming both in architecture and in urbanism. This paper highlights the key definitions, considerations and approaches that make both research and programing closely connected to contemporary environmental interests. It reviews relevant terminology at the theoretical level with a view to present further insight into the different ways in which research and programming could be made more sensitive and responsive to environmental needs and contexts. The paper consists of four parts, first introducing the relationship between environmental concerns and research activity. Part two discusses the focused research and programming in environmental studies, highlighting the aptitude of this newly developed sub-discipline. Focal issues and values are classified under five categories: site, climate, context, natural resources, and efficiency and management. Next, The environmental approach in architectural programming is examined and its basic types identified. Part four is a concise review of the standard format and contents of architectural programs. The paper concludes with an integrated outlook and broad considerations designated to promote the environmentally oriented studies, and focused inquiries, at the levels of research and programming for design and planning.

يتناول هذا البحث الموضوعات و المصطلحات البيئية التى يتم ادخالها بصورة متزايدة ضمن مجال البحوث و وضع البرامج المعمارية. من وجهة النظر البيئية، تتشكل باستمرار العديد من التوجهات، العناوين و الافكار، التى تولد جدلا واسعا على المستوى العالمى بخصوص امكانات و فرص تطبيقها. تلك الموضوعات و الاهتمامات يجب ان تتداخل مع الجهود البحثية المبذولة، و ان تؤخذ فى الاعتبار ضمن المفهوم الممتد للبرمجة فى مجالات العمارة و العمران. يوضح البحث التعاريف الرئيسية ، الاعتبـــارات و المداخل التى تجعل البحوث و البرامج اكثر اتصالا بالتوجهات البيئية المعاصرة. و يعرض المفـــردات المرتبطـــــة بالمجـــال و نظرياته، بهدف تقديم تفهم اوضح للسبل التى من شانها توجيه البحوث و وضع البرامج لتكون اكثر حساسية و تجاوبا مع الاحتياجات و الاطر البيئية المحددة. يتكون البحث من اربعة اجزاء، اولها تعريف للعلاقة بين الاهتمامات البيئية و العملية البحثية. الجزء الثانى يناقش مجال البحوث و البرمجة الموجهة بيئيا، موضحا القدرات ، و الموضوعات التى تشكل بؤرة الاهتمام داخل هذا التخصص: الموقع، المناخ، الاطار العام، الموارد الطبيعية، و اخيرا الكفاءة و التحكم. فى الجزء الثالث يعرض البحث المدخل البيئى فى عملية البرمجة المعمارية، بانواعه المختلفة، ثم يعرض الجزء الرابع التنظيم و المحتويات للبرامج النمطية. يختتم البحث برؤية تكاملية و مجموعة من الاعتبارات التى تدعم الدراسات البيئية المتخصصة ، و الاتجاه البيئى لعمليات البحث و وضع البرامج فى مجالات التصميم و التخطيط العمرانى.

Keywords: Environmental concerns/issues, Academic research, Architectural programming, Predesign management, Environmentalism

1. Environmental concerns and research activity

In the numerous studies that emerged in the past two decades, the term “environment” has been thoroughly used, and usually meant to refer to one of two main domains. The first endorses the definition mostly ‘ecological’ and refers to the natural context or external conditions affecting the presence and diversity of resources, plants and animals. The second domain is related to the man-made realm and often refers to the physical surroundings and conditions especially as affecting people’s lives. Also, the latter denotes a situation and circumstances of living, and the places designed to be experienced by users - in their

every day life - as a work of vision, creativeness and gratification.

In the fields of academic research and architectural programming, however, this plain definition is often expanded [1]. Rightly, it becomes a rather intricate notion with a multi-faceted delineation. Here, the term environment is conceived to holistically embrace the setting in which people exist and perform, as a complex state with multiple orders and conditions that continually interact within it. This specific explanation involves a set of complementary parameters from both the natural environment and the physical built-up environment created by man's intervention. Thus, environmental concerns, as relevant to designers in the fields of architecture and urbanism, fundamentally incorporate a broader repertoire of issues, subjects and problems. This is a valid point of view, held by many writers and critics, since these components are inextricably connected and associated together in many ways.

Research activity in the academic fields is more than just searching, which can be randomly, or just solving problems, since this too can remain merely pragmatic. Researchers systematically use their experience to investigate certain issues, learn on the subject, gain insight, develop theories and draw conclusions. Environmentally conscious researchers draw on existing theories, training, inquiries, accumulated knowledge, and experience to generate ideas, develop proposals, and formulate recommendations [1]. In the course of their work, researchers develop concepts, formulate hypotheses, and test their ideas. These activities are carried out in various sequences, and combinations, using many different techniques.

With regard to linking academic research to environmental concerns, the activity all over again takes on a broad and complex scope [2]. Such a specific activity requires a clear vision, creative ability, skill, and careful planning to be carried out. Research should address environmentally relevant issues, not only as isolated areas of concern, but rather adopt an integrated approach that is environmentally responsive and responsible. This approach is believed to be the most direct way to tackle the issue of "Sustainability", watchfully study its principles, and seek appropriate methods to implement them in different contexts. This overall approach must jointly consider and/or emphasize the structure, function and management of the environment [2]. Accordingly, several topics come into play, namely including classified environmental systems, ecology, environmental limits, resources, environmental problems, and management approaches. This list of aspects is not exhaustive and could be further elaborated. However, the main aim remains to study such issues in relation to human practices, lifestyles, interventions and development procedures. Challenges and opportunities could thus be firmly established, and patterns of association between causes, effects, and remedies all identified.

The above-suggested approach represents a lengthy process of learning, a cyclical course of action, involving successive and sequential acquisition and re-interpretation of information [3]. The collected body of information, along with acquired experience, are systematically analyzed and synthesized in order to (fig. 1):

- Explore a subject thoroughly;
- Understand how others regard it and why, i.e. the current debate it generates;
- Investigate relevant issues and constituent elements;
- Develop concepts, generate ideas and formulate opinions;
- Organize thoughts through critical reasoning as to build a rationale, research argument and statements; and
- Interpret the findings and outcome into final documents using creative academic writing.

The information collected for an environmentally oriented research, in the design fields of architecture and urbanism, ought to relate directly to the field of environment, with its rather complex definitions. Indeed, this field has expanded to involve a multitude of disciplines and parameters, the fact that poses further challenge to concerned scholars. It is thus essential to narrow the scope of inquiry down towards one particular aspect of the subject, often referred to as the topic (fig. 2). A particular question, or set of questions, emphasized by the researcher becomes the

focus of the whole research program/scheme [3]. Identifying specific keywords or areas of concern, carefully for each of the above levels within the broad domain of environmental studies, will help in the following (fig. 3):

- Ensure that a research raises significant issues;
- Direct the investigation of resources;
- Focus the inquiry and guide the diagnostic studies;
- Provide thoughtful reasoning and discussion about a specific topic; and
- Produce light informative and/or argumentative research documents.

A typical research proceeds in a Cyclical Pattern, rather than a linear one (fig. 4). Productive research and writing advance in a looping line of progress [4]. This implies that initial steps and ideas are continually being revised, amended, and re-written as work proceeds. Irregular patterns of progress should not discourage research efforts and inquiry processes (fig. 5).

The overall quality of a research scheme will finally be expressed in several aspects that highlight the real value and inbuilt contribution. Research project and the resulting document must vividly exemplify the scholarly arena for reviewing information and debating ideas and express conceptions about diverse topics, and from multiple disciplines. With a view to these objectives, the Overall Quality of a research could be perceived in two different ways, the technical content and the manner of presentation. Few of the underlying aspects could be listed as follows:

I. Technical content

- Extent to which it introduces, helps explain and refine concepts;
- Information: valid, instructive and reliable;
- Thought: order, flow and integrity;
- Contribution: methodology, Innovation and Originality.

II. Presentation

- Interpretation of information: Clarity, sequence and linkage;
- Skills as in writing, illustrations and documentation;
- Final document: format, thoroughness and coherence.

2. Research and programming in environmental studies: a sub-discipline with aptitude: issues and values

The environmentalist ideology has become more and more pervasive and widely embraced across relevant literature currently available on the subjects of architecture and urbanism. Environmental orientation and environmental management, in addition to several analogous idioms have proliferated, and are still engendering a considerable debate and deliberation among researchers and designers. How stable are environments is currently provoking the main concern and anxiety underlying the quest for sustainability and its lofty principles and objectives. The built and natural environments, entwined as they are, do form the comprehensive milieu in which

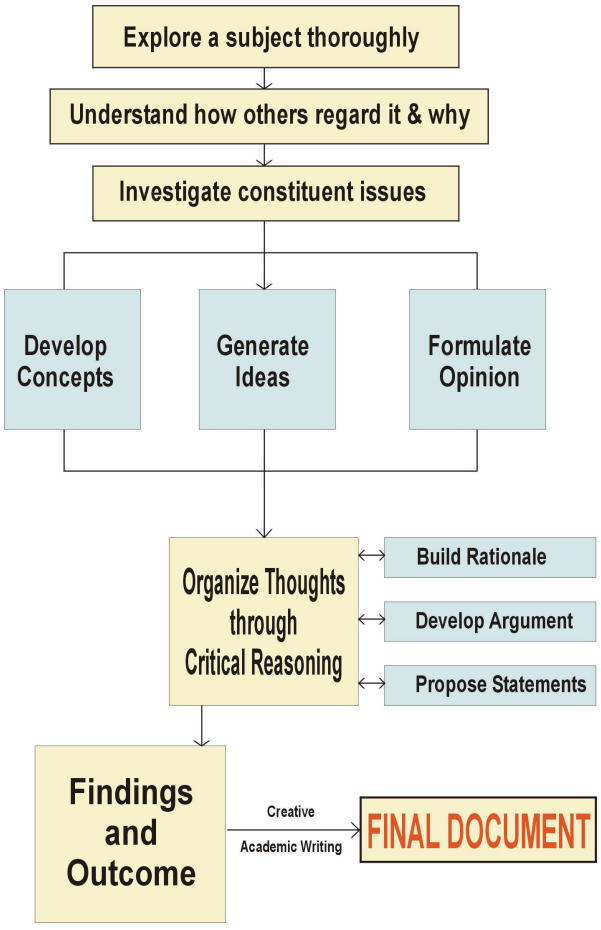

Fig. 1. Systematic research activity: steps of analysis and synthesis of the collected body of information and acquired experience.

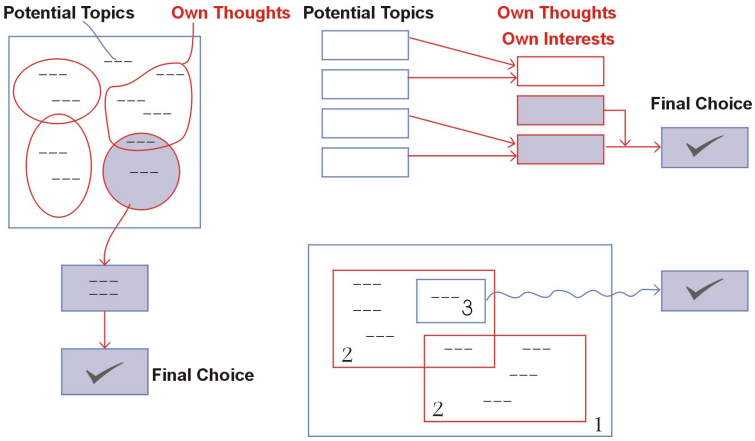

Fig. 2. Selection of specific topics for research through various methods that correlate topics to interests, as suggested by [1]. Such as Clustering Ideas, Relating to Own Thoughts, and Zooming In.

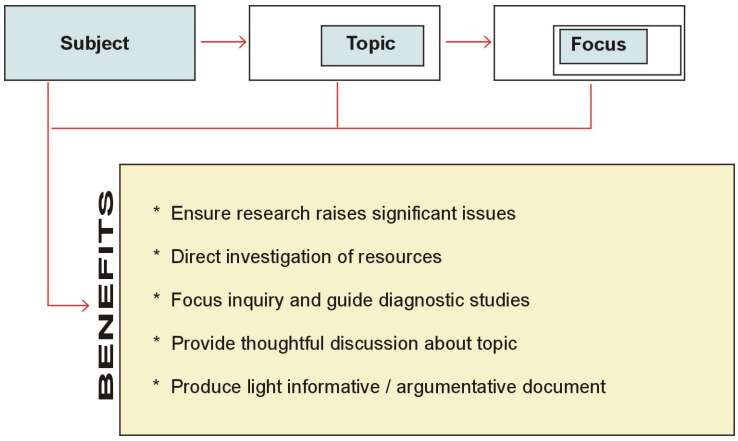

Fig. 3. Careful identification of specific areas of concern within the broad domain of environmental studies, at the levels of "subject, topic, and focus" offers several benefits in the subsequent steps of work.

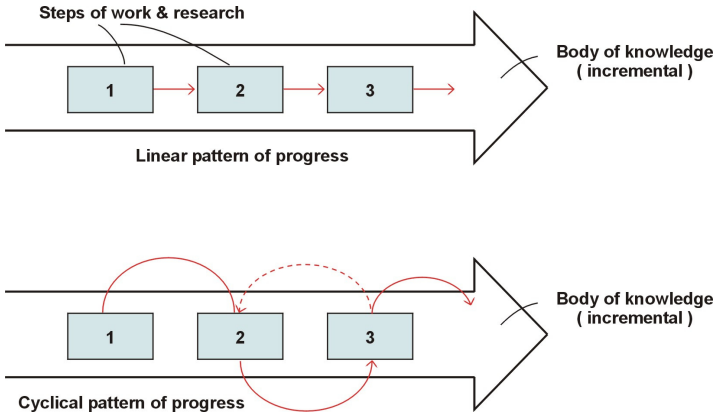

Fig. 4. Comparative diagrams of the linear and cyclical patterns of progress for a typical research in environmental studies and related inquiries.

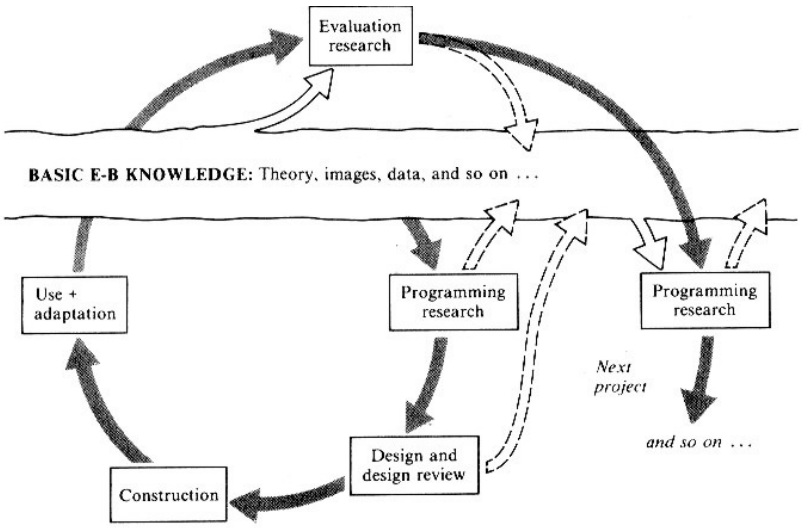

Fig. 5. Occasions for cooperation between research and programming, in the course of developing environment behavior (E-B) knowledge, and design cycle [4].

architects work. Together they engender a twofold and diversified body of knowledge with multiple tiers of input and output, environmentally oriented research is precisely about developing this intricate knowledge.

Research and studies in "architecture and environmental design" is a focused inquiry into particular attributes associated with the elements being studied, for example functional facilities, new development, area-wide plans and the like. Towards this end, several research strategies are applicable [4]. They involve and jointly employ specific *approaches*, research *designs* and research *settings*. In the environmental field, reliable approaches include the diagnostic studies, which set the stage for further investigation, and also the descriptive, theoretical, and action research studies. Also, research designs are selected based on the nature of environmental issues being addressed. Designs include the case study, survey, and experiment types (fig. 6). In addition, the research settings mostly suited to carrying out such inquiries include the natural and contrived ones: both being the places where the research problem is to be studied [4]. A large repertoire of *research methods* is used in environment related investigations. Information gathering techniques namely include the literature search and review, diagnostic interviewing, diagnostic observation, polls and questionnaires surveys, site and climate analysis and group work sessions.

Together, these strategies are inductive and normative in goal, and offer explanations and conceptual frameworks of environmental problems and situations. Programming, on the opposite end, is about experimenting with the useful information that research yields. Devising an architectural program is a direct application of gained knowledge into a forecast project, plan or a large-scale policy: currently a fully acknowledged sub-discipline with high prospects and aptitude. A program is an overall proposal for an environmental intervention with concise statements. The nature and content of these statements need to be considered and further taken into account (e.g. clarity, influence, role assignment, and designation of functions).

First the environmental issues that must be addressed by the new discipline are broad & diverse, yet relevant and pertinent to almost all works of architecture and urbanism. In addition an expanded list of other important value areas must be sought to describe all the important issues that environmentally oriented research and programming must address in the present time. Other value areas that become important issues could be categorized under such headings as

human, cultural, technological, temporal, economic, aesthetic, and safety [5]. These were shown to encompass the so-called other important issues that might have a significant impact on decisions by programmers and designers. Initially it is the programmer who must identify what are the issues of priority and of significance. Also to be decided, are the values held by participating actors involved in and concerned with environmental change.

It is however important to note that all of the issues are not of equal importance to every research situation. It is essential to uncover, review, examine and decide, which issues should be the focus for particular contexts. Though this paper mainly gives attention to the environmental issues and considerations, it is necessary to mention that further issues must come into play in other stages of research on the built and natural environments, and their delivery processes.

In his milestone book Architectural programming, Hershberger states that the environmental concerns that may become focusing issues in the research and programming activity include site, climate, urban and regional context, available resources, and waste products. These categories are often viewed as the principal issues because their influence is very direct and crucial, impacting on the evolution and performance of human settlements, natural settings, and survival of both milieus. If neglected, any work of architecture, plans, or other types of intervention, would inevitably suffer some loss itself, and cause further problems to its surroundings. It is important to communicate complete environmental information (e.g. impact and repercussions) through research and programs, so that designers and decision-makers could make the appropriate responses. The following is brief review of the five categories that incorporate the potential focal issues in the field (fig. 7) [5].

2.1. Site

With regard to the site issue, concerns that ought to be emphasized include geology, topography, soil qualities, hydrology and ground water, vegetation types and characteristics, and wildlife (if present). In addition, the area history might interfere in cases where archeological sites exist that need to explored and recorded prior to any kind of intervention. Similarly, urban areas with very high land costs, mixture of functions and abandoned plots, could all impact on subsequent opportunities. Attributes and parameters of each of these areas need to be identified, clearly presented, and then efficiently employed to their ultimate advantage, and with least damage. This perspective also draws attention to specific entities, those of the natural and built features, within and beyond particular sites. Such features namely include natural views, landforms, adjacent buildings, urban situation (e.g. use, height, shape of buildings), physical characteristics, and circulation / traffic patterns. In many cases, a careful site analysis during programming will reveal significant attributes and features, such as external and internal views, existing landforms, landscape, materials and colors associated with a particular location and its entourage. This data have a tremendous impact on the design and planning decisions that would follow. Such information become especially crucial in cases where direct problems are recognized to put at risk the safety of humans or that of vulnerable nature.

2.2. Climate

Climate is the long-term effect of the sun's radiation on the rotating earth's varied surface and atmosphere. Land and sea areas, being so variable, react in many different ways to the atmosphere, which is constantly circulating in a state of dynamic activity. Day-by day variations in a given area constitute the *weather*, whereas *climate* is the long-term synthesis of such variations [6]. Thus, climate considerations are of great importance in environmentally directed research and programming. Climate has consistently had the most evident effects on the way humans develop their built environment. Responses to climate have guided the industries of building, planning, and engineering, in what is clearly an ongoing attempt to harness the forces of nature.

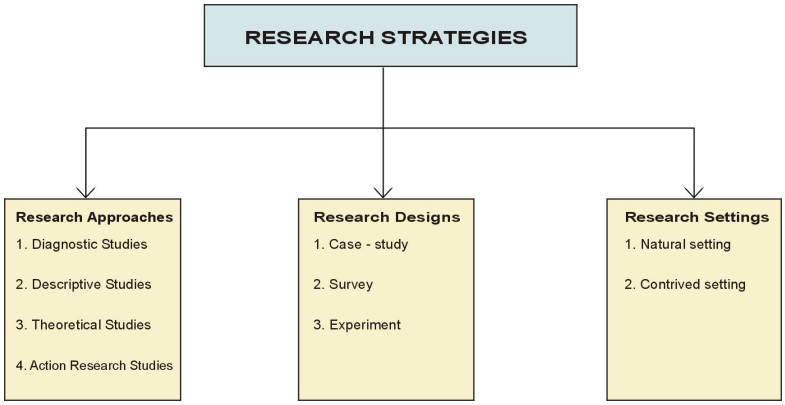

Fig. 6. Studies in architecture and urbanism involve and selectively employ specific research approaches, research designs, and research settings.

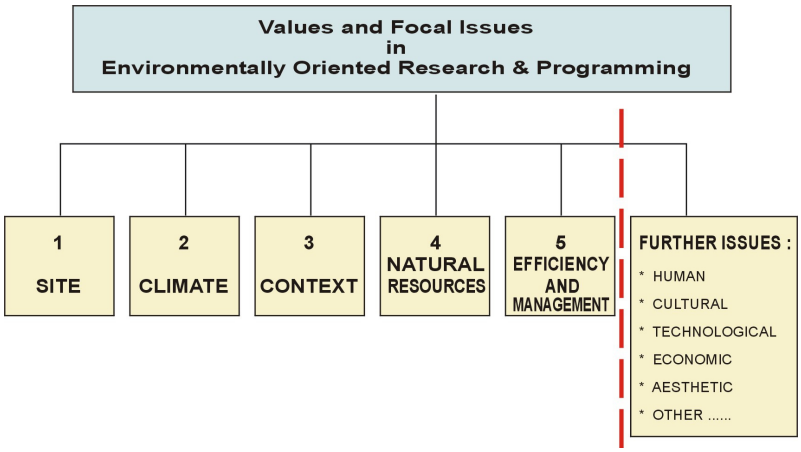

Fig. 7. In progressive environmental studies, five main categories of focal issues are sought, independently or conjointly. Further issues must also be categorized and their association taken into consideration.

Climate remains a major research focus and programmatic issues, engendering diverse areas of inquiry, and analysis of influence on aspects such as architectural form and spatial organization. Especially in areas of harsh or extreme conditions, the relationship of climatic conditions and human performance - even survival - become issues of great importance. Studies of climate would cover such issues as air temperature, humidity, rainfall, precipitation, wind direction and velocity, frost, daylight span and glare, pollen count, and any further features as specific to individual cases, all at the Macro and Micro levels. Investigation of climatic changes over time and contemporary phenomena, referred to as paleoclimatology, is a field that requires the tools and methods of meteorological and geological research.

2.3. Context

Here the interdependence of built and natural environments comes under assessment. Researchers systematically examine the relationship between man and nature to establish whether it is one of mutual support or otherwise of reciprocal impairment. The notion of sustainability is indeed intrinsic at this level of investigation, and its principles are central issues for study. The work of research and pre-design programming is seen as a tool to optimize the role of designers with regard to environmental obligations. contex-

tual considerations represent a departure from what is seen as token green gestures added in contemporary design patterns, resulting in superficial responses to environmental threats [7].

Investigations of the environment involve examining all the visible aspects, and beyond, to tie in the context and establish the broader image. Environment is basically all of the external factors affecting the living organisms. These factors may be other living organisms (biotic factors), or nonliving variables (abiotic factors), such as temperature, rainfall, and day length. The interaction of organisms with biotic and abiotic factors forms an ecosystem [8]. Human actions have clearly changed the environment, which in return would affect the life quality and performance of humans. Some of the human-induced changes have led to altered climate patterns, and disturbed cycles in different ecosystems. Thus, the long-term consequences of human intervention have become a focal concern, and the rising environmentalist movement advocates ways to lessen the impact of human activity on the natural world [9], yet another complex set of focusing issues for research and programming.

2.4. Natural resources

Environmental resources-primarily natural ones such as water, air, fuel, and building materials-can have a profound influence on built form. Human presence, settlements, and evolved civilization have consistently depended crucially on the existence and stability of such resources. Here again, the notion of sustainability becomes a focal issue for inquiry. Especially underlined in this regard is the argument built around the availability, misuse, inflicted harm, threats to, and protection of nature resources as assets for coming generations. The energy crisis of the 1970s alerted the world and especially the architecture-related professions, to the prospect of a time when conventional technologies might not be possible or feasible. Since then, a completely new value/dimension began to have a significant impact on the design and planning practice. More concern has steadily been expressed for energy efficient approaches, technologies, and designs with studied thermal performance, and orientation.

There has been a notable growth of interest in such issues as the passive modes of management, an appreciation of wisdom in vernacular precedents, and a whole new direction towards intelligent environmental control of spaces. Energy efficiency became the norm, and somehow indirectly has resulted in a completely new aesthetic in architecture and rationale in development schemes. In addition to sources of energy, resources also comprise available building material. Issues related to construction materials would encompass the quantity, location, qualities, and energy needed for their manufacture and transportation (also known as embodied and grey energy respectively). In addition to these criteria, the durability, recyclability and performance of building materials are observed and coded to facilitate decision-making in the process. With modern technologies and transportation capabilities, many materials become nearly universally available. Nevertheless, as resources the use of materials must be observed depending on their economic availability, appropriateness relative to local conditions such as climate, labor, and community considerations.

2.5. Efficiency and management (consumption and waste)

This category involves a special set of issues, differentiated by their nature from the previous ones, because they associate with the practices and processes adopted/operated in designing and managing the built environment. Here the functioning or “metabolism” of buildings and projects is observed in order to examine the ways in which energy and other input material are assimilated to allow the lively operation of different functions included. Also monitored are the waste produced, types, quantities, qualities and potential for utilization in a beneficial manner. The issue of energy conservation now constitutes a major part of the green movement that is coupled with intensive research. In addition to environmental idealism, most researchers need to incorporate the practical aspects, and worka-

ble strategies that promote energy efficiency. More emphasis is needed for actual implications on the design and programming of new facilities, better planning and management, exploiting technical innovations, patterns of development which lead to less consumption and waste, and use of renewable resources and nature-friendly processing [10]. Besides energy itself, the issue of efficiency/management encompasses consideration of building materials, for example those having recycled content (post or pre-consumer), easily reused (whole or disassembled), and easily recycled (preferably in closed loop systems). Seeking conscientious design strategies is the focal issue here, with selection of environmentally preferable materials as main concern, aiming to conserve natural resources and to minimize the generation of waste and pollution. Accordingly, one guideline for decisions relating to efficiency could be expressed in the hierarchy of '*reduce, reuse, recycle*' [11].

According to Hershberger [5], waste products from buildings and their ultimate disposition is a problem that receives only limited attention in pre-design research and during the programming process [5]. Environmentally- conscious research ought to involve the systems of waste handling and screening, and accommodate innovative ideas in this regard. Of particular significance here are programs for waste recycling, and use of recyclable materials in manufacturing and construction. Similarly relevant is the issue of airborne waste and special systems that reduce/treat gaseous waste, emissions, and pollutants. Further requirements that are proposed need to be considered so that they will not interfere with other important design considerations. Such perspectives, principally oriented towards efficiency, would predictably have an effect on how buildings, development, cities, and circulation networks are designed and planned [7].

Together, the above five sets of values and concerns are presented as focal matters and core issues, that generate widespread attention, and to which most research in the field is geared. This categorization could be further expanded and elaborated, depending on the level of detailing and specificity, as required in particular studies and research situations. Research activity is always centered on one certain problem, or sometimes a set of linked ones. Problem identification is a step that also needs awareness and concentration on problem-solving processes, which are most suited for environmentally specific investigations. In accordance with the above sets of values and issues, problem identification formats should also express the underlying values and assumptions of the groups of actors involved. Various systems for problem identification, examination, and solving, are currently adopted [12]. common phases would include [6]:

- Stating the Problem (in general terms, what needs to be considered, what are the manifestations and measurable aspects);
- Listing facts and assumptions (and determine other required studies);
- Stating the objectives (in measurable terms);
- Establishing criteria (how should aspects be evaluated and problem approached);
- Generating strategies and Alternatives (as workable ways/solutions to achieve goals and objectives);
- Evaluating solutions (on the basis of criteria such as viability or phased effect);
- Formulating recommendations (by documenting findings and concluding argument).

In the common step where goals and objectives are stated, words are sometimes used interchangeably. The term "*goals*" could imply a broad aim, while "*objectives*" can be quantified in figures. Exactly the opposite is also a valid stance, as many references accord similar definitions inversely for the two words goals and objectives. Other common steps include the facts and assumptions listing, alternatively putting forward strategies that encompass available resources and concepts for how to use them. Designing strategies and formulating alternatives require a close look at the goals and the situation a researcher works within, here most creative ideas materialize. The evaluation step is a common phase where difficulties are bound to occur, due to vague definitions and statements, and the possible lack of specific information. According to Cherry [12], the requirements for problem solving clearly go beyond the development of a

format/process. Researchers, designers and other participants must be willing or instructed to work toward solutions. Effective research and programming needs an open atmosphere in which all points of view are taken into consideration, disagreement expected, mutual interests determined, problem-mindedness replaces solution-mindedness, and finally differences/ pluralism accepted.

The most inspiring Scandinavian architect Alvar Aalto (1898-1976) fairly states: “the methods of architecture are sometimes reminiscent of those of science, the kind of research that natural science uses can also be applied to architecture. Architectural research may well be methodical than before, but its essence can never be purely analytical. Architectural research must always be of an art and an instinct”. The scientific method or process remains essentially unchanged with standard actions to follow such as: pose a question, collect pertinent evidence, form a hypothesis, deduce the implications, test them, accept, reject or modify the hypothesis, state findings and outline your conclusive position.

3. The environmental approach in architectural programming: basic types

Architectural Programming is of a distinct nature, broad and complex, because it draws on the different specialties within the design profession: architecture, planning, urbanism, environmental design, and estate management. Programming is the first & most important stage in the Architecture delivery process [7]. Programming is the definitional stage of design - the time to discover the nature of the design problem, rather than the nature of the design solution. Here, most important "Formative Decisions" are made before the design or policy-making begins, as a result of the interaction between the ideas of actors involved in the tasks of designing, altering, and preserving the natural and built environments.

With regard to architectural programming, diverse definitions exist & relate to such combinations as building programming, facility programming, functional programming, and design programming. However, the most comprehensive is certainly the expression of "environmental programming". The latter indicates an activity dedicated to a broad realm encompassing both the natural and man-made components. Architectural Programming is the first stage of the design process (refer to fig. 8), in which:

- Environmentally relevant issues of the client, users, architect and society are identified;
- Important environmental goals are articulated;
- Facts about proposed intervention are uncovered; and
- Dual needs of a project and its surrounding environment are made explicit and correlated.

Thus, the architectural program is the document in which the identified values, goals, facts and needs are presented. Also, it is the document that contains rigorous definition of the actual requirements and the priorities attached to those requirements [13].

Various approaches to programming have been developed and used to address particular architectural situations and environmental contexts [5: 6-34]. Among the numerous models developed and applied in diverse cases, four approaches are noteworthy and of significant potential to relate to the environmental sciences. They are selected according to the degree of flexibility; appropriateness and robustness that makes them suit varied situations (fig. 9). Together, they present a repertoire of environmentally conscious and inductive processes primed for application.

3.1. Design-based architectural programming

This is the most frequently used method. It occurs simultaneously with the design process. Minimum amount of information, or a short program statement, is generated prior to initiation of the physical design process. In later phases, new information and problems unfold. They are then taken into account. Such issues as usually affect this approach to architectural programming include:

- Thoroughness and accuracy of initial brief, especially when presenting necessary environmental information and facts;

• Effectiveness of the designer / architect as interviewer, who deals with a multiplicity of views, values and conceptions held by different parties; and
• Scope of the project or program, type of intervention involved and extent of impact.
Thus, the design-based approach, though highly flexible remains most appropriate for limited range projects, mostly with limited effect.

3.2. Knowledge-based architectural programming

This second approach utilizes several research methods and tools in the actual programming practice. It requires extensive research and investigation in order to develop adequate knowledge about environmental needs, attitudes and interests. Special attention is paid to the findings and careful consideration of results is necessary in the actual programming and design. This informed approach is particularly useful if:
• Dealing with large complex projects; or
• Participants may not have a good conception of needs.

The knowledge-based approach is mainly characterized by the fact that it consumes time and resources (budget, facilities, manpower,…). Nevertheless it provides highly reliable information and basis for rationale in subsequent physical design and decision-making regarding the environment.

3.3. Agreement-based architectural programming

The third approach is chiefly relying on the knowledge of client to generate program information. In relevant cases, key participants are often committee members who give basic information, hire the architect and even go onto advanced phases of monitoring the construction. Here, the programmer serves as a knowledgeable coordinator, whose duty is to assemble the program, collect available data and seek additional information from committee members and local bodies concerned with the environment. Due to this complex structure or situation, potential areas of conflict often arise, and are systematically resolved in order to arrive at agreeable program statements. This agreement-based approach depends on such issues as:
• Programmer's understanding of requirements, current problems, true needs, and environmental determinants and contextual framework; and
• Capabilities of committee members, and other bodies involved, to provide reliable and accurate information, analyze, discuss, and deduce viable guidelines.

3.4. Value-based architectural programming

This last approach ensures that pertinent information is obtained for every design concern or "the whole problem". It requires intense exploration of problem with the client, community, and user groups. The approach is responsive enough that it develops good understanding of:
• Values and goals of client and community; and
• Constraints and opportunities of site, context, budget, … etc.

Systematic information gathering incorporated into this approach ensures careful consideration of important issues and values, as they differ across the client, user groups, and entire community. The value-based programming method represents an attempt to incorporate the best aspects and avoid the problems, of previously mentioned programming approaches. It offers a degree of sensitivity to specific perceptions and aspirations of the larger community, and in early stages could entice participation, and promote wider awareness, involvement and support for environmental causes.

4. Architectural programming: format and contents

In the present time, many formats for architectural and environmental programming are in common use. The shared aim is to process and organize architectural information so it can be effectively communicated to various actors and concerned groups (figs. 10 and 11). Programs are prepared for three different stages: master planning, schematic design and design development. A comprehen-

sive architectural program covers all three phases, but organizes data so that the designer finds relevant information, and data that is useful in making informed decisions at each phase. A complete program is likely to have up to eight major sections, depending on the nature or type of project (Figure 12). The following is a concise explanation of standard components [5: 367-430]:

1. *Preliminaries*: such as cover sheet; transmittal letter from programmer to client indicating nature and intended use of document; acknowledgement of any help received in developing the program; Directory of persons to contact relative to specific areas of data; methodology or summary of info gathering and analysis procedures used to produce the program document; and list of references or useful material for particular aspects.
2. *Executive summary:* that states the purpose (to give concise idea about the nature of project & broad issues within the program); and Format (pages containing information about all program areas, goals, issues, constraints, opportunities, user needs, relationships, qualities, schedule, budget, …etc.).
3. *Values and goals*: (listing a clear set of values and goals of both client and user; simple sentences are most effective to direct to important issues to be dealt with in schematic proposals; values include major areas such as: human, environmental, cultural, technological, economic, and aesthetic. These could be stated in order of importance, with specific goals listed besides each heading.
4. *Design considerations and facts:* covering areas such as human activities and characteristics, environmental (site and climate), cultural (traditions, laws, codes & ordinances), technical aspects, and other (image, form, color, signage).
5. *Project requirements*: spatial needs, Performance Requirements (PRs), and Design requirements (DRs). Requirements are included for *master planning* (e.g. site design, circulation, parking, utilities, buildings layout, overall relationships, sizes, location, orientation, future expansion), for *Schematic design requirements* (e.g. building design, landscaping, activities, needs), and for *design development requirements* (space program sheets, systems provisions).
6. *Space identification and allocation*: Listing required spaces and size/capacity for each. presentation could be in the form of tables, and must account for unprogrammed space (e.g. circulation spaces, services).
7. *Relationship matrices and diagrams: Matrices* show how various spaces are related and reveal spatial relationships as a step toward developing diagrams. *Diagrams* show important linkages, while avoiding preconceptions built into them.

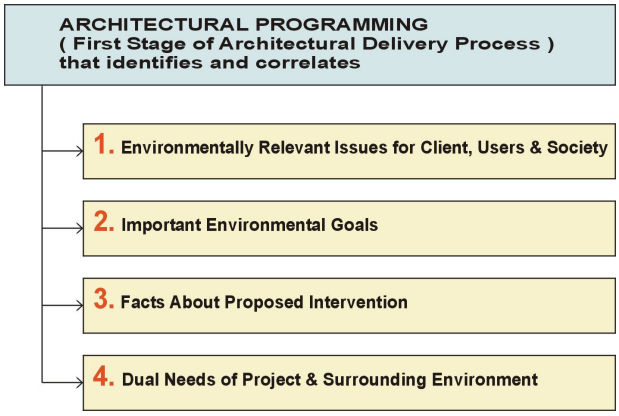

Fig. 8. Programming in architecture and urbanism is the "definitional stage" for values, goals, facts and needs, compiled along with actual requirements and priorities attached to them.

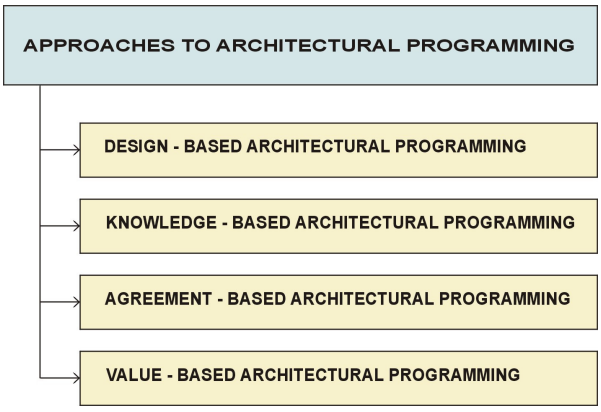

Fig. 9. Four approaches to architectural programming with significant potential to address environmental concerns and integrate important issues into the decision-making and designing process.

8. *Budget and cost analysis*: statement of owner or sponsor budget, construction cost, implementation costs, and lifecycle costs.
9. *Time schedule*: Explanation of time plan and phasing, clearly indicating what is to be accomplished and when, setting an agenda for completion of various stages.
10. *Design outlook*: These pre-design guidelines include the following:
• Client Ideas, conceptions, arrangements, and solutions;
• Precedents: information about similar projects and examples;
• Programmatic concepts: Important ideas with form implications;
• Design precepts: rules and principles to develop a concept;
• Design concepts and diagrams added as concluding part of programming activity;
• Design exploration: taking the program into initial schematic phase of design.
11. *Appendix:* explanatory material underlying the basic information in the program itself (e.g. results of any Literature search, observation studies, interviewing, site analysis).

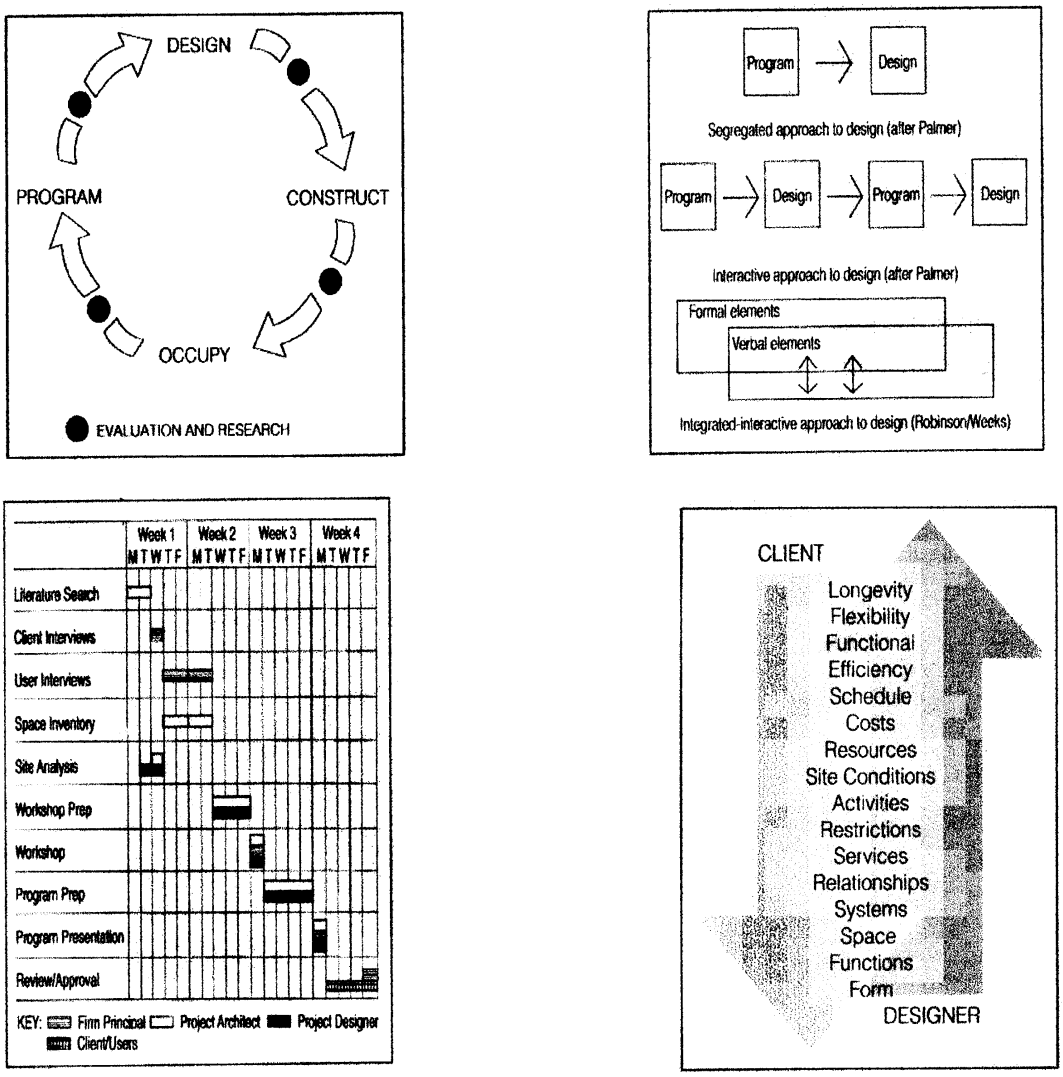

Fig. 10. Selective diagrams of: (clockwise) architecture delivery process, programming approaches, client versus designer interests, and simple programming schedule [5].

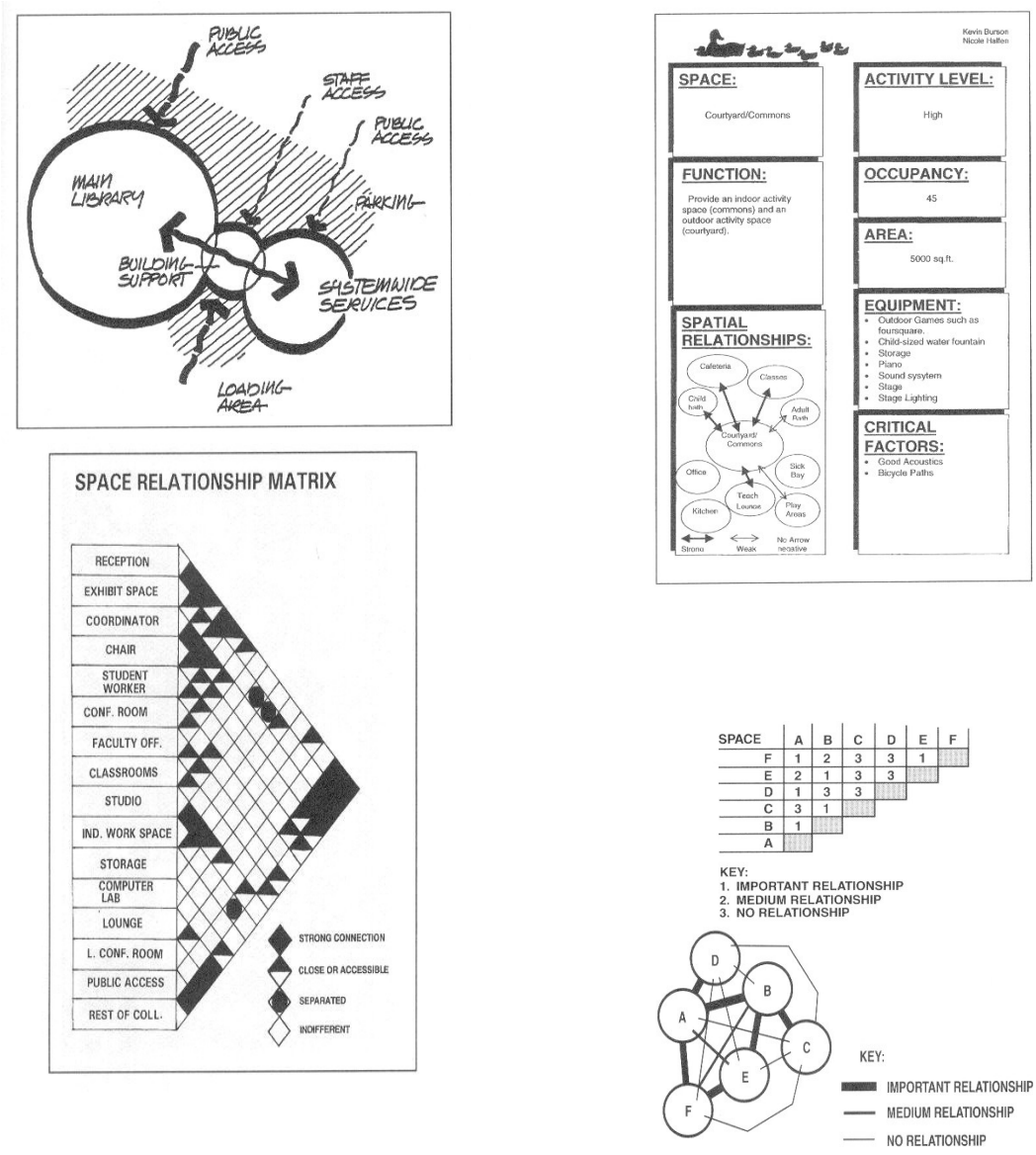

Fig. 11. Explanatory samples of program sheets: (clockwise) zoning diagram, space relationship matrix, space considerations, and overall relationships diagram [5,12].

Different versions of formats share certain characteristics that can be compared. They all begin with a literature search. The ensuing definition of goals, criteria, objectives and issues is to a great extent analogous. However, efforts to collect data and information are at variance, and notably depart from mere data gathering to organizing and analyzing the content, as to be synthesized into usable records. Also dissimilar are the creative steps of involving users, developing alternatives, strategies, and approaches for achieving goals, where some formats uncover precedents, and test concepts to guide future intervention. Evaluation is sometimes emphasized as a separate step. Costs, their implications, economic feasibility and budget goals, all remain somehow under-stated, and not given

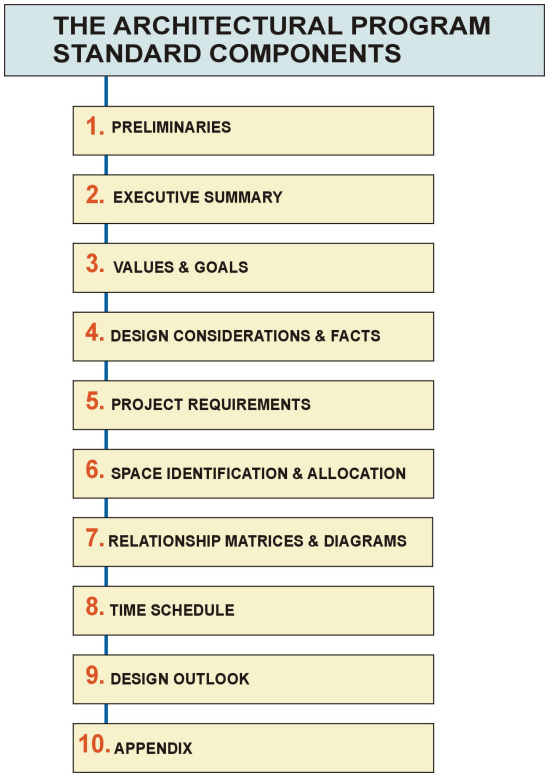

Fig. 12. Architectural programming: main sections in which data is organized in a final document. However, other components might be added or merged depending on the nature / type of project, and also the information that needs be communicated.

adequate emphasis by specialists. Generally, in all adopted formats, programming is accepted as a separate step/activity from design and planning [12]. Most programmers admit that ideas do not always fit into formats as neatly as they would like. In practice, the description of a linear process implied by the way contents are listed, is largely untrue or impractical. Therefore, information obtained sequentially by research activity, ought to be managed according to the way the program is organized, avoiding repetition in steps, and achieving control of flow. The final issue here is attempting to adjust the scale of information and discussion forwarded in the document, appropriately in consideration to the audience and other task groups (the familiar pattern of *large-scale issues first* is not always the best).

4. Conclusion: the integrated outlook for environmentally oriented studies and programs

This research has presented an overview of the newly developed sub-discipline, coined in the nineties under the title of "*Research And Programming*", as to merge research methodologies with architectural programming. Primarily at the theoretical level, the paper has reviewed the activity of research that is geared towards environmental concerns, and the growing debate and argument established in the field. Attempts to link environmental concerns to academic research have recently taken a rather broad scope. This should be viewed as a specific activity that needs careful planning, thoughtful assessment, and creative judgment.

Focused investigations and diagnostic studies need not to emphasize environmentally sensitive issues as remote areas of concern, but rather adopt a fresh integrated approach that is environmentally responsive. Responsiveness is here viewed as a core interest, in the new role sought by specialists and other groups involved in the design and development professions. A clearer vision of environmental problems is considered necessary, in order to acknowledge the complexity of issues incorporated. Identification of problems remains to be developed, as they are intricate by nature, with a multiplicity of causes, and interrelationships operating within both the natural and built environments. Problem solving approaches will have to employ a more scientific standpoint, and make use of the judgment and reasoning processes developed in engineering disciplines.

The overall contribution of research schemes will depend on presenting rich technical content, instructive information, integral thoughts all expressed in innovative methodologies. The quality of new research will also depend on genuine presentation skills, clear interpretation, thoroughness and coherence of information they communicate. This paper has proposed five areas of environmental concerns that may become focusing issues in the research and programming activity: Site, Climate, Context, natural Resources, and Efficiency and management.

Together these topics are believed to encompass the principal issues with direct influence on shaping a contemporary approach towards environmental welfare.

Nonetheless, further avenues for research could adopt different / compatible ways to define the problems, to identify values, and to address environmental interests. Ongoing studies in architecture and environmental studies will continue to gain momentum, and enjoy a high degree of flexibility that allows new impressions and concepts, to better serve environmental causes and objectives.

Programming in the field of environmental studies must be viewed as the research and decision-making process that defines the problems to be solved in a later stage by architectural design, planning and policy-making. However, it sometimes goes into a second leap of further inquiry and investigations that would also lead to inventive decisions and proposals. It is argued that this is sometimes an unconscious process, sometimes a conscious one, and sometimes it intertwines with the design effort. programming as a recognized sub-discipline of environmental studies, including architecture, will continue to evolve according to changes in society, and ideological transformation in professional attitudes. Indeed environmental orientation, awareness and sensibility together form a doctrine that causes a noticeable shift in most fields of knowledge, conceptions and practices on multiple levels ranging from local to global. Programming that usually precedes the design phase, is sometimes not readily accepted, nor properly addressed by design professionals. At present, there is a real need to address its significance, and importance in inducing change. The validity, prospects and impact need further review and consideration. This includes the reasons why programming should be done, when and how it could be effectively prepared. Also to be further advocated are the ways in which programming and focused research could be engaged on the subject of environment, and employed toward environmental objectives.

The problems facing the environment are getting more substantial and diverse. Some of these problems are highly publicized and generate growing concern, while others remain less known or low profile. Many scientists and researchers believe that some of these problems will reach critical proportions in the coming decades. This perspective constitutes the underlying motive for further activity in the discipline of research and programming. It is important however to admit that this is a new discipline that still requires expansion, improvement, and refinement, based on experience of the last decade. Further research into this field would consequently steer the current drive towards repairing damage, seeking better practices and future prospects for environmental protection, at once conscious, feasible, practicable and lasting.

5. Endnotes

1. The contents and structure of this research paper constitute the main core and key issues of the technical material used in seminar-like lectures run by the author as part of modules "Academic Research Principles and Architectural Programming", which the author has taught for the past four years at both the undergraduate and postgraduate levels.
2. Extending the benefits/output of research into the practice of Architecture, Planning and Management currently generates widespread interest as discussed by John Glasson in his article [14].
3. Further aspects/stages of academic writing and research are discussed in detail in the concise yet highly informative textbook by Robert Dees [1].
4. In his book "*Inquiry by Design*", John Zeisel further examines the relationship and mutual impact between environment and behavior and presents useful tools to collect data, observe physical traces and behavior, and assess attitudes of different actors.
5. The five categories do not represent a comprehensive list, yet they serve as a start point for standard research organization, and for categorizing environmental concerns, common problems, and management approaches.
6. Ref. [5] presents a useful review of Architectural Programming Formats, and highlights their common characteristics,
7. Ref [5], contains a clear account of environmental programming approaches, how to

use the techniques, set values, resolve issues, apply tested methods, and leverage working skills. Also covered are ways to gather and analyze information, including literature search, diagnostic interviewing, observation, site analysis, and group work sessions.

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