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A Case Study on Redesigning the Dynamic Indian Market to Mitigate Pandemic Impacts

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Abstract

The pandemic has caused a profound upheaval in countless lives, catalyzing substantial alterations in lifestyles and daily routines worldwide. This study undertakes a focused examination of the intricate ramifications of pandemics on individuals navigating bustling marketplaces. It aims not only to comprehend these effects but also to proffer pragmatic solutions aimed at curtailing disease transmission within such vital economic nodes. It seeks to both understand these impacts and suggest workable strategies to stop the spread of diseases. Employing a robust case study methodology, this research delves into the multifaceted impact of pandemic diseases on commercial hubs, with a particular emphasis on a prominent wholesale market complex. Through the lens of a comprehensive analytical framework, the study endeavors to dissect the operational dynamics underpinning markets across the diverse landscape of India. By meticulously conducting surveys both preceding and following the onset of the pandemic, the study meticulously identifies the challenges inherent in the functioning of these markets. With the help of the findings of the survey, it finds and extrapolates proposed solutions and recommendations, rigorously evaluating their efficacy through subsequent surveys. Furthermore, this investigation extends beyond mere observation, delving into the nuanced shifts in operational dynamics within wholesale market complexes. In response to these findings, the study advocates for a blend of architectural and non-architectural interventions to mitigate the adverse effects of pandemic diseases on existing markets. Moreover, it furnishes recommendations for future market planning, underlining the imperative of prioritizing visitor safety and proactively addressing significant threats to public health.

Keywords: Built Environment, Built-Up Space, Pandemic, Urban Planning, Urban Spaces.

Introduction

Pandemic diseases have stirred people's lives significantly. Cities have seen long-term changes because of pandemic diseases. This is due to the various cities' economic, social, and political changes (1). The expectation is that this could change on a small scale, although its impact is comparatively minimal on a larger scale. The impact depended on the timeline of this pandemic (2). The urban environment where kids spend their time influences their lifestyles and behaviors. Pandemic diseases induced a sedentary lifestyle in many people's lives with lower access to open spaces, including children (3). Such significant challenges experienced by urban built environments can be overcome by strategic planning of built environments. This can also prepare people for future pandemics (4). Askarizad observed the design of city streets after a pandemic should help with social distance and other physical measures (5). Further, multidisciplinary studies are the only way to clarify several unanswered questions (6). The design of urban environments requires attention regarding pandemics. Urbanism and architecture are bound to change completely to a post-pandemic. The recent pandemic experience necessitates futuristic, resilient designs and policies. This provides several opportunities for future pandemics, and climatic changes (7). It creates the chance to redesign built environment and transportation infrastructures to provide short-term solutions for reducing long-term health issues (8). People's mental health and well-being have changed after the virus breaks out compared to before pandemic diseases (9). Lower neighborhood density or smaller communities, proximity to parks with fewer people visiting them every day and shifting to the suburbs were all factors that aided people's psychological well-

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being. Depending on their geographical coordinates, location and arrangement of places concerning each other, and their physical features impact of pandemic diseases in different cities (10). Mitigation strategies have proven unsuccessful eventually for urban health. They have also changed the air quality, noise, and traffic, among other things. Built environments influence public health measures and reduce injection risk. A few suggestions for a post-pandemic urban design approach are the proper organization of spaces, physical barriers, and structural adaptations to material changes in designing urban areas (11). Preventive interventions minimize human health interactions. Sustainable living requires healthy lifestyles and behaviors (12). Several physical and social parameters affect built environments. Compact, mixed-use development and better transportation support sustainable urban development. Crowding, poverty, and poor air quality are common issues leading to high virus transmission risks. Adaptations in built environments, urban spaces, street design, transportation, and provision and location of parks and green spaces are expected to be the long-term impacts of pandemic diseases (13). With a reduced workforce and widespread job losses worldwide, the economic crisis and recession have instilled fear. The need for products and commodities has also decreased, causing a reduced need for labor. Due to the pandemic, grocery and food shopping modes have changed phenomenally worldwide (14). Since the virus outbreak in March 2020, supermarkets worldwide have developed many initiatives to decrease its spreading in retail shops for prevention. These changes include limiting the number of customers who can be in a store at one time, changing the store's layout, and making it a law that people must cover their faces (15). Consumers' spending on groceries has surged since the outbreak of pandemic diseases, leading to the temporary closure of numerous food-away-from-home enterprises. While grocery shopping is necessary, little is known about the dynamic interaction between the pandemic diseases' epidemic and grocery buyer behavior (16). Food habits have also changed with the increasing number of pandemic diseases cases. During the lockdown, people turned to unhealthy eating habits, like eating more salty snacks, sweets, sugary drinks, and alcohol. Panic buying and stocking food articles increased the demand. Supermarkets have seen a high demand for food products. Restaurants and cafes have had no choice but to shut down completely, leading to people losing their jobs.People have made many changes in their lifestyles to avoid being affected by pandemic diseases. Many such changes that influenced the food sector included people preferring home-cooked food. These food choices brought about health concerns, made people choose local shops over supermarkets, and government-sponsored pandemic restrictions. This also led to increased food wastage (17). People bought more packaged items and products from brands they had never heard of before. The response to the pandemic made respondents adopt healthy eating habits that differ depending on their gender, age, and household income (18). With pandemic diseases cases like wildfire, unemployment increased, working hours decreased, and vulnerable groups' isolation increased. This led to increased food insecurity and dietary health issues. The pandemic-related socioeconomic crises have revealed the food-aid system's inadequacy, which is currently a fundamental response to rising poverty. Stockpiling has strained a vulnerable food system with just-in-time supply lines. Food charities, particularly independent food banks, have been weakened due to food supply challenges at food banks, which have coincided with fast increasing demand and declining volunteer numbers (19). Fruit and vegetable prices were rising globally. Although few industries grew beyond the fluctuating prices, many succumbed to them, decreasing customers, staff, and articles bought and sold. Changes in the structural system of families like the family's collective income, household expenditure, and the pattern of buying food articles could bring about adaptations in food industries (20). A survey in China showed how the virus outbreak had pushed customers to show oscillating behaviors. Farmers' markets lost several customers, while smaller independent retail shops in local areas showed higher resistance to shutting down due to pandemic diseases (21). A large-scale study in Finland showed that during pandemic diseases, addiction to online shopping increased due to demographics, household traits, and health issues. In age groups above 45 years, only gender was a concern for this adoption. Occupation did not make much of a difference. Health issues were also a reason for this adoption.

This shows that online grocery shopping increased post the pandemic, increasing online market demand (22). For commercial activities in a market, bazaar, mandi, or mall, the concept of a physical market still exists as people are used to and are more comfortable purchasing items in person than by other online or home delivery methods (23). This brings people to these large spaces where physical distancing is eventually compromised. Physical distancing rules have been redefined by convenience. It introduced a lockdown affected the country's economy, eventually affecting every dependent person (24). Thus, several researchers investigated the impacts of pandemics and measures to mitigate the impacts. However, minimal research was carried out regarding the designing the dynamic market-built spaces to minimize the pandemic spread without the lockdown restrictions. Despite efforts to mitigate pandemic diseases' impact, their dynamic nature presents ongoing challenges, necessitating innovative solutions for urban spaces that can withstand future outbreaks without resorting to lockdowns. Although there have been prior studies on the impact of pandemics on built spaces, this study through a comprehensive case study approach aims to understand the impact of pandemic diseases on built environments, particularly wholesale markets where large groups of people from different backgrounds and exposures gather. By analyzing the food supply chain and addressing users' issues and challenges in wholesale markets, the study seeks to identify effective solutions to enhance market resilience in the face of pandemic diseases.

Methodology

Understanding the issue was broadly classified into three parts: case study, analysis, and survey. The spread of pandemic diseases was reviewed before studying the wholesale market complex and the issues faced by buyers, sellers, and ordinary people. The functioning of the wholesale market considered for the case study was understood in detail with various aspects of influence for the pandemic. The spread of pandemic diseases in the wholesale market over the past year has been analyzed and understood. Various users of the market were identified for conducting a survey based on the usage of the market. A sample size of 100 users with a difference in target items, target areas within the wholesale market, timings, and transportation means were identified to take the survey. The changes and reforms suggested and implemented in the wholesale market are measures suggested by researchers, journalists, and other interested parties. Solutions, recommendations, and futuristic predictions were illustrated and validated with a survey spread to the architecture fraternity and the commoners visiting the wholesale market. This broadened the solutions from both an ordinary person's and an architect's perspectives.

The selected market complex

A typical wholesale market for perishable merchandise is considered for this study. The market complex gets its goods delivered from multiple parts of India. It employs over ten thousand workers every day. The wholesale market would see at least one million visitors every day. Hence, overcrowding and congestion are frequent situations in this market. The first lockdown saw a rise in cases because of overcrowding and congestion. From there on, the circumstance held on as individuals started purchasing out of panic. Amidst all this, there was insufficient regard for physical distancing. Several efforts were made to shut down the wholesale market and limit the crowds. But the infection had spread, leaving the market complex prone to virus transmission. This wholesale market had turned into the biggest hotspot for spreading pandemic diseases. While an increase in vendors tested positive for the virus by the day, laborers from several districts also tested positive. The government traced all contacts of the affected personnel, which was a big challenge due to extreme crowding at the marketplace. Public health authorities said that every individual who evaluated positive on the market had more than 200 contacts.

An Overview of the Wholesale Market Complex

The wholesale market studied typically spreads across 300 acres as in Figure 1. As of April 2021, this market complex consists of around 3100 shops. This is further divided into about two thousand retail shops and 1000 wholesale shops. The wholesale market functions throughout the day and night, with wholesale loading and unloading services happening from 10 pm to 10 am when the presence of the public is negligible.

Retail services are open throughout the day from 10 am to 10 pm. The wholesale market complex is expected to have one lakh visitors daily. Vehicular traffic is expected to be around 550 private vehicles and around 350 trader lorries daily. People from distinct parts reach the wholesale market complex. Traders from the neighboring cities frequently go around the wholesale market for goods. The market depends on the neighboring residential area and the surrounding neighborhoods, which justifies the mixed land use pattern as shown in Figure 2.

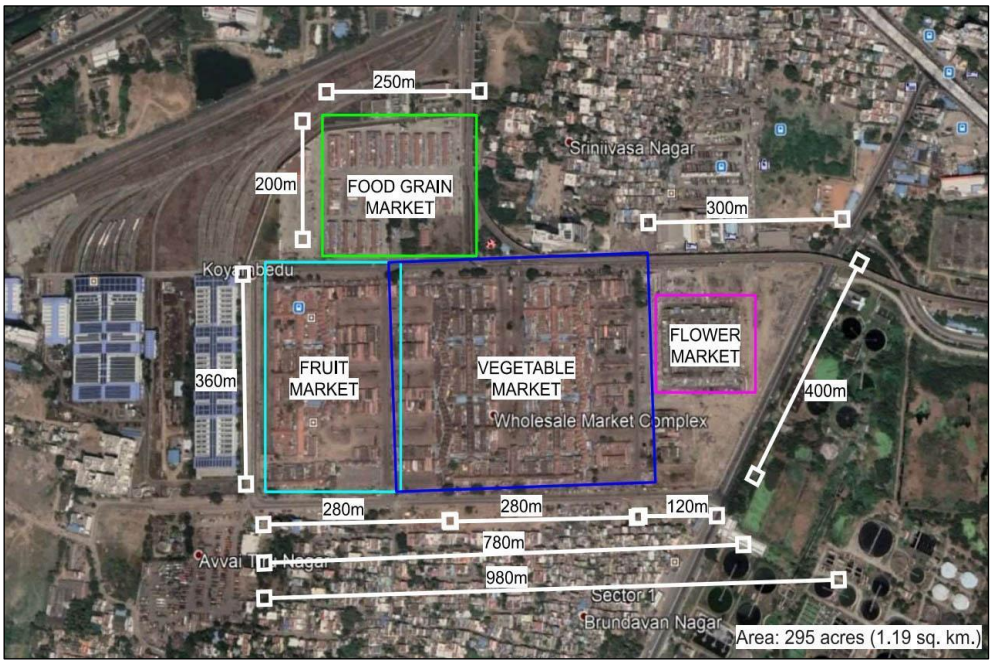

Figure 1: Extents of the Wholesale Market Complex

As per market organization, it is located near a major Bus Terminus. Two major metro rail stations make it well connected with the help of both bus and train services, which also contributed to last-mile connections like auto-rickshaws, and cabs. The main access roads have multiple bus stops and an overhead metro track on one side, making these roads active throughout the day. The first sight as we enter the complex hosting the market on the northern side of the wholesale market complex is the flower market which also contains an open piece of land used for parking purposes. Further down the road is the vegetable market, followed by the fruit market and the food grain market on either side. This road then goes around the market space. A few streets run across the market complex used by people accessing the market.

The Functioning of the Wholesale Market

The used road to access the market complex is on the northern side of the wholesale market. The second most used road is on the southern side of the wholesale market. Vehicular traffic is extremely high throughout the day on both roads. Pedestrian traffic is the highest on the streets inside the vegetable market. The streets abutting the flower and fruit market see moderate pedestrian traffic. As depicted in Figure 3, the food grain market experiences less pedestrian traffic. As far as the servicing of the various wholesale markets is concerned, as shown in Figure 4, the vegetable market is serviced using the central lanes inside the vegetable market. The fruit market is serviced using the street adjacent to the fruit market. The food grain market experiences trader lorries parked in the frontage of the wholesale market. Where a small plot of open land exists. The inner servicing is done using the smaller streets between the food grain market. The flower market is surrounded by open land used for parking and servicing. Figure 5 shows the spatial context of the selected market.

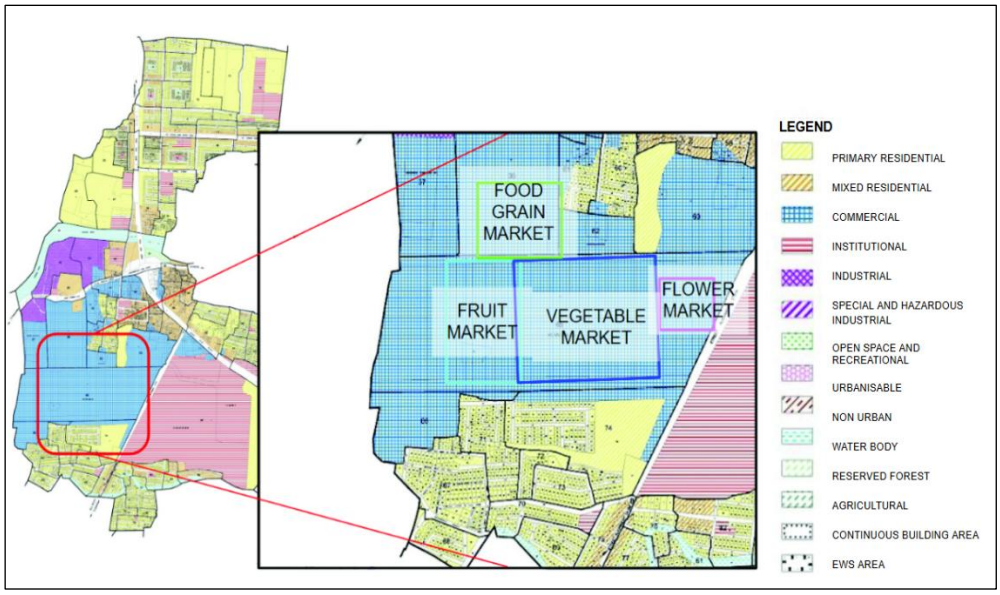

Figure 2: Masterplan and its Land Use (25)

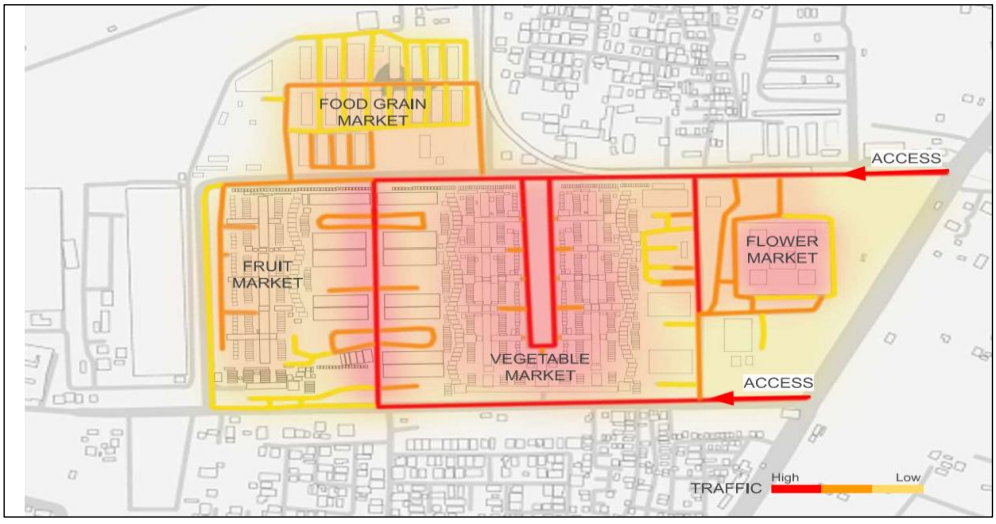

Figure 3: Congestion Points in the Wholesale Market Complex

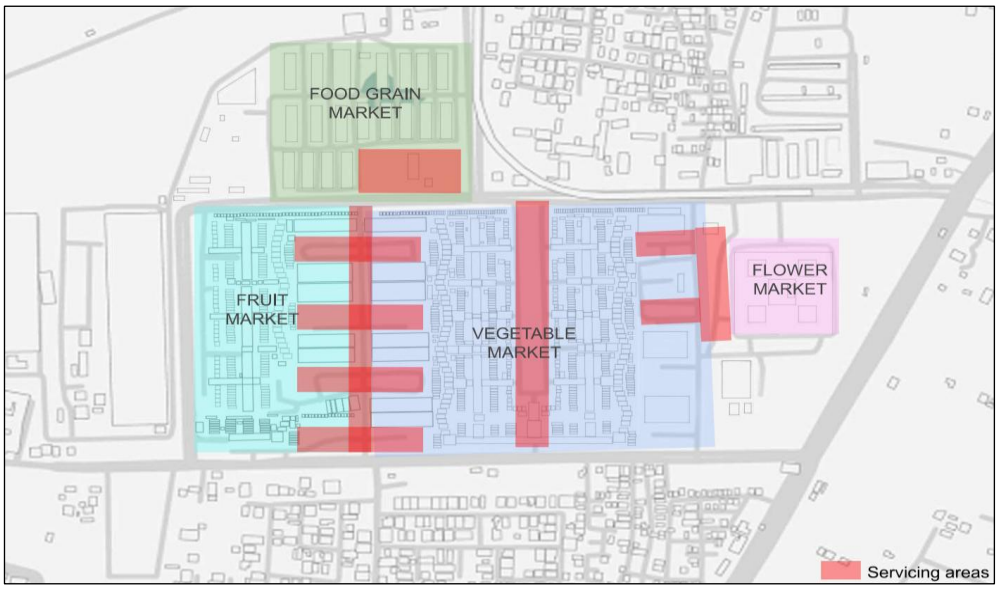

Figure 4: Servicing Areas of the Wholesale Market Complex

Food Supply and Distribution Chain of Markets

The study's wholesale market's food supply and distribution chain are taken up in four legs. The first leg is the supply of goods from the farmers in remote states to agents and auctioneers who use mini trucks, bullock carts, bicycles, tricycles, motorcycles, and head carrying to get their goods delivered to their locations. The second leg of the process is where the goods are collectively transported using unconditioned trucks and farm tractors to deliver the goods to the wholesalers from the market. These wholesalers then sell it to cart vendors and traditional retailers who use mini trucks, motorcycles, bicycles, tricycles, and pushcarts to get delivered to the neighboring shops. The goods then reach the customers who visit these neighboring shops to take these goods home in their private vehicles.

The Wholesale Market During Pandemic Diseases

This infamous market being studied has had around 3,000 cases. About 35% of pandemic diseases cases reported in Tamil Nadu are speculated to have been contributed by this wholesale market. The virus outbreak in the wholesale market complex forced public authorities to suspend all kinds of activities at the market complex despite higher authorities. But the market associations advocate that the market be kept open with preventive methods to avoid loss of livelihood and interruptions in food supply chains. The food distribution chain used to experience the wholesalers from the market selling their products to zonal shops, supermarkets, other shops, mobile vendors, and hawkers. With pandemic diseases spreading widely, the shuttling of people around all the units in food supply and distribution chain only increases the transmissibility of pandemic diseases. To decrease this transmission, traders from the wholesale market dealt directly with ward-wise door-to-door servicing trucks, volunteers from various containment zones, direct-to-home services, and mobile app-based services. The food supply and distribution chain stakeholders have changed since pandemic diseases. The national stakeholders were the Central Government politicians and the Farmers and Farmers Association. The regional stakeholders are the state government's politicians, the city corporation, technical bureaucracies and experts from the Market Management Committee and the city's Development Authority, the markets' Food Grain Wholesale Association, the Wholesale Vegetables Merchants Association, Agents and Auctioneers and the local stakeholders being the wholesalers, vendors, retailers and the consumers/visitors of the wholesale market. This chain was altered to decrease the transmission of pandemic diseases. Two new local stakeholders, namely the digital platforms and the mobile vendors, were added to this chain. This decreased the number of people who were exposed to the virus.

Issues and Solutions for Indian Markets

Most markets in India have faced criticisms and complaints from the various users of the wholesale market for its functioning and maintenance. A few majorly faced issues of markets in India as recorded from its user are poor drainage system, poor garbage cleaning and disposal methods, haphazard movement of pedestrians creating much chaos, encroachments of shop space into circulation space, improper storage space inside the shop, lack of drinking facilities, inadequate toilets, and dangerous electricity connections. Since the pandemic diseases, markets have become hotspots for transmitting pandemic diseases, given the vast numbers of people visiting the market regularly with no public health safety norms followed while roaming inside the wholesale market. This sprouted a few issues faced by the users of markets during pandemic diseases. People experienced a lack of space and regulation of movement for physical distancing, improper means of disposing of worn masks around the complex, no public sanitizer availability and improper hand wash facilities to maintain personal hygiene. Chaos is observed among the people in the vegetable market. The people were without proper physical distancing. This is typically the scenario of most markets in India. This proves why markets need strict reforms that can enable people to follow physical distancing without compromising on the wholesale market on which the livelihoods of people depend. Struggling with crowding and congestion bustling at the wholesale market for vegetables, fruits, flowers and foodgrain, the authorities involved evolved a plan to streamline traffic in and around the market complex. The market was compartmentalized with dedicated areas for vegetables, fruits, flowers, and food

grains. A parking facility of 40000 m^2. was proposed to cater to 550 heavy vehicles, fifty small load vehicles, seventy-five cars and 500 two-wheelers. A few solutions to decongest the wholesale market complex to enable circulation with physical distancing followed include shifting the market to two other locations. One was expected to cater to people from the Central and Southern city; The other was expected to cater to people from the northern side of the city. Both facilities were equipped with drinking water and toilets. The second solution was removing encroachments at the wholesale market complex that was initially built with about fifteen feet of uninterrupted circulation space but now experiences 4 feet or more of encroachments from traders. This, when cleared up, can aid people's movement inside the complex, adhering to physical distancing. Another solution was to keep unlicensed retailers out and develop alternate markets in other parts: Other facilities around the city could hold around 10,000 buyers a day. Splitting the market can lead to lesser congestion at the wholesale market complex. With increasing pandemic diseases cases around the world and this market in the study turning out to be a hotspot in the state, something was to be done to mitigate the spread of the virus. A decision was made to shift the whole market to two other parts of the city's suburbs. Semi wholesale vendors and food grains stayed back at the original complex. One of those shifted locations was a plot of land of twenty-five acres that was modified to accommodate 250 temporary wholesale outlets of vegetables. Unfortunately, this market became slushy with rain making entry of vehicles difficult. The other shifted location was seven acres of the local bus depot, which was transformed to accommodate 250 fruit and flower outlets. Unfortunately, this market lacked storage provision of produce and fair distribution of resources amongst vendors. This led to vendors requesting the reopening of the original location of the wholesale market. Ever since the reopening of the original location of the wholesale market, only about 40000-50000 retailers have visited every day. The fear of the transmission of the virus made people stay indoors and choose the multiple digital platforms that had started supplying groceries at their doorstep.

Considering the rate of spread of pandemic diseases and the chances of shutting down the wholesale market being close to impossible, other operational procedures were implemented that had to be adhered to for the wholesale market to function properly despite a pandemic. These include limiting the users allowed in the wholesale market. Only about one-fifth of the expected population was allowed. The exact number is set at a maximum of 10000 a day; only about 200-1900 wholesale stalls were open for buying and selling. These stalls had been zoned to function only from the vegetable market section of the wholesale market complex. All traders who use the facility were expected to undergo. Pandemic diseases testing, an upper limit of two hundred mini trucks were allowed in an hour with a maximum limit of 2000 small vehicles in a day. Entry and exit for vehicular traffic had been segregated and divided to avoid chaos and confusion. The wholesale market dedicated to retail buyers buying goods at a cheaper rate was now functioning only to attract retailers. The common public was not allowed inside the market complex.

A survey was taken up with a group of about one hundred individuals. Some of these individuals belonged to the architecture and related domains, while some belonged to the common public who had prior market experience to share. The learnings from the survey are as follows. The visiting frequencies of people have gone down phenomenally over time. The various issues contributed to this visiting frequency reduction in the wholesale market complex and pandemic diseases.

Results

From this study, the significant issues in the order of highest priority to lowest as per the survey taken from Figure 5 are as follows.

- Congestion and crowding
- Lack of space and no regulated movement with physical distancing
- Encroachments into circulation space
- Lack of drinking water facilities
- Lack of hand washing facilities

Based on the issues recorded, some interventions and solutions have been suggested by keeping the current functioning of markets in mind.

Interventions to Mitigate Pandemic Diseases in Existing Markets

Figure 6 shows the regulated pedestrian movement with dedicated lanes for buying and walking. Limiting seller spaces and opening buyer

spaces can allow better social distancing. Parallel tracks can be introduced for users to move around, reducing crowding. One row can be dedicated to the customers who are strolling around to find suitable shops or vendors and the next row towards the shops can be for people buying from shops. Halting spots can be introduced between these dedicated rows allowing physical distancing to be possible in all directions. Maintaining one-directional movement through visual indication on the floor can also help manage the crowd's movement. Market complexes can contain intermediate streets that form smaller loops in the market for pedestrian movement.

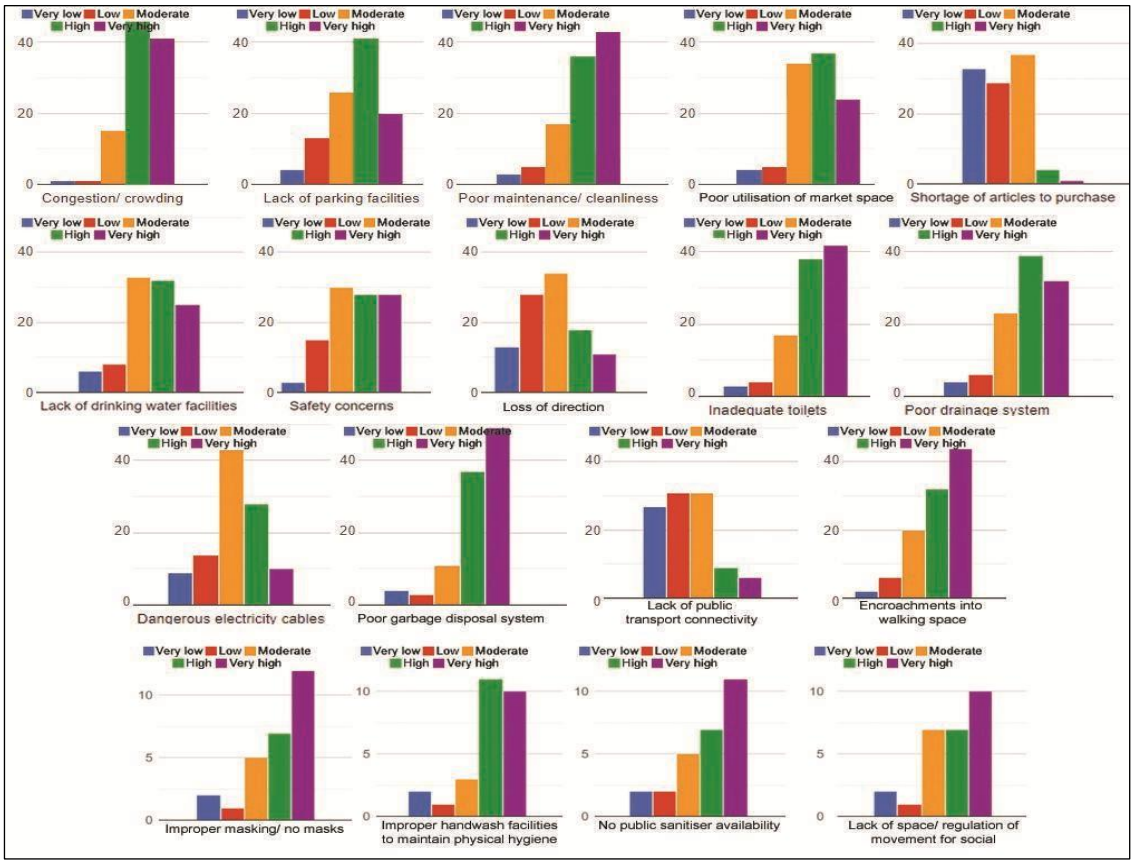

Figure 5: Issues and their Intensities of Experience (X Axis Denotes the Issue, Y Axis Denotes the Quantum of Sample Size)

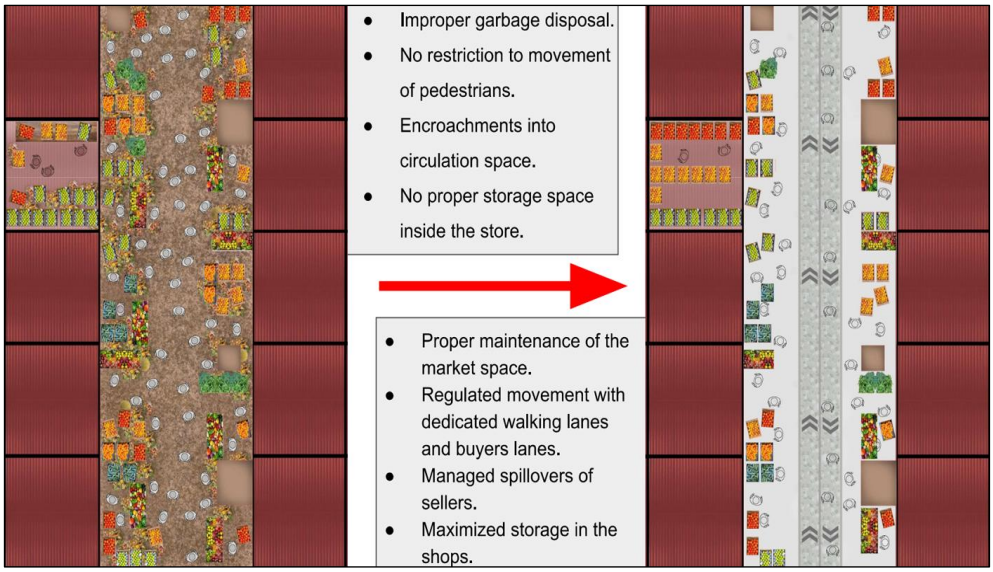

Figure 6: Qualities of Existing and Proposed Markets

Regulated vehicular movement with one-way traffic throughout the market, as shown in Figure 7. Can be useful. The circulation around the market can be unidirectional with loops through dedicated vegetable and fruit market sections for regulated movement of vehicles. This unidirectional movement inside the market ensures orderly movement and easy management of people in the wholesale market. Parking spots can be provided for every section of the wholesale market complex along its abutting road. This car park should be numbered and orderly. This reduces the threat to the safety of vehicles.

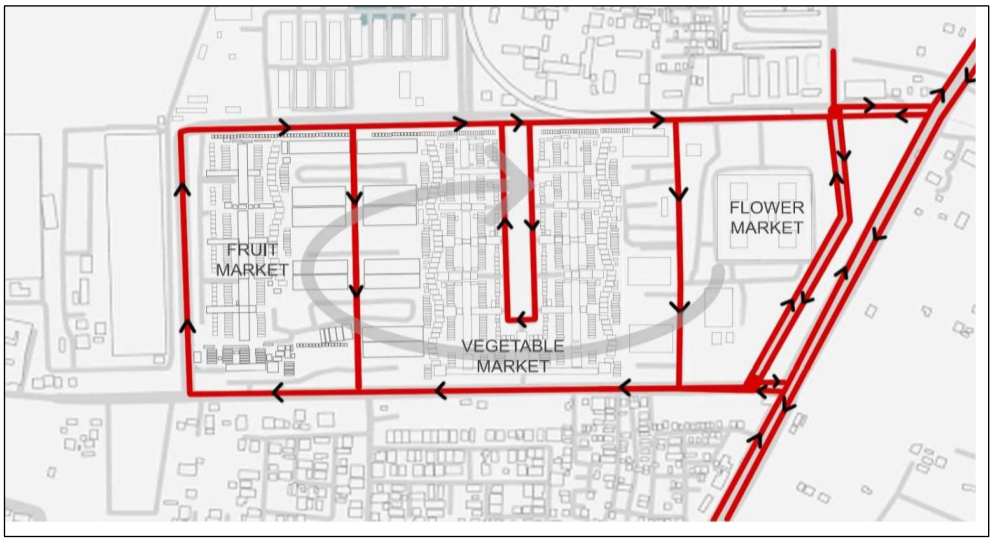

Figure 7: Proposed Internal Circulation Loop of the Existing Market

Restructuring and redesigning existing markets to accommodate the rising health norms and concerns due to the pandemic is ideal for the market studied in this research. Digital markets, mobile markets and private vendors with home delivery have been on the rise and promise a remarkably successful future for retailing, especially after the pandemic. People prefer to get their groceries and other commodities delivered at their doorstep than go in person to a crowded public place with customers coming in and going out. This also reduces the spread of pandemic diseases. Physical distancing norms have proven to fail in such situations as people overrule safety restrictions to get their work done. Despite the difficulty of the pandemic, rotational turns in buying supplies for two or more families could be possible. A few families could take turns visiting the market to buy commodities collectively for those families. This ensures that fewer people visit the market at any given point. Shutting down the market is the last resort. It is expected to be highly unsuccessful as the livelihoods of people who work in or for the market depend on the market. Without this source of income, functioning their lives is almost impossible.

Interventions and Recommendations to Prevent a Pandemic in Future Markets

Wholesale distribution could be decentralized by dividing and dispersing it across the city, thereby alleviating traffic congestion. The European government has introduced a new concept called "social bubbles" between households, allowing smaller groups to interact, distinguishing between a person's private and social circles. This measure promotes better mental well-being by offering a smaller yet vibrant social life. Similarly, markets could be subdivided into smaller units to facilitate safer interactions among people. Unused spaces such as parking lots, left idle due to the pandemic, could be repurposed as smaller markets. Although previous attempts at dividing markets were partially unsuccessful, this approach could succeed if coordinated with the city's growth and accessibility plans. All smaller markets should have equitable access to facilities, ensuring equal opportunities for traders in all sectors.

Discussion

Implementing neighborhood markets spanning a couple of streets with lower foot traffic could foster community cohesion, with residents becoming familiar with one another and their daily routines. This approach promotes socialization while

adhering to safety protocols. Terrace gardening initiatives could be explored to cater to households in the vicinity, reducing the need for residents to travel to unfamiliar locations and purchase from strangers, thereby enhancing safety. Pandemic diseases have presented numerous challenges for communities. This research focuses on the difficulties encountered by patrons of a bustling market in Tamil Nadu. The study concludes that the regular operation of markets has been significantly disrupted due to pandemic diseases. It highlights various issues faced by individuals in markets, such as congestion, overcrowding, insufficient space for maintaining social distancing, inadequate management, and maintenance. Drawing from responses collected through a survey of one hundred individuals from diverse backgrounds, the research identifies various strategies to enhance the usability and comfort of the market.

Architectural interventions to prevent virus transmission in existing markets are as follows.

- Regulated movement of pedestrians with dedicated walking and buying spaces. Proper maintenance of market spaces.
- Management of encroachments and spillover of sellers.
- Maximized storage inside the shops to avoid storage outside in the circulation space. Regulated vehicular movement around the market by enforcing one-directional movement forming loops around the market.

Non-architectural interventions to prevent virus transmission in existing markets are as follows.

- Encouraging mobile vendors, digital markets, and private vendors to reduce congestion. People take rotational turns in buying groceries for a few families.
- Case studies based on pandemic diseases can be studied as a lesson to prevent future. pandemics. Today's interventions become outdated the next day with every day passing by. These suggested interventions are for the issues faced today in existing markets.

Architectural interventions to prevent the virus for future market planning are as follows.

- Utilization of parking lots and other redundant spaces for building a smaller market, attracting a smaller population.
- Splitting the main market into submarkets and segregating them as wholesale and retail markets separately.
- Increasing the number of neighborhood markets.

Non-architectural interventions to prevent the virus for future planning of markets are as follows.

- Decentralization of markets and spreading it all around the city.
- Encouraging terrace gardening to reduce congestion of traffic for groceries in markets.

Conclusion

As people and the pandemic evolve over time, interventions must also adapt. This research has the potential to inform future responses to pandemics, improving our ability to manage them effectively. Given the ongoing nature of pandemic diseases like coronavirus, new discoveries are made daily, laying the groundwork for future studies that can yield further insights. Additionally, studying pandemic diseases as case studies can help in preventing future outbreaks. In Market redesign processes—such as spatial planning and adaptive design strategies has to be employed to mitigate the pandemic's effects on the Indian market and the role of Architects and planners to create flexible, resilient market spaces that respond to changing market demands. This provides a more comprehensive understanding of the relationship between design interventions and market resilience. strategic urban planning, spatial reconfiguration, and adaptive design interventions act as critical tools in mitigating the adverse effects on the Indian market. It's important to recognize that interventions tailored for today's challenges in existing markets may become outdated rapidly. Therefore, it's crucial to continually modify or update these interventions as people, the world, and the pandemic continue to change. This research holds significant promise for the future, as a better understanding of the current pandemic can enhance our preparedness for future pandemics in the evolving global landscape.

Abbreviation

Nil.

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Author contributions

Mahima Muraliram: Conceptualization, Methodology, Formal analysis, Investigation,

Writing -Original draft, Radhakrishnan Shanthi Priya: Conceptualization, Methodology, Investigation, Writing-Original draft, Prashanthini Rajagopal: Methodology, Investigation, Writing-Original draft, Chandramouli Pradeepa: review & editing. Ramalingam Senthil: Methodology, Validation, Writing–review and editing.

Conflict of interest

The authors declare that there is no conflict of interest.

Ethics approval

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References

1. Nicola M, Alsafi Z, Sohrabi C, Kerwan A, Al-Jabir A, Iosifidis C, Agha M, Agha R. The socio-economic implications of the coronavirus pandemic (COVID-19): A review. Int J Surg. 2020;78:185-193.
2. Florida R, Rodríguez-Pose A, Storper M. Critical Commentary: Cities in a post-COVID world. Urban Stud. 2023;60(8):1509-1531.
3. Mitra R, Moore SA, Gillespie M, Faulkner G, Vanderloo LM, Chulak-Bozzer T, Rhodes RE, Brussoni M, Tremblay MS. Healthy Movement Behaviours in Children and Youth during the COVID-19 Pandemic: Exploring the Role of the Neighbourhood Environment. Health Place. 2020;65:102418.
4. Ahsan MM. Strategic Decisions on Urban Built Environment to Pandemics in Turkey: Lessons from Covid-19. J Urban Manag. 2020;9(3):281–285.
5. Askarizad R and Jinliao H. Post-Pandemic Urban Design: The Equilibrium between Social Distancing and Social Interactions within the Built Environment. Cities. 2022; 124:103618.
6. Megahed NA and Ehab MG. Antivirus-Built Environment: Lessons Learned from Covid-19 Pandemic. Sustain Cities Soc. 2020; 61:102350.
7. Keenan JM. Covid, Resilience, and the Built Environment. Environ Syst Decis. 2020; 40(2):216–221.
8. Rojas-Rueda D and Emily M-Z. Built Environment, Transport, and Covid-19: A Review. Curr Environ Health Rep. 2021;8(2):138–145.
9. Mouratidis K and Athena Y. Covid-19 and Urban Planning: Built Environment, Health, and Well-Being in Greek Cities before and during the Pandemic. Cities. 2022;121:103491.
10. Gaisie E, Oppong-Yeboah NY, Cobbinah PB. Geographies of Infections: Built Environment and Covid-19 Pandemic in Metropolitan Melbourne. Sustain Cities Soc. 2022;81:103838.
11. Pinheiro MD, Nuno CL. Covid-19 Could Leverage a Sustainable Built Environment. Sustainability. 2020;12(14):5863.
12. Sarkar C and Chris W. Urban Environments and Human Health: Current Trends and Future Directions. Curr Opin Env Sust. 2017;25:33–44.
13. Frumkin H. Covid-19, the Built Environment, and Health. Environ Health Perspect. 2021; 129(7):075001.
14. Gerritsen S, Egli V, Roy R, Haszard J, Backer CD, Teunissen, *et al*. Seven weeks of home-cooked meals: changes to New Zealanders' grocery shopping, cooking and eating during the COVID-19 lockdown. J Roy Soc New Zeal. 2020; 51(sup1):S4–S22.
15. Ying F and Neave OC. Modelling Covid-19 Transmission in Supermarkets Using an Agent-Based Model. Plos One. 2021;16(4):02498221.
16. Grashuis J, Skevas T, Segovia MS. Grocery Shopping Preferences during the COVID-19 Pandemic. Sustainability. 2020;12(13):5369.
17. Rodgers RF, Lombardo C, Cerolini S, Franko DL, Omori M, Linardon J, Guillaume S, Fischer L, Tyszkiewicz MF. "Waste not and stay at home" evidence of decreased food waste during the COVID-19 pandemic from the U.S. and Italy. Appetite. 2021;160:105110.
18. Shamim K, Ahmad S, Alam MA. Covid -19 Health Safety Practices: Influence on Grocery Shopping Behavior. J Public Aff. 2021;21(4):e2624.
19. Power M, Doherty B, Pybus KJ, Pickett KE. How COVID-19 has exposed inequalities in the UK food system: the case of UK food and poverty. Emerald Open Res. 2023; 1(10). https://doi.org/10.1108/EOR-10-2023-0003
20. Çakır M, Li Q, Yang X. COVID-19 and fresh produce markets in the United States and China. Applied Economic Perspectives and Policy. 2021;43(1):341-54.
21. Li J, Hallsworth AG, Coca-Stefaniak JA. Changing Grocery Shopping Behaviours among Chinese Consumers at the Outset of the Covid-19 Outbreak. Tijdschrift Voor Economische En Sociale Geografie. 2020;111(3):574–583.
22. Eriksson N and Minna S. Online Grocery Shoppers Due to the COVID-19 Pandemic - an Analysis of Demographic and Household Characteristics. Procedia Comput Sci. 2022;196:93–100.
23. Che J, Lee JS, Kim S. How has COVID-19 impacted the economic resilience of retail clusters?: Examining the difference between neighborhood-level and district-level retail clusters. Cities.2023;140:104457.
24. Wanniarachchige MK. Effects of macroeconomic disturbances on the banking sector and equity markets in Sri Lanka: with special reference to civil war and COVID-19 pandemic. Int J Innov Sustain Dev. 2023;18(1-2):71–90.
25. https://www.cmdachennai.gov.in