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Delineating The Impact on Design Parameters Due to Covid-19

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Abstract
The lockdown imposed due to Covid-19 has caused economic and social challenges around the world. It has adversely impacted the real estate and construction sector. The ongoing pandemic has created a need to reassess the building design strategies to mitigate the threat of the virus. The novelty of the research lies in ranking the design parameters with regards to the pandemic, to provide better design solutions for all stakeholders. This research aims to identify, assess and rank the impact due to Covid-19 on different design parameters in architecture. An analysis of the identified parameters has been carried out by surveying architects and occupants. Recommendations have been made to provide better design solutions for the pandemic age.
Keywords: Architecture; Design Parameters; Covid-19; Pandemic.

1. Introduction

The Covid-19 or novel coronavirus has changed the world as we know it. The virus which had emerged in Wuhan City, Hubei Provence by the end of 2019, was declared as a cause for international concern and a global pandemic on March 11, 2020.

India reported its first case of Covid-19 on January 30, 2020 (Vasantha Raju Na, 2020). The country has been in a continuous series of lockdowns and restrictions since March 24, 2020. This disease has led to home quarantine in many countries creating psychological and social challenges as a result of long-term stay at home (MahsaZarrabi, 2021). An economic and social crises has followed in its aftermath. This economic recession has had varying impacts across different sectors. The real estate and construction sectors have witnessed the brunt of this fallout as seen in the empty offices and vacant construction sites.

Architecture and urbanism as academic disciplines and professions that influence, in many different ways, individuals, communities, and societies, can support the fight against the pandemic by conducting research to comprehend the socio-spatial implications of COVID-19; identifying new conceptions related to emerging lifestyles which stem from the new spatial environments that integrate working and living patterns; and ultimately developing design responses towards creating healthy environments that successfully accommodate the infected populations while addressing the associated social and psychological ramifications (J.Foss, 2020). To effectively reduce the spread of the virus, it is crucial to highlight the effectiveness of building design strategies in mitigating threats to occupants (Naglaa A. Megahed, 2021).

The design parameters for architecture change continuously according to the time and situation. As early as 30-15 BC, Marcus Vitruvius Pollio had laid down the principles of architecture in his handbook 'De architectura.' He had written the essential parameters of architecture as *firmitas, utilitas*, and *venustas* (i.e., structural stability, function and space arrangement, and aesthetics).The weightage or dynamics of these parameters keep changing with time. In his essay titled "The New World" published in 1926, Hannes Meyer has pointed out that "Each age demands its own form." We are presently living in the Covid-age. This has created a need to assess the weightage of design parameters in architecture with regards to the pandemic. The importance of this is that identifying architect and occupant priorities can provide better design solutions for all stakeholders.

2. Aim

The aim of this research is to identify, assess and rank the impact due to Covid-19 on different design parameters in architecture.

3. Objectives and Methodology

Objectives of this research are-

- To identify & categorize the qualitative design parameters in architecture through literature study.
- To understand the possible effect of Covid-19 on the identified design parameters.
- To assess and rank the impact due to Covid-19 on the design parameters by RII derived from user survey.

The Relative importance index is calculated by using the Eq. 1; where W - ranges from 1 to 5 - denotes weighting given to each statement by the respondents, A signifies higher response integer (i.e. 5 in this case), and N denotes total number of respondents.

$$RII = \sum W/(A*N) \quad (1)$$

4. Defining the Design Parameters

Design parameters – a corpus of variables - decompose the complexity of the human and social needs, environmental requirements, utilities and technological requirements to create a fundamental basis of design, on which the building architecture can evolve to its full potential. Since the building architecture and environment are inextricably correlated to each other, changes of any sort can bring enormous impact on the role of the parameters in design. In this section, a total of 60 different qualitative design parameters have been identified which have been broadly assorted into 5 categories as described below and the impact of the Covid-19 on each category has been discussed in Table 1, Table 2, Table 3, Table 4 and Table 5 –

- Site surrounding parameters (SS),
- Site parameters (S),
- Building parameters (B),
- Human and socio-economic parameters (HS)
- Smart building system (SBS)

Table 1. Site surrounding parameters (SS)

Parameters	Description
Location	Geographic location not only determines its connectivity with the urban centres but also reveals the vulnerability to the Covid-19 infection. (Balbontin, 2020)
Neighbourhood context	If the immediate surroundings of the site encounter any containment zone, social contact should be avoided in all respect. (NDMA)
Accessibility to the site	Width of the road should be such so that it reinforces efficient circulation by allowing emergency access, social distancing, and access to amenities.
Access to amenities/essentials	Proximity to the food and nutrition security, clean water, reliable waste management, health services, transportation, technology, etc. is essential for sustainable living.
Access to public health infrastructure	Availability of sufficient and well-equipped public health infrastructure within the accessible limit of any neighbourhood plays an important role in fighting pandemic. As per National Health Policy minimum 2 beds are required per 1000 population (National Public Health, 2017).
Access to public open space	The accessibility to the public open space such as parks, green spaces etc. helps improving mental state, reducing stress level and thereby facilitating the balance between social life and work life. Moreover the public open spaces has to adaptable and multi-functional in nature in order to use them in emergency situation. (UN-Habitat, 2020)
Population density	Relation between population density and mortality rates demonstrates, people living in a densely populated areas are more susceptible to infection. (Bhadra, Mukherjee, & Sarkar, 2021)
Urban network	Connected to an adaptive transportation network as well as digital network is crucial to cope with the pandemic situation (Bogdan-Martin, 2020) (Network lessons: improving connectivity for the post-Covid economy, 2021).
Urban water cycle	Water pollution caused by drugs and untreated waste water can elevate extent of infection. In-situ and tertiary (with chlorination, UV irradiation etc.) waste water treatment can restrict the contamination. Moreover, to ensure good quality of water WHO guidelines need to be implemented at different water collection, distribution and consumption point. (Bhowmick, et al., 2020)
Waste management	A proper in-situ treatment of solid-waste and proper implementation of guidelines prescribed by WHO are very essential in thwarting the contamination. (Bhowmick, et al., 2020)

Table 2. Site parameters (S)

Parameters	Description
Zoning and size	Zoning at site level defines the accessibility to the site, required setbacks from the boundary, connectivity within the site, separation of different functional areas, building height, size and location which helps in reducing the probability of contamination.
Natural physical features	The coexistence of different natural site features like existing greenery, site topography, water body etc. create microclimate, introduce diversity and also function as a private gathering space during the period of lockdown.
Manmade features	Diversified elements like pathways, seating areas, feature wall, fountain, statues, building materials, landscaping etc. act as mood accelerator during the pandemic period while reducing the need of gathering in a city level public space.
Open space	The mandatory open space of a particular site depends on the exiting bye-laws of a particular location. However, the larger open spaces of a site act as private outdoor areas as well as buffer zones that shield the building and its occupants from the surrounding infection.
Circulation	Separation of vehicular and pedestrian movements (like the movement of ambulance transporting Covid-19 patients etc.) of the containment areas, from the neighbouring areas is the key to confine the level of infection to a limited areas.
Utilities at site level	Uninterrupted on-site services like gas, internet, electricity, telephone, security, water supply and sewage, facilitate the quarantined period. In this context, on-site treatment of the sewage and waste water of infected person is crucial to restrict the contamination.
Sensory	Visual connection with the surrounding, noise reduction, coexistence of flora etc. have a direct correlation with the improved mental health especially during the phases of lockdown.

Table 3. Building parameters (B)

Parameters	Description
Personal vision and style of the architect	Architect's vision and style integrate diverse parameters into the design which enables a space adaptable, flexible and aesthetically pleasing.
Orientation	Positioning a space according to the prevailing wind direction and sun path can improve energy efficiency, thereby facilitating money saving.
Climate	Designing a building considering different climatological factors like wind direction, sun path, rainfall, temperatures, snowfall etc. makes it climate responsive, sustainable and efficient; it reduces the need of artificial lighting, heating and cooling systems which results in cost saving and limits magnitude of infection.
Occupancy pattern	As the human behaviour, active and inactive hours etc. varies at different types of occupancies, it's very important to isolate different occupancies (mainly the public areas) to the reduce risk (Barbosa, Mateus, & Bragança, 2016).
Form	Different building forms (like circular, square, plane roof, pitch roof, tall building, clusters short building etc.) not only add diversity into our built environment but also its meticulous use enables a designer to achieve the optimum level of energy efficiency which reinforce the reduction of cost for Operational Energy.
Function	Segregation of private and semi-private space from the public space; allocation of proper quarantine zone neutralizes the potential risks to a great extent.
Durability	Durability of the structural and non-structural elements, building services and mechanical equipment plays an important role in preventing the infection during pandemic and post-pandemic by reducing the frequency of required maintenance.

Aesthetics	An aesthetic environment can improve the mental health of people by making them happy and thereby it improves psychic balance, reduces negative emotions and improves work efficiency.
Circulation	Unobstructed and automated circulation reduces the spread of infection.
Space size	The functionality, flexibility and adaptability of a space largely depend on its size. In a large space, its congruent elements can be rearranged as per the need in a far easier way than that in a small space. For example, the growing trend in Work From Home has resulted in the conversion of most of the office space into the co-working space.
Spatial layout	The arrangement of furniture, feature wall and other interior elements should facilitate the separation of private space from public space and quarantined space to ensure safety of the occupants.
Spatial flexibility/adaptability	A flexible & adaptable space allows multiple functions as per the present & future requirements. The decrease in capacity of food court of a mall to enhance social distancing, use of a screen wall to separate working space from the rest of the areas, conversion of large colleges into the quarantine centre etc. exhibit the usefulness of adaptable spaces.
Building level zoning	Zoning within the building helps in controlling the mobility of the residents/ visitors. It helps in efficient monitoring, decontamination and containment.
Private outdoor / balcony / terrace	During the lockdown, the balcony/ terrace has served as a space for family congregation. It has also turned into a flexible space for activities ranging from meditation to office work. The balcony/terrace has provided access to fresh air and sunlight.
Material specification	Covid-19 has resulted in the escalation of prices of several materials, and the imposed restrictions within different regions have caused a disruption in procurement. The demand of refractory materials has also witnessed a setback.
Height (building, floor)	The height restrictions for buildings were altered in many cities due to Covid-19. For example, the Chinese government placed a ban on 500 meter or taller buildings. In Mumbai, India however, the HC set aside an Airport Authority of India rule to cap building height providing relief to developers.
Vision & perspective / view / Visual connection	Psychologists have recommended spaces that are visually connected to nature for mental well-being after the pandemic. White rooms with large windows instil a sense of connectivity to the outdoors and give a sense of safety.
Acoustic/noise control	Common mental health disorders like anxiety, stroke and depression are linked to noise pollution. The lockdown has resulted in a decline in noise pollution across multiple cities.
Day lighting	A study has correlated the exposure to sunlight to increased Covid-19 recovery rates, due to increased production of vitamin D. (Asyary & Veruswati, 2020)
Artificial lighting/illumination	Artificial light from electric fixtures as well as blue light emitted from electronic devices are directly linked to physical and mental well-being. The level of illumination and exposure period impact the productivity and sleep cycles.
Ventilation (natural & artificial)	A study found that bringing ventilation to recommended levels had the same mitigating effect as a vaccination coverage of 50-60%. (Smieszek T, 2020)
Indoor air quality	Studies have found that better indoor air quality decreases the risk of coronavirus. Air pollution has also been linked to respiratory diseases and poor health outcomes due to Covid-19. (COVID-19: How Passive House = Passive Health, n.d.)
Heating system	Cold dry air is found to facilitate the spread of Covid-19. Statnews reported that turning on the heat dries the tissues lining the airways, impairing the mucus filtering of Covid-19.
Air conditioning	Air-Conditioning systems are responsible for air filtering, temperature and humidity control. The recirculation of air from air-conditioners increases the risk of Covid-19 transmission. High-efficiency particulate air (HEPA) filters have been recommended to remove airborne contaminants, especially in hospital buildings.

Water quality	Polluted water leads to the spread of bacterial, viral and parasitic diseases. Safe drinking water eliminates toxins from the body, while building immunity. Immunity has proven to be a key-factor in warding off Covid-19.
Waste generation & management	The focus has shifted to dealing with bio-medical waste generated from PPE equipment. Due to the lockdown, the commercial and food waste has reduced. The disposal and management of waste is important, because waste can become a health hazard if not handled properly.
Telecom and data system	The Covid-19 pandemic has underscored the necessity of digital connectivity to maintain a connection between community in order to reduce the negative socio-economic impact due to lockdown
Fire detection, alarm system & protection	Even in the time of the pandemic, the fire safety guidelines need to be in reviewed and updated to plan an evacuation in the event of fire, and ensure continued safety of life and property.
Safety and security system	As per the new norms and safety standards, thermal scanners are being used for checking temperature and face detection systems have been upgraded for mask recognition.
Maintenance	New maintenance processes have been developed to inhibit the spread of Covid-19 and provide user support. Cleanliness and hygiene standards have become more robust.
Environmental friendliness	Covid-19 has exposed the flaws in the built environment. The pandemic has also necessitated the need to increase building resilience, lower energy requirements and explore sustainable building design.

Table 4. Human and socio-economic parameters (HS)

Parameters	Description
Comfort	The health of an individual is directly linked to comfort. Building design plays a key role in providing both general comfort (aesthetic, recreational) and thermal comfort (through temperature, humidity and air-flow).
Working efficiency	The efficiency of work has been deeply impacted due to Covid-19. Working from home has hampered the productivity due to lack of access to office resources for some people. In other cases, the efficiency has improved from the time saved in commuting.
Privacy	The need for privacy for all individuals has been highlighted while working from home, doing chores or attending classes. It became more important when public places were shut, with no place to escape.
Mental health	Covid-19 has greatly impacted mental health by creating an atmosphere of fear, worry and stress. The building design could improve mental health by creating the feeling of safety and comfort, while also boosting productivity and reducing stress.
Social & cultural quality	Proximity to neighbours and family members with controlled zones for interaction decreases the chances of isolation and loneliness, while boosting mental health and improving the quality of life.
Social distancing	The Covid-19 outbreak has redefined the design of spaces keeping social distancing (1 m separation) in mind and avoiding close contact to promote a safe environment.
Cost factor (rent, maintenance, utility)	Due to the economic slowdown, the real estate market has suffered a major slump. There has been a rental crises for the landlords, and tenants have found it difficult to pay for utilities, maintenance and service charges.

Table 5. Smart building system (SBS)

Parameters	Description
Intelligent skin & interactive façade	A controlled building environment can result in cost saving and improved building performance. A well designed façade controls ventilation, sunlight and air-filtration and improves thermal performance.

Building Automation System	The building automation system has developed during Covid-19 depending upon varying occupancies and requirements. This system has also allowed the building owners to analyse and audit the energy consumption data.
Passive design	Passive designing is a cost effective measure that utilizes the natural energy sources like sunlight and wind. This in turn creates healthy indoor spaces that inhibit the transmission of pathogens.
Renewable resources	There has been a radical shift in the power sector during the lockdown as several grid operators have turned to renewable energy, as an economic way to meet electricity demands.
Life cycle costing	The cost of running and maintaining a facility has become a critical outlook for the building stakeholders, as the pandemic has had a long-term economic impact.

5. Assessing and Ranking the Design Parameters

To assess the impact due to Covid-19 on the design parameters a survey has been conducted between 72 experienced professionals of architecture where they have been asked to rate different parameters on a scale of 1 to 5. The collated data have been analyzed to evaluate RII by using Eq. 1; the Table 6 describes the calculated weighted average (∑W/ N) and RII of each design parameters. Depending upon the derived RII all the design parameters have been ranked and arranged in descending order as shown in Table 7. It has been observed that few parameters – like public health infrastructure, Indoor air quality and social distancing (each scored 0.908); location and accessibility to the site (each scored 0.776) etc. - have scored same RII value which accentuate equal importance of the parameters and therefore they have been assigned same rank.

Table 6. Weighted average and RII of different design parameters based on data collated through survey.

Design parameters	Weighted average (∑W/ N)	RII
Location	3.88	0.776
Neighbourhood context	3.69	0.738
Accessibility to the site	3.88	0.776
Access to amenities/essentials	4.35	0.87
Access to public health infrastructure	4.54	0.908
Access to public open space	3.51	0.702
Population density	3.89	0.778
Urban network	3.58	0.716
Urban water cycle	3.96	0.792
Waste management	4.21	0.842
Zoning and size	3.54	0.708
Natural physical features	3.47	0.694
Manmade features	2.89	0.578
Open space	3.86	0.772
Circulation	4.04	0.808
Utilities at site level	4.22	0.844
Sensory (visual, audible and tactile aspects of the site)	3.83	0.766
Personal vision and style of the architect	3.07	0.614
Orientation	3.5	0.7
Climate	4	0.8
Occupancy pattern	3.75	0.75
Form	2.89	0.578
Function	3.94	0.788
Durability	3.76	0.752
Aesthetics	3.08	0.616

Circulation	3.97	0.794
Space size	4.24	0.848
Spatial layout	4.17	0.834
Spatial flexibility/adaptability	4.18	0.836
Building level zoning	3.93	0.786
Private outdoor/balcony/terrace	4.13	0.826
Material specification	3.46	0.692
Height (of building and floor)	3.21	0.642
Vision & perspective/view/visual connection	3.47	0.694
Acoustic/noise control	3.57	0.714
Day lighting	4.11	0.822
Artificial lighting/illumination	3.56	0.712
Ventilation (natural & artificial)	4.47	0.894
Indoor air quality	4.54	0.908
Heating system	3.49	0.698
Air conditioning	3.61	0.722
Water quality	4.31	0.862
Waste generation & management	4.29	0.858
Telecom and data system	3.97	0.794
Fire detection, alarm system & protection	3.81	0.762
Safety and security system	3.94	0.788
Maintenance	4.13	0.826
Environmental friendliness	4.07	0.814
Comfort	4.29	0.858
Working efficiency	4.32	0.864
Privacy	4.24	0.848
Mental health	4.65	0.93
Social & cultural quality	3.86	0.772
Social distancing	4.54	0.908
Cost factor (rent, maintenance, utility)	4.19	0.838
Intelligent skin & interactive façade	3.06	0.612
Building Automation System	3.44	0.688
Passive design	3.33	0.666
Renewable resources	4.06	0.812
Life cycle costing	3.94	0.788

Table 7. Assigned rank to different design parameters based on RII.

Sl. No.	Design parameters	Category	RII	Rank
1	Mental health	HS	0.93	1
2	Access to public health infrastructure	SS	0.908	2
3	Indoor air quality	B	0.908	2
4	Social distancing	HS	0.908	2
5	Ventilation (natural & artificial)	B	0.894	3
6	Access to amenities/essentials	SS	0.87	4
7	Working efficiency	HS	0.864	5
8	Water quality	B	0.862	6
9	Waste generation & management	B	0.858	7

10	Comfort	HS	0.858	7
11	Space size	B	0.848	8
12	Privacy	HS	0.848	8
13	Utilities at site level	S	0.844	9
14	Waste management	SS	0.842	10
15	Cost factor (rent, maintenance, utility)	HS	0.838	11
16	Spatial flexibility/adaptability	B	0.836	12
17	Spatial layout	B	0.834	13
18	Private outdoor/balcony/terrace	B	0.826	14
19	Maintenance	B	0.826	14
20	Day lighting	B	0.822	15
21	Environmental friendliness	B	0.814	16
22	Renewable resources	SBS	0.812	17
23	Circulation	S	0.808	18
24	Climate	B	0.8	19
25	Circulation	B	0.794	20
26	Telecom and data system	B	0.794	20
27	Urban water cycle	SS	0.792	21
28	Function	B	0.788	22
29	Safety and security system	B	0.788	22
30	Life cycle costing	SBS	0.788	22
31	Building level zoning	B	0.786	23
32	Population density	SS	0.778	24
33	Location	SS	0.776	25
34	Accessibility to the site	SS	0.776	25
35	Open space	S	0.772	26
36	Social & cultural quality	HS	0.772	26
37	Sensory (visual, audible and tactile aspects of the site)	S	0.766	27
38	Fire detection, alarm system & protection	B	0.762	28
39	Durability	B	0.752	29
40	Occupancy pattern	B	0.75	30
41	Neighbourhood context	SS	0.738	31
42	Air conditioning	B	0.722	32
43	Urban network	SS	0.716	33
44	Acoustic/noise control	B	0.714	34
45	Artificial lighting/illumination	B	0.712	35
46	Zoning and size	S	0.708	36
47	Access to public open space	SS	0.702	37
48	Orientation	B	0.7	38
49	Heating system	B	0.698	39
50	Natural physical features	S	0.694	40
51	Vision & perspective/view/visual connection	B	0.694	40
52	Material specification	B	0.692	41
53	Building Automation System	SBS	0.688	42
54	Passive design	SBS	0.666	43
55	Height (of building and floor)	B	0.642	44

56	Aesthetics	B	0.616	45
57	Personal vision and style of the architect	B	0.614	46
58	Intelligent skin & interactive facade	SBS	0.612	47
59	Manmade features	S	0.578	48
60	Form	B	0.578	48

The 'Figure 1' depicts that the average RII (0.773) of all design parameters divides the data set into 2 parts – the first part consists of parameters from 1 to 36 and the second part consists of the parameters from 37 to 60 (Refer Table 7) – where the cumulative RII of the first part (29.862) is 1.8 times than that of the second part (16.514). So, during the design development process, more deliberation on the constituent parameters of the first part is a prerequisite towards the user responsive design in post-pandemic period.

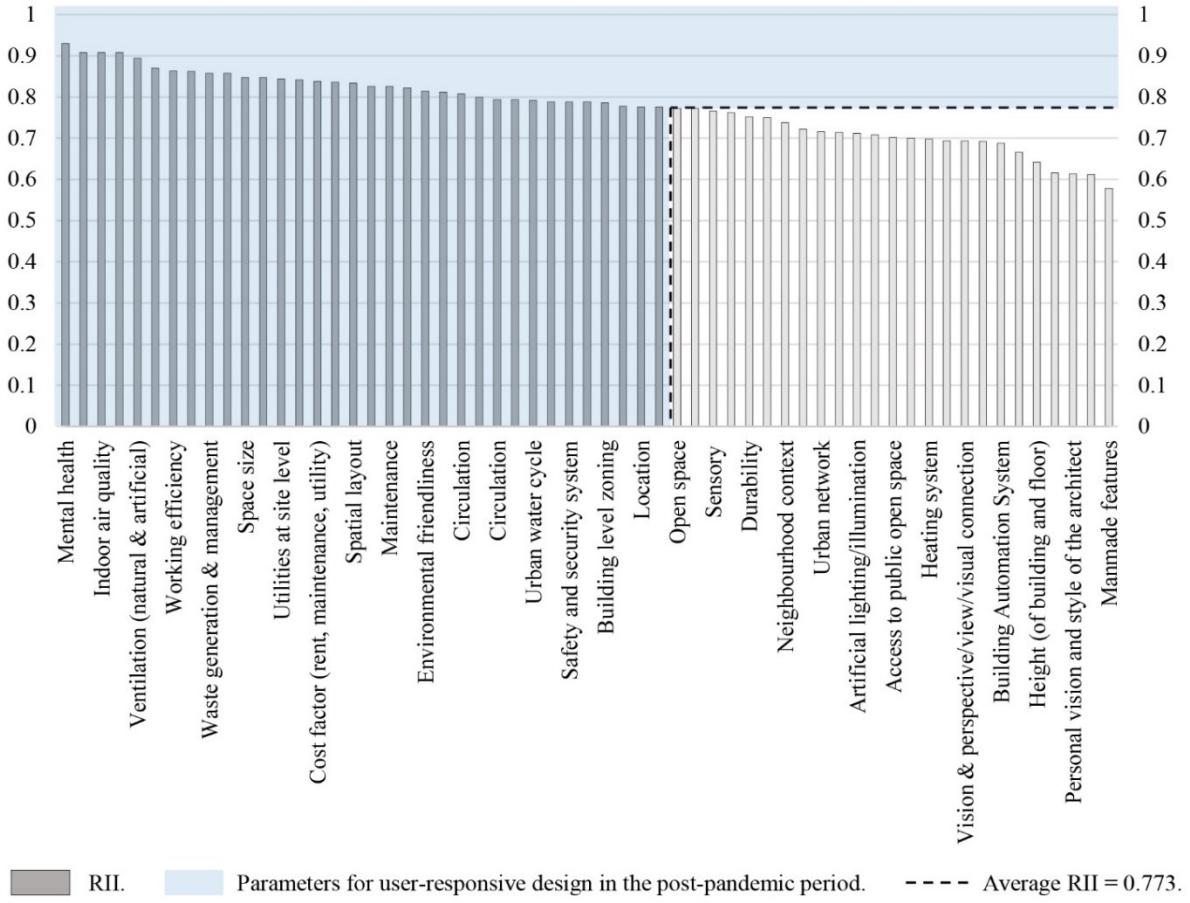

Figure 1. Correlation between average RII and the design parameters.

Further if we compare the 5 categories – site surrounding parameters (SS), site parameters (S), building parameters (B), Human and socio-economic factor (HS), and smart building system (SBS) – based on their average RII (Refer 'Figure 2'), it has been observed that the 4th category (HS) has scored higher than the other categories, accentuating the need to shift towards human-centric architecture.

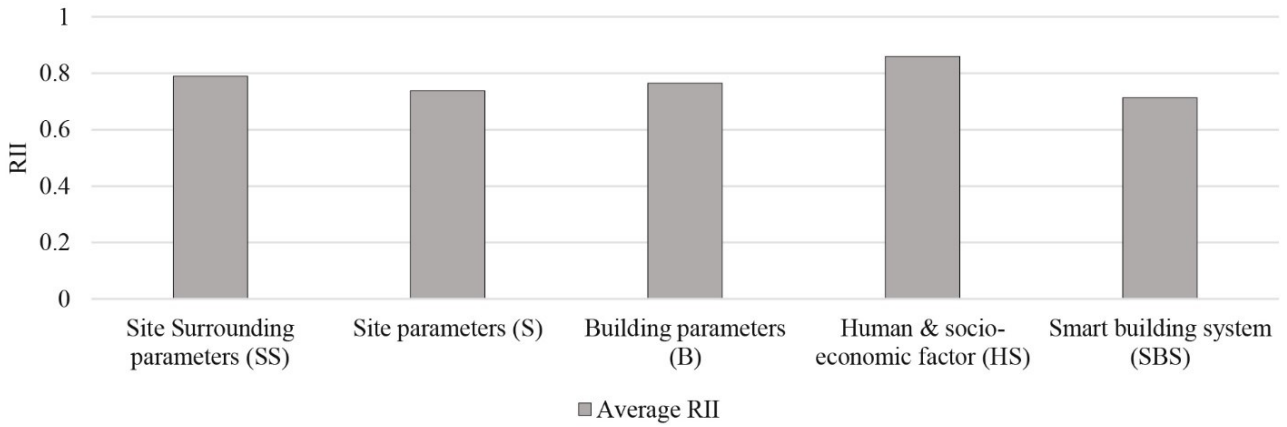

Figure 2. Comparison between Average RII of the categories

6. Conclusion

This paper has listed down the design parameters relevant today, and grouped them into five broad categories- i) Site surroundings ii) Site parameters iii) Building factors iv) Human and socio-economic factor v) Smart building system. Based on the survey of 72 experienced professionals of architecture, it has been found that mental health has emerged as the paramount factor to be considered while designing for the present times. Covid-19 and the ensuing lockdown has amplified the effect of the physical environment on the mental health of individuals. The World Health Organization had reported a 13% rise in mental health problems in the last decade. The long lasting pandemic has aggravated the illness. By focusing on well-being, architecture can help improve the mental health of the residents. Access to natural light, fresh air, controlling temperature and noise levels in the built-environment can enhance well-being. These factors have a high ranking in the survey as well.

Covid-19 is a virus affecting the respiratory system without a known medical cure. Therefore in the event of emergency, 'access to health infrastructure' like hospital and dispensaries has ranked second in the survey. This should be considered in the planning and zoning of the built-environment. Indoor air-quality has been ranked third in the survey conducted for this paper. In a recent study reported by the World Green Building Council, it was suggested that enhancing indoor air quality could be as effective in reducing aerosol transmission of viruses as vaccinating 50-60% of the population. Social distancing has ranked fourth in the survey indicating that it should be considered while designing the spatial layout. The imposed lockdowns due to the virus have hindered the workflow of several people. Therefore, working efficiency has been given a high weightage in the designing of spaces. Basic services like water quality and waste management have ranked high as well. Based on Table 7 the average value of RII is 0.773 and the close clustering of the RII values is indicative of the relevance of the selected parameters.

Overall out of the five broad categories in which the architectural parameters were grouped, 'Human and socio-economic factors' have emerged to be prominent. This indicates a shift towards human-centric design after the onset and spread of Covid-19. The perception and response of the residents towards the built-environment need to be considered in architectural planning. Further, the social and economic implications need to be factored in at the design stage to ensure sustainability.

Based on the results of this study, the next actions recommended are:

- Architects need to research about the impact of building design on the mental health of the occupants. Design guidelines need to be drafted accordingly, that focuses on well-being.
- Health-care infrastructure needs to be upgraded based on the present and forecasted pandemic requirements. The zoning in Master Plans should include easy access to hospitals and health-care facilities for all citizens.
- Covid-19 protocols like social distancing are to be reflected in architecture, to cater to the pandemic lifestyle of the residents.
- The building design needs to adapt to the new work from home culture. Buildings should be made to facilitate remote working and improve efficiency.
- This study has used an analytical-descriptive framework to identify the impact of Covid-19 on design parameters. A quantitative assessment system can be developed further to establish an empirical link.

7. Future Scope

The Covid-19 virus variants are mutating rapidly, and it is difficult to assess the impact of each new strain or wave. The design parameters will continue to evolve alongside the pandemic. A continuous study is required to monitor

the shift in parameters to keep up with the present and make way for the future pandemic stage. The following are a few areas for future research:

- How are the design parameters across different building typologies (residential, commercial, educational etc.) being impacted?
- How should the design of the existing buildings be modified to increase functionality in a pandemic ridden world?
- What are the building, site and urban level transformations in the Covid-19 context?
- What are the architectural measures that can be taken to deal with dual disaster?

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Conflict of Interests
The authors declare no conflict of interest.

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