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Material paradoxes and priorities in: "Architectural sustainability*

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Abstract
The sustainability is now becoming mainstream discourse of modern architecture and through either scientific and social approaches, many analytic and theoretical studies meaning of it have been made and are going to be made. There is no doubt that these studies have considerable contributions on the architectural discourse and the intentions but it is also an undeniable fact that the environment we live is generally quite far from healing through any progress in sustainability. Moreover, the unpleasant conditions contradict to almost the whole of intention can be lived in the mean of architecture of our built environment.

The paper indicates the contradictions between the executions and the intention in architectural sustainability through the material approaches and the material role in the integration of discourse and practice in design is defined. The paradoxes originated from the extreme architectural submitting are respectively discussed due to the technology refers under the title of 'Design for Material' and at the other side due to the so-called natural refers under the title of 'Material for Design'. The sustainability is defined as 'the architectural adaptation to pulsing life in the existing environment' and it is advocated that the process of adaptation due to the architectural components as "place, human and time" requires an approach referring as 'Material Design'. What is meant in this approach inspires the architecture where the material is also the design itself.

In this respect, it is proposed that although the living conditions alter in time, concerning the material priorities in the detailing design can make the architecture to manage a stable balance and a harmonic integration between the intention of design and the practice of execution. The systematic procedure which is put forward in conclusion is based on the author's latest studies and the research project with the title of "The Research on Material Priorities in Sustainable Architectural Detailing Localized on The Region". The systematic procedure is being postulating in the paper under the title of "Material Priorities in "Architectural Sustainability"" has been developed in the extent of research project.

Keywords: *Architecture, sustainability, architectural material, paradoxes, detailing design*

Introduction

Besides all the progress and value systems it is a fact that what we understand as “the environment” is a restricted local region where our daily lives are going on. And unfortunately, our living environment consists of any noticeable progress in the way of we conceive from the architectural sustainability. Also it is considerable point, what is expected from a noticeable progress. The advanced level reached in scientific progress should mean more than an evaluation opportunity for further consideration in particular issues, also it should be used in practice for solving more problems existing in daily life, either. However, the scientific progress and the technological development offer more to facilitate the modern life of man, the inhabitant expectations from the built environment are promoted and altered spontaneously in an increasing rate. As an unavoidable consequence of industrial manufacturing, the inspiring slogan of “desire more, consume more” rules on contemporary life styles and the inspiration becomes to mean a compulsive evolution in the facilities of both design and material through their reciprocal inventions. This is the time of advanced material and the design in tandem gets more chance to submit in an accelerated rate increasing day by day. In charge of ‘surviving the life on existing environment’, the evolution rate of material and design gives more responsibility to each concern where they have never belonged in their history before.

Following the material evolution, the metal domination in engineering has been officially started on by the technology of iron casting thriving through the development of steels and going on with the light and the specific alloys. Up to 1960s the metals were associated with the call of “engineering material”. Then from 1960s as the development rate of new metal alloys had become to decelerate, a compulsion has occurred in the progress of the other material families. Also the industries of polymerization and composites have keep on going to develop particularly. Basically, the developments compel the intentions to offer new opportunities for designer which can not be limited by any material constraint. That can be shorted as “If you wish we make your design lighter or heavier, more flexible or more rigid, more opaque or more transparent…Let us make your design “the more”(Baş Yanarateş, 2007:956). However, an interpretation such as ‘It is a temporary design and it will be replaced by a promoted one which is the recently developed’ is adopted in each design transformed through the material. Everything we use in our daily- lives becomes to be a design object by the immense range of material. On the other hand, the design itself is also tending to be evaluated such a market item that has to be consumed in short time, either. The material approaches treating the design as a ‘market item’ can be permitted by the mass production logic of industrial design, but for the architecture they are rigged throughout. Each built, from the biggest scale of urban to the smallest scale of interiors, means permanent interference to construct of our living environment. So a building as an architectural facility in the mean living environment is intended to survive in long-term and that is already contradicting to the expectation from a marketing item to be consumed in a short- time period.

In this respect, a building can not be evaluated by a temporary utilizing expectation considered in industrial products such as a mobile- phone or a vacuum-cleaner which are having used with an expectation of the latest model replacement. A building is intending to construct for serving ever after

ever with its architecture that makes it a participant of the built environment. That is why the sustainability is going to have a mainstream discourse and moreover subjected for both scientific and social studies in contemporary architecture. Today there is no architect can dare to deny conceptual awareness for his or her works on regarding the terms of "sustainability, ecology or environment" and it is also not to be surprised to utilize from the vesting services of the building material sector contributing to architects in doing their jobs. On the other hand, we are obliged to live with the consequences of extreme material approaches contradicting to our praising discourse of architectural sustainability. The material approaches causing unavoidable contradiction between the intention and the practice are aimed to be defined and discussed as the purposes of this study. The material paradoxes involve an extreme approach which can be interpreted as "there is no need to search anywhere instead of technology to solve the problems". The sustainability is entirely based on quantities of environmental performance assessment accounting for saving energy and conservation of resources. The quantities of physical performance on energy efficiency can be calculated and scored in degrees and they can be improved by the mean of technology and the technical expertise. In this respect, the material can not be considered as an architectural issue though it is the major concern of technology. And the building materials refer building elements and components as the industry products having maximum performance on any issues such as thermal isolation, re-cycling facilities and the supply of energy.

As the binary opposition, it is noticing that all the environmental problems have already based on the technology, so what will save the earth, can not be the technology, but it can be the nature itself. In the extreme, it is insisted on architecture to use more natural materials which makes a building more related with nature. Nature reserves the sustainable materials and the most exotic ones refer the most appropriate material for authentic design.

1. The material paradoxes in: "Architectural sustainability"

The deceptions of material approach in sustainability can affect the building sector more than the other sectors concerning industrial product design. A building is executed with little tolerances and the purposes on extensive test and controls on the total quality of each execution process, which will be performed by distinct services, become impossible at all. That is why each process has to be considered before by the projects at concerning scales. Each building is being constructed to serve at least for 50-100 years nearly an age. The physical performances, which are required by the standards and regulations for sustainability, are generally based on assumptions that they can be experienced in the end of a long-life period.

On the other hand, it can be basically point out that the contradiction between the numerical quanta of assumed energy performance in design project and concluding executions in built environment can occur during the dynamic adaptation of 'the inhabitant' and 'the place' as the main components which are being served by 'the architecture'. In this respect, the material paradoxes between intention and practice are defined in the term of 'sustainability' such a qualified concept by 'architecture' itself. That is why the title of the study is written following as "…the architectural sustainability" instead of "… the sustainable architecture".

1.1. Design for material

Following the contemporary material technology, the requirements for technical services of architecture have been rapidly increased and varied. The exaggerated expectations come forward in architecture, so the intensive energy using and resources consumption accelerate in enormous amount for each process of constructing, using and reusing. Sebetsyen emphasizes that the increase in physical requirements for buildings has been simultaneously encouraged by the impact of technological change on services. Just then he points out that the total energy requirements during the history of mankind are ascending with the increase of performances requirements for buildings in tandem.

A numerical quanta scoring system for assessment has become inevitably necessary to determine “the sustainability” with a best known term as “the green”. The reduction of thermal load and energy consumption for the process of construction and using of building has essentially determined in consideration of advanced building systems and alternative air-conditioning. More than an effective isolation, such building elements or components mainly consisted of composite materials are introduced in architecture to supply a deliberate amount of required energy for services. The executions of those technological products as thermal glazing systems, solar cells façades etc. have a registered priority and they have become the foremost subjects of design insisted through to get higher score in assessments. However, the building components are articulated and qualified with pre-titles as “sustainable, ecologic, friendly with environment, green etc.”, in fact they require an extra-amount of energy for production in phase of extraction, processing of the entry materials and also for transportation to site, storing, execution, servicing and maintaining. So it is a contradiction between the amount of energy which is required for execution of the building element and which is assumed to supply by using of it.

The technological materials advising in regulations of ‘green architecture’ drive the paradoxes and the contradictions inspire many recently researches and studies, as well. One of them is the study of Cook and Golton is written on the inconsistencies in environmental assessment methods points at the remarkable cases of technological materials. The thermal isolation glazes composed of laminated glass and argon filled space tolerances have been evaluated in the study, as one of the remarkable case. It is underlined that the production of these glazes is being entirely based on an intensive processing of industry and the required energy amount is obviously contradicted, although they are highly advised by ‘London Ecology Center’ for the efficiency of energy and resources in the mean of ‘green architecture’ (Cook and Golton:1994).

In order to clarify the blurred corners of sustainability Farmer and Guy have analyzed and reviewed three buildings in the same region context, although they have differed entirely in design as particular examples of sustainable construction. In the review, the Doxford Solar Office building has been chosen as a high-tech execution with its 532m² of the European’s largest photovoltaic façade. The building has an “excellent” degree of environmental performance score in BREEAM (Building Research Establishment Environmental Assessment Method) and it has assumed that between one quarter and one third of the building’s electricity demand is going to generate by it is own photovoltaic façade. On the other hand it is

emphasized that the façade element of the design could be possible by a significant grant from the European Union, and the façade cost alone more than the entire budget of a “green building” as one of the other reviewed cases. Besides their cost price in huge amount, the panels had imported from Germany and their transportation to the site at North England means a remarkable cost, indeed.

Through an approach for a privileged particular technology, the solar panels dominate the architecture. Meanwhile, an intensive processing will be required for each step from production to execution. This is a significant contradiction in comparison between the assumed energy-efficiency performance in using and the required energy-consumption to execute.

The re-cycling materials are also advised to use in order to decrease the waste-production of building sector, and to reduce resource depilation in this way. They oblige the deconstructing performance of the building to prioritize and it means a preliminary acceptation for such an architecture temporally constructed to disassemble ‘sooner or later’ in assumed periods. Otherwise, using of the re-cycling materials alone will have no sense on performance-based environmental issues. As it is mentioned before, a building is constructed to be used in an expectation of not less than a hundred years; therefore the manufacturers can undervalue the returns of their products up to a long-used time till the deconstruction. Although the recycling is not included as a part of the manufacturing process, the most of manufacturers are encouraged to produce more and sell more with a kind of an environmental sense.

Nearly entire of spatial elements are consisting of composites as hybrids. Yet the most of the hybrids are not produced to make possible any decomposing process, the disassembling and the reusing of them require advanced technology executions wherein an intensive energy has to be consumed, indeed.

On the other hand, following the increase in technical service demands from a building the accelerated evolution in delight has also become unavoidable. Today we know that having “excellent” physical performances in term of “green building” does not always guarantee a healing, delightful built environment. The cultural factors can have also unintended and unforeseen consequences of drives through to design for technical concerns of materials.

1.2. Material for design

The approach tends to use the materials virgin as their natural origins can compress the architectural sustainability with such a pre-acceptance as “to construct related with nature”. Even a material is less processed and more naturally originated for design, free from the technological insistence it will require less energy and supply more efficiency, indeed.

The nature can cure itself and the natural components will have no affection on environment as wastes. So providing materials for design as the last-product of nature can be seen enough to have an ecological sensitivity in public consciousness. This is obsolesce value system encouraging the exaggerated consumption of nature. As a conclusion of this encouragement, the consumption rate of the resource tends to accelerate more rapid than the natural process to renew itself. Even it can become such a provoking to

consider nature alone commercially, whereas the ecology sells more in nowadays. Thus the exotic materials are the major products for design due to the approach stands “the most rarely found can make a design more environmentally-friend”.

The researchers warn us about the eco-labeled materials, essentially for the exemplar of timber products. A modest forest which is beneficial to use is being consisted in hundreds years and some major species are reserved intended to support the natural cycling rate. This circumstance indicates a need for an authorative control on resources depletion to reduce through a periodical planning.

A similar approach in low-tech architecture can be followed for local materials had been used at know-how techniques of vernacular architecture. Through the intention of sustainability, the nonexistent artifact techniques can be copied without seeking for the alternatives. The copy practices are contradicted with architectural sustainability due to the insufficient local resource and indigenous hand-made executions. The technology is promoted the life styles with multi-significant fields and it causes a compulsion in conceiving of what we understand from “the dwelling” as our living environment. The architectural sustainability implies to dynamic adaptation of surviving conditions, thus the copy constructions of vernacular and traditional architecture with imitate executions do not mean anything else except the revealing endeavors of artisan’s works for the cultural memory. On the other hand, the depletion of resources through the exaggerated material using in the exemplar of logging house, and the impracticability in building, repair, maintenance and re-building process through the inadequate detailing with exhausted techniques are some contradicting major issues.

In the study of “Designing for composites: traditional and future views”, C.Rose emphasizes that instead of a descriptive approach in a symbolic mean, the observation and the inquiry of environment natural or built are being inherent at the very basic of the architecture: ““we begin by noticing what is there. It has been shown that we see with our brains and our memory and ideas as much as we see with our eyes. Let’s get our ideas shaping up to what we are looking at, when we look at natural examples. In fact, technology is giving us the tools to see these attributes of nature and to be so much less ignorant, but we have to change our thinking and our imperatives truly to see with these tools, otherwise we will continue only to see what we always have; that is, how to make a quick buck at someone else’s expense (Rose, 2004:10).”

Our living environment is consisted by the architectural embodiment rather than the natural. And this is a fact that we can not change by burying the buildings under the earth or constructing with exhausted techniques as logging. Either to build with natural materials does not demonstrate how to live with nature, to build as the copy of vernacular architecture also does not demonstrate how to live as the way of local cultural life.

1.3. Material design

The major concern of architecture is to enrich the quality of life and advanced technology and techniques give the tools to architecture to success it. The approaches do not take care of material priorities through the

inquiry of designing mind can cause paradoxes in architectural sustainability. So the intentions of these approaches can be contrary to the subjects of existing environment as “place, human and time” in practice.

“The greenwash is manifest in some of the claims made for the plethora of building materials, features and gadgets that by their presence alone are held to authenticate a green building. Sometimes these are rustic materials (mud brick, straw bales,rammed earth). Sometimes they are high- tech gadgets (solar panels,sun scoops and geothermal heating system). The important point is that while biodegradable materials and technical devices can make effective contributions, and symbolic elements can be important in their own right, the use of such materials and devices is not alone a sufficient indicator of an environmentally friendly building. There must be demonstrable benefits in the particular case (Williamson, Redford, Bennetts, 2003:11).”

The embodiment of living culture is the mission of architecture and it can not be transfer alone under the responsibility of the nature or the technology, either. However the mission can be completed with the tools of technology and nature with collaboration in design.

The adaptation and the balance between the discourse and the embodiment of architectural sustainability can be achieved through the material approach based on the observation competence of architect with all the tools to inquiry design priorities as material preferences.

The researches on individual materials have been replaced by the framework of material innovations. The innovations are inspired through the possible relationships of material families leading to the hybrids, is included multi-material combinations as the composites. This is a big challenge and it makes a compulsion in comprehension of materials towards an approach “defining material as design” instead of “detecting material in design”.

Into symbiotic whole of material and architecture the evolutions in material is promoted the user’s expectations from the built environment. It is such a departure point for the architectural sustainability whereas the material has become one of the major issues contributing living quality for delight and service. “The very basis of a humane and appropriate architecture is the impassioned search for materials and methods to achieve an optimal mix of delight and service. This is why there s no real separation between technique and form-technique and design (Fernandez, 2006:5). Fernandez continues his statements in consideration of new material approach: “It is reasonable to suppose that enhancing the knowledge of materials, traditional and novel, will improve the ability of designer to better respond to contemporary needs and produce a more humane built environment that also serves the contemporary imagination. Today improving the environment requires a reconsideration of the contribution of new materials in this process (Fernandez, 2006:6).”

So it has become impossible to eliminate material consideration from the design process as well as the execution process of technical expertise.

2. Material priorities in: “Architectural sustainability”

Today the nature of the material has become the nature of design. Design and material intensions contribute to an integrated life. They offer extended

opportunities for designer. On the other hand many major concerns are also being put forward to the designer. Using of a material through an architectural reflex without seeking out the alternatives has become obsolesce for ages. However, concerning the understanding of sustainability it is seen as contradictory aspect that coming to material decisions with the respect of either predicted performance values and utilized form and techniques which can not be adapted to temporal design conditions of buildings. As it is stated by Asby, the number of materials is vast which is about 120,000 or over and so the material selection based on intuitive experiences would not be enough for the mechanical design of industrial product. Asby emphasizes that material selection enters each stage of design and in reaching accurate decisions about materials a recognized systematic procedure has to be evaluated and followed from the beginning of design till the final stages of executions. Furthermore such a systematic evaluation is inevitable for the building design in spatial scales where all of the material families simultaneously can be watched. There are also existing evaluation systems for material selection, but to avoid material paradoxes as concerning “architectural sustainability” (instead of “sustainability”) it is needed to submit alternative systems distinguished from the logic of industrial product design. The industrial design intention in material selection as “developing existing product to encourage growing market as well as the new ones” is one of the essential factor causes to arise such logical contraries with the architecture. That means beside the production of new designs, the improvement for existing industrial product as promoted model can be either intended to manage by the selection of materials. So a product can be supplied to the market with an expectation of temporal utilizing would inspire a rapid consumption at the same time. Such an expectation from a building to serve its user with a temporal acceptability until the promoted one comes is contrary to nature of job and sustainability, either.

So it is clear that the distinction between the each design discipline as industrial design and architecture points at the intentions. As the industrial design tends to the “the mass product” in manufacturing, the architectural design tends to “the living environment” in the mean of building. The manufacturing does not purpose to restrict the market within a narrower localization. Even in architecture, it is tended to be peculiar to the site beginning from the region in the biggest scale to the smallest focuses through the space. If we stand at this point concerning “the architecture and the material paradoxes”, the concept of “sustainability” can be defined as “architectural adaptation of life flows in full scales”. The buildings are the major components of living environment engaging permanent changes with their huge bodies and they are being expected to live long for ages. Because of those expectation and definition a systematic procedure is needed to submit for adaptation of existing building stocks and even wholly new designs to the dynamic conditions in a contingent set of priorities and practices.

So the systematic procedure for the assessment of the emergent material preferences in “architectural sustainability” is being proposed from the departure points can be set as following:

Detail analyzing has to be made to conceive “adaptation process of the architectural building”,

And those analyses have to be made on civil architectural buildings as the models integrated in each scale to the life-flows depending on “place – human and time”.

Through such departure points it is mainly purposed by a proposal to avoid “material paradoxes emerged from the contradiction of practice and intention” based on assumed performance assessment in architectural sustainability.

2.1. Detail analysis based on the adaptation process of building components:

The building components wear out at different rate and they require replacement and transformation with different motivations. As the interior stuff and spatial components have faster cycling, the building systems, structural and sub-structural components have slower. Kibert, Sendzimir and Guy emphasize “a hierarchy of control” to define the faster and slower components of a building. “Management of a building’s temporal tension might be most efficient use of materials through spatial decoupling of slow and fast components with faster replacement cycles would be more readily accessible. This hierarchy is also a hierarchy of control, i.e. the slower components will control the faster components (Kibert, Sendzimir, Guy, 2002:11)”. Kibert, Sendzimir and Guy state this hierarchy as “Temporal hierarchy of building components”: (Fig. 1)

Longer Life
↑ Site (land)
↑ Structure (reinforced concrete, steel)
↑ Skin (brick veneer, curtain wall)
↑ Services (HVAC system, fire protection)
↑ Space (interior walls and partitions)
↑ Stuff (furnishings, interior finishes)
Shorter Life

Figure 1: *Temporal hierarchy of building components (Kibert, Sendzimir, Guy, 2002:13).*

With respect to the hierarchy, the faster spatial components are controlled by the slower structural components as in a example of suspended ceiling or raised floor systems executions requirements for accessible installations. However, Kibert, Sendzimir, Guy point out the critical thresholds as the physical or technical degradation of the faster components drive the slowest components to dynamic structural change and they imply that the articulation of the hierarchy control performance can be achieved in the mean of Odum’s Emergy Theory. “At some critical threshold the motivation to maintain the overall building ebbs and the building rapidly fallls into disuse and disrepair simply because of the degradation of the faster, more technology-dependent components. Odum(1983) developed the concept of “emergy”, the energy embodied in the creation and maintenance of a factor or process, as a means to quantify the relative contributions of different components to the operation of a hierarchy. Odum’s theory predicts that the control of faster components by slower components is reflected in the latter’s higher emergy transformity values (Kibert, Sendzimir, Guy, 2002:12)”. And so the outputs of emergy performance recognized on the hierarchical control “would allow designers to couple buildings to external processes of manufacture, reuse,

and recycling more rationally. As such, this theory provides a quantitative framework for relating building design to its material components based on their relative contributions to the functions of an “ecosystems” that includes the built environment and the materials and processes that sustain it (Kibert, Sendzimir, Guy, 2002:12)”.

The critical thresholds insisted on the hierarchy of building components imply the interferences of building-life, which also bring about the material paradoxes in consequences of unpredicted changes in design-decisions depending on assumed performance assessment at the process of executions. The thresholds affect “the values of emergent capacity” conceptualized in the mean of “emergy theory”, thus the quality of sustainability would be driven to be inferior and furthermore it could be entirely eliminated, either. Why these thresholds occur could be associated with the lack of a systematic procedure in architecture independent from the numerical quanta of assumed energy performance influenced on the material selection of a building. In another words, with the lack of such a systematic procedure in architecture it could be possible to live “the contradiction of practice and intention” surviving in built environment which is inadaptable in each scale to the dynamics of design conditions with interferences in “components hierarchy”. So in the main frame of architectural sustainability, a system means a dual-phase interweaving as “analyzing the process of architectural detailing” and “articulation of the material priorities in the analysis process of detailing”.

Emmitt, Olie and Schmid define the detailing in all process from the conceptual stage of design to the physical stage of construction. They emphasize that the innovative architecture could be merely possible by detailing as not only an issue of execution also an issue of all design stages as well. And also in the study standing with the consideration of detailing through its philosophy, the “ecological aspect” is being evaluated as one of the major factor of a model for creative detailing.

In their study a matrix model for detailing is suggested in nine cell arrangements respectively evaluated as: “Materials and Energy, Building Components and Structure, Morphological Factors, Process of Production, Goals and Performance, Indoor Climate, Ecological Factors, Human Factors, The Knot”. However, “material” is being considered as independent factor, same as the other eight factors also where “building components and structure” is one of the eight.

For the embodiment of design idea as a practice, architectural detail design is the key mechanism processing thoroughly with materials. So as promoting from “workman’s job”, material makes detailing an “issue of design”. It is an unavoidable result of “material design approach”. As following this approach it is being possible to structure alogic for detailing process in material preferences which is postulating as “systematic procedure for articulation of material priorities in sustainable detailing”. Through the basic functions as “connecting, joining and knotting” (following the definitions of Emmitt, Olie and Schmid) in the paper titled as “Malzemenin Detayda Kurgulanması (Baş, 2006)” an aspect is being advocated to build up the material from unit to whole projecting as detail itself. For that aspect, material’s factors are being considered in the extent of preferences as architectural detail at the intersection of two mainly classified group for “ practicing and selection”.

However, “the control mechanism on components hierarchy” is not considered and the preferences based on material behaviors effecting “the values of emergent capacity” is not being remarked at all. That is the major concern of this study, in the mean of “material priorities” referring the paper title as “Material Priorities in “Architectural Sustainability”.

So what it is being put forward as “the values of emergent capacity” is being based on an inference from the coordination of components hierarchy. The inference refers to the hierarchy of building components in perpendicular extent which demonstrates ascending acceleration of the life-times in increasing differences between slower and faster components and that is the main issue makes “the hierarchy control getting harder” furthermore comes to mean “more interference in hierarchy”. In this way for the purpose of getting “maximum emergent performance”, the transformation rate of building components has to be equaled at “optimum life –times” which can be achieved by changing the “perpendicular hierarchy” to “horizontally coordinated hierarchy”. Maximum emergent performance can be demonstrated with a horizontal line indicating coordination in transformation of each building component as shown in Fig. 2.

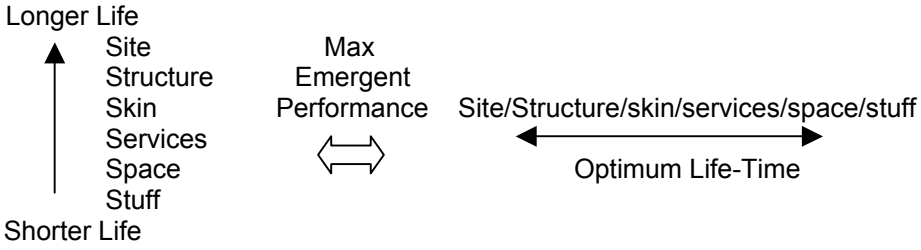

Figure 2: *Maximum emergent performance in “horizontally coordinated hierarchy”.*

The transformation rate of a component means as well as the adaptation rate of that component determined in systematic architectural configuration in the whole of building.

Thus, the adaptation rate of the component at whole rules the assessment of “the values of emergent capacity” and the equality of the components adaptation rates implies coordinated composing-(de)composing process of building as an architectural structure. The implication of higher emergent capacity value can be demonstrated with a line segment indicating “the adaptation capacity of architectural composing-(de)composing” as shown in Fig. 3.

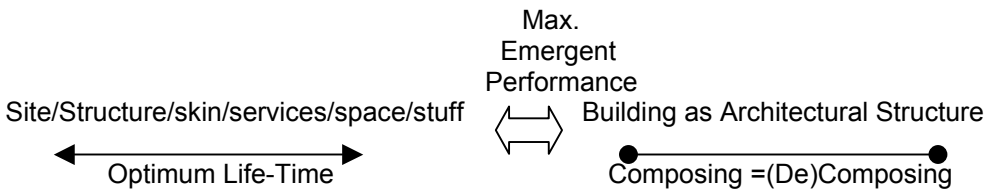

Figure 3. *The higher transformation value through “the adaptation capacity of architectural composing=(de)composing”.*

An architecture composed in an adaptable hierarchy points out a logic that can be codified an integrated whole in each scale from the general structures to the irreducible parts. So the codification in a building as an integrated structure can be followed in “systems, elements and components” classified as below and shown in Fig. 4.

- “Systems” integrate the whole.
- “Elements” integrate the systems.
- “Components” integrate the elements.

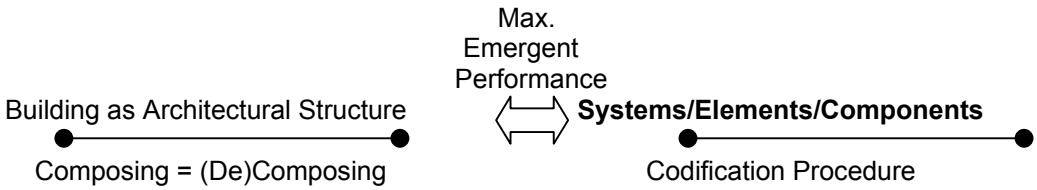

***Figure 4**: Architectural Composing-(De)Composing Through a Codification of Systems/Elements/Components.*

2.2. Determination of material priorities in sustainable architectural detailing

A codification can be achieved by the analysis of detailing beginning from the whole integration at systems scale as the biggest and going on the smaller in a hierarchy follows as elements and components. Such hierarchy defines a deduction in analysis of detailing points as “knots, connections and joints” which are being determined by the basic functions of structural integration.

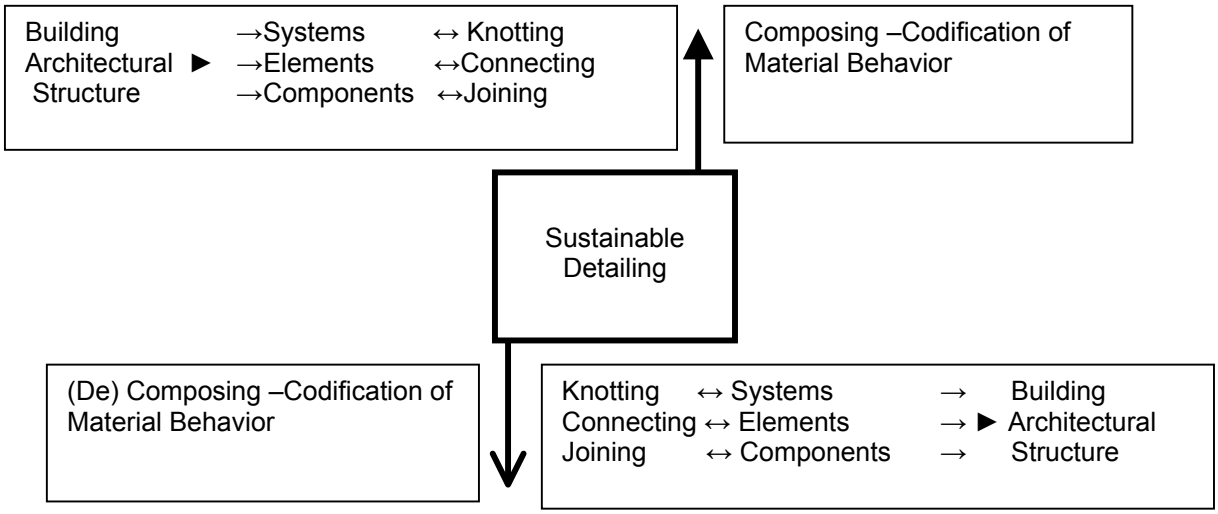

***Figure 5**: Defining of Sustainable Detailing Through a Codification of Systems/Elements/Components.*

As following the systematic procedure in steps demonstrating respectively in figures, the conclusions will come to a definition of “sustainable detailing” which is also shown in Fig. 5.

The systematic procedure reviewing details purposes a codification of material behaviors. So the material classification in detailing becomes a preliminary base to be associated with definitions.

As it is mentioned before, material factors for detailing has been classified mainly in two groups as “practicing and selection” (Baş,2006). The first group of that classification is being divided for the factors evaluating in structural and perceptional properties: “Structural and Aesthetics” and also for the factors evaluating in dimension and execution properties: “Based on Form and Based on Execution”. However, the second group concerns on the practicing of detailing furthermore the design intention, and it is being divided as “Environmental and Cultural” -“Technical and Economical”. Fernandez also classifies the material properties similarly in two groups as “Intrinsic” and “Extrinsic”. According to the Fernandez’s classification, the properties of intrinsic are “mechanical, physical, thermal, optical and deteriorative”, yet the extrinsic ones are distinct properties “Economic, environmental, societal and cultural” which are not related with the structural characteristic of material. Similarly in two approaches a classification has been made in two distinct groups. The groups are based on the structural and behavior characteristic of material. So it appears that the materials in same the family and having similar structural characteristic can behave entirely distinct in detailing according to the local factors. However, it also means that the characteristic behavior pattern of material in detailing can be clearly read and codified from the civil architectures locally integrated and thoroughly subjected by “place, human and time”.

Conclusion

The conclusions can be followed in the paper mainly framed as a binary approach referring “material paradoxes and material priorities”. It is purposed to clarify the concept of “sustainability” in sense of “architecture” wherein a re-definition as “architectural sustainability” is discussed. As the stance adopted in the paper the role of material in integration of architecture and sustainability is defined and construed with a systematic procedure which is also put forward with a respective configuration. So the conclusions are managed to remark in the following sections of the paper as “Material Paradoxes In: “Architectural Sustainability” and “Material Priorities in: “Architectural Sustainability””.

1. Material paradoxes in: “Architectural sustainability:

The paradoxes are being discussed as the binary opposition of extreme material approaches as ‘Design for Material’ and ‘Material for Design’. Through the aspect of “Material Design” which is adopted in the paper “the architectural sustainability” is defined.

► ‘Design for Material’ implies the sustainability in the domain of technology through the materials already require the heavy-industrial and intensive energy process.

► ‘Material for Design’ implies the sustainability in the domain of so-called ecology through the materials are rarely found in the reserve of nature and ready to use for design and the vernacular techniques exhausted in practical mean which are also ready to copy in design.

By defining the sustainability as “the architectural adaptation to pulsing life in existing environment” it is advocated in the paper towards the approach as ‘Material Design’.

► ‘Material Design’ implies the architectural sustainability in the domain of architecture through as the component of existing environment integrates the materials to the dynamic process of design in the flow of life.

2. Material priorities in: “Architectural sustainability”:
The determination of material priorities in sustainable architecture is advocated through the aspect, that the material rules on sustainable detailing in the adaptation of building components to avoid paradoxes. A systematic procedure is being postulated as a codification of emergent material preference in sustainable detailing:

Consequently, the civil architectural buildings are determined to review for detailing where the material priorities will be distinguished. What it has to be understood from the priorities is the characteristic behavior pattern of material in detailing. And concerning the architectural sustainability the material priority means emergent material preferences as well. The codification of characteristic material behavior has to be consisted in systematic definitions. The codification flows as stages defining a hierarchy .

Each of the stages in flow can be followed as:
► Defining The Building Components: Analyzing stage of the whole to detect specific building components identified in domain.
► Defining The Details: Analyzing stage of the building components to detect specific details having identified material characteristic.
▼Systems ►Knots
▼Elements ►Connections
▼Components ►Joints
►Material Classification: Classification stage of each material consisting detail structure in related material families.
►Defining The Material Behavior: Identifying stage of the material characteristic behavior pattern in detailing.

A study on “The Determination of Material Priorities in Sustainable Architectural Detailing” postulates a “systematic procedure in analyzing stages” comes to mean “The Codification of Characteristic Material Behavior Pattern”. The analyzing stages extent full scale of built environment as following from building components to building and region. The codification can be illustrated by a flow chart demonstrating each of the stages in defined hierarchy (Fig. 6).

By following each stage in systematic procedure;

- At detail scale of each building component, the similar materials detecting in classification and having common behavior codes will define building codes at whole;
- And so detecting the common material behavior codes for each building will define regional codes to consist a “characteristic behavior model”.

By the last stage of the procedure it is being purposed to achieve “The Determination of Material Priorities in Sustainable Architectural Detailing Localized on the Region”.

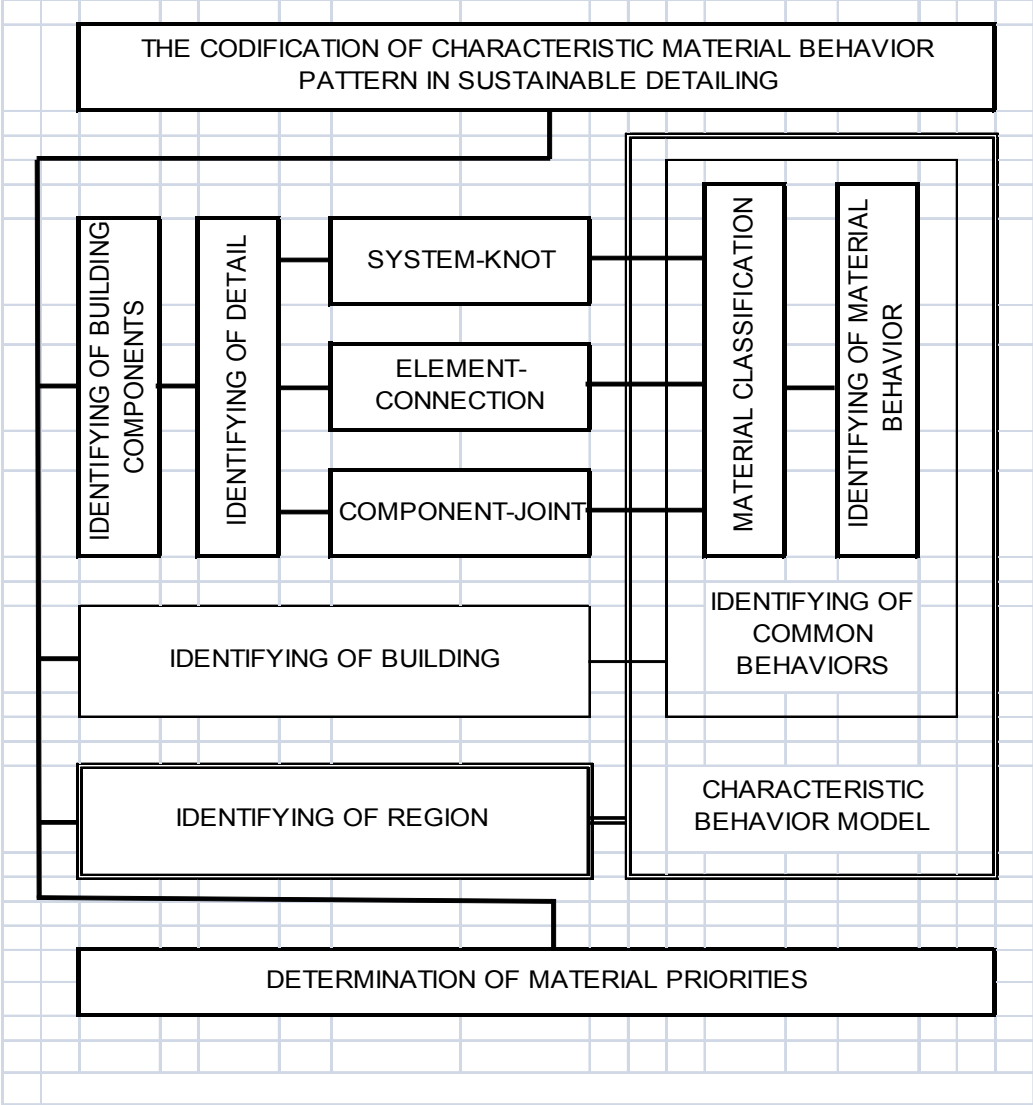

Figure 6. *Systematic Procedure Flow Chart*

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Mimari sürdürülebilirlikte malzeme paradoksları ve öncelikleri

Yükselen bir değer olarak çağımız modern mimari söylemlerinin başında gelen sürdürülebilirlik adına, bilimsel ve kültürel anlamda birçok araştırma, analiz, kuram çalışmaları yapıldı ve yapılmaya devam edilmekte. Bütün çalışmalar şüphesiz, mimaride söylem ve iyi niyet arayışlarına önemli katkılar sağlamaktadır. Ancak şu da yadsınamaz bir gerçektir ki tüm bu katkılara rağmen, gerçekleşen uygulamalarla yapılı çevremizde sürdürülebilirlik adına yaşanan bir gelişmeyi izlemek çoğu zaman mümkün olamamaktadır. Hatta kimi zamanda yapılı çevremizi oluşturan mimari, neredeyse tamamen niyeti ile çelişen zıtlıkta olumsuzlukların yaşanmasına sebep olabilmektedir.

Çalışmada, sürdürülebilir mimarideki niyet ve gerçekleşen uygulamalar arasında, malzeme yaklaşımlarından kaynaklanan aykırılıklara işaret edilmekte ve malzemenin, tasarım-uygulama birlikteliğini sağlamadaki rolü tanımlanmaktadır. 'Malzeme için Tasarım' başlığı ile belirlenen yaklaşımda teknolojinin, 'Tasarım için Malzeme' başlığı altında ise doğanın aşırı uçlarda mimariyi koşullandırması sonucunda yaşanan paradokslar tartışılmaktadır. Sürdürülebilirlik, 'Var olan çevrenin süregelen yaşamına uyarlanabilen mimari' olarak tanımlanmaktadır ve doğru işletim sürecinin, 'Yer-İnsan-Zaman' bileşenlerine bağlı olarak

"Tasarımda Malzeme" yaklaşımını gerektirdiği görüşüne varılmaktadır.
Malzemelerin, yapılarda yalnızca belirli bir süre için öngörülen sayısal performans verilerine dayandırılarak değerlendirilmeleri ve tasarım koşullarına uyarlanmamış ön-kabul biçim ve teknikler ile sorgulanmadan

uygulanmaları sürdürülebilirlik anlayışı ile çelişen yaklaşımlar olarak tartışılmaktadır.

Tasarımcıdan bağımsız olarak geliştirilen malzeme aileleri, belirli ürünlerle tanımlanamayacak sayıda malzeme çeşitliliğine sahiptir. Bu çeşitlilik, malzemelerin tasarımda sorgulanmasını gerektirmiş ve bu sorgulamada analitik bir sistematiğe ihtiyaç duyulmasına sebep olmuştur.
Bu doğrultuda, endüstriyel ürün tasarımı uygulamalarında kullanılmak üzere, malzeme seçimi ile ilgili analitik sistematikler geliştiren çalışmalar bulunmaktadır. Öte yandan endüstriyel bir üründen farklı olarak, tüm malzeme ailelerinin bir arada kullanıldığı yapı ölçeğindeki tasarımda malzeme kararları ile ilgili sistematiklerin geliştirilmesi de zorunluluk olarak görülmektedir.

"Pazar yaratabilecek ürün" beklentisine karşılık tasarım ürünü uygulaması "yaşam çevresi" yaratma gayesi ile mimari ölçeklerde değerlendirildiğinde, endüstriyel ürün tasarımı mantığına uygun geliştirilen sistematiklerle ele alınacak "sürdürülebilirlik" kavramının geçerli olamayacağı makalede vurgulamaktadır. Seri üretim mantığında yere bağlı kalmaksızın mümkün olan en geniş ölçekte pazar bulma tasarım hedefi haline gelebilirken, mimari tasarım bölgesel, kentsel ölçekten yapının konumlandırıldığı sit alanına doğru inerek mekâna odaklanan mümkün olan en küçük ölçeği hedeflemektedir. Böylece ürün ölçeğine bağlı olarak tasarımda mantık farklılığına dayanan "mimari sürdürülebilirlik", "süregelen yaşama tüm ölçeklerde uyarlanabilen mimari" olarak yeniden tanımlanmaktadır.

Konu "mimari sürdürülebilirlik" olunca, yapıda malzeme seçimi ile ilgili enerji verimliliğini esas alan sayısal performans verilerinin tek başına yeterli olmadığı görüşü benimsenmektedir. Benimsenen görüş çerçevesinde, mimari kurgulama mantığının dikkate alınmadığı malzeme kararlarında görülen performans değerlendirme yanılgıları, malzeme paradoksları olarak tartışılmaktadır. Malzemenin ister teknolojik ister doğal olsun işlevsiz olduğu, malzemeye işlev kazandıranın tasarım; tasarıma geçerlilik, varlık kazandıranın ise malzeme olduğu açıktır. Makalede benimsenen görüş, malzemenin tasarımın kendisi olarak söylem-uygulama birlikteliğini sağlayan detay tasarımında kurgulanmasıdır. Malzeme önceliklerinin sürdürülebilir detay tasarımında sorgulanması "tasarımda malzeme" yaklaşımının gereği olarak görülmektedir.

Bu doğrultuda geliştirilmiş bir değerlendirme sistematiği önerisi, makalenin "Mimari Sürdürülebilirlikte Tanımlanan Malzeme Öncelikleri" başlığı kapsamında, son bölümünde yer almaktadır. Önerilen sistematik yöntem, Çukurova bölgesi, 1.Etap Adana – Osmaniye illeri sivil mimarlık örnekleri üzerinde yazarın yürütmekte olduğu "Bölge Odaklı Sürdürülebilir Mimari Detay Tasarımının Tanımlanmasında Malzeme Önceliklerinin Araştırılması" başlıklı bireysel araştırma projesi kapsamında geliştirilmiştir. Yürütülen projede, bulguların değerlendirilmesinin önerilen sistematik çerçevesinde yapılması ve böylece çalışmanın tüm aşamaları sonuçlandırıldığında bölge odaklı bir kodlamanın yapılabilmesi hedeflenmektedir.

Makalede, geliştirilen sistematik çözümleme mantığı akış şemaları haline dönüştürülerek gösterilmektedir. Öneri, yapının "yer-insan-zaman" etmenlerine bağlı bölge odaklı koşullara uyarlanabilmesini mümkün kılan bir kurgulama sistematiği olarak açıklanmaktadır.

Mimari sürdürülebilirlikte malzeme önceliklerinin belirlenmesi: “yapının mimari uyarlanma süreçlerine olanak sağlayan detay çözümlemesine” ve bu çözümlemenin tüm yapılı çevre ölçeklerinde süregelen yaşama uyarlanmış mimari elemanlar olarak “sivil mimarlık örnekleri yapılar üzerinde değerlendirme yapılmasına” dayandırılmaktadır:

Öncelikle bir yapının uyarlanma sürecinin, Charles J. Kibert, Jan Sendzimir, and G. Bradley Guy ‘ın “Defining an ecology of construction” başlıklı çalışmalarında yer alan, farklı yenilenme ivmelerine ile daha uzun ömürlüden kısa olana doğru (saha, taşıyıcı sistem, kabuk, servisler, mekan ve donatılar olarak) yapısal öğelerin düşey hiyerarşik sıralamasına bağlı olduğu, görüşünden hareket edilmektedir. Odum’un “emergy teorisi” ne göre, hızlı dönüştürülen kısa ömürlü yapısal öğelerin, daha yavaş dönüştürülen yapısal öğeler tarafından kontrollü, tüm yapının uyarlanabilme süreçlerini etkilemektedir. Mimari sürdürülebilirlikte malzeme paradokslarının yaşanmaması için, öngörülen “enerji” performans değerlendirilmesi yerine makalede, “emergy” kavramı çerçevesinde “yapının maksimum etkinlik sağlayan uyarlanabilme kapasitesine” bağlı performans değerlendirilmesi esas alınmaktadır. Böyle bir değerlendirmenin de birbirlerinden büyük farklılıklar gösteren ömür beklentileri ve dönüştürülme ivmelerine sahip yapısal öğelerin düşey hiyerarşisinin, optimum ömür ve dönüştürülme ivmesi ile eşitlenerek yatay bir hiyerarşiye getirilmesi ile sağlanabileceği görüşü ileri sürülmektedir. Yapıyı oluşturan tüm öğelerinin “yatay bir hiyerarşi ile uyarlanma süreçlerinde” eşitlenebilmesinin, aynı mantık sonucunda kurgulanan “oluşturulma -çözümlenme potansiyelleri” ile mümkün olduğu kanısına varılmaktadır: Buna göre tüm yapısal öğeler “sistemlerden, elemanlara ve bileşenlere” doğru “bağlanma, birleşme ve eklenme” temel işlev hiyerarşisi içinde “okunabilir bir detay kurgusuna” sahip olmalıdır. Yapı bütünlüğünün, indirgenemeyen en küçük bileşenine, oluşturulmasında -çözümlenmesinde mantık birliği sağlanması “sürdürülebilir detay tasarımını” tanımlamaktadır.

Bu doğrultuda geliştirilen sistematik, sürdürülebilir detaylarda bir çözümleme- okuma yöntemi kodlamasıdır. Bu yöntemin kullanılarak sürdürülebilir detay tasarımında malzeme önceliklerini belirleyen tanımlamalar getirilmesi amaçlanmaktadır.

İncelenecek olan mimarlık örneklerinin ait olduğu bölgeye göre farklılık gösteren malzeme öncelikleri; detayda malzemenin temel işlev tanımı ile belirlenen karakteristik davranış şekillerini ifade etmektedir. Sistematikle ileri sürülen “yapıdan başlayarak tüm yapılı çevre ölçeklerinde belirlenen hiyerarşi ve çözümleme mantığı”, öncelikle detay kurgusunda faydalanılan-kazanılmış yapısal özelliklerine göre “malzemenin sınıflandırılması” ve sonrasında detay kurgulamada kullanım şekli ile kazandırılmış “malzeme davranış tanımlanmalarının yapılması” aşamalarını izlemektedir. Böylece detayda malzeme sınıflandırılması ve davranış şekli tanımlamalarında ortak olanlarının, yapısal öğelerin tamamında okunabilmesi yapıda, yapıların tamamında okunabilmesi ise bölgede, malzeme önceliklerini belirleyen karakteristik davranış modelini oluşturacaktır.