

# Contemplation on the Potential of Nature in Developing Inventive Architectural Concepts

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**ABSTRACT:** Properly investigating the potential of nature in the formation of architectural concepts needs a theoretical framework in which its analytical components can explain the methods of utilization of nature. Although some attempts have been made in this regard, considering the missing elements, there is still a significant gap in the literature and a study for introducing a more comprehensive theoretical framework has yet to be conducted. The aim of this study is, therefore, firstly, to present a theoretical framework that can explain the role of nature in the creation of architectural concepts by its detailed factors and, secondly, to apply this framework for investigating nature-inspired works of Toyo Ito. Accordingly, this documentary paper is based on a theoretical approach supported mainly by the outcomes of a literature review and case study analysis, which utilizes the descriptive-analytical method. For the case study part, projects were selected from various scales and functions to ensure proper evaluation. Both qualitative and quantitative tactics have been used in data analysis. Findings demonstrated that the highest rate in regards to the itemized factors of the Theoretical Framework of the study relates to 'Integration of natural elements in spatial articulation' and the lowest rate corresponds to 'Usage of material in their raw and brutal state'. Moreover, though the highest level of utilization of nature among the cases, is related to 'Grin Grin', a large-scale project, yet considering all the frequencies, it can be argued that the larger scale does not necessarily imply the higher frequency.

**Keywords:** Nature, Architectural Concept, Utilization of Nature, Theoretical Framework, Toyo Ito's Architecture.

## INTRODUCTION

Nature has always been a rich source of inspiration for humankind throughout its evolution. From prehistoric times when people used to live in caves, nature has always provided educational solutions to man's problems to the present day. In effect, only organisms that have been able to adapt to environments and have ample versatility have survived through the evolutionary phase of nature (Benyus, 1997). In the course of history, architects and designers have regarded nature as a source of inspiration for various forms, techniques, and functions.

Ancient Greek philosophers looked at species that gave them perfect models with a rather enchanting harmony and proportion between their parts, where that was the classical ideal of beauty at that era. The structure, the integrity, and the elegance of any design are associated with the consistency of the integration of its forming parts and therefore no small part could be removed without deforming and destroying the whole (Aziz & El Sherif,

2016). At the age of Aristotle, these principles were the key themes, as they were the basic aesthetic value and features of the best way to make a piece of art in the natural history of the Aristotelian age. He was indeed among the first to point to the capacity of nature as a source of rich inspiration. He believed that the functional aesthetic exists even in the smallest species in the world (Taghizadeh, 2007). Ergo, it is possible to count nature as a wise mentor.

It should be noted that, when nature is used as a source of inspiration in architecture, it is not limited to merely superficial biological analogies, i.e., imitating and mimicking the forms of plants and animals, but this topic covers a broader comprehension of nature as a tutor in terms of methods of development and evolution. Unfortunately, the industrialized societies have not cared enough for nature for several decades, and have neglected their concealed potentials. This brought about a tremendous environmental crisis and faced mankind with many adversities. However, in recent decades after the

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revelation of the detrimental consequences of a lack of attention to the potentials of nature, man has once again returned to nature and has thus pursued the optimal utilization of these capacities in different disciplines, including architecture.

Certainly, the role of nature in architecture is an extensive issue and can be studied from different perspectives. However, the theoretical focus of this paper is on the role of nature in evolving architectural concepts; that is, the methods that the potentials of nature can be utilized for processing architectural concepts. Thus, it should be remembered that this paper's argument is essentially about project conceptual properties, and other non-relevant topics have not been covered.

**Theoretical Foundations**

**Architectural Concepts:** Architectural concepts are related to a process; that is, they can be developed through a process. One of the main concerns for architects (designers) when intending to embark upon a new project is discovering the proper formative idea (subjective realm) and transpose them through a process of encrypting and encoding to a certain formal configuration (objective realm). In this sense, architectural concepts are evolved through a process and travel from formative ideas (subjective realm) to the formal configuration (objective realm). This process can be called the 'process of conceptualization' (Ashtari & Yeganeh, 2020a).

It should be considered, however, that this statement is from the point of view of the designer, whereas oppositely when the observer of the architectural work as an analyst looks at the formal configuration of the project, the design process should be reversed, which can be called the analyzing process. As it is illustrated in Fig. 1, this is a reciprocal process, in a sense that the process progressed by the designer could be surveyed by the observer transversely. If the designer processes his inner thoughts to a specific formal configuration, the observer should decipher the traces that were provided by material form to find out principal references. Thus, the architectural concept may be considered as a notion that plays a significant role in both the design process, i.e. moving from the subjective to the objective, and the analyzing process, i.e., moving from the objective to the subjective realm.

In essence, the peculiar physical form of architectural work has notations and connotations, either as plain implications or as complicated codes, which stimulate the mind to unfold the concealed logical structure behind this material configuration. This underlying logical structure can be counted as 'architectural concepts' which transcend the material condition, i.e., the presentness of the formal configuration, to certain references (formative ideas) as the principal origins of which are absent. That is to say, architectural concepts go far beyond the 'being' to the 'process of becoming'.

**Toyo Ito as A Conceptualist Architect:** Ito has been regarded as one of the most creative and prominent contemporary architects globally, a person for whom architectural concepts have played a critical role in his architecture. In 2013, he was awarded the Pritzker Prize, one of the most prestigious awards in architecture. According to Pritzker's jury, all across his career, Toyo Ito has been able to create a body of work that integrates conceptual creativity with magnificently executed buildings. As they maintained, he has steadily developed and mastered a personal architectural syntax that combines structural and technological innovation with formal clarity (Quirk, 2013). The jury members pointed out that he is looking to expand the possibilities of architecture, and Ito appreciated this and argued that he has always attempted to move his architecture forward without letting his style to remain stagnant. As he claimed, this was done both in the interests of architectural innovation and to achieve a level of calmness (Ito, 2013).

Ito believes that making architecture is an attempt to establish order amid an unstable and ceaselessly changing social and natural world. As he stated, "For me, the task of the architect is to release people from those restrictive frameworks by creating spaces in which they feel at ease and in which they can attain some degree of freedom" (Ito, 2013). It can be argued that the blurring of established dualities such as artificial versus natural, architecture versus city, and similar boundaries that architecture discipline has to deal with, has been a constant concern in Ito's architecture, as he has always made a noticeable effort to undermine established spatial boundaries and provide more spatial emancipation (Fujimoto, 2009). In particular, the rethinking of the potential of nature,

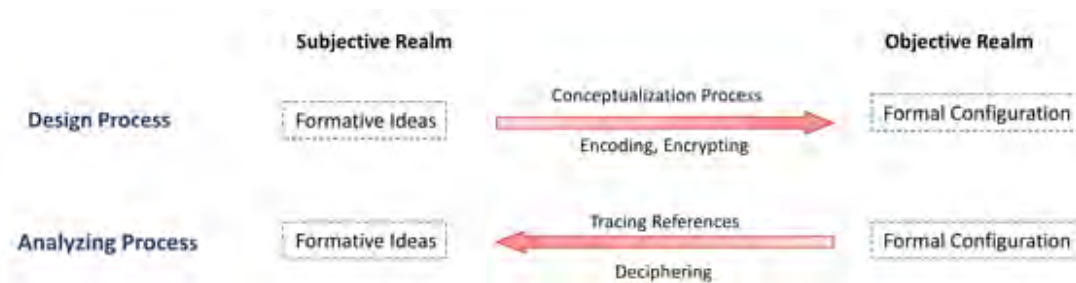


Fig. 1: Architectural concepts deal with a certain process from formative ideas to formal configuration. (Ashtari & Yeganeh, 2020b)

which has somehow become a neglected feature of architecture under the superiority of the machine-like lifestyle of today's metropolises, has become a major concern in Ito's philosophy of architecture.

As can be seen, the notion of architectural concepts and their associated determinants has always been a matter of significance to Ito. That is why he typically counted as one of the leading figures of conceptualist architects alongside some of his influential fellow peers, such as Eisenman, Koolhaas, Tschumi, and Libeskind. In essence, 'conceptualist architecture' is the approach in which the concepts and the process through which they evolved, that is, the 'process of conceptualization' are much more significant than the final results.

In facing different projects, ranging from a wide spectrum of functions and scales, Ito tries to develop inventive architectural concepts that challenge the established archetypal ideas. From his early works, which were mostly private houses, to his more recent ventures, generally in the form of public buildings, he focused on integrating landscape and structure, on finding a method of contextualizing the building with its physical environment (Taki, 1994). He always tries to challenge the established standards by delivering a critical message within the field of architecture.

For instance, concerning Sendai Mediatheque, one of his most recognized and admired works, which is a complex containing a media library, an art gallery, a library, and an information service center, he argued that it embodies the proposal for a radically new definition of architecture. As he argued, 'during the open competition and the ensuing period of basic design, the primary initiative was to take down the archetypal ideas of an art museum or library and recreate a modern concept of architecture called 'Mediatheque', i.e., a media gallery incorporating state-of-the-art media. This method of reconstructing architectural concepts applied not just to hardware, but also software (Ito, 2001). As Allen (2012) argued, in at least three cases in his long career, Ito designed buildings that literally "rewrite the rules of the game — definitive statements of architectural principles that become new points of reference for other architects." The cases addressed by Allen were: White U House, Sendai Mediatheque, and Tama Art University Library; three seminal works, which he claimed to create a state of play between before and after.

Ito clearly distinguishes between different phases of design, namely the process through which he travels from the conception of the basic ideas (subjective realm) to realization of those ideas as actual objects (objective realms). It is worthwhile to cite his own words in this regard:

"It takes multiple stages: when I am in the design phase, I need to rely on logic because it's pure brain work. I am physically detached from my project. But when construction starts and the conceptual ideas begin to transform into actual objects, the design develops into something very sensorial again. Senses such as smell or touch which are almost dormant during the

design stage, suddenly are stimulated and begin to work hard again once they come face to face with real materials." (Fuji, 2018)

To grasp the importance of architectural concepts in Ito's projects, his brilliant use of the 'conceptual diagram' should be considered as a 'generative device' that helps him to advance the process of conceptualization. For Ito, these diagrams are not merely analytical instruments for understanding various aspects of projects, yet they serve as mediators between tangible material objects and intangible formative ideas. As can be observed in Table 1, Ito's conceptual diagrams convey subtle implications for the conceptual properties of projects.

### Study Background

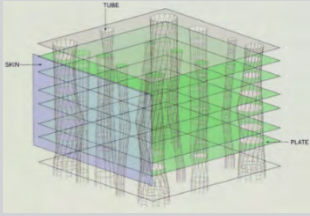
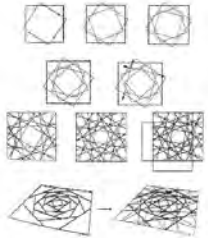
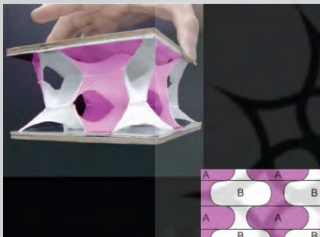
The relationship between architecture and nature and the subject of nature-inspired design has been addressed in several studies from a variety of perspectives. In some cases, the research focuses more on the issue of structure; for instance, Taghizadeh (2007) elaborated on some samples of efficient structures in nature and some man-made structure influenced by nature and concluded that proper imitation of natural forms and structures would result in the efficiency of edifices in terms of structure, performance, and aesthetics. Rouhizadeh et al. (2019) considered the potential that nature could provide for the education of structural design in architecture and established a pathology for the integration of structure and architecture in the architectural design process.

However, some studies are more relevant to the subject of architecture design, e.g., Khakzand & Ahmadi (2007), while explaining some capacity of nature for inspiring designers, argue that mere imitation of natural form is not the correct approach to design. As they contended, studying the principles that influence the development of a certain form in nature would have far more advantages for architects than imitating that form.

In the same vein, while considering the concept as the most important and primary elements during the design process, El-Ghobashy and Mosaad (2016) tried to develop guidelines for the design of buildings integrated with nature by explaining the role of analogical reasoning and the nature-driven metaphors in the creation of architectural concepts.

Although there are not a few studies on the subject, those which have attempted to set out a certain theoretical framework to explain the role of nature in architecture are not extensive. In this regard, by examining the works of Ando and Calatrava and comparing certain features of their architecture, Pesaran et al. (2014) provided some detailed factors regarding the methods of utilization of nature in architecture. In the same approach, Eliaszadeh Moghadam et al. (2013), Feizabadi et al. (2015), and Daneshjoo et al. (2015) have provided some analytical factors concerning the use of nature in architecture, but in a much more rigorous framework, and with a focus on Iranian architecture as a case study. It can be argued, however,

Table 1: Ito's instructive employment of Conceptual Diagram as a generative device.

Project	Conceptual Diagram	Conceptual Features (Implied by a diagram)
Sendai Mediatheque (2001)		The proposal consists of three elements of 'plate', 'tube', and 'skin'. 'Plate' implies six square slabs. 'Tubes' means 13 tree-like elements that vertically penetrate the plates to coordinate and incorporate the latter. They are versatile structural elements that also serve as a vertical traffic line and as space where energy (light, air, water, sound, etc.) and information flows. 'Skin' means the elements that separate the inside of the building from the outside. (Ito, 2001)
Serpentine Pavilion (2002)		Application of an algorithmic mechanism of geometric generation consisting of a sequence of squares rotated one by one and reduced in size, one within the other, i.e., a spiral movement of squares (Cortes, 2005). By drawing the first line that cuts across the corner, and then allowing the computer to repeat that line almost indefinitely, a random pattern appears. It is then cut and folded to form the roof, walls, and ceiling of the pavilion, with the lines articulated in steel. Approximately half of the gaps between the lines are filled with solid panels, while others are left open (Worsley, 2002).
National Taichung Theater (2016)		The initial concept for the project consisted of taking two flat surfaces, dividing them into a grid, and then systematically linking circles around alternating points vertically with a versatile fabric to create a three-dimensionally curved, continuous surface. If you replicate this form vertically, this A/B space organization would be linked vertically and horizontally. The building is made up of four levels in the vertical direction. By repeating the polyhedrons and then vertically connecting them and then smoothing them out, this structural system was developed (Ito, 2009, 56).

that each of these restricted efforts has some shortcomings and some missing factors have not been taken into account.

### Problem Statement and Objectives

Nature has always been a great source of inspiration for designers, either in terms of its impressive formal configurations or functional efficiency. Architects can therefore use these extraordinary potentials of nature to develop innovative architectural concepts. Toyo Ito can be considered a remarkable figure in this regard, an architect whose innovative concepts convey in themselves deft methods of utilization of nature in architecture, and thus, if they are being subjected to careful investigation employing a specific theoretical framework, they reveal didactic points concerning the subject matter, i.e., potential determinant agents which have provided by nature and maybe engaged in the development of architectural concepts.

Although some efforts have been made in the past to examine the influence of nature in some architectural projects and have somehow delivered certain factors in this regard, there is still a considerable gap in current literature in terms of investigating the potential of nature in the development of architectural concepts utilizing a detailed theoretical framework.

The main objectives of this study are, therefore: first, the introduction of a certain theoretical framework in which its

itemized factors can elucidate the potential of nature in the progress of architectural concepts; and, second, the investigation of some of Ito's most acclaimed projects to unfold the role of nature in the evolution of their architectural concepts.

### MATERIALS AND METHODS

Given the objectives of the study, this documentary paper employed the descriptive-analytical method and, first, reviewed the existing literature to deduce the theoretical framework of the research; and then, for the case study section, ten of Ito's projects were chosen from various scales and functions, and attempts were also made to pick up projects from different periods of his career to the selected cases cover general characteristics of his projects. As for the first step of the study, i.e. the method for deducing the Theoretical Framework of the research based on previous studies, this will be discussed extensively in the following section. The required data concerning the conceptual properties of the cases were collected through a literature survey and document analysis. For the data analysis part, both qualitative and quantitative tactics have been used to provide a clear understanding of the results. Fig. 2 shows the overall research process, including structure and methodology.

### Establishing the Theoretical Framework of the Study

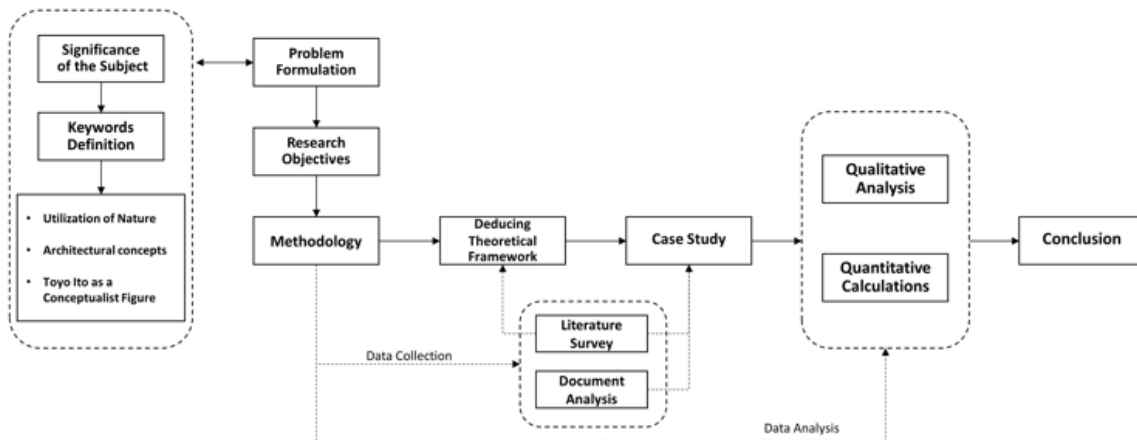


Fig. 2: Diagrammatic illustration of the research process.

Table 2: Analogy between proposed Theoretical Frameworks concerning methods of utilization of nature in architecture.

Proposed Theoretical Frameworks (Regarding methods of utilization of nature in architecture)		
Framework A (Pesaran et al., 2014)	Framework B (Daneshjoo et al., 2015)	Framework C (Eliaszadeh Moghadam et al., 2013; Feizabadi et al., 2015)
A1. Selection of site inside nature	B1. Water	C1. Formal
A2. Infiltration of light into the building	B2. Climate	C2. Functional
A3. Physical penetration into nature	B3. Porch	C3. Structural
A4. Visual penetration into nature	B4. Context	C4. Spatial
A5. Combining the space with natural elements	B5. Utilizing natural Complexity	C5. Symbolic (Concepts)
A6. Creating a dynamic landscape	B6. Ornament	C6. Ornamental
A7. Inspiration from trees, birds, animals, and living creatures	B7. Natural Scenery	C7. Climatic
A8. Integration and connection with the surrounding environment	B8. Courtyard	C8. Contextual
	B9. Nature-inspired structures	C9. Scenery
	B10. Nature-inspired Forms	C10. Material
	B11. Materials	
	B12. Symbols	

As one of the most efficient means of developing an appropriate theoretical framework is to make a comparison between the existing proposed frameworks in the literature and to make a correlation between their itemized factors, this paper only opted for those studies which provided a certain theoretical framework with definite factors. As a consequence, three theoretical frameworks were detected according to the criteria mentioned above. Table 2 illustrates the selected frameworks as the basis for the development of the Theoretical Framework for this study, explaining the factors that have been introduced in each of them concerning methods of utilizing nature in architecture.

It would be possible to make an accurate comparison between these frameworks by correlating the relevant items in them. Some of the correlations are direct and apparent, such as A4 B7 C9, but some of them are somewhat more complicated and include two or more items from different frameworks, such as A1 A8 B4 C8. Besides, each framework has its unique items; that is, some items are limited to only one of the frameworks and have not been mentioned in the others, i.e., ‘porch’ or

‘courtyard’ in Framework B or ‘functional’ in Framework C. However, a profound comparison between the frameworks and in-depth analysis of their proposed items suggest that unique items may also be correlated with some of the items in other frameworks, i.e., A5 B3 B8 C4, and may therefore be re-labeled and grouped in new ways.

However, there are still a few missing points that need to be incorporated into the Theoretical Framework of the study. Accordingly, through comparison and making correlations between the factors which has been previously proposed in frameworks and re-grouping them in a more orchestrated way, and also introducing some missing points, the Theoretical Framework of the study has been deduced (Table 3).

#### Literature Review

Through analyzing Ito's architectural concepts, it is evident that the structure has a major role to play in the development of inventive concepts; that is, Ito's structure is not only an agent that helps to crystallize formative ideas as a physical object but is also one of the determinants of the process of conceptualization.

Table 3: Deduced Theoretical Framework of the study.

<b>Deduced Theoretical Framework</b> (Itemized factors regarding the role of nature in developing architectural concept)	
1)	Integration of natural elements in spatial articulation <ul style="list-style-type: none"> <li>• Flora and vegetation</li> <li>• Water</li> <li>• Natural light</li> </ul>
2)	Consideration of open and semi-open spaces <ul style="list-style-type: none"> <li>• Courtyard</li> <li>• Porch</li> <li>• Patio</li> </ul>
3)	Optimal utilization of climatic factors <ul style="list-style-type: none"> <li>• Sun radiation</li> <li>• Wind direction</li> <li>• Humidity and rainfalls</li> </ul>
4)	Metaphoric / Symbolic inspiration from nature
5)	Figural imitation of natural species
6)	Utilization of natural scenery
7)	Employment of abstract geometrical proportion and mathematical roles in nature
8)	Utilization of physical potential of the site for locating the building <ul style="list-style-type: none"> <li>• Traces of topography</li> <li>• Implied natural axis</li> </ul>
9)	Nature-inspired structures
10)	Nature-inspired ornaments
11)	Usage of material in their raw and brutal state

In particular, a series of creative collaborations with structural engineers such as Mutsuro Sasaki for the Sendai Mediatheque and the Tama Art University Library and Cecil Balmond for the Serpentine Pavilion and the National Taichung Theater (Fig. 3) could be seen from the Sendai project. These approaches contradict the orthodox design working methods since both the architect and the engineer are engaged in the initial conceptual and generative stage (Oxman, 2012). A classic example of such design partnerships that take into account structural and material requirements early in the design process can be found in the process details of the Serpentine Pavilion, a project that was realized in 2002. Ito described the structure of the project as an episode or a particular moment in a sequential process, a structure as a footprint or a trace, a structure as an implementation of an algorithm, and in general, a structure connected to a mobile sense of geometry (Cortes, 2005).

The same is true of the new library project for Tama Art University, in which Ito blends a new kind of grid with an inventive arch system that produces high-tech concrete curves,

each different, gracefully tiptoe in multiple directions within the building. As Pollock put it, the outcome is a continuous sheet of concrete through which the cave-like ground floor of the building flows down to the north, along the natural slope of the ground, and thus the entire structure can be understood as a single, curving space accessed through an arcaded gallery (Pollock, 2008).

Of course, the origins of such an approach can be traced back to Ito's early projects, where, in collaboration with structural engineer Masato Araya, he explored the potential of aluminum sheets, i.e., airy perforated-aluminum wrappers as attractively fluid skins or screens that became emblems of his architecture in many of the finest buildings in the 1980s, such as Silver Hut (1984) and Tower of Winds (1986) (Buntrock, 2016). One of the most interesting elements that play a major role in Ito's architecture is the grid. As Hybel (2013) pointed out, Ito offers Mies van der Rohe's interest in the grid as parametric and boundless geometry; however, unlike Mies, who explored the static potential of the grid, "Ito seeks to distort and



Fig. 3: Taichung Metropolitan Opera House, Interior structure of the continuous shell. (Ito, 2009, 55)

Table 4: Ito's metaphorical formulae as critical responses to the Status quo. (Cortes, 2005)

Proposed Formula (Critical Ideas)	Elaboration
<b>The architecture of the Wind</b>	Shapeless architecture, light as the wind, floating in the air; with little matter, with no significant weight.
<b>Architecture in the State of Flux</b> (Fluid Architecture)	A space created as a fluid, soft, and versatile space; space as the place where the constant activities of man occur, where things happen as time goes by.
<b>Architecture as a Transparency</b> (Transparent Wrapper)	Architecture as a thin film that envelops the human body, the supporting evidence like a thin, transparent film that homogenizes today's society, as one that brings structure to this film.
<b>Architecture as an Unstable, Ephemeral Manifestation</b>	Architecture that seeks consistency and resilience but reveals that it is unpredictable, fictitious, and transitory.
<b>Architecture as Phenomenalism</b> (Device that Produces Phenomena)	Architecture as an activity wrapper, a phenomenon filter and a generator of vortexes or whirlwinds in natural (air, wind, light, and sound) and artificial currents (information, transport, electron flows); a mechanism that interprets form as a phenomenon, that renders the flow of invisible things visible and that points out the human activity.
<b>Architecture as a Garden of Light, a Garden of Wind, a Garden of Microchips</b>	Architecture as a device that produces landscape, as a garden plowed by these natural and artificial flows.
<b>Architecture as a Crossing Point</b>	Architecture that converts a destination into a way station and in which movement plays a crucial role; architecture as an intersection in a network of activities, an architecture in which heterogeneous spaces are superimposed or intersected.
<b>Blurring Architecture</b>	Open architecture with oscillating or sinuous limits, the boundary as a membrane, an osmotic film that lets things pass through instead of separating the interior from the exterior.

modulate the grid, to get what he calls an 'emergent grid'". This approach, which provides a refinement, clarity, and minimization of the structure while at the same time utilizing its expressive potential, is extremely well known in his later work (Mostafavi, 2009). In effect, structure and creativity at the level of structural design and its relationship with concepts are becoming thematic, or rather, a line of inquiry that continues to unfold today.

He has consistently criticized the state of the contemporary city, its people, and architecture, and has therefore attempted in his writings to set out those ideas as critical responses to the status quo. In fact, in the form of concise metaphorical formulae, Ito expresses his potential architectural answers to the problem of man and his life in the contemporary nature-eliminated metropolis. Cortes (2005) summarized some of Ito's thoughtful formulae, as can be noticed in Table 4.

#### Significant Role of Nature in Ito's Architecture

The relationship between man and nature, how he interacts with his surrounding environment, from the very early stages of his career, has been a long-lasting concern for Ito. He has taken issue with the prevalent preoccupation with the lavish city-based lifestyle and claimed that architects should no longer follow the development of mega-cities, but are committed to creating simple communal spaces where individuals can interact, function, and perform daily practices (Tamari, 2014). He, therefore, suggests that architects ought to start by questioning how we relate to nature, our surrounding world, and rethinking the people or community that architects are always arguing for, and asking, aren't they simply turning into an abstract scheme?

Some sources have attempted to distinguish various

intellectual stages in Ito's evolutionary architecture. The point that is common in all of them is the main role of nature as a constant concern for the creation of innovative architectural concepts. For instance, in his introduction to a recent collection of translations of writing by Toyo Ito, Daniell (2011) depicts the development of Ito's concept in four themes, each linked to a decade of his four-decade career: robot, city, body, and nature. Daniell notes that these reflect a trajectory that indicates a telescopic reversal of the human civilization history, a kind of inverse teleology culminating in the most primitive ground of existence (Daniell, as cited in Worrall, 2012, 121). In the same vein, as described in the preface to the book, Toyo Ito: Forces of Nature, "Ito's architecture responds to forces within a broadly understood environment; flows of digital information, social ecologies, and constructs, as well as natural forces and even disasters".

Ito has constantly sought to create a kind of architecture that ensures that people are in contact with nature, or at least with the community and its surroundings. As he argued, since human beings are free while they are in nature, he often tried to develop an organic design in which humans are not limited in their activity within a man-made structure. He also stressed that Architecture should be following nature and people, representing people's needs rather than relying on promoting outer beauty (Ito, 2013). Ito claims that the natural world is highly dynamic and unpredictable and that its structures are fluid, so it can be a didactic source of inspiration for the development of adaptive and resilient architecture. Indeed, he found simple natural elements, such as water and air, to be his architectural mentor, as they can simply inform us that architecture can have infinite possibilities (Crossley-Baxter, 2018).

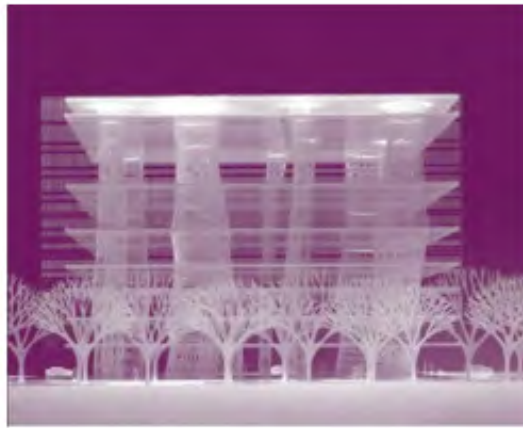


Fig. 4: Sendai Mediatheque, Abstract model; the tubular columns can metaphorically be expressed as seaweeds swaying and dancing in a tank of water. (Allen, 2012, 11)

Probably one of the most instructive passages from his words, which unfolds the criticality of nature as a source of inspiration for Ito, can be found at the end of his 2009 lecture, entitled 'Generative Order', in which he proposed the image of a single tree as the easiest way to understand the ultimate objective of his title and argued:

"A tree assumes its form depending on its variety. By repeating very simple rules, the tree creates a very complex order. But a tree also decides its specific form as it grows. A tree decides its shape in response to its surroundings. A tree is always open to the environment. When you stand beneath a tree – with the span of its branches, within the space it creates – it is impossible to determine whether you are inside or outside." (Ito, 2009, 88)

Given its fundamental principle that rapidly evolving technology would allow the economic mass production of universal architecture in every region of the globe, Ito argued that modernist architecture led to the massive migration of people from rural to urban areas. This very notion has meant that the cities of the world lose their local identity when they were reduced to a series of generic and indistinguishable grids (Ito, 2013). He thinks that the idea of modernity also entailed the assumption that nature could be conquered by technological development, and therefore privileged operation and productivity, and cut itself off from the unique history and culture of its local settings.

Ito admired prehistoric people for their occupation of caves as dwellings, just as birds built nests among tree branches; he believes that instituting architecture implied a departure from life in a cave guided by an animalistic instinct to join a rational world dominated by geometric order. Hence, Ito's practice has often made it possible to eliminate the barrier that distinguishes modern architecture from nature and the local community, to establish an architecture that is accessible to both. He believed that the time has come for us to restore our affection for nature, to open up our monotonous city grids to the bounty of nature, and to create a more vibrant and human environment.

Moreover, Ito has always criticized the established grid of modern architecture for its resulting homogeneity. Even in a project like Sendai Mediatheque, in which he based his concept on the abstract geometry of the implied grid, by using tubular columns, he tried to create a fluid space like a reservoir of water in which some plants are swaying (Fig. 4). He believes that the grid, as the dominant order in modern architecture, made the world's cities homogeneous and, in turn, made people living and working there homogeneous. Accordingly, he ceaselessly strived to liberate himself from the inorganic abstraction of modern architecture and move towards a kind of 'lightness' and 'ephemerality' that reflects the ever-changing quality of nature (Taki, 2004, 6). In reaction to the rigidity of the grid, particularly after Sendai, Ito felt his way through several strategies that continuously unregulated and undermined the dominance of the modernist grid over the architectural framework, shape, and envelope, resulting in the space method he called the 'emergent grid' (Worrall, 2012, 122). As he argued, for the last ten years, by slightly modifying the grid, he has been seeking to find a way to establish relationships that put buildings closer to their environment (Ito, 2009, 33). In this approach, while the trace of the grid can be identified as a generative order, it dramatically loses its unified rigidity and becomes a more resilient, nature-friendly conceptual device.

As the closing point of this section, it is worth noting that Ito's approach to nature, i.e., his commitment to the rich subjective perception of space in a nature-friendly setting, is rooted in Japanese architectural tradition. As Fridh (2017) put it, Ito is focusing on the creation of mental processes, including spatial perceptions, but also haptic sensations. In this sense, his architecture involves unexpected and easy to change experiences of materiality and spatial organization, which contribute to dynamic interaction with the surroundings. This, in turn, leads to a new subjectivity concerning the traditional Japanese conception of space, where space is a subjective perception and a changeable phenomenon in the mind of the



observer, not an outside object.

**Case Study**

As mentioned, for the case study section, ten of Ito's projects were selected from various scales and functions, and attempts were also made to gather projects from different periods of his

career to cover the general characteristics of his projects in the case chosen (Table 5).

Given the theoretical focus of this paper, which is the role of nature in the evolvement of architectural concepts, key statements on the conceptual properties of the cases about


Table 5: Investigation of the cases, analysis of their conceptual properties based on itemized factors of the Theoretical Framework of the research!

Scale	Name Image	Utilization of Nature (Conceptual Properties)	Analysis based on Theoretical Framework
	<p><b>Silver Hut</b> Tokyo, Japan, 1984</p> 	<p>The principal plan was to make the building light and transparent. The house integrates perforated and transparent screens that refer to the lightness and translucency of traditional Japanese construction methods but add a contemporary twist.</p> <p>Perforated aluminum was utilized because it has the same capabilities and effects as paper screens and movable walls, which are common Japanese design techniques.</p> <p>The house consists of a series of crisscrossed arches creating different roofs. The central area has the longest arches and acts as an outdoor retreat. These braced arches produce a pattern of triangles, some of which are transparent, while others have a light skin spread over them to block some of the light.</p>	<p>(1)</p> <p>(2)</p>
	<p><b>Serpentine Gallery Pavilion</b> London, UK, 2002</p> 	<p>A basic white cube, but dissected by random intersecting lines, generated by an algorithmic pattern. Transforming a conventional grid structure into an algorithmic grid derived from the rotation and expansion of a square.</p> <p>The form of the pavilion was determined by the algorithmic rotation of the square, with the rotation style deformed into a type of square pattern, referred to as an irregular spider web of lines. A perforated box that is enclosed and still open.</p> <p>Develop a column-less architecture that can be both architecture, and non-architecture at the same time.</p> <p>A deconstructed, rotated cube with multiple triangles and trapezoids. Comprising of transparent and translucent panels out of the balance between solid and void.</p>	<p>(1)</p> <p>(6)</p> <p>(7)</p> <p>(8)</p>
Small	<p><b>TOD'S Omotesando Building</b> Tokyo, Japan, 2004</p> 	<p>The building is wrapped in a skin of interlocking concrete supports and glass, imitating the trees that line the streets.</p> <p>The facade design simulates the natural growth patterns of the surrounding trees.</p> <p>Searching for a new approach that defines transparency and opacity at the same time and attempting to incorporate both lines (columns), surfaces (walls), and openings in an innovative way.</p> <p>Develop a surface-like structure that explicitly reflects the flow of force. This exterior surface acts as both a graphic pattern and a structural system.</p> <p>The pattern of overlapping tree silhouettes also induces rational force flows. Following the structural logic of the botany, the branched tree diagram adapted as it goes up the building, being smaller with multiple branches, with a higher proportion of the openings. Tree silhouette produces a new image with a persistent voltage generated by the symbolic realization of the building and its abstract nature.</p>	<p>(1)</p> <p>(4)</p> <p>(7)</p> <p>(9)</p> <p>(10)</p>
	<p><b>White O</b> Marbella, Chile, 2009</p> 	<p>The site slopes slightly to the north-east and enjoys attractive views in the same direction. The goal of the proposal is to allow the dynamic use of the whole site, taking advantage of the unique qualities produced by this slope.</p> <p>The house and the site are composed together as a single continuous space, flowing along a spiral path, centered on a partially enclosed garden. The entrance to the house takes place along the natural line of the slope, attracting visitors to the rear of the site. Within the inner garden, the slope becomes continuous with the floor of the house and then runs around and up to the more intimate parts of the house.</p> <p>The project is a circular house that offers the same image if you lived up to the treetops.</p>	<p>(1)</p> <p>(2)</p> <p>(3)</p> <p>(6)</p> <p>(8)</p> <p>(11)</p>

Continue of Table 5: Investigation of the cases, analysis of their conceptual properties based on itemized factors of the Theoretical Framework of the research<sup>1</sup>

	<p><b>Sendai Mediatheque</b> Sendai, Japan, 2000</p> 	<p>A transparent cultural media hub sponsored by a unique system to give the surrounding community maximum exposure and openness The simplest purpose of relying on plates (floors), tubes (columns), and skin (facade/exterior walls) allow for a poetic and visually fascinating architecture, as well as a dynamic structure of operations and information systems. (1)</p> <p>Tubes are organic in nature, like plants in their forms and behavior. (4)</p> <p>The tubular columns are conceived as something that sways and dances like seaweed in the sea. The cubic volume is the embodiment of a water tank, and 13 tubes can be imagined as plants swaying gently in the virtual water that fills the tank. (9)</p> <p>The tree-like appearance of the Metal Columns of the Mediatheque is continuous with the natural surroundings of the region, as the design is found on a street lined with trees. The building shifts along with the seasons, the transparency representing the summer green and the streets throughout the winter. (10)</p>
Medium	<p><b>Toyo Ito Museum of Architecture</b> Imabari, Japan, 2011</p> 	<p>The museum is located on a site overlooking the Seto inland sea; situated at the top of a hill covered with mandarin orange trees. (4)</p> <p>Four types of 3m-sided polyhedron modules, which can be freely assembled and tightly packed, have been used to produce this building. The mixture of forms such as octahedron, tetrahedron, and cuboctahedron resembles natural rock above the sea. (5)</p> <p>Although the holistic outline of the structure is sculpted to resemble the deck of a ship, the interior room is painted like floating clouds above the water. (8)</p> <p>There are no obvious, defined planes for ceilings, walls, or floors. Space has a centripetal quality that produces an illusion close to that of being inside a sphere. (10)</p>
	<p><b>International Museum of the Baroque</b> Puebla, Mexico, 2016</p> 	<p>Employing sculpted and flowing, all-white precast concrete forms that evoke the scale and tension that was often associated with the Baroque era. Suggesting the dissolving of rigid order by using curving rather than flat concrete slabs to create fluidity between exhibitions. (1)</p> <p>Conceptually we want the architecture to blossom from the earth like spring water and grow. Since light symbolizes God's revelation against the darkness of ambivalence, in baroque art, the light also has a special meaning in this project. (2)</p> <p>A museum of light wells and fluid spaces featuring baroque art, visitors can feel the light that comes from the sky, as if a dialog is taking place between man and nature. Circulation in the building revolves around a light-filled dome. The museum is situated on the water plane in the center of the Urban Eco Park of Puebla; the museum's terraces overlook the surrounding greenery, while the museum itself makes use of the stable climate for cooling and lowering its energy consumption. (3)</p> <p>(4)</p> <p>(6)</p> <p>(8)</p>
	<p><b>National Taichung Theater</b> Taichung, Taiwan, 2016</p> 	<p>The exterior form of the building is orthogonal, but the interior is punctured by many gaps so that the levels are related horizontally and vertically. (1)</p> <p>Cave-like holes penetrate the form, creating a sponge-like matrix created by a continuous series of fluidly curving surfaces. (4)</p> <p>The venue is based on a three-dimensional grid, which has been relocated and sculpted into an irregular form resembling the coral reef. The project uses an integrated spatial-structural system that offers a sense of the dynamism of nature. (5)</p> <p>The perception of the continuous path that links the ground-level city garden to the rooftop landscape is just like a good walk in the park. The beamless system of curved walls, which merges into floors and ceilings, creates spaces where light and sound proceed easily, creating a unique and remarkable atmosphere. (7)</p> <p>(9)</p>
Large	<p><b>Building for Island City Central Park "GRIN GRIN"</b> Fukuoka, Japan, 2005</p> 	<p>The project is not an independent object, but rather a whole new ecosystem that merges into the topographical changes of the surrounding undulating terrain and forms a gentle spatial spiral in which people can gather. From the pond, the architecture appears to merge with the location, creating a topography that blends the natural and the constructed, maybe similar to the mountainous nature of the region. (1)</p> <p>Its organic form is very unique and original, it can be viewed as a park-like building, as well as a building like a park. (2)</p> <p>The entire landscape becomes a sequence of hills, constant across the interior and the outside, where people, light, and air crisscross. The interior of the complex is divided into three approximately equal spaces, each with different flowers and vegetation. All three spaces are continuous to one another by the spiral form, which also creates consistency between the inside and the outside. (3)</p> <p>(5)</p> <p>(6)</p> <p>(8)</p> <p>(9)</p> <p>The completely planted rooftop acts as a walkway offering a sweeping view of the entire island. (11)</p>

Continuie of Table 5: Investigation of the cases, analysis of their conceptual properties based on itemized factors of the Theoretical Framework of the research<sup>1</sup>

Large	<p><b>Vivo City</b> HarbourFront Walk Singapore, 2006</p> 	The design is based on the qualities of the bay waters adjacent to the site, which elicit depictions of waves in the sea, with each space leading intuitively to the next. (1)
		The undulating shapes give continuous curvature to the structure's halls, façade, and roof, reformulating the typical hard-edged, 'big box' mall type. The rooftop is an open-air deck shaped by organic shapes to create topographies of landscaped gardens. (2)
		Integration of water at the level of the rooftop garden, enabling simultaneous perception of water and visual assimilation to the sea. (4)
		Roof gardens, such as Sky Park, enhance the energy usage of the buildings. Enjoying the surfing motif by reinterpreting the elements found in marine ecosystems, i.e., utilization of dunes and vegetation dunes in a stylized manner at The Plaza and the Sky Park. The ripples of the sea are taken through the interior of the building through a large expanse of curved corridors. The incorporation of skylights helps natural lighting to enter interior spaces. (6)
		(10)

the use of nature have been extracted and, subsequently, the conceptual properties of each case have been analyzed based on the Theoretical Framework of the study.

### RESULTS AND DISCUSSIONS

As can be seen from the results (Table 6), the highest level of utilization of nature among the cases relates to Grin Grin with a frequency of 72.7% and the lowest level corresponds to Silver Hut with a frequency of 18.2%. However, the

average frequency of the cases based on itemized factors of the Theoretical Framework of the research is 45.4%.

Regarding the itemized factors of the Theoretical Framework of the study, the highest rate is related to 'Integration of natural elements in spatial articulation' which gained the frequency of 90%, and the lowest rate is corresponded to 'Usage of material in their raw and brutal state' which gained the frequency of 20%. The average frequency of itemized factors is 45.5%. The two items, namely 'Metaphoric / Symbolic inspiration from

Table 6: Level of the utilization of nature regarding each case and utilization rate of each factor of the Theoretical framework in the processing of architectural concepts.

Theoretical Framework (Itemized Factors)	Silver Hut	Serpentine Gallery Pavilion	TOD'S Building	White O	Sendai Mediatheque	Toyo Ito Museum of Architecture	International Museum of the Baroque	National Taichung Theater	GRIN GRIN	Vivo City	Frequency (%)
Integration of natural elements in spatial articulation	*	*	*	*	*	—	*	*	*	*	90
Consideration of open and semi-open spaces	*	—	—	*	—	—	*	—	*	*	50
Optimal utilization of climatic factors	—	—	—	*	—	—	*	—	*	—	30
Metaphoric / Symbolic inspiration from nature	—	—	*	—	*	*	*	*	—	*	60
Figural imitation of natural species	—	—	—	—	—	*	—	*	*	—	30
Utilization of natural scenery	—	*	—	*	—	*	*	—	*	*	60
Employment of abstract geometrical proportion and mathematical roles in nature	—	*	*	—	—	—	—	*	—	—	30
Utilization of physical potential of the site for locating the building	—	*	—	*	—	*	*	—	*	—	50
Nature-inspired structures	—	—	*	—	*	—	—	*	*	—	40
Nature-inspired ornaments	—	—	*	—	*	*	—	—	—	*	40
Usage of material in their raw and brutal state	—	—	—	*	—	—	—	—	*	—	20
Frequency (%)	18.2	36.4	45.4	54.6	36.4	45.4	54.6	45.4	72.7	45.4	

nature' and 'Utilization of natural scenery' have an above-average frequency of 60%, and three items to wit 'Optimal utilization of climatic factors', 'Figural imitation of natural species' and 'Employment of abstract geometrical proportion and mathematical roles in nature' got the frequency of 30%, which is obviously below average.

**CONCLUSION**

In the light of the findings of the research, it can be argued that Ito usually pays attention to the potential of nature and aims to use certain factors related to this capacity to develop inventive architectural concepts. However, as the results have revealed, that is, an average frequency of 45.4% for the level of utilization of nature among all cases, it can be deduced that Ito dismisses some potential factors, based on the Theoretical Framework of this paper, in each case.

Even though the highest rate among the cases is related to one of the large-scale projects and the lowest corresponds to one of the small-scale ones, the findings have nevertheless proven that a larger scale does not necessarily mean the higher frequency concerning the utilization of nature. For instance, the frequency concerning White O, which relates to small-scale cases, is 54.6% that stands at a second-place together with the International Museum of the Baroque which is from the medium-scale cases. Also, the Vivo City, which is related to large-scale cases and due to the unique characteristics of its site, can take considerable maneuver in terms of the utilization of nature in the development of architectural concepts, but still stands at the average frequency of 45.4%, which is less than some other cases from medium and small scale (Fig. 5).

On this account, although this study classified the cases based on their scale, it can be argued, however, that there are some

other effective factors, such as the specificity of the site, the brief of the project, certain limitations imposed by the clients that significantly affect the level of utilization of nature in the processing of architectural concepts.

Given the study results concerning the itemized factors of the Theoretical Framework of the study, it may be argued that while Ito regularly cares for the integration of natural elements such as natural light, vegetation, and water into the spatial articulation of his projects, on the other hand, the typical material of his building is the combination of steel and concrete and therefore one should claim that he doesn't pay much attention to the usage of material in their brutal state.

Furthermore, for Ito 'Metaphoric / Symbolic inspiration from nature' and 'Utilization of natural scenery', have a noticeable role in the evolution of inventive architectural concepts. Contrarily, the cases examined in this paper implied that such factors as 'Optimal utilization of climatic factors', 'Figural imitation of natural species' and 'Employment of abstract geometrical proportion and mathematical roles in nature' do not play a critical role in processing Ito's inventive architectural concepts (Fig. 6).

Moreover, despite the substantial role of the structure in Ito's projects and the fact that Ito is undoubtedly one of the forerunners of integrating complex, innovative structural systems into architecture, but taking into account the frequency of 40%, regarding the respective item in the Theoretical Framework, it may be argued that it is still further space for utilization of nature-inspired structures.

**Lessons for Local Architecture and Future Studies Direction**

To finalize the paper, it should be noted that this study sought



Fig. 5: Comparison of the level of utilization of nature concerning each case.

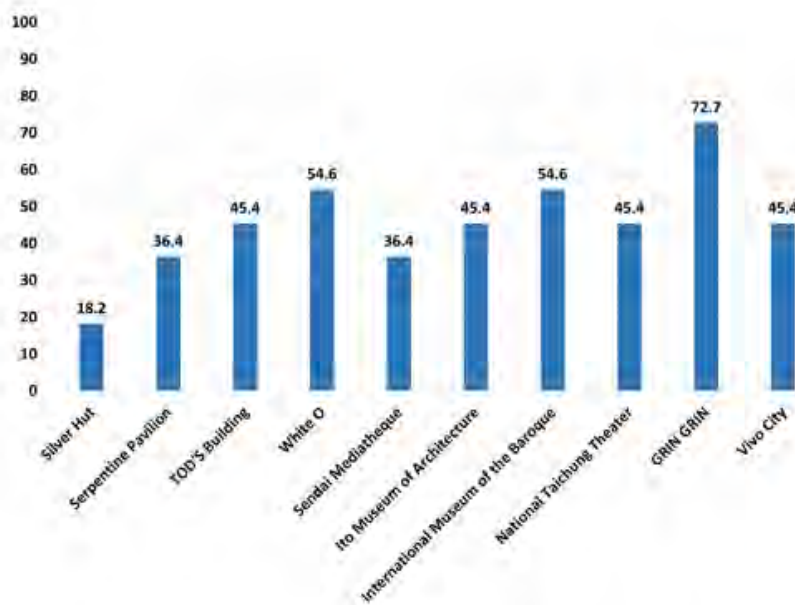


Fig. 6: Comparison of the utilization rates of each factor in the processing of architectural concepts.

to establish a certain Theoretical Framework, whose itemized factors provided a reliable measure for assessing the level of utilization of nature in the development of architectural concepts. In a holistic view, with an overview of what has been delivered by contemporary Iranian architecture, especially over recent decades, it can be argued that there are some confusion and ambiguity in terms of the proper understanding of architectural concepts and the process in which they have evolved. Consequently, the development of theoretical frameworks through systematic academic research in such a way that the indicators of these frameworks can explain the factors that influence the formation of architectural concepts, such as the potential role of nature in this regard, would significantly boost the theoretical discourse of Iranian architecture.

In this context, the identified factors introduced in this study can be viewed as recommendations for design in both academic and practical terms. In particular design criteria based on nature and potential considerations that may be applied in the development of architectural concepts should be further promoted in the field of design education. Moreover, given Iran's favorable climatic diversity, focusing on the potential of nature and promoting vernacular architecture, given that this approach seeks to leverage the region's bio-climate capacity, would make a significant contribution to the creation of far more appropriate and diverse architectural concepts.

However, there is a potential for further advances in the components of this article. As a direction for future studies, more development of the Theoretical Framework of the paper can be recommended. While this paper attempted to incorporate successful itemized variables by comparing and correlating some of the previously proposed frameworks and re-grouping

them in a more coordinated manner, and also adding some of the missing points to them, there is still space for more enhancement. Moreover, the theoretical framework provided in this research has some potential to be used to investigate the level of utilization of nature in different local architectures, for instance, it can be applied to Iranian contemporary architecture to determine the extent to which each of the indicators is used and how they change over different periods.

## ENDNOTES

1. The required data regarding the conceptual properties of the cases have been extracted mainly from the following Sources:  
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 Toyo Ito 2001-2005. *El Croquis Monographs*, 123, (2004).  
 Toyo Ito 2005-2009. *El Croquis Monographs*, 147, (2009).  
 'Archdaily' can be found at <https://www.archdaily.com/>  
 'Dezeen' can be found at <https://www.dezeen.com/>  
 'area' can be found at <https://www.area-arch.it/>  
 'Toyo Ito & Associates, Architects' can be found at <http://www.toyo-ito.co.jp/>

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