What is the sustainable method enough for our built environment?

A. Djoko Istiadji[1], Gagoek Hardiman[2], Prasasto Satwiko[1]
Universitas Atma Jaya, Yogyakarta, Indonesia[1]
Universitas Diponegoro, Semarang, Indonesia[2]

Corresponding e-mail: istiadji@yahoo.com

Abstract. The sustainable movement has grown and evolved rapidly in the 21st century. This movement is a response to the various problems of the relationship between humans and the earth that appear more disruptive and seemingly intractable problems. After the era of sustainable development emerges, many concepts and new methodologies such as biophilia, cradle-to-cradle, resilience planning, natural step, permaculture, living buildings, eco-districts, transition cities, and integrative and biomimetic design, etc. The superabundance of these theories indicates the notion of sustainability that is still not yet rigid and massive and rises curiosity to seek its end-line. This paper has done the extensive literature reviews on the field of Green Building Sustainable Development, Biophilic, Biomimetic, Resilience, Restorative and Regenerative for mapping it, created the constellation, and seed the relationship between these strategies and how they fit together. The mapping results with the matrix method of relevant research factors have succeeded in displaying the focus and assumptions built by each sustainability method. The results of this study have also provided a picture of a complex and complicated universe of how to achieve sustainability. One way or one method is not enough to gain sustainability Therefore, situational and contextual problems encountered must be handled with various approaches, and complex strategy must be elaborated in a systemic, organic, holistic and nonlinear way. The wave of sustainability ideas still seems continuously find the united and rigid concepts based on the existing theory and method.

Keywords: *Sustainable Development, Biophilic, Resilience, Regenerative, Rigid Sustainability Concepts*

1. Introduction

Environmental issues that are still and continuously faced by environmental experts and practitioners today are the climate change and its effect on human life. Population growth and industrial development are thought to be the causes of the increasing energy use. The consequence of this usage is the significant accumulation of CO_2 emissions causing global warming [1]. Climatic anomalies have been evaluated statistically and also have shown a significant change. Climate changes in three decades describe that the earth's surface is warmer in every decade since 1850. In the Northern Hemisphere, the period from 1983 to 2012 is the hottest 30-year-period within the last 1400 years. The combined global ground and sea surface data computed with linear trend show heating of 0.85 ° C (0.65 to 1.06) 2 during the period 1880 to 2012 [2]

Climate change makes broad impacts on living systems on the Earth [2] Some of the impacts can be large or small, have a positive or negative consequence, and have a direct or indirect effect. The impacts have various forms such as the occurrence of weather changes, polar ice melting, sea level rise, changes in the hydrological cycle, changes in wind cycles, and other phenomena. These impacts then trigger other problems such as more extensive and frequent disasters, changes in animal biological cycles, the emergence of new epidemics, increasing the death toll, and even the extinction of individual species. Climate change gives a very significant effect in all aspects of life. The World Health Organization estimated 600.000 people worldwide died from natural disasters due to weather conditions in the 1990s, and most of them lived in developing countries [3]. The Global Humanitarian Forum report presented that since 2009 there has been more than 300.000 deaths, and around 125 billion dollars have lost each year. Most of these; thus, because of worse floods and droughts happening in developing countries [4]. In addition to the previously mentioned terrible phenomena, the climate changes also affect the cost of

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adaptation in which it is estimated that adaptation cost for the increase of the global average temperature (as many as 2.0 degrees Celsius) is between 70 and 100 billion dollars per year [5]
Experts have responded to these environmental issues since the early middle ages. Environmentalists have come to understand that the Mechanistic-Reductionism paradigm that drives people to dominate and excessive nature exploration can adversely affect the "SUSTAINABILITY" of life on earth. Experts and practitioners have been cultivating the idea of sustainable development nearly three decades, and by reviewing at the development of environmental problems faced today, it appears that its approach and problem-solving strategies are still effective. The results of the research conducted by Pamela Mang and friends indicated that the problem lies in two of many aspects, namely [6]
The role of the man who forgets that he belongs and depends on a complex network of nature and the fact that he in the network to preserve the nature. Experts and practitioners more focused more on how they technically resolved environmental issues. They talked more about aspects of strategy and methods than to talk more about the essence of how this life system works. For nearly 20 years, practitioners and experts talked about a green building and its measuring tools that tend to be technological sustainability. In response to this indication, it appears that aspects of human and natural relationships are the key problem. The importance of creating togetherness of man and nature has been understood for a long time, but in practice, the balance of both is not maximally applied yet. This matter encourages the wave of thoughts on sustainability continues to grow and bring new concepts and approaches. Environmental-Architectural concepts such as Biophilic, Biomimetic, Resilience, Restorative, Permaculture and Regenerative have emerged to realize the harmony in life.
Based on the above facts, this study was conducted with the aim to examine how these new sustainability concepts accommodate human and natural relationships. Mapping the existence and constructing their constellations in order to make them more precise when applied in environmental activities. We hope that this research can find a new conceptual framework based on those various concepts and approaches.

2. Methods

This study did a critical review of the literature regarding the new sustainability concepts and approaches. The focus of the study is to understand, map and find the constellation among the approaches. At the initial stage, the study was oriented to find the basic theory, conceptual framework and empirical indicators of each concept. The theories' system of thought was also explored to understand the universe and widespread environmental issues. The results of the study were then compiled, tabulated and analyzed for their constellations. The final phase of the study would review its role and contribution to the achievement of sustainability. This stage aims to see the opportunities and ways in which existing approaches can be integrated into a new sustainability approach.

3. Discussion

3.1 Timeline and Constellation of Environmental Movement

Environmental movements have emerged since the early middle ages. They are social and moral movements. The concern on excessive nature exploited for industrial interests was the background of the movement. Preservation and conservation actions by building some national parks were proposed for accomplishing the actions to save nature and their habitats. Although the call for environmental existence is continuously voiced, technological developments for the industry were also rapidly progressing and even increasingly endangering the earth's safety. The advance of pesticide technology resulting in soil, water and air degradation, free usage of Chlorofluorocarbons (CFC) which caused ozone deflection, and the use of nuclear technology where its security was still not guaranteed. These issues have led to a stronger environmental movement which transforms itself into ecological movement since the 1960s. In the past, ecological movements were predominantly from Americans. After that, concepts of sustainability develop progressively and become popular internationally.

Furthermore, the conditions of livelihood got worse, and the energy crisis caused by the oil embargo happened encouraging environmentalists to do more to protect the environment. They proclaimed Earth Day and established environmental protection institutions such as Green Peace, Occupational Safety and Health Administration (OSHA), Environmental Protection Agency (EPA), the American Green Building Council. As time goes by, the awareness related the importance of preserving nature develops and and continues to grow for maintaining the life sustainability on earth.

The issue of sustainability is not only a mere ecological problem but also a systemic problem to other disciplines like economic and social. The impacts of green building actions should also be measured in the economy and social points of view in a balanced way to achieve an optimal sustainability; namely sustainable development [7]. This approach refers to nature carrying capacity measured by the maximum number of environmentally-supporting organisms in a particular habitat that is considered determinants for the development [8]. The grand idea of self-reliance, self-sufficiency and economic sovereignty through the exploitation of natural resources must consider the limit of carrying-capacity that the balance and sustainability between ecological, social, economic, cultural, existential lives and human beings are still well-maintained and sustainable [9]

The development of environmental movements in Japan looked different. They concerned more about the aspects of disasters which frequently happened with the larger impacts. Environmental issues related to the existence of nature were not the core of the problem. It is possible because eastern culture respects nature, so they always tried to preserve the nature well. From disasters side, some programs to overcome the impacts were created such as Hyogo framework program which was all about how to reduce impacts and build resilience. Then, Sendai framework was held to increase more impact in reduction programs yielding seven clear targets and four action priorities: (i) Understanding disaster risk; (ii) Strengthening disaster risk governance to manage disaster risk; (iii) Investing in disaster reduction for resilience and; (iv) Enhancing disaster preparedness for effective responses, and "Build Back Better" in recovery, rehabilitation, and reconstruction.

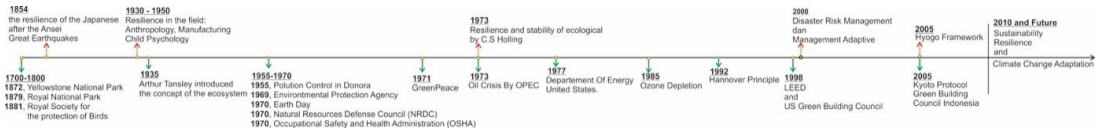

Figure 1 Environmental-Ecological Movements Timeline
Sources: (10),(11), (12), (13) (14)

Timeline of Environmental-Ecological Movements is shown in Figure 1. These actions did not just happen nationally in United States, Japan or some other countries, but then became a global action through some international conferences, started from Stockholm 1972, Rio de Janeiro 1992 and Johannesburg 2002. The event at Rio de Janeiro in 2012 discussed a lot about sustainable development. Conferences on climate changes were held in Kyoto Protocol 1992, Bali Road Map 2007 and Copenhagen 2009. Disaster aspects were studied in three conferences: Yokohama in 1994, Kobe in 2005 and Sendai in 2015 as the latest one. The above conferences are described in Figure 2. Some conferences involved some countries in the world indicating that environmental issues have become a critical agenda of the world community, and there were three focuses namely sustainability, climate change, and disaster risk management.

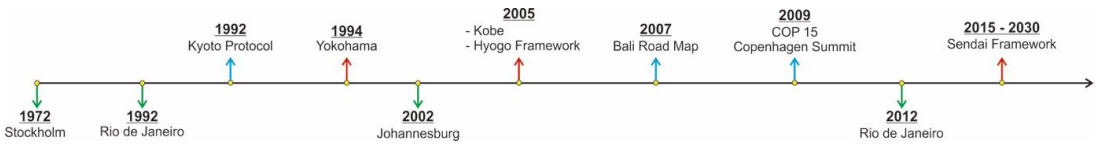

Figure 2 Environmental International Conferences Timeline
Sources: (10),(11),(12),(15)

Environmental aspects are always related to the building. During this time, built-environment is known to have negative impact toward nature, and it affects sustainability. Therefore, environmental agendas also become a concern to architects. They collaborate with environmental experts to create environmentally friendly architectural design concepts as shown in Figure 3. Since the early 20th century, world great architects have attempted to adopt environment concepts to finish their works. Bioclimatic Architecture (1906-19), Environmental Architecture (1963-1972), Energy Conscious Architecture (1972-1983), Sustainable Architecture (1980-1993), Green Architecture (1990-2006), Carbon Neutral Architecture (2006-2015), and the last, Regenerative Architecture is a series of concepts and approaches in connection with the environmentally friendly concept [15]. The worsening of

environmental conditions encourage the engineering of problem solving methods. Bioclimatic is a response to environmental and climate problems while Green Building and Sustainable Development tend to solve more complex and integrated technical-environmental problems. Considering the environmental conditions that are worsening indicated by the increasing number of disasters, the concept of Resilience arises. Natural conditions that are not conducive are responded by acknowledging the importance of the presence of natural elements. Humans and nature are interconnected. Bionic, Biophilic, and Biomimetic designs appear to encourage the passive use of natural elements for the humans. Knowing that the latter approach is still more inclined to human interests and there is no equality of interest between human and nature, the Restorative, Permaculture and Regenerative are proposed ones. These last concepts carry a living system approach. Humans are the part of nature and play an active role in co-evolution. Their activities must contribute positively to nature, besides for themselves. These approaches replace the old concept of 'giving less negative impact to nature'.

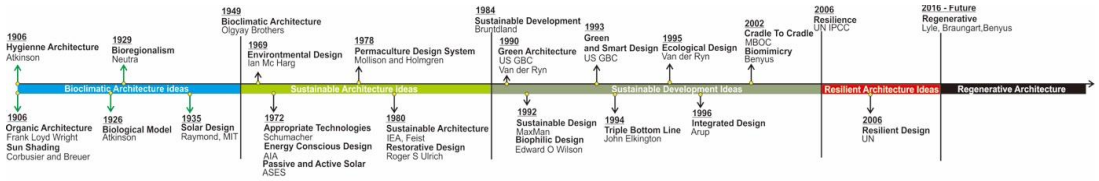

Figure 3. The Timeline of Environmental-Architectural Design Concept
Sources: (10),(11), (12), (13), (14), (15)

Observing and analyzing some environmental concepts and approaches since the early middle ages, it is clear that these are broad issues. Corresponding to the civilization, Environmentalists and Architects have attempted to understand and resolve environmental issues, following their interest. From merely social and moral movement efforts to engineering movement, and the last is the living system. There are three essential things that have been observed until today: (i) Environmental issues cover three significant aspects: sustainability, climate change, and disasters risk reduction. (ii) Environmental issues cannot be looked at just as environmental issues, but they are related to some other disciplines. Competitive modern lifestyle demands encourage exploitation of natural resources use and development of less environmentally friendly technologies. Furthermore, these various issues seem to be overlapping and more complicated; hence integrated problem-solving based on other disciplines. Social, economic, psychological, and cultural aspects must be considered. Besides expanding from the disciplinary side, it also enlarges to a wider scale. The scope of the issues has spread more extensive involving larger geographic areas. The conferences held showed the efforts to solve the problems and to overcome the complex network of issues. (iii) There are three focuses related to solving environmental issues i.e. environmental engineering (Bioclimatic, Sustainable & Green Architecture), Disaster issue (Resilience) and the human-nature relationship (Permaculture, Restorative & Regenerative Design). It can be seen from the timeline, that experts have discussed the three topics above since the early 18th century, but they emerge to be a popular environmental approach one by one. It shows the great effort of humans to understand and solve environmental problems that are complex and broad. This finding is also proof that at the first, the experts preferred to use technological approaches to achieve sustainability rather than to use ecological approaches. This approaches are useful but do not effectively solve the problem. These facts match with Pamela Mang's opinion [6] stating that the issues are not only about engineering but also about the human-nature relationship beside the engineering matter. Therefore, it means we need both approaches for solving the problem (technological and ecological sustainability). Beside to understand technically, we need to understand the way our universe works (ecological matter). We have to support our living system.

3.2 Environmental-Architectural Design Concepts and Approaches

In more details, the study on concepts and approaches of environmental-architectural design is shown in Table 1. As previously mentioned, there are 3 different approaches in Figure 4. The first group (G1) consists of Bioclimatic, Green Building, and Sustainable Development while the second group (G2) consists of Biophilic, Biomimetic, Restorative, Permaculture, Regenerative approaches. The last group (G3), then, is Resilience. In the first group, they attempt to make the design have high performance

Table 1. Concept and Approaches of Environmental-Architectural Design

Approaches	Background and Aim	Concept and Definitions	Elements
Green Building Paradigm : Mechanistic-Reductionist **System of Thinking:** Linear, One way-Open Loop and Partial.	Green building is an effort to change the way the built-environment designed, built and used. Green building is a building with an integrated approach started from early planning phase until the use of building, environment and entire community. Therefore, the green building is the building that is ready to incorporate climate adaptation to reduce the negative impacts of climate in the future (16)	The high performance green building is the building designed and built in which it can be operated by considering environmental conditions and having economic value from time to time (17)	Land Development, Energy Conservation and Efficiency, Water Conservation, Material Use and Waste Management, Environment Comfort and Health, Built Environment Management (18)
		Building designs give less bad impacts towards environment and consider the right use of technology (16)	Sustainable Site Design. Water Conservation and Quality, Energy and Environment, Indoor Environment Quality, Conservation of Materials and Resources (19)
	One way to measure the success of the implementation of green building is one of the benefits which can be shown in the lower cost compared to other conventional buildings. The reduced cost is also followed by the decline of energy consumption in green buildings, compared to conventional buildings (20)	Green building is able to accommodate health purposes, surrounding environment, built environment and design with an effective cost and measurable building performance (21)	• Can be operated and maintained by energy usage and resources efficiently and effectively • Give high performance and support users' productivity • Create a better and healthier built environment (22)
Sustainable Development Paradigm : Mechanistic-Reductionist **System of Thinking :** Linear, One way-Open Loop and Partial.	The sufficient availability of natural resources, preserved ecology process, social-cultural environment and suitable economy (22)	**Humanity has the ability to make development sustainable to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs** (23)	• Social • Economy • Ecology
	The harmonic two-way relationship from economy and social factor will create an equitable relationship. The connection between economy and environment will maintain sustainability, both activities work with mutual and viable benefits. The connection between social and environment will create resilience (24)	Sustainability can also be defined as an urge to get more benefits in investing but still consider the nature without ignoring it. (17)	• Adaptation toward climate on site and adjustment toward condition changes. • Not producing waste • Promoting society's health and well-being as well as ecosystem health. • Supposedly consist of integrated energy saving system which maximize efficiency and comfort.
	The main act of sustainable development is ecology conservation which aims to ensure that the action and decisions made in the present time will not inhibit chances of future generation to be able to make use of the same natural resources (24)	The key concept of sustainable architecture contains responsibility in minimizing negative impacts of building toward environment with efficiency of material and energy usage (24)	• Improving health and local biodiversity ecosystem instead of degrading it (25) • Futurity: focusing not only toward initial or short term of time but toward long term in the future.
		Environmental value: giving substantial effect in enhancement environmental value (27)	• Equity: be able to give equity toward social life in present time (26)
Biophilic Paradigm : Mechanistic-reductionist **System of Thinking:** Linear, One way-Open Loop and Partial.	The application of biophilic design is considered successful if the design can improve physical, mental and behavior in better condition toward humans in built environment (28)	Biophilic designs include nature elements inside human life to improve human life and health quality (28)	• The direct experience of nature: referring to contacts between built environment with nature.
		The main idea of biophilic approach is believing that human being evolved 99% because of adaptive biological responses caused by nature and not by man-made.	• The indirect experience of nature: referring to contacts which represent contacts with nature and later are transferred to some forms and conditions inside.
	The biophilic-based design aims to maintain productivity, function and resilience owned by nature in long term of time (29)	Biophilic designs take into consideration more in balancing nature condition between human activity and life as a final result (28)	• The experience of space and place: referring to spatial characteristics in natural environment which benefit in health and human life quality (28)
Restorative Paradigm : Organic-Holistic **System Thinking:** Non-linear, Closed loop and Systemic.	Decreasing and un-prioritizing of environment quality make the environment gives bad impacts toward human health. Restorative design is needed to close the distance between man and nature (32)	Creating a healthy comfortable environment in which several sectors of nature elements being included, such as form, vegetation use, lighting, sound, materials and room smell to reach a good relationship rate between human and nature. (33)	• Biophilic Design • Responsibility of nature • Responsibility of well-being
	Restorative is the beginning of environmental psychology development aims to reduce stress or treating mental health experienced by humans. This approach believes that humans	Restorative approach means maintaining and conserving nature or environment more importantly for humans to maintain sustainability. (33)	• Application of restorative approach often used on healthcare building and the city park. (33)

	have relationship with nature much stronger than relationship between humans and the built environment (33). While a restored condition can evolve positively after the intervention, the success of the process is usually dependent on further human management (34)	Restorative approach focus on understanding the difference between natural and artificial or man-made condition. Maximizing the use of restorative based approach is believed to improve human life quality so human diseases can be prevented because nature give positive impacts for humans (35)		
Permaculture Paradigm : Organic-Holistic **System Thinking:** Non-linear, Closed loop and Systemic.	Permaculture is a design system aims to integrate fabrication system, nature, temporary, sosial and ethnics to be one pattern of form and benefits each other in the systems according their functions. Ancient society could manage natural resources only by using materials from nature. Permaculture conserves, supports and cooperates with nature. grow up with in the same time. This means humans learn from nature, not the other way by going against or competing with nature (36) (37)	Permaculture focuses on how connection of each components and how function of each systems instead of focuses on just one component system. This proves that sustainability aims to protect all systems of line in earth (37) The main focus of permaculture is value and ethics to be back to natural function. Permaculture improves the ecosystem life quality to fulfill human life need in the future. Permaculture attempts to fix earth ruined by humans (37)		• Care of the Earth: Provisions of all life on earth to stay continuously and multiply. • Care of people: Provisions on all humans to continue using available natural resources. • Fair share, or share the surplus: By adjusting what we need and design what earth has so that the resources can overflow for all human and other species on earth (37) • Permaculture principles: Observing and interacting, Capturing and restoring energy, Earning results, Self-respecting and receiving feedback, Using and respecting natural resources, Waste-free, Designing from patterns to details, Integrating better than separating, Using and respecting diversity, Edge-effect, Facing up every change more creatively (38)
Regenerative Paradigm : Organic-Holistic **System Thinking:** Non-linear, Closed loop and Systemic.	Regenerative approach aims to eliminate waste from industrial products or making the waste usable in other processes (39)	The main foundation of regenerative-based development is a method to integrate or involve regeneration in practical challenge of land use and community development (6)		• Regenerates: adding potential factors related to the bigger systems • Improve: changing focus toward how to add capacity owned by humans and nature. • Permaculture approach and holistic management • Maintain: attempting to maintain impacts and effectivity of performance to deal with uncertain environment conditions. • Resilience, cradle to cradle and green movement • Operate: increasing energy and material use efficiency, eliminating toxic and reaching standard level of interdisciplinary capacity (6)
	Regenerative approach aims to create a healthier and more resilient living quality and equity of community. Regenerative aspects supposedly can be accepted by society and made use to change built environment faster. This change can make built environment more adaptable and resilient to face climate change situation (40) Regenerative development aims to restore or create the capacity of ecosystems and biogeochemical cycles to function optimally without constant human intervention.(34)	Environmental problems occur because of broken relationship between nature and human. The main problem lies on cultural and human psychological rather than technical or technological. It is a fully conscious awareness that the health of an ecosystem is dependent on human health and human health is dependent on the health of the whole ecology. It is co-evolutionary (6)		
Resilience Paradigm : Mechanistic-Reductionist **System Thinking:** Linear, One way-Open Loop and Partial.	Disaster risk reduction is an objective set of rules in managing the reduction risk of disaster which also contributes in strengthen resilience and achieving sustainability level (41)	The building can withstand physical damages, quickly recover, maintain main building function, not only when the disturbing incidents occurring, but also restoring operational target level faster after the incident had happened (42)		• Preparation (Prevention) • Response • Recovery
	Damage and loss level when disasters happen can be indicators of social and economy conditions failing in their sustainability. 70-85% of investment done by investors show that they did not have a backup plan in considering an abnormal condition (43)	Resilience as the network components ability aims to revive toward the desired performance condition after experiencing disturbance. Resilience as an aim of four interacting paradigms: reliability, vulnerability, survivability and recovery (44)		

and less negative impact on nature, whereas the two other groups act to achieve a better quality of the environment; hence balancing the living system. This variation shows a different solving phase. The first attempts to make energy and resources efficient technologically (engineering approach) while the other ones try to support positively human-nature relationship and creating abundance (social-cultural approach)[6].

Furthermore, discussing the second group, Restorative, Permaculture, and Regenerative concept (G2b) is a bit different than other concepts in this group. They actively build a relationship between human and nature and give positive impacts on the environment aside to human. Restorative and Permaculture attempts to improve environmental quality by doing a thing to nature, whereas Regenerative acts more actively by making the environment stronger and healthier and supporting human-nature living process positively. It means the other concepts, besides Regenerative, are passive. They attempt to drag and turn back nature in the design (reconciliatory) for bringing the benefits to human life. It fits to the hypothesis that humans will be healthier and better in the natural environment.

Based on this above fact, (G1-G2a), it is founded that one of the weakness indicators of those various environment concepts is human domination to stay controlled. They utilize nature for their own benefits. Then, taking a closer look at the definition of sustainable development in Table 1, it could be seen clearly that the definition still takes on the human-interest side. There are no words that give an indication toward the sake of nature. This further confirms that sustainability issues lay on human's part in their relationship with nature. Humans should not only stand outside of nature, but they should also be inside and give mutual benefit, just as proposed in Regenerative. Human and nature should do a co-evolution.

Comparing the background of Resilience concept to the other concepts, the most prominent difference is their substance. Resilience arises driven by hazards issues, whereas the others by ecological issues. All this time, the ecological concepts attempt to prevent natural damage because of human's exploitation. They attempt to reduce or heal the environment's diseases. Whereas, Resilience concept act to reduce hazards impacts (the pain) that caused by natural system damages such as global warming and climate change. The earth is sick, and Resilience attempts to prevent the pain. It attempts to survive the shock and recovered fast. It could be seen that both concepts appear to solve the environmental issues faced from two different but interconnected perspectives. The diseases and the pain should be treated so the condition does not get worse.

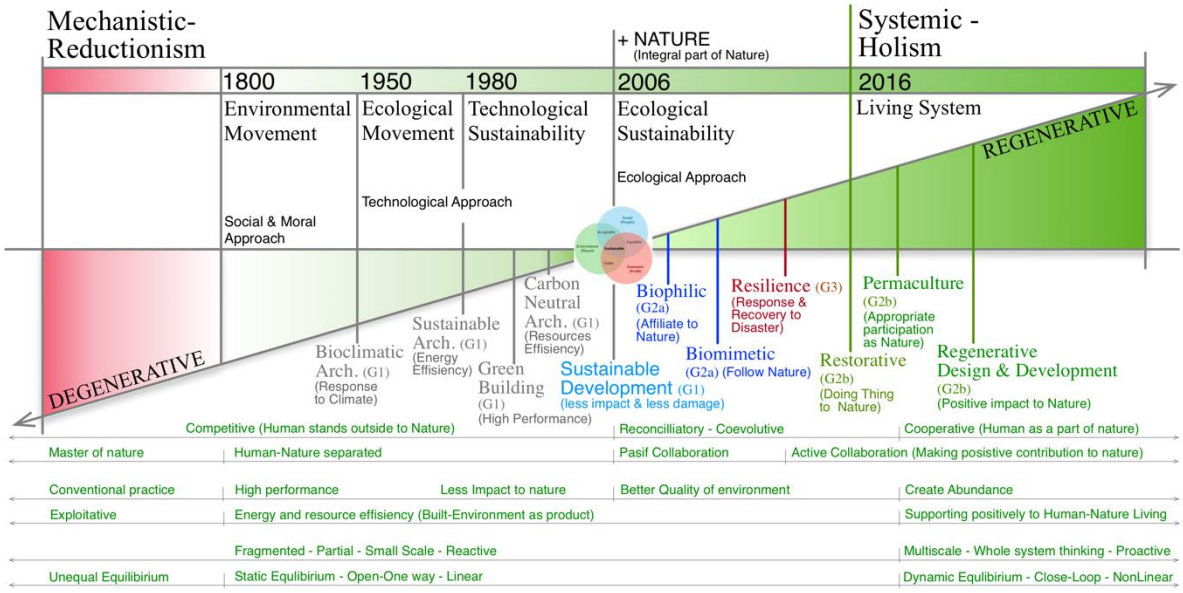

Figure *4* The Map of Environmental-Architectural Concept
Sources: (6),(10),(11), (12), (13), (14), (15) combined & modified

Maintaining natural balance is the core of the Sustainability Concept. The first group with concepts based on technological sustainability believes that earth and all living in it will just be fine if the natural balance can be maintained statically. This balance means if humans take from nature for say ten units,

then humans should give back also ten units in order to keep the natural balance. System thinking should be made in such a way so that balance input and output can happen precisely. This paradigm is called steady-state equilibrium [6] which is believed to be the basic thinking of environmental movements in the early of 20th century (G1-G2a). Hence, to achieve it, attempts are made by preservation and conservation approaches and strategies. Natural conditions that should not be touched and exploited by humans will be maintained, while others that could be used for human life will be preserved. Conservation is an attempt to produce product optimally by using resources as less as possible. But this still gives an indication that one day all those resources will run out. But, to renew resources is not easy to do, especially following entropy which states energy transfer process takes place in one-way because of recovery time issues. Returning one liter of gasoline for a motorcycle takes millions of years. Responding to this, another idea comes up. This idea assumes that balance will always be changing. Balance is dynamic (dynamic equilibrium) just as Heraclitus said in Ancient Greek Era. The balance tends to be dynamic and moving forward, never stops at one point hence the change itself is the only permanent cause by the life activities on earth [45]. This incident happens constantly so the only thing left to do is surviving by changing and adapting following Homeostatis concept. Nature life has Autopoiesis Dissipative behavior. Universe has the ability to produce, regenerate and readjust itself in the form of dynamic, absorbing energy and materials process from environment and simultaneously produces product and residue which functions as energy and materials for the other life systems. It continuously happens, and through that process, every organisms and life systems regenerate, form and maintain themselves alone or together [9]. All component of life in the universe viewed as one large organism in unity and interrelated. They support and allow the universe to develop, regenerate and form a new balance [46]. Nature is a big and complex system. Accordingly, they do not discuss and think about balance again but think about the relation system for regenerating and adapting. This is shown in sustainability concepts in G2b. They discuss ideas on eco-literacy which encourages the use of ecological principles and human-nature living system as the base of development in modern society [9].

Solving the big and complex of environmental issues, according to Capra, lies on the main characteristics non-linear of the system. Complexity itself is a set of concepts and mathematical techniques related to other subsystems in a non-linear way, forming a complex network. They cannot be understood in the method that is characteristics fragmented. This perspective asserts that we could never sort out the universe to be smallest units standing independently. The universe is a relationship that related to each other as a whole system [46]. The old system of thinking with Mechanistic-Reductionism appears to be less conducive used. The Mechanistic-Reductionism paradigm has a linear and partial of thinking, a causality conception that runs one direction, simplifies the problem and fills the limitations with many assumptions. This approach will give a chance of failure significantly when be used for solve the ecosystem problems that are complication and complex.

Inspired by the successes of the information system in modeling a complex problem, right now, there is a theory that offers systemic, holistic and non-linear called complexity theory. The main feature of complexity theory is an anti-reductionist through the fundamental rethinking of the system of nature so that conceptualization interrelationship and dynamic-relationship can happen better simultaneously between each phenomenon randomly [47]. The “study of complexity” attempts to find common principles underlying the behavior of complex systems. They are large collections of components interact in nonlinear ways. This behavior implies that the system cannot be understood simply by understanding its individual components. They interactions cause the whole to be “more than the sum of its parts” [48]. The advantages are the modeling closes to the real complexity of the phenomena as well as the broader network that covers multi-disciplines, multi-scales, and multistage. However, up to this moment, there are only a few people using this complexity theory to study life network and doing research on this field [46]. Adopting this theory might help the various concepts mentioned above to pick opportunities to achieve better sustainability.

After reviewing environmental concepts above, the result shows that the concepts and frameworks of Sustainability Concept has been being developed, progressing toward one more rigid concept. This goes in line with Gou and Xie’s saying that to answer all critics on sustainability, it is not by bringing more ambiguous and suggesting more complicated indicators, but by the influences, relationships and context [33]. It is more important to develop a holistic approach by expanding the indicators more comprehensive and the framework more flexible that to be adjusted with different contexts, directed to

co-existence and co-evolution through technological sustainability approach as well as ecological sustainability. Human should be active giving positive contribution to nature, and supporting the human-nature living system. The universe is a complex system that needs a approach and method based on complex situation. Using Complexity Theory could be a change to achieve it. It is the new light of sustainability.

4. Conclusion

a) The emergence of various concepts and approaches discussed is a wave of ideas to obtain sustainability. Concepts and approaches have emerged, even though literally separate, both technological sustainability, ecological sustainability, and living system is co-related and all needed.
b) One of the sustainability issues that always need to be observed lies in human's role and position that conscious or unconscious, standing outside of environmental activities. Humans should understand their roles and become a part of the nature to do co-evolution. They must know the way our universe works and support our living system that is the 'new' sustainability approach.
c) Mechanistic-reductionism approach is not conducive for maintaining the sustainability, because basically nature is a complex system. The sustainability paradigm needs to be shifted toward Systemic-Holism approach that has dynamic networking and dynamic equilibrium.
d) Moreover, it should utilize a suitable characterized; systemic, dynamic, organic, holistic and non-linear approach. It could be accomplished by adopting the complexity theory. However, complexity theory should be researched in detail for its application.
e) The wave of sustainability thinking still seems to be moving forward to find the unity and rigid of the concept based on the existing theories and methods.

5. Acknowledgement

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