

Chapter 2

Modern History of Sustainable Architecture

Abstract In order to understand the changes that accrued in the field of architectural, building design and urbanisation practices during the last hundred years we must follow the history of sustainability in the built environment. We can classify this history under five major phases that shaped the architectural discourse and practice we are witnessing today. Four out of five of those phases were influenced mainly by a major reductionist paradigm that defined sustainability for architecture and buildings design. The reductionist paradigm is seeking mainly the reduction of negative building impact through environmental efficiency. However, we are on a verge of a paradigm shift that operates from a different paradigm. This chapter describes the historical progress and different phases of the modern sustainable architecture and explore the sustainability paradigms associated with those phases.

2.1 Historical Background

From the beginning of the 20th century there have been five influential paradigms that shaped sustainability in architecture and the built environment. A review of the last 120 years reveals that the architectural discourse was influenced significantly by the economic and ecological crisis associated with industrialisation (see Table 2.1 and Fig. 2.1). This classification is not rigid and should not be interpreted as a rigid classification that creates borders it is a trial of categorization of thoughts that aims to provide a better understanding of the evolution and relation between sustainability and the creation of the built environment. Thus for thinking on sustainability we distinguish seven paradigms.

The first paradigm named Bioclimatic Architecture was dominated by ideas of Wright in 1906 on organic architecture (Uechi 2009), Corbusier and Breuer in 1906 on sun shading (Braham 2000), Atkinson in 1906 on hygiene (Banham 1984), Meyer in 1926 on the biological model (Mertins 2007), Neutra in 1929 on bioregionalism (Porteous 2013), Aalto in 1935 on health and precautionary principle (Anderson 2010) until formulation of the Bioclimatic Architecture paradigm by the Olgyay Brothers in 1949 and Olgyay (1953). Buildings of those architects showed a

Table 2.1 Sustainability paradigms influencing architecture in 20th and 21th century

Paradigm	Years	Influencer	Paradigm
Bioclimatic architecture	1908–1968	Olgyay, Wright, Neutra	Discovery
Environmental architecture	1969–1972	Ian McHarg	Harmony
Energy conscious architecture	1973–1983	AIA, Balcomb, ASES, PLEA	Energy efficiency
Sustainable architecture	1984–1993	Brundtland, IEA, Feist	Resource efficiency
Green architecture	1993–2006	USGBC, Van der Ryn	Neutrality
Carbon neutral architecture	2006–2015	UN IPCC, Mazria	Resilience
Regenerative architecture	2016–Future	Lyle, Braungart, Benyus	Recovery

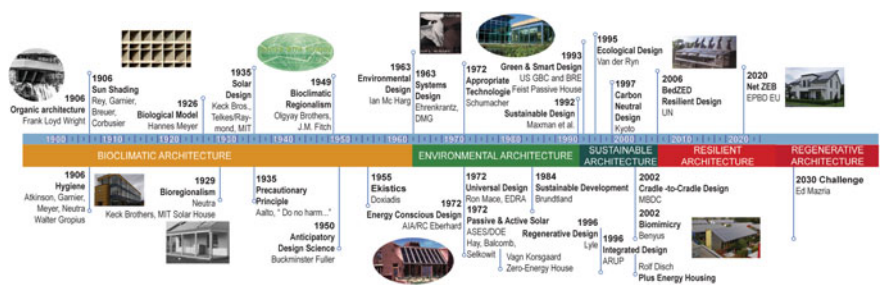


Fig. 2.1 Timeline of modern history of sustainable architecture

tendency of rationalism and functionalism while being fascinated by the beauty of nature. Bioclimatic adaptation, hygiene, safety and the notion of experimental and empirical design was not developed. Until the brothers Olgyay set up the first architecture lab in the 1950s combining academic research and practice. This was a major change that moved architecture into the scientific and empirical research world that is evidence based.

The second paradigm named Environmental Architecture was dominated by the ideas of McHarg in 1963 on design with nature (McHarg and Mumford 1969), Ehrenkrantz in 1963 on systems design (Ehrenkrantz 1989), Schumacher in 1972 on appropriate technology (Stewart 1974) and Ron Mace in 1972 on universal design (Thompson et al. 2002). Buildings of those architects showed a tendency of inclusiveness of environment and biology from the building interior to urban and planning scale.

The third paradigm followed the first energy crisis and was dominated by the ideas of the American Institute of Architecture (AIA) in 1972 on energy conscious architecture (Villecco 1977), the American Solar Energy Society (ASES) including the work of Balcomb in 1972 on passive and active solar architecture (Balcomb 1992), the Passive and Low Energy Architecture (PLEA) society in 1980 and

Herzog in 1980 (Herzog et al. 2001). Buildings of those architects showed a tendency of inclusiveness of solar and energy saving design strategies. The first ideas of energy neutral buildings and renewable energy integrated systems were introduced in several building prototypes and concepts. The use of empirical simulation and measuring based technique to quantify building performance was based on energy codes and standards that were created in this phase.

The fourth paradigm named Sustainable Architecture was dominated by the ideas of Brundtland (1987), ranging from Baker on sustainable designs (Bhatia 1991), Fathy's congruent with nature designs to build architecture from what beneath our feet (Fathy 1973) to Sam Mockbee. Along with many others, they expanded the purview of sustainable design by embracing aesthetics and human experience in addition to environmental performance.

The fifth paradigm named Green Architecture was dominated by the ideas of the US Green Building Council in 1993 on green and smart design, Van der Ryn in 1995 on ecological community design (Van der Ryn et al. 1991), ARUP in 1996 on integrated design (Uihlein 2014) and Feist in 1996 on Passive Haus Concept (Feist et al. 1999). With the emergence of this paradigm the greening of architecture proliferated globally with more complex and broader environmental considerations (Deviren and Tabb 2014).

The sixth paradigm named Carbon Neutral Architecture was dominated by the ideas of the Kyoto Protocol in 1997 on carbon neutrality (Protocol 1997) and UN IPCC report (2006) on climate change. The work of Bill Dunster on Zero Energy Development and Ed Mazria on the 2030 Challenge had a strong impact on architectural research and practice. With the EU 2020 nearly zero energy targets for 28 member states, energy neutral architecture became a reality embracing resilience, dynamism, and integration.

For the coming 20 years, we will be on the verge of the seventh paradigm named Regenerative Architecture. This paradigm will be dominated by the ideas of Lyle since 1996 on regenerative design (Lyle 1996a), Braungart and McDonough since 2002 (McDonough and Braungart 2010) on cradle to cradle design and Benyus on Biomimicry (Benyus 2002). We are on a verge of a paradigm shift that operates from a positive impact creation through environmentally effective sustainable buildings. Three of the presented cases studies, in this research, serve as showcases for a positive impact creation.

2.2 Towards a New Architectural Design Paradigm

Until the start of the 21st century, promoting sustainable architecture and green building concepts was a specialist niche issue, a storm in a glass of water in the margin of a linear economic mass production. This classification allows us identify the ideas and trends in the field of sustainability of architecture and the built

environment. In the last hundred years, architecture was influenced by the sustainability discourse and many architectural and building innovations were tied to progress of ideas listed earlier. The influence of the seven phases was profound on architectural practice, driven by new construction technologies such as insulation materials, renewable systems and efficient heating and cooling technologies. Sustainability represented a vision for new practice and performance driven architecture and resulted in new production and performance calculation indices and methods. Several paradigms dominated the architectural and building practice. The most recent two are: ultra-efficiency and effectiveness. Being in a transitional verge between both paradigms the following chapter explain the difference between both paradigms.

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