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Reinventing Sustainable Construction: Exploring the Paradigm Shift Needed to Reconcile Environmental Conservation and Sustainability Objectives

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Abstract

Nowadays it is a well-known fact that the conventional architectural and urban development model has difficulty in being adapted to the new requirements that society and industry demands, particularly with regard to cultural aspects and sustainability. Regardless there is a constant progress in such technology and research, the historical inertia of construction procedures and techniques have had the consequence that the building process is un-synchronised with current requirements. A recent contribution in this regard is the "House Master School (HMS)" education and career model that integrates the concepts of *Sustainable Building (SB)*, *Sustainable Conservation (SC)* and *Education for Sustainable Development (ESD)*. Thus, the HMS model integrates a unitary set of transdisciplinary and holistic key concepts involved in sustainable development, planning and design, involving architecture; engineering; conservation; energy; natural and social sciences; economy; innovation; management; quality; logistics; ICT; arts and crafts, that may be locally or globally applied. It is generally applicable, and may be transferred to other countries, regions and/or fields. This paper introduces the HMS model and analyzes the pros and cons of adapting this model in Spain. It analyzes the possible implications of its introduction in the production-system and building. Potential impact and effects of this change in a Spanish context are discussed, and the role of such implications on decision-making.

Keywords:

Sustainable Building, Sustainable Integrated Conservation (SIC), Education for Sustainable Development (ESD), architectural conservation, environmental management, leadership, building crafts and techniques.

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1. INTRODUCTION

Nowadays it is a well-known fact that the conventional architectural and urban development model has difficulty in being adapted to the new requirements that society and industry demands, particularly with regard to cultural aspects and sustainability. Regardless there is a constant progress in such technology and research, the historical inertia of construction procedures and techniques have had the consequence that the building process is un-synchronised with current requirements. This technical and cultural inertia contradicts new variables that have been emerged as a result of the need to build our cities more sustainably, and to ensure their continuity. As this conference suggests, the values emerging from this movement defines a major paradigm shift, which inevitably will result in new policies and views about the way we should work, build and learn, maintain and ultimately live in our communities.

The sustainability of built environments is sensitive to environmental, financial, knowledge and time constraints. One major problem is that the overall conceptual framework for such integrated policy, education, practice, science and research, has not clearly been defined. As a result, there has been no holistic model, which adequately deals with the sustainability of the built environment. Currently in Sweden and Spain, as well as in other countries, there is an increasing interest in cross-disciplinary leadership, training systems, education models and specific competence in order to appropriately assess, build, monitor, manage and demonstrate building quality, performance, impact and different values that may be shared and disseminated among different groups. In this article, a scientific research, network and consensus-building process, a conceptual framework and a model for integrated lifelong learning, educational development, collaboration and research in this field is introduced, i.e. the "House Master School" (HMS) - and this paper analyzes the pros and cons of adapting this model in Spain. Potential implications and effects in a Spanish context are discussed, and the role of such implications on decision-making.

2. BACKGROUND

Integrated Conservation is a well-established discourse and approach to conservation research and applications in sustainable urban planning, design and development - and to ecological, architectural and nature conservation. In Europe, the theoretical roots of this concept can be found in the formation of the Italian concept *conservazione integrata*, introduced by Piero Gazzola and promoted by the Council of Europe as an important component to the *European Charter of the Architectural Heritage* and related policy in 1975. Already in the 1960s and 70s, this concept was introduced in Sweden, which led to the establishment of a comprehensive conservation theory and new innovative courses, continuing higher education and research programs at the Department of Conservation, University of Gothenburg (1).

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This in turn led to the establishment of the NMK Postgraduate Enterprising Research School: *Natural, Sustainable and Conservation Materials* placed at GMV Centre for Environment and Sustainability, Chalmers University of Technology and University of Gothenburg; and the 'Göteborg model' for cross-disciplinary collaboration, education, training, research and development (R&D) – i.e. a model that is based on the principles of sustainable conservation, *mode 2 knowledge production* and the *triple helix model* (2). The Göteborg model and theory represents an evolution of the classical conservation principles toward the new trajectories of sustainable urban development and design, in which cultural heritage plays a dual role: a) that of a driving sector on the side of added value production and capacities, and b) that of a conceptual and managerial platform for sustainable building activities and ESD; promoting preventive architectural conservation, maintenance and rehabilitation; educational, regional and work development; innovation and dissemination of cognitive and traditional skills, necessary for the construction of a complete new paradigm of sustainability (3).

An advanced research and development project was conducted in 2004-2008 resulting in the House Master School (HMS) education and career model and a Ph.D. dissertation by one of the authors (4). The HMS model integrates the three concepts of *Sustainable Building* (SB), *Sustainable Conservation* (SC) and *Education for Sustainable Development* (ESD). A theoretical conceptual framework and definitions are provided below. The HMS project (ongoing) has shown that one of the main barriers to ensuring the proper conservation and renewal, and to improving sustainability, management and the design quality of the built environment is a lack of cross-disciplinary knowledge production and cooperation, a relevant education system and an integrated education and career structure promoting ESD and the development of such multi- and interdisciplinary leadership, competence and skills. In the Swedish building sector today, very few individuals have the capacity to effectively manage, lead and *sustainably master* projects taking into account all the different aspects of sustainability and the built environment. The assumption of this R&D project was that there is a shortage in the number of individuals who are sufficiently qualified to holistically and creatively plan for, assess, procure, design, build, manage, maintain and upgrade such integrated systems.

3. SUSTAINABLE BUILDING AND CONSERVATION: THE BASICS

The paradigm shift in conservation and renewal of the built environment has given birth to *Sustainable Building* (SB), *Conservation* (SC) and *Development practices* – also referred to as sustainable renovation, management and renewal or "transformation" of the built environment. This includes the assessment, research, documentation, maintenance, management and monitoring of built cultural heritage and related assets; i.e. in conjunction with sustainable urban planning, development and design; social, environmental and material science; new "green" construction technology; legislative issues, economy, entrepreneurship, architectural history, materials, arts and crafts etc. The theoretical foundation of this paradigm has its roots in sustainable urban design and development, the construction technology and architectural

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heritage fields and is to be viewed as an emerging discipline. This includes the cross-disciplinary assessment and determination of the following (5):

- Proactive planning of design
- Sustainability and performance requirements
- Tangible and Intangible cultural heritage values and needs
- Social, environmental and economic aspects and needs
- Environmental and human-technological impacts and risks
- Recyclability and qualitative potentials of an existing resource
- Determination of additional competence needs for consultancy, management and operation, and
- Optimization of renovation/refurbishment requirements, long-term maintenance, management and options for continued use.

Based on the above, SB and SC support ESD, development of innovations, enterprises and other organizations to enable sustainability and competitiveness within the field. They are concepts and activities within or outside an organization that impacts organizational functions, decisions, policies, resources, standards and quality of work, and the work environment. They are based a combined top-down and bottom-up approach and adopts the view that sustainability cannot be addressed as one subject; it must be based on a *multi- and transdisciplinary approach*, which includes participation of local citizens and stakeholders, requiring *integrative systemic thinking* (10). They assert that traditional design, construction and preservation of historic buildings, landscapes, districts and communities should inform future building practices, providing essential models for future learning and research, and a more sustainable built environment. In this context, the terms SB and SC means an integrated system of conservation and green building practices having a local, city or site-specific application that will, over the long term:

- satisfy social, economic and environmental sustainability needs;
- enhance environmental and building quality and the natural resource base upon which preservation and the construction industry depends;
- make the most efficient use of nonrenewable resources and other resources and integrate, where appropriate, natural, cultural and biological systems, knowledge, skills, standards, systems and goods;
- to develop preventive and strategic measures, innovations, education/training, long-term maintenance programs and controls;
- promote and sustain the economic viability of architectural rehabilitation, repair and maintenance operations, such learning and careers; and
- enhance the quality of life for humans and society as a whole.

Based on the above, SB, SC and ESD are three directly inter-related concepts. This emerging discipline is a form of sustainability science and technology that may be defined as "...neither

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basic nor applied research, but as a field defined by the problems it addresses rather than by the disciplines it employs; it serves the need for advancing both knowledge and action by creating a dynamic bridge between the two" (8). These concepts are to be conceived as part of a *dynamic change process* representing the flow of time, meaning, values, and the continuity of the built environment and life itself, and are based on an *interactive learning process*. Together, they form part of a "*sustainable integrated conservation and planning approach*" where preventive conservation measures and maintenance, assessment, management, learning and evaluation are combined within the entire design, development and planning process (9).

4.1. Sustainable resource management and design is dependent on ESD, integrated conservation and development activities

The principles of SB and SC are defined and discussed in many international documents, such as the *Agenda 21* and the *Habitat Agenda* etc. Most of these principles have a correspondence also with those expressed in the case of e.g. ESD, integrated life cycle assessment (LCA), environmental impact assessment and environmental declaration of buildings. However, there are some principles, which are not always fully linked or included: e.g. a) Global thinking and local action; b) Holistic and preventative approach (integrated and proactive); c) Precaution and risk; d) Participatory mechanisms in city development and decision-making; e) The role of education, training and research, f) Traditional building technologies and crafts, and; g) Preventive conservation and maintenance (15).

Sustainable Conservation and Development Projects (SCDPs) may be defined as dynamic systemic processes linking architectural/urban conservation and sustainable construction with local socio-economic development. They have become management and conservation approaches linking architectural design, heritage, landscape and nature conservation with the interests of different stakeholders at local, regional and national levels. Such projects rely upon integrated and proactive leadership, participation, collaboration, preventive conservation and management techniques that bring together disciplines and stakeholders from different sectors in the creation and implementation of "*sustainable conservation, development and management plans*". *Sustainable integrated and planned conservation* in this context implies appropriate heritage management, where collaboration between disciplines, timing and frequency are crucial. It means an early identification and assessment of inherent qualities, materials, techniques, potential risks and different values, existing conditions and possible damage, competencies and skills, in avoiding the progression of damage or in reducing negative effects caused by environmental, human-technological impact or damage (11). This vision is based on a systemic view of the interactions between objects, people and the environment, laying the proper foundations for sustainable development, rehabilitation and reuse.

The conceptual framework and approach presented above means a knowledge-and-art-based intervention in built surroundings, leaning on *Participatory and Preventative Practices* (PPP),

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cross-disciplinary collaboration and synergetic learning having the potential of anchoring the community's *intangible inheritance* (12, 13). To a large extent, this approach corresponds to the North American concept *Preservation of Community Assets* (PCA), which is also offered as a tool both for community empowerment and as part of educational curriculums (14). As opposed to traditional heritage preservation, this also means sustainable renovation, management and cooperation with industry and the use of contemporary "green" materials, processes and techniques as opposed to rigorous adherence to authenticity or significance of the past. From the perspective of ESD, there is a need for increased consensus on how to implement this conceptual framework not only in city and regional planning, research, development and design, but also in primary and secondary schools, in continuing and work-based training (CPD), and in higher educational curriculums.

5. COOPERATION AND BEST PRACTICES IN ARCHITECTURAL CONSERVATION AND SUSTAINABLE BUILDING AND THE ROLE OF TRADITIONAL CRAFTS

The emergence of sustainable building and planning practices, along with climate changes, and an increasing need for integrated and preventive measures, preservation, rehabilitation, maintenance, regeneration and reuse, is creating situations that are more and more complex to manage. These practices are all depending on complex co-dependent knowledge, strategic interaction and collaboration, inter- and transdisciplinary research. Regardless there has been a considerable progress in such science and technology in later years, far too little attention has been given to the essential role of cross-disciplinary knowledge production and integration, and the incorporation of preventive conservation and traditional craft skills and knowledge in helping conserve energy and other resources, i.e. as a resource in the city planning and development process.

The vanishing of traditional building practices, craft skills and knowledge is a directly inter-related, urgent and globally important problem, not only from a physical and cultural standpoint but also from an environmental and socio-economic point of view. In Europe, the first European draft resolution on the value of traditional crafts and heritage conservation skills has been produced by Baroness Hooper, for the Council of Europe, Committee on Culture, Science and Education; i.e. in addition to other relevant publications, studies and reports (16). This report is an attempt to identify practical ways in which the Council of Europe can help promote the necessary skills. The "value" of such skills cannot be overstated, and therefore the investment in education and training must be seen as an "invaluable" advantage of improving the quality and sustainability of the built environment; i.e. through a better-trained and educated workforce. Nowadays, it is a well-known fact that traditional technologies have built-in mechanisms for sustainability, innovation and growth of new dimensions according to changing challenges and circumstances. Integration of craft workers' knowledge, skills and perception with building owners'; professionals'; manufacturers'; artists' and scientific researchers' knowledge is of crucial importance for planning resource-conserving technologies and for the appropriate

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design, assessment, construction, preservation and management of both new and existing assets (17).

6. INNOVATIVE STRATEGIES FOR EDUCATIONAL DEVELOPMENT, LEARNING AND RESEARCH: THE HOUSE MASTER SCHOOL

As mentioned in the introduction, the House Master School (HMS) is a general model for integrated lifelong learning and ESD, research and development for multiple disciplines in the sustainable building and architectural heritage field. HMS demonstrates the epistemological basis, an appropriate conceptual framework and an organizational and methodological design for ESD, R&D, educational change and development. The HMS model and its conceptual framework may be understood as a logic outcome and extension of NMK and the Göteborg model, combining a theoretical integrated conservation framework with inter- and transdisciplinary programs, activities, science and research of sustainability and application-oriented nature. From an industry perspective, the HMS model and consortium is also a direct response to the new economy, ESD and sustainability-oriented demands. The HMS consortium was initiated and formalized in 2004 under the auspices of NMK and the Swedish Construction Federation (BI) together with educational and non-educational partners in the Dalecarlia (Dalarna) region, Sweden, focusing on the following four objectives: 1) local community participation and ESD; 2) advanced R&D; 3) curriculum and organizational development; and 4) developing a national and international network (18).

6.1. Collaboration between industry, academia and society for the future

The current objective of the HMS consortium is to develop a) a new international master degree curriculum and eventually b) a cross-disciplinary enterprising research school, c) a joint bachelor curriculum and d) continuing professional development (CPD) courses at the undergraduate, master and Ph.D. levels. For this purpose (a), funding has been received from the Swedish Knowledge Foundation (19). The HMS project is a joint-development venture between Chalmers University of Technology, Dalarna University, Gotland University and GMV Centre for Environment and Sustainability, Chalmers and University of Gothenburg in collaboration with construction industry stakeholders, heritage organisations, companies/SMEs and other educational and non-educational partners (20). Special innovative features of the HMS consortium and its anticipated program/-s are as follows:

The HMS consortium aims to continuously interact with the construction industry, the heritage and traditional crafts sectors and the community through activities built into the academic curriculum like e.g. collaborative field studies, internships, interactive design projects, graduation projects, integrated workshops, seminars and cluster initiatives. Through its multi- and interdisciplinary network and the transdisciplinary platform GMV (a support platform for

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ESD and R&D) - the consortium will be pooling, sharing and disseminating information to various stakeholders, designers, researchers, centers and entrepreneurs, that plays a pivotal role in building the bridge between the various sectors involved.

There is already a strong collaboration with other existing networks, Ph.D. and Master programs developed in Europe, the Nordic countries and in other parts of the world, particularly for R&D, ESD, international joint curriculum development and module sharing in the field. HMS will also have a direct link to the mandate created by the Chalmers Environmental Initiative (CEI) and Chalmers new strength area *Built Environment*, Chalmers existing master's programs, the existing research group Built Environment and Sustainable Development, as well as to other existing programs within and outside Chalmers. This includes on-going work within the framework of the UN-HABITAT Partner University agreement between Chalmers and UN-HABITAT as well as GMV and the emerging new Mistra centre Göteborg Centre of Excellence for Sustainable Urban Futures (GotSUF) at Chalmers and University of Gothenburg (21).

To promote ESD, and to generate greater interest in sustainability, environmental issues, traditional crafts, continuing education and research, the HMS consortium collaborates with the construction industry, national and international heritage organisations, SMEs, property owners as well as schools in the three participating regions. The HMS model has become internationally recognized as a leading academic and conceptual model for ESD and future training of professionals through its active research and collaborations with different universities, government agencies, NGOs, industry and other organizations that set international policies and standards in education, training and research on a national and international level, e.g. the European Council; the European Network on Heritage and Conservation Skills, FEMP; UNESCO; ICOMOS and the North American National Council for Preservation Education, NCPE.

6.2. Description of the anticipated Master programme

The anticipated HMS Master curriculum will be specifically designed to attract top Swedish architects, engineers, conservators, economists, planners, qualified craftspeople, construction and facilities managers early in their careers to learning how to become more effective leaders. This means delivering cross-disciplinary leadership, conservation, construction and design skills for sustainable development - through enhanced technical and managerial skills, through better understanding of the issues surrounding sustainable development, decision-making, urban planning, and through an improved awareness of the role of cultural heritage, conservation, traditional crafts and related values, social and financial aspects, commercial business and environmental management techniques to deliver more sustainable practices. The curricula will be based on the requirements of the *Bologna process*, and the principles of so call *Liberal* and *Triad education*. Liberal education is defined as "...a philosophy of education that empowers individuals with broad knowledge and transferable skills, and a stronger sense of values, ethics, and civic engagement. Triad education means that the education will be driven by a threefold

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"triad" principle: "Academics for the mind", "Work for the hands" and "Service-Learning from the heart"(22).

The HMS programme will be multi- and transdisciplinary, and will aim to have the same lateral rigor across the disciplines as the vertical rigor within the disciplines. The courses will be research oriented, participatory, practical and experiential, focusing on the information and understanding required to working with real objects and situations. To fill the gap between academic and vocational skills, the program will include participatory action and learning, including experiential and apprentice-based pedagogic forms to a certain degree. Master craftspeople, stakeholders and entrepreneurs should be able to participate and deliver lectures or courses at the university, and the academic students will have an opportunity for training in real situations together with various actors and stakeholders in the field.

Students will have the opportunity to compile a combination of elective modules that will allow them to follow the program, i.e. in Sweden and/or abroad, which is relevant to their interests and career aspirations. Furthermore, the curricula will be designed so that mid-career workers and teachers can update their knowledge on the subject, particularly with regard to environmental concerns and sustainability and; through university-based CPD courses, allowing them to obtain credits and recognizable qualifications. The training received will not only give the students new skills in particular forms of research, cooperation, assessment, monitoring and analysis etc., but will provide exposure to a multidisciplinary way of thinking and problem solving. Construction economics, management and leadership, business, quality, entrepreneurship, the role of traditional building technologies and crafts will be integrated subjects at the core.

6.3. Environmental management training on SCDP

Traditional sustainable building projects have often had limited success in addressing the often conflicting objectives of architectural conservation and development. This also applies to education at various levels and R&D. The HMS project and its consortium is an example of a successful SCDP research and development project implemented in the Gothenburg, Dalarna and Gotland regions, Sweden. The HMS model is based on almost 20 years of continual cooperation, dialogue and experience, the results from participatory and advanced research, key informant interviews, needs assessments and evaluations etc. Still in its initial stages, this process of R&D has succeeded in establishing a transparent and generally applicable model for ESD, R&D, cooperation and development, combining perspectives of architectural conservation with sustainable building, urban planning and design.

The anticipated HMS education will emphasize the value of integrated lifelong learning and ESD, and the experiences of major stakeholders and other organizations in Sweden and in other countries will be heavily integrated into the course. The programme will provide an introduction

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to the complexities of sustainable building and SCDPs, with an emphasis on architectural conservation, rehabilitation and reuse – such holistic leadership, planning and management. Participants will learn the history and rationale of SCDPs; introduction to issues related to sustainable building technology, urban planning and design, architectural conservation and assessments, professional aspects, management, maintenance and rehabilitation; energy, recycling and reuse; sustainability-oriented livelihood; and participatory and managerial approaches to SCDPs. At the end of the course participants will use action planning to formulate their own SCDP project papers and career plans.

The anticipated HMS programme will provide students a unique opportunity to gain an integrated academic qualification and degree; i.e. *Master of Built Environment*, which do not exist elsewhere at this time. On completion of their studies, the students will be part of a “critical mass” of professionals and scholar-scientists that represent a significant expansion of the current expertise involved in the international conservation and sustainable development community. The program will provide the HMS students with a highly transferable skill set, facilitating career mobility and flexibility. This holistic educational approach, which is at the heart of the HMS consortium, asserts that the establishment of a common language among those involved will allow the newly trained to better work and share knowledge within an “sustainable integrated conservation and development system”.

7. CONCLUSIONS AND EXPECTED IMPACT

From the perspective of this article and the discussion above, *transforming cultural environments* has emerged as the focus for future higher education, training and research programs, as e.g. in the case for Chalmers Academy of Built Environment, the new GotSUF centre, NMK and HMS, drawing together the fields of heritage preservation, sustainable construction, urban planning and design into a consistent and integrated whole. The existing built environment will require such integrated skills for many decades to come. The fact that there is a large amount of inadequately trained professionals, technicians, managers, craftspeople, teachers, scientists and particularly construction leaders has raised the need for a more efficient coordination among education, training and research activities, and among different networks, scientists and companies around Sweden, Europe and the world. A large part of rehabilitation and ‘new build’ outputs are demanding more innovative skill sets, which require new integrated training programmes and qualifications on different levels.

These problems indicate that more attention must be paid to integrated conservation knowledge; ICT; traditional building practices and crafts; the development of continuing education programs and adaptive change management tools; best practice transfer; collaboration and satisfaction of different competences and stakeholder needs and increased understanding of architectural heritage, quality aspects and potential risks in relation to sustainability. Based on this statement, it is expected that increased cooperation between

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different disciplines and non-academic actors, individuals, construction companies and SMEs etc. will promote the diffusion of the highest level of research, develop potential new applications and appropriate services, and offer opportunities for continuing and advanced training of young professionals, managers, teachers, craftspeople and scientists. Such cooperation and learning would facilitate the establishment of common views, attitudes and agreements as well as the sharing of best practices, the development of new innovations, projects and standards etc.

The HMS initiative is only a modest beginning of developing an integrated and sustainable career model with associated programs, research and training activities in this field. It is realistic to believe that this will not be generated overnight and the main challenge is in finding robust ways of implementing sustainability, ESD and most importantly; a *team-based preventative and proactive mindset* among young students, scientists, policy-makers, teachers and practitioners, i.e. to achieve an integrated and harmonious whole through continuous cooperation, research, learning and dialogue, and through small, manageable steps.

7.1. Implementation of the HMS model in Spain: Triad Education, Social Consensus and Technical Training

The Spanish Association of Cultural Heritage define Management of Cultural Heritage as "the efficient management of resources (cultural, human, economic and otherwise) ordered to the social goals that affect the cultural heritage. Over the past thirty years in Spain, communities have begun to value these assets to a much greater extent than in previous centuries (23). But that does not mean that the heritage is protected from all unnecessary harm. For example, many agree that the understanding and appreciation of heritage and traditional skills should be infused into people's minds from an early age, preferably to be included in curricula of both primary and secondary education. However, this is not enough - it takes a lot more social involvement in all decisions concerning architectural heritage and the built environment. This is why democracy and ethics must be present also in this sector. Only with a strong social consensus and an appropriate ethical framework it is possible to conduct sustainable actions and SCDPs, and to provide social ownership as in the examples cited here. From this perspective, Spain should imitate the models and action lines of Nordic and traditional Anglo-Saxon countries, e.g. the United States, Canada, Australia, the United Kingdom etc., where social consensus-building through a comprehensive and informative work is made explanatory – i.e. as an essential component of any "Sustainable Conservation, Building or Development Plan".

To achieve sustainability and quality of life objectives, the life cycle performance and management of built environments must be optimized to maximize the return on investment and ensure that the needs of sustainability are met, taking into consideration the requirements of cultural heritage, aesthetics, quality, health, safety, functionality, durability, economy, and environmental and societal impacts. After taking the appropriate decision on a process for a

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specific project and/or site and the stakeholders involved, the implementation of a sustainable building/SCDP programme must be carried out by professionals trained specifically for this function, i.e. by committed leaders and management professionals, qualified builders, technicians and craftspeople, for whom conservation of integral values as well as quality management are fundamental assumptions of its code of ethics. Wealth management requires no divine inspiration: it is simply a technique, with procedures and methodologies capable to be learned by normal people. There is no need for geniuses, but rather professionals that are properly trained and prepared – and of course; a good dose of vision and imagination, a willingness to cooperate, practice and learn, to share perspectives and creativity never hurts. It is asserted that this triad of learning; i.e. of instilling in our citizens conservation values through education and training, to seek social consensus in the decisions affecting them, and to implement these decisions through negotiative and participatory processes, continuous collaborative action, learning and research, would be the most valuable and appropriate contribution – not only in a Spanish context or in Europe, but in most parts of the world.

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