

Article

# Promoting Social Equity and Building Resilience through Value-Inclusive Design

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**Abstract:** Urban design and architecture have inadvertently contributed to the bifurcation of societies divided into haves and have-nots, thus undermining social equity, restricting opportunity, and resulting in poverty next to overabundance and waste. Global population growth and urban migration pressures compound the problem. The call for social equity and justice is, therefore, urgent from a social perspective and an environmental one. This study explores a concept we call 'value-inclusive design' and its potential for transformation toward 'judicial equity'. Our value-inclusive design method proposes neighborhood interactions and co-design as a way to create welcoming spaces that preserve natural resources, support economic sustainability, and improve architectural design to foster health and wellbeing for people and the environment. This article discusses the potential of our value-inclusive design model in contributing to judicial equity by applying it to an international student competition called the 'Global Greenhouse Challenge #3', launched by Wageningen University and Research. By viewing the results of the Global Greenhouse challenge through the lens of value-inclusive design, we find that the model has merit and provides a useful theoretical framework for promoting social equity in urban planning and design. We conclude that by applying the model, its constructs can enhance design approaches that seek to improve the quality of life of residents while building resilience and shifting agency through co-design. The model can, thus, be a means for driving continuous improvement in architectural design and applying it in an educational setting such as the Global Greenhouse Challenge student competition.

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## 1. Background

Urban design and architecture have inadvertently contributed to the bifurcation of societies into haves that invest in designing, developing, and building their environment and have-nots that must accept the outcomes ushered in by others, which contributes to social inequity. Standard design approaches, thus, restrict opportunities for some, while others indulge in overabundance and waste. Global population growth and urban migration pressures compound the problem. Therefore, the call for social equity and justice is urgent from both a social perspective and an environmental one. Design can foster equity and justice, build resilience, and ameliorate the current bifurcation. Yet, in order to do so successfully, architects, planners, designers, scientists, and other stakeholders must promote a green urbanism to create sustainable and resilient spaces that improve community health and wellbeing [1]. Integral to this kind of green urbanism is the integration of food production into the urban-scape. Communities and neighborhoods within growing cities can create sustainable food systems, mitigate poverty, and increase resilience [2]. To develop a comprehensive model for social equity and justice, this study proposes a new urban planning and architecture model using value-inclusive design (VID). In this approach, community interaction is solicited to co-create inclusive environments that seek

to conserve natural resources, strengthen sustainable economic development, and enhance green architecture. This approach incorporates food production with the goals of promoting health and wellbeing. VID builds on the urban design and planning framework of Meerow et al. [2] which incorporates recognitional, procedural, and distributional equity, whereby healthy urbanism is described as ‘inclusive, equitable, and sustainable’. VID also builds on the values of empathy, placement, accessibility, and identity developed by Stuiver et al. [3,4]. It aims to outline equitable approaches for promoting social equity and building urban resilience by engaging local stakeholders. This article suggests that, in doing so, value-inclusive design also improves educational outcomes, which is a prerequisite for improving more equitable design outcomes in the future. The current literature discusses parallels to value-based education for inclusion. The VID concept builds on these value-based concepts as it applies to architectural education and community resilience.

To test its suitability for improved educational outcomes that advance goals of ‘social equity’ and ‘resilience’, we apply our model of value-inclusive design to an international student competition. This competition was launched by Wageningen University and Research’s (WUR), a university with a focus on agriculture and sustainability in the Netherlands called the Global Greenhouse Challenge. It engaged international teams of students in designing an urban greenhouse for a low-income, disinvested neighborhood in Washington DC. The neighborhood houses one of four urban food hub locations of the College of Agriculture, Urban Sustainability, and Environmental Sciences (CAUSES) of the University of the District of Columbia called the East Capitol Urban Farm [5]. Student teams were asked to design an urban greenhouse that meaningfully improves the quality of life of residents while meeting financial and environmental sustainability objectives. At the outset of the Urban Greenhouse Challenge, an instructive online lecture on inclusive design through co-creation was presented to the competing student teams. This introductory lecture was important in clarifying for the student teams how design can be used for transformation. Proposals with designs representing design indicators for the value of ‘transformation’ and considering ‘judicial equity’ as a social equity dimension were judged superior to other submissions. In analyzing the designs submitted by 20 teams, we found that VID criteria were clearly observable in guiding the development of socially equitable and sustainable designs that advance human health and dignity, as well as form the basis for improved quality of life outcomes. The next section briefly discusses frameworks that influenced the concept of value-inclusive design before turning to the application of the concept to the designs submitted by the student teams who competed in the 2022–23 Urban Greenhouse Challenge.

### *1.1. Definitions for Wellbeing in Urban Architecture and the Dimensions of Inclusive Design*

Goals of green design and social inclusion are values underpinning any planning and design process that can be considered inclusive design [1–6]. The model depicted in Figure 1 shows how the three facets of social equity intersect. The case study process underlying our assessment of the effectiveness of value-inclusive design consists of a two-step process for examining the model and its constructs: step one consists of the construct validation similar to hypothesis-testing in research; step two consists of an in-depth limited-scope study [7–9]. Applying the case study material from the Global Greenhouse Challenge to Meerow’s model for social equity in the context of urban resilience planning yielded four emerging values —Identity, Placement, Accessibility, and Empathy [10]. These four core values were presented in a workshop offered to student teams competing in the Global Greenhouse Challenge [11]. From this framework and resulting values, an inclusive design canvas with design principles was prepared that planners, designers, and architects can adopt as their own design approaches in order to qualify as inclusive green design practices.

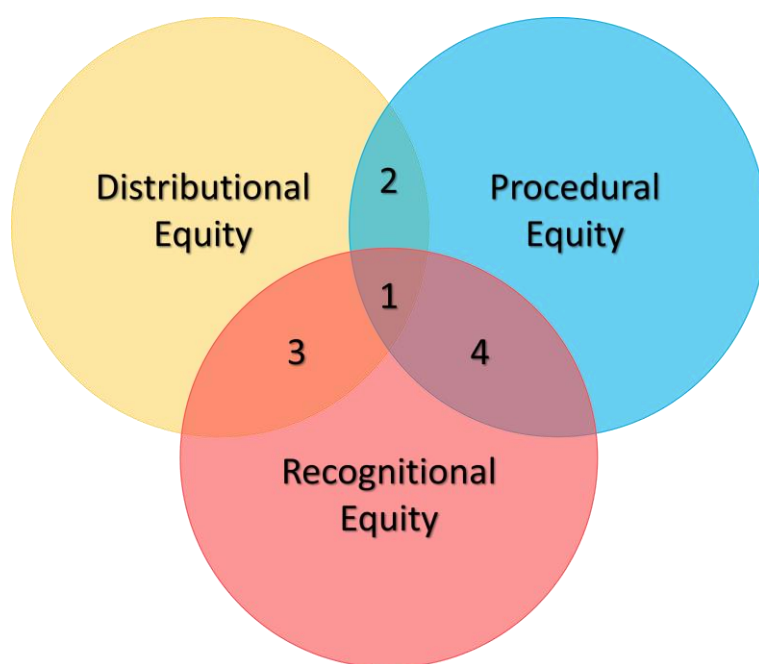
(1) Identity. An individual’s identity is determined by the values of human necessities and dignity, and by their acceptance of different lifestyles. It involves understanding human histories, skills, and physical, mental, social, and spiritual health needs. Identity

allows people to express themselves without fear of judgment. Habermas advanced a similar definition with his term “Lebenswelt”, the life world of individuals [12].

(2) Placement. This value is associated with overcoming distrust and anonymity in the public and private spheres of buildings and private and public areas as the basis of healthy living. Placement looks at the magnitude of relationships and explores solutions by applying building blocks for improved health outcomes and quality of life.

(3) Accessibility. For cities to be accessible, humans and nonhumans must have access. As a result, it reflects the scale of the urban environment. The availability of accessible architectural, landscape, and interior design resources promotes equitable distribution of resources.

(4) Empathy. Figure 1 highlights empathy as the central value of wellbeing in urban architecture. Embracing the needs of both human and nonhuman actors (Latour) [13] is the basis of the design. Empathy acknowledges the need for co-existence for all creatures in the city as the basis for truly co-creating public environments [1].



**Figure 1.** Model for inclusive green design. Four values that intersect with Meerow’s model for social equity (2019): 1 = empathy; 2 = placement; 3 = accessibility; 4 = identity. This figure was developed by M. Stuiver, S. Sarabi, M. Takken, L. Rondard, R. Valkenburg, and T. Yuksel for “<https://ewuu.nl> (accessed online 22 January 2023)” [10].

The systematic bibliometric analysis and literature review presented in The International Journal of Sustainable Development and World Ecology presented further details of this high-level framework for inclusion [14]. The framework suggests mapping the critical dimensions of an inclusive approach, which incorporates economic, social, political, spatial, and environmental aspects. When these dimensions are combined, they create equitable and inclusive spaces, enhancing wellness and quality of life. As the social scientists Ora and Isaac Prillettensky stated, ‘those who live in more egalitarian countries live longer and achieve better outcomes’ [15]. Designs are based on assumptions about human behavior and the space requirements of groups, families, and individuals [16]. These theories, taught in architecture schools, were created through actual research into how people utilize buildings and public spaces, as well as historical studies of different building types and layouts. Additionally, architects create hypotheses on the basis of their observations of the world and how people interact [16]. These notions result from design thinking, user-centered design, and co-creation methodologies. All of these support good health,

happiness, and a sense of community to raise living standards in neighborhoods, cities, and nations.

This paper proposes two concepts of the VID that enhance the framework summarized in Figure 1, namely, ‘transformation’ and ‘judicial equity’. Both are generated by social capital.

### *1.2. Social Capital Link to Wellbeing and Social Impact*

Social networks within a community give rise to social capital [15]. It appears because our networks enable us to complete tasks we cannot complete on our own, such as seeking employment, providing care for a loved one with an ailment, or simply quickly disseminating knowledge. They provide us with materials that we might not have access to on our own. Social networks have advantages for the community and each of us individually. They ‘foster trust and reciprocity, facilitate the flow of generosity and altruism, contribute to lower crime rates, advance better public health, and support reduced political corruption’, as noted by Nicholas Christakis [17]. Infrastructure can have an essential impact on the growth of social networks and the ensuing values of civic engagement and community involvement. For instance, public gathering places such as libraries, parks, and community centers might support the growth of social networks [14]. Strongly individualist designs, in contrast, would obstruct the development of social capital. John Helliwell and Robert Putnam, authors of *The Social Context of Wellbeing*, examined social capital’s direct relationship to what they refer to as ‘subjective wellbeing’ through a variety of avenues [18,19]:

“New research supports the notion that social capital influences subjective wellbeing through a variety of independent pathways and manifestations. Marriage and family bonds, ties to friends and neighbors, workplace ties, civic participation (both personally and collectively), trustworthiness, and confidence all appear independently and robustly connected to happiness and life satisfaction, both directly and through their effects on health.”

As a result, active social networks are essential to both communal wellbeing and personal wellbeing. Furthermore, it is crucial that everyone in the neighborhood has access to those networks. Infrastructure, physical places, and services that cater to the community’s requirements are additional crucial components of the community that influence individual wellbeing [15]. The VID framework takes into consideration the value of community space, how the term ‘commons’ is used, and how value is or can be promoted utilizing public vs. private space for the advancement of economic and social development in communities. Because of social capital, wellbeing is regarded as a measure of the worth of ‘transformation’. The more people perceive their social environment as hostile, the more unequal the nation is [15]. This prevents the development of larger social networks and public confidence. People in unequal societies not only profit less from social networks, but they also have less access to essential resources such as decent housing, quality healthcare, and quality education. They have less or no opportunities to find fulfilling work. They are more prone to be victims of crime and to reside in places with pollution or other health dangers. Additionally, kids are constantly exposed to the elevated stress caused by a hostile environment in both big and minor ways [15]. Social capital produces equality, viewed as a sign of ‘judicial equity’. According to O’Hara’s analysis of these disparities, specific individuals of society bear heavier sink capacity than others and are disproportionately exposed to the adverse effects of tiredness, stress, and pollution [20]. Following 25 years of research, British scientist Michael Marmot concluded that ‘the chances you have for full social involvement and participation are vital for health, wellbeing, and lifespan’ [15]:

“Responding to the needs of the neighborhood community to encourage an equitable division of rewards and responsibilities, encouraging underprivileged groups to engage in fair commerce, respect for human rights, and other equity-

related behaviors. Community wellbeing is the collection of social, economic, environmental, cultural, and political factors that people and their communities believe are necessary for them to thrive and reach their full potential. Research shows that individual empowerment is linked to overall community wellbeing, especially when people have a say in how policies are implemented. Individual participation fosters teamwork and a sense of ownership, which raises community satisfaction levels and improves both individual and group wellbeing.”

### *1.3. Framework for Inclusive Design and Economic Development*

The research’s proposed framework for inclusive design strengthens the three social justice pillars listed in Meerow’s tripartite framework for social justice [2]. It became apparent that the prevalent conceptions of equity are often linked to a distributional orientation, with less emphasis on the recognitional and procedural aspects, when this framework was initially employed to analyze how much cities focus on equity. Here, the distinction between equity and equality is significant [21,22]. While equity refers to a fair conclusion that need not be equal, equality refers to equal measures regardless of the outcome. For instance, using health as an example, an equity approach would encourage measures such as green spaces, healthcare, and social work in underprivileged rather than privileged neighborhoods. In contrast, an equality approach would offer all neighborhoods the same number of measures [23]. An approach that includes equity and equality fosters wellbeing and builds social capital. This regenerates underserved communities and increases proprietary engagement within communities to improve the quality of life. Economic development promotes opportunities for fair distribution of capital, labor, and resources.

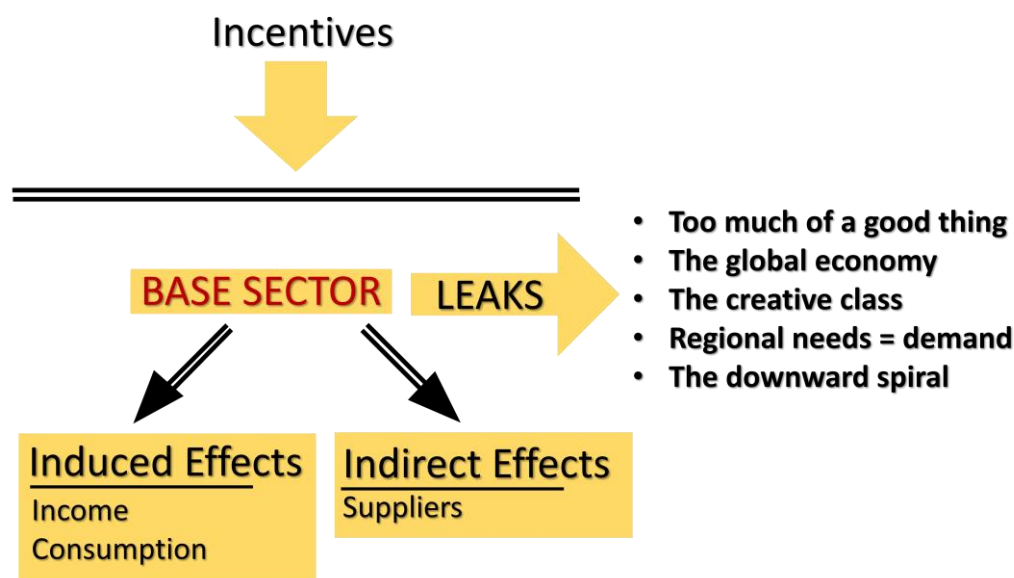
### *1.4. The Commons*

The infrastructure (physical places and services which serve the community’s requirements) is another essential aspect of the community influencing individual wellbeing [15]. All members of an equal community share the entire advantages of society. Everyone is given fair and reasonable treatment in such a community and can actively engage in social, cultural, and economic life. Infrastructure that may enhance personal wellness in several ways, such as through addressing fundamental human needs, fostering social capital, and facilitating good lifestyle decisions. Lack of equal access to the same number and quality of community resources and services is one of the traits of systemic racism [15]. Everyone in the community needs access to these resources, and there is a conscious commitment to guarantee equality for all marginalized groups. More people now perceive their social environment as a secure place to live and work. This encourages the development of more extensive social networks and community trust. Social networks provide advantages such as access to essential resources including decent housing, healthcare, and education. Additionally, this creates new chances for employment and business, which lowers crime, lowers health hazards, and boosts long-term returns on investment. Public spaces (the commons) boost social networks and social capital through urban resilience and sustainability.

According to a Chicago study, residents in public housing who lived near trees and greenery said they knew more people, felt closer to their neighbors, cared more about supporting and helping one another, and felt more a part of their community than those who lived in buildings without trees [24]. Public space may significantly influence the growth of social networks and subsequent values of community involvement and civic engagement. For instance, public gathering places such as libraries, parks, and community centers can support the growth of social networks. Infrastructure contributes to creating social networks that enable community members to exchange opportunities and information and offer crucial resources. The wellbeing of individuals and the community can be improved by a community that works to guarantee fair access to these resources. It can also take away obstacles to good behavior. People will, for instance, walk more in a

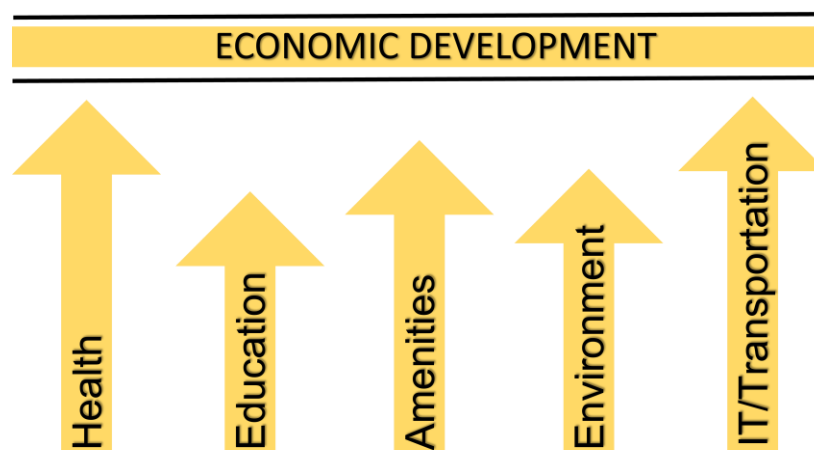
community if it seems secure for them to do so, whether through the installation of sidewalks on busy streets, improved lighting, or a neighborhood watch program. With lovely green landscapes, walking could also be more enticing [14]. Per O'Hara's five pillars of economic development, the 'commons' build participatory environments for healthy communal living and quality of life [25,26]. The 'base theory' of economic growth used to be the main concept in past economic discussions. It made the case that a region's economy will expand if its foundation sector prospers. Therefore, economic policy should concentrate on establishing a robust base sector and ensuring its success. According to the five pillars approach, successful economic development strategies today should instead concentrate on the three primary objectives:

1. Enhancing a region's capacity for economic development.
2. Enhancing a region's quality of life.
3. Fostering a diverse regional economy to avoid reliance on a single industry or business [25] (see Figure 2).



**Figure 2.** Base theory of economic development [25].

Five indicator categories can gauge a community's likelihood of long-term economic success using the five pillars model as a baseline: (1) health, (2) education, (3) environmental quality and recreation, (4) social and cultural amenities, and (5) information and transportation access [25,26]. These categories cover a variety of pertinent elements in which local stakeholders and governmental, corporate, and nonprofit organizations are interested. Therefore, the 'five pillars' categories can help these organizations work together and coordinate their development activities more effectively. By monitoring important indicators of local needs and resources, the 'five pillars of economic development' idea offers a useful, consistent, yet flexible method for assessing a region's quality of life and determining its ability to fix gaps [26]. Indicators that are considered leads, as opposed to lags, are the emphasis of the five pillars approach. In other words, it looks at markers that offer a future trajectory [25]. Figure 3 depicts this future in which social capital will increase through acceptable behaviors and equal access to resources.



**Figure 3.** The five pillars of economic development [25].

### 1.5. Design Values: Review of the Literature

This literature review provides a broad overview as it relates to ‘values’ and their impact on design, the built environment, and its agency to build resilience. This includes social equity and inclusive frameworks that lack ‘transformation’ as a social value for economic development. To start, several ‘ethics-first’ methodologies have been demonstrated in academic writing and design practice [27]. These methods frequently concentrate on detailing methods for openly infusing values into design or explaining the normative aspects of design. Although this body of literature has grown significantly over the past 20 years, two key themes—(a) designer agency, and (b) the strength of normative claims informing the design process—have not yet been systematically discussed concerning one another. In order to address this gap, the literature looked at a methodical evaluation of the most influential ethics and values in design (E + VID) methods and criticisms [26–36]. In the literature, 13 critiques and 18 various approaches were found to satisfy the review’s inclusion criteria [27–37]. A variety of opinions on normative strength were represented among the included articles, and it was found that neither the methodology nor any of the critiques pointed to a position characteristic of ‘low’ designer agency, which impacts socioeconomic factors and builds resilience in communities.

According to the research, the lack of methods with ‘low’ designer agency led to designers failing to consider essential impacts on design as potential targets for their interventions [28]. The study concluded with recommendations for future research that could shed light on methods to achieve an ethical design in information-mature societies. It makes the case that ‘meaningful’ ethical design would continue to face difficulties if the tensions caused by balancing normatively ‘strong’ future visions with restrictions placed on designer agency in corporate-driven design settings are not addressed [27]. The literature argues that moral principles and ethical issues are no longer separate from society [28]. Human values, particularly those with an ethical significance—such as the right to privacy and property, physical wellbeing, informed consent, trust, and responsibility, to mention a few—are crucial, but that does not make them any less contentious. What qualities matter? Who makes the decisions? Are values relative? Do universal ideals have varying cultural and contextual expressions? If not, how do values enter the design process? It also is evident that values might clash. Innovations in technology affect human values. However, how precisely can moral principles enter into technical conceptions? This debate over ‘who evaluates’ and ‘whose values are applied’ is similar to the lively debate about community development and the function of involvement in decision making [29].

The literature offers three categories: embodied, exogenous, and interactional stances. The embodied approach contends that designers imbue technology with their own objectives and ideals, and that this imbuing results in a system that, once developed



and put to use, prescribes specific patterns of human behavior. According to the exogenous approach, sociocultural elements that have to do with the economics, politics, racism, class, and religion have a significant impact on how a design is used. Lastly, the interactional approach asserts that, although people have a tendency to build characteristics or qualities into their communities which more easily encourages some values and hinders others, the purposeful use of such features or qualities depends on the goals of the people using them. Communities have made great strides in incorporating moral principles and ethical behavior into the design profession during the past 10 years [27,28]. The task of designing intelligently and morally to establish the necessary circumstances for humans to exist and prosper persists as the subject develops [27]. An inclusive design strategy must expand the principles of ethics and values in design for effectiveness.

Inclusive design, an ethical design technique incorporating the human ideal of inclusion, may generate economic value [28]. However, considerable research on the connection between economic value and human values in inclusive design still needs to be completed. The topic of value and values in the investigation of inclusive design is the main subject of this literature survey. The research shows how evolving views on inclusive design affect how people perceive value and values. The benefits of inclusive design for human values at the individual and social levels have been discussed, along with the economic benefits of inclusive design. In the literature, these contradictory talks are categorized into 'value creation' and 'value distribution', and chances for an integrated strategy that would link conversations on economic value and human values in future studies have been suggested [30].

To build inclusive designs, several layers of thought are required [31]. The relationships between layers of this framework are vital to address in accordance with a systems-based approach. Many methods for inclusive design are presented in this section, and the concerns presented here are relevant regardless of the methodological approach. Building interdisciplinary teams, involving members of a community or individuals with extensive understanding of the target community, and continuing to practice iterative design are all recommended practices for inclusive design, regardless of technique [31]. The more designers and design students can experience the world and their ideas through the eyes and skin of individuals who are older or less capable than them, the more likely they are to sympathize with and want to problem-solve for those who are less capable than themselves [32]. Inclusive design is a well-established, although yet relatively new, subject. Early pioneers laid out the subject's enormous region, and we now have strong examples of best practice, for both design and industry, as well as tools and methodologies to assist practitioners. However, there is still much work needed, as well as a great opportunity for a new generation of young and committed designers to complete the transition from the margins to the mainstream and deliver a truly inclusive and considerate environment for the predominantly urban society of the 21st century. Extending that user-centered and accessible design approach to bring comparable advantages to rural people, particularly in developing countries, is another difficulty that has yet to be addressed. It will be in the less advantaged and resourced areas that we will witness dramatic new breakthroughs in the more mature period of inclusive design that we are now approaching. Moreover, it is in these sectors that we may have the most possibilities to create inclusive and sustainable products and services [32].

According to studies, the architectural design community's acceptance of inclusive design is still fairly restricted [33]. Inclusive design integrates accessibility principles, and its expanded definition takes into account essential social and behavioral components such as physical, sensory, and cognitive demands [33]. Inclusive design has just recently begun to be considered in architectural design practice [34]. With the progression of design for disability into accessible design, as well as the increased awareness of inclusive design among architects and design professionals, governments have lately begun to enact guidelines and rules to foster the creation of more inclusive spaces [35]. However, the research shows that complete acceptance of inclusive design with an expanded idea of



inclusion, diversity, equality, and accessibility in architectural design is currently restricted. This appears to be prompted by various problems, including a misunderstanding of inclusive design owing to professional mentality, unconscious prejudice, unsubstantiated regulatory constraints, and time/cost-efficiency considerations during the building development process.

Inclusive design trails physical accessibility, yet research has found that complete acceptance of inclusive design in architectural design practice was restricted during the previous two decades, and that inclusive design is often misunderstood by architectural design professionals [34,36,37]. As a result, inequities, exclusion, and prejudice still can be seen at various levels and in various settings. Moreover, these difficulties have the ability to influence people's behavior and perceptions of society [35]. Rather than starting with relative moral norms, it is feasible to talk with people from other cultures about their values and create a 'bottom-up' or participatory framework influenced by worldwide partnerships in the field [38]. To establish a successful conservation process in our historic and vernacular built environment, cultural values must be grasped on a broader scale [39]. This observation is to propose a system that enables a mindful reflection of the cultural traits and values of the community and surroundings in one's creations. This problem is mostly related to the architecture of vernacular surroundings [40]. The proposed value-inclusive design model aims to address these issues by testing the social value of 'transformation' and construct of 'judicial equity' and its impact on community resilience. This is achieved by promoting human and moral values to increase social equity.

Similarly, Manders-Huits and Zimmer [41] first coined the term value-conscious design (VCD) to refer to a group of initiatives that promote human and moral values as an essential component of the conception, design, and development of technological artifacts and systems. The word is given additional weight in this essay, including the other projects, and introducing an ethical element. Various VCDs actively impact the design of technologies that take moral and ethical principles into account throughout conceptualization and design process. Recently, design frameworks have been created which incorporate moral and ethical intelligence into commercial and technology design environments. Two efforts incorporate ethical intelligence for technical design communities, influencing how technology is designed ethically and by values, with mixed results [41]. The paper highlights three significant obstacles to pragmatic engagement with technical design groups taking into account these failed attempts: (1) addressing conflicting values; (2) determining the role of the values advocate; (3) providing evidence to support a value framework. If one wants to be successful in pragmatically interacting with real-world business and design settings to bring moral and ethical intelligence to bear on the design of developing information and communication technologies, addressing these issues must take priority. The VID framework is a proposed catalyst for future change in design.

Value-sensitive design (VSD), a theoretically grounded approach to the design of technology that accounts for human values in a principled and comprehensive manner, has drawn the most attention for this objective in ethics and technology. More focus has been recently placed on integrating moral concepts into emergent design's conception, creation, and evolution [42–44]. According to this research, VSD is an excellent option for incorporating prescriptive considerations into the design. These approaches are assessed from conceptual, analytical, and preceptive angles. Here, the attention is on whether VSD may be used to incorporate moral ideas into technical design in a way that supports an analytical perspective on technology ethics. Although promising, VSD falls short in several ways: (1) it needs a transparent methodology for identifying stakeholders, (2) it needs to be clarified how empirical methods and conceptual research integrate within the VSD methodology, (3) it runs the risk of making a naturalistic fallacy when using empirical knowledge to implement values in design, (4) the concept of values, as well as their realization, is left undetermined, and (5) it does not include a framework for evaluating the effectiveness of the approach [43,44]. For the prescriptive evaluation of technology, a justified ethical guiding principle is required. The value-inclusive design model surpasses

prescriptive principles of VSD for more equitable and inclusive approaches that foster co-creation and co-design.

Additionally, the examination of VSD as the top contender for implementing moral principles in design [42–44] leads to the requirements for an adequate strategy or methodology. Value-inclusive design has nothing to do with these claims. Values may be ingrained in technical systems and objects (artifacts), according to a number of academic approaches to the study of technology, society, and humanity [45,46]. Designers and producers are compelled by pragmatic pressure to consciously include values into the criteria according to which the perfection of technology assesses this descriptive stance. This is possible by changing the emphasis from description to design. The design of systems must take into account both the first and the second values if the ideal world is one in which technologies support the fundamental social, moral, and political values that societies and their citizens uphold, as well as the instrumental values of functional efficiency, safety, reliability, and ease of use. These values may include autonomy, nourishment, privacy, security, companionship, comfort, justice, and enlightenment in technologically sophisticated liberal democracies. Generally, supporting and committing to these ideas is one thing, but putting them into reality through the design of technological systems, which may be viewed as political or moral activism, is not straightforward [45,46]. Companies, users, and society all benefit from design [47]. Value statements indicate whether a particular product or situation is excellent or valuable in a particular way. When items or situations are unpleasant, they frequently lack worth and could have a negative value. Value statements should be separate from preference statements or declarations of personal preferences. Probing something's value or asserting its existence entails saying it is essential and that it is or ought to be helpful to others. Evaluative statements evaluate something or a state of affairs in terms of value [47]. These statements discuss the value of things or states of affairs. Figure 4 summarizes the links among inclusive design features.



**Figure 4.** Inclusive design dimensions that promote social equity and inclusivity [48].

### 1.6. Social Values and their Impact on Design

In his 1977 book 'A pattern language on urban planning', Christopher Alexander stated that 'towns and buildings will not be able to come alive unless all members of society create them and create these structures within a common pattern language' [49].

‘Society struggles to comprehend the value of culture because it cannot measure in terms of a number; rather, its worth is determined by the significance that individuals and communities place on it’, according to John Young [50]. The culture in development choices is crucial for social sustainability, particularly in inner cities susceptible to gentrification. On the basis of architectural choices that are socially fair, cities and urban areas either separate or unite their inhabitants. According to E. Harris in personal correspondence, ‘we must appreciate the importance of the opportunity to transform our local communities into the green cities of today through co-creation and value-inclusive design approaches with an empathic lens and perspective for wellbeing’ [1]. It might be challenging to select the proper measurements [51]. The objective is to establish key performance indicators (KPIs) that properly and meaningfully assess progress toward the anticipated project outcomes. KPIs also must be directly tied to the main objectives [51]. It might be challenging to determine whether a social innovation is practical without a measurement method [52].

### *1.7. Value-Inclusive Design for Socially Equitable Communities: A New Model for Promoting Opportunity through Recognition, Health, and Wellbeing, and Equitable Distribution of Resources*

In recent years, there have been conversations about mental health and wellbeing that have spread throughout the field of architecture. As a response, architects have conducted evidence-based research to support their ideas. This includes research in environmental psychology that demonstrates the behavioral effects of nature-based design and offers essential and well-documented contributions to architecture [53]. In order to comprehend learning settings and to support the best solutions for complicated problems, the programmatic design underwent a thorough examination. This field of knowledge enables architects to make well-informed choices on the materials, colors, lighting, and several other components that go into the design of a place. It is possible to produce a human-centered design by fusing social science knowledge with architecture [53]. Architecture contributes to health and wellbeing, enriches life artistically and spiritually, creates economic possibilities, and leaves behind a legacy embodying and reflecting culture and customs. It promotes all forms of human activity and gives a feeling of location [54]. It is a mutually beneficial process. Infrastructure not only provides necessary resources but also aids in developing social networks enabling community members to exchange knowledge and opportunities. The wellbeing of individuals and the community as a whole promotes a community that works to guarantee equal access to these resources [14].

### *1.8. Food Systems*

Conflicts, pandemics, and natural disasters have all shown how urgently we need more equitable, sustainable, and resilient food systems with food produced close to where it will be consumed [55,56]. Urban farms are potential game changers in countering these challenges. If designed with multiple purposes in mind, urban farming can improve the livelihood and health of urban dwellers, reduce the ecological footprint of food production, and improve the living environment in our cities. Research into new ways of food production is essential, and systems such as indoor farming, urban greenhouses, and urban food hubs can help counter the many issues cities face in feeding their urban dwellers. Simultaneously, ensuring equitable access to food and creating a convincing business model supporting underserved communities’ livelihoods is not easy. However, it is a prerequisite to contributing to an equitable, healthy, and sustainable future. Exploring the potential of new food systems and concepts, such as urban food hubs, will result in long-term solutions that embrace the inclusive-design ideology [56–58]. These are the backdrops for the Global Greenhouse Challenge held in 2021–2022. As an extension of the previously launched competition by Wageningen University and Research, this third competition brought an explicit focus on social equity into the competition.

### *1.9. Applying Inclusive Design Values: The Intersection of Design (Translating Theory to Practice)*

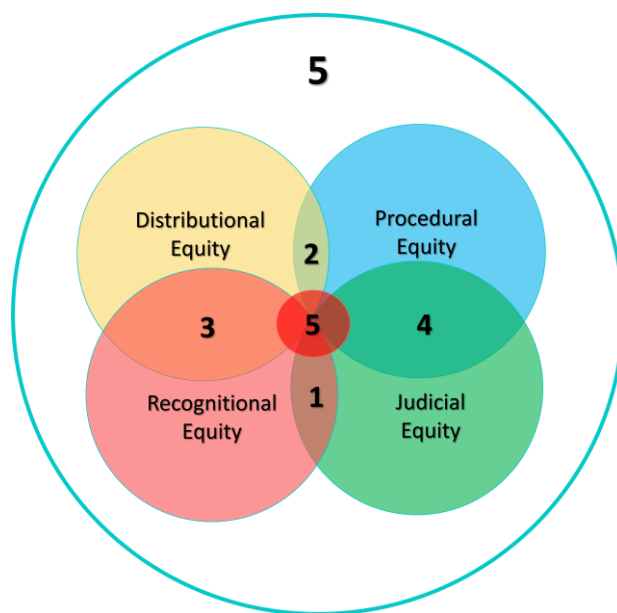
The VID framework expounds value principles that translate theory into practice. These principles, illustrated in a design canvas in Section 1.13, address a broad range of research-based knowledge fields and call for the capacity to apply theory to practice. In collaborative design processes, this study evaluates the adoption of values influencing social equity and how these values translate to socially equitable communities that promote opportunity. VID fosters socially equitable communities by intersecting design principles through the value of ‘transformation’ and the dimension of ‘judicial equity’. The East Capitol Urban Farm at the University of the District of Columbia is the VID model’s testing ground for problem-based projects. This urban farm utilizes The University of the District of Columbia (UDC) Urban Food Hubs Models and its College of Agriculture, Urban Sustainability, and Environmental Sciences (CAUSES) programs of multidisciplinary studies dedicated to serving the needs of the community in Washington, DC. It became the location for participants in the Urban Greenhouse Challenge #3, the Social Edition. The intention in choosing this location was to offer a specific site to teach socially equitable values and develop co-created solutions within a community. In order to plan the urban extensions around such areas, architects, planners, urban designers, politicians, and administrative authorities must agree. Rather than just considering metropolitan nodal development, inclusive development is necessary because these areas will eventually join metropolises, making cohesive development desirable [58]. Thus, in this challenge, VID meets today’s urgent call for social equity and the need for urban vibrancy and health.

Cities evolve and grow due to economic, social, and political forces. However, the most significant impact of these factors is on the growth and development of the country’s residents and communities, which have seen significant reductions in money, labor, and resources to promote socially equal communities. The inclusive design framework tackles these socioeconomic gaps. It encourages student-designed responses to architectural issues that are socially just and enhances people’s health and the general wellbeing of communities. VID fosters economic opportunity, social fairness, and sustainable ecosystems. Section 1.13 shows a framework for inclusion with ‘judicial equity’. Integrating food production with the development of the built environment is readily envisioned as a step toward positive and socially fair urbanization and poverty alleviation through economic opportunity. Given that rural communities may have more access to land and other resources due to the availability and affordability of land, the development of cities is more difficult.

### *1.10. Social Equity and Inclusion*

The value-inclusive design model fosters transactions that translate into social equity. The VID model takes an ‘inter-transformational’ position; design, context, and interaction result in equal distribution of social equity in inclusive design thinking and practices. All members of an equal community share the full advantages of society. Everyone is given fair and reasonable treatment in such a community, and everyone can actively engage in social, cultural, and economic life. Figure 5 proposes five values, identity, placement, accessibility, empathy, and ‘transformation’, as well as the fourth dimension of social equity, ‘judicial equity’; these values underscore social equity and inclusion as defined by the research:

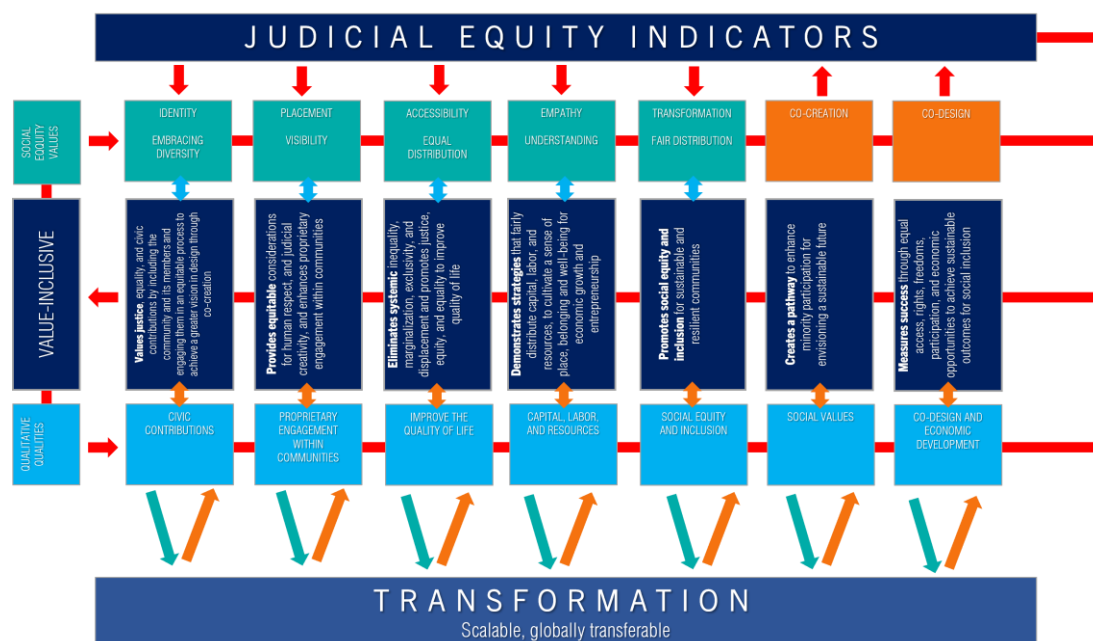
1. Identity recognizes individual human value and worth.
2. Placement considers the quality of apparent relations.
3. Equal distribution is made possible through accessibility.
4. Empathy recognizes the presence of all beings in harmony.
5. Both the micro and macro levels of ‘transformation’ within a community are present.



**Figure 5.** Value-inclusive design model. This model expands the four values that intersect with Meerow’s 2019 model for social equity, 1: Identity, 2: Placement, 3: Accessibility for all, 4: Empathy, and introduces, 5: Transformation as a new social value construct.

1.11. Transformation as a Missing Value

Transformation is the central value in the figure as the NEXUS for innovative solutions in urban architecture for wellbeing that informs how we live in society. The design looks at the scale of the community by embracing heritage, social values, and transformational qualities to promote economic investment, facilitate the preservation of infrastructure, regeneration of communities, and job acquisition and advancement. This includes fair distribution of capital, labor, and resources that impact policy, laws, and codes in the public environment to support local populations and restore and sustain ecosystems. These conditions, combined with social equity and inclusion, result in ‘transformation’, as shown in Figure 6. The next section provides a summarized description of ‘judicial equity’ and its application to inclusive design values.



**Figure 6.** Value-inclusive design model: judicial equity indicators and transformation value.

### 1.12. Judicial Equity as a Fourth Dimension of Social Equity

Judicial Equity is a symbiotic component of Meerow et al.'s [2] recognitional, procedural, and distributional social equity model and design canvas that forges a new holistic link among theory, research, teaching, and application in architecture and urban sustainability for co-creation and co-design. Figure 6 highlights policy and governance and the importance of 'the commons'. This dimension of social equity includes the following values:

- Values justice, equality, and civic contributions by including the community and its members and engaging them in an equitable process to achieve a greater vision in design through co-creation.
- Provides equitable considerations for human respect, and judicial creativity, and enhances proprietary engagement within communities.
- Eliminates systemic inequality, marginalization, exclusivity, and displacement and promotes justice, equity, and equality to improve quality of life.
- Demonstrates strategies that fairly distribute capital, labor, and resources, to cultivate a sense of place, belonging, and wellbeing for economic growth and entrepreneurship.
- Creates a pathway to enhance minority participation for envisioning a sustainable future.
- Measures success through equal access, rights, freedoms, participation, and economic opportunities to achieve sustainable outcomes for social inclusion.

### 1.13. Design Objectives

Values are connected to design objectives. A design canvas was prepared to map planning, design, and policy construct complexities and show how theory translates to practice as a primary design objective. Figure 7 represents a dynamic set of processes that connect human health and dignity, interactive settings for the quality of life, and inclusive green cities.

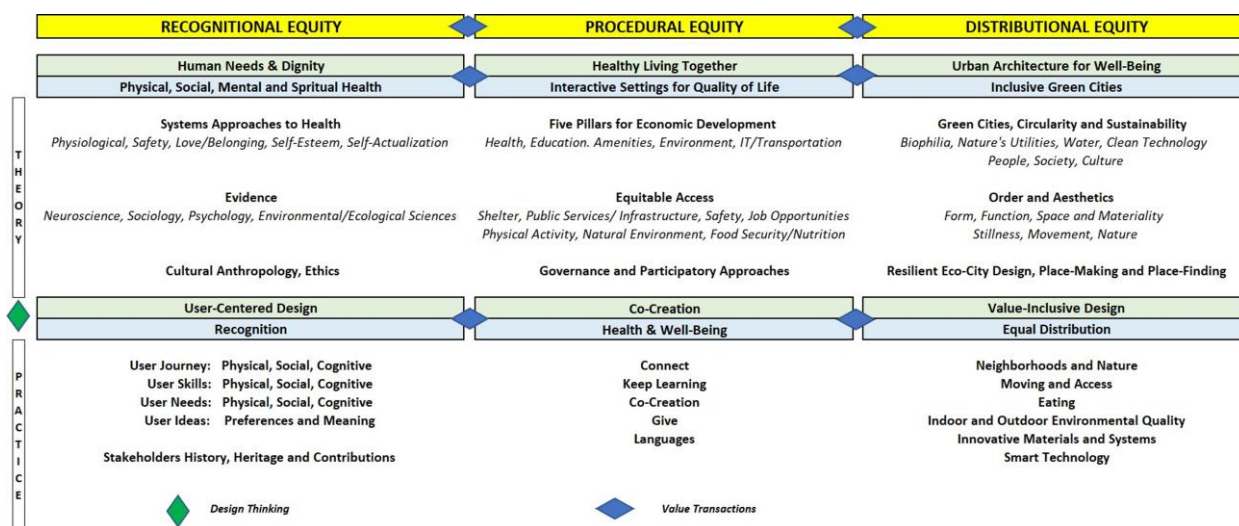


Figure 7. Inclusive design: design canvas for inclusion [3,11].

Judicial equity is added to Figure 3, outlining the necessity for equitable policy and governance, as shown in Figure 8. In Figure 8, symbiotic cities better represent urban architecture for wellbeing and sustainable place-making, and place-finding further defines inclusive green cities. Appropriately, value-inclusive design was moved under judicial equity for socially equitable communities resulting in regeneration and equal access through co-creation and co-design. The design canvas is supported by the earlier work of Zallio and Clarkson [33,35], fostering an inclusive mentality. The second objective was to capture a comprehensive picture of community resilience.



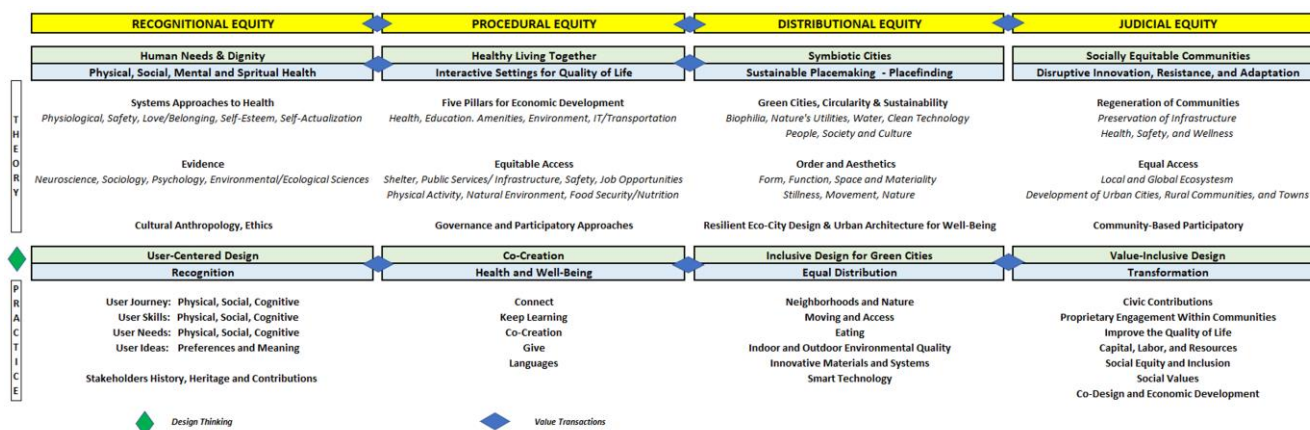


Figure 8. Inclusive design: design canvas for inclusion and judicial equity.

## 2. Materials and Methods

### 2.1. Methodology: Qualitative Case Study Method

A case study approach was chosen to examine value-inclusive design constructs, as well as construct validation akin to hypothesis-testing research. This allowed to an in-depth limited-scope study [7–9] of the design cases collected and analyzed as a part of the Urban Greenhouse Challenge (Figure 9). The first part of the study examines the Urban Greenhouse Challenge #3 competition methodology leading to the top three winning teams. The second part examined the constructs of ‘transformation’ as a leadership value and ‘judicial equity’ as a fourth dimension to social equity based on a case study examination of the designs submitted to the Challenge.

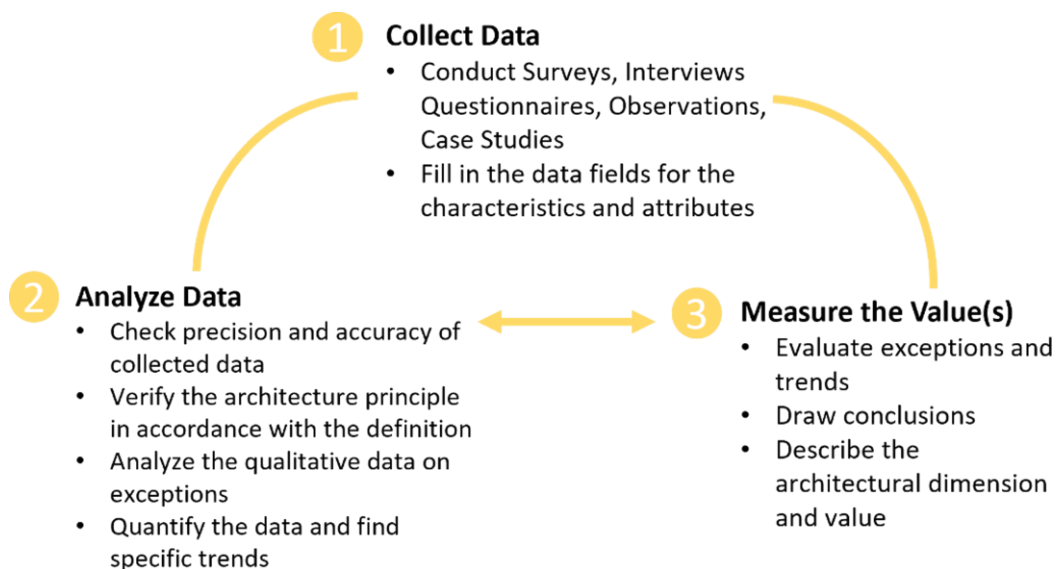


Figure 9. Measurement methods [7,8].

### 2.2. Part One: Case Study Method—Urban Greenhouse Challenge #3, the Social Edition

Inclusive design promotes social impact through urban farming in rural and urban environments. The Wageningen University and Research (WUR) launched the Urban Greenhouse Challenge in 2018, intending to foster innovation in urban farming. This competition was open to students from all disciplines and from around the world. Students were tasked with creating an urban farming site that significantly enhances the quality of life and nutritional needs of residents in one of the most diverse lower-income neighborhoods of Washington, DC, as part of the Urban Greenhouse Challenge. This meant that



students had to address the social context of Ward 7, an underserved area in Washington DC where residents struggle to access healthy food in what experts define as ‘food apartheid’ areas. 30 teams of 260 students from 74 colleges across 19 countries set out on a mission to solve these problems by the end of 2021. Twenty of the 30 teams advanced in the design competition. The challenge inspired many young minds to rethink how they would produce food in their home cities. Several also reported that the competition influenced their future career choice. Apart from interaction with each other and with residents from the Ward 7 location, students were also able to connect with leading companies in the horticultural sector. The challenge aimed to foster creativity among the participating students as well as cross-disciplinary innovation. Teams of participating students collaborated with coaches from the corporate, public, and nonprofit sectors to create their concepts (see Figure 10). After two successful competitions, the third Urban Greenhouse Challenge added a fresh twist with its deliberate focus on improving the quality of life for residents in a food apartheid neighborhood. Through the collaboration between Wageningen University and Research and the University of the District of Columbia (UDC), the competition was able to establish connections to community members to help the competing student teams better understand existing challenges and needed improvements. The competition also engaged UDC architecture student as resident advisors to the competing student teams from around the world.



**Figure 10.** Competing teams in the Urban Greenhouse Challenge #3: the social impact edition [59].

### 2.3. East Capitol Urban Farm—Site for the WUR Challenge

The East Capitol Urban Farm (Figure 11) is located on a three-acre site in Washington DC’s Ward 7. UDC leased the site from the DC Housing Authority for 3 years to build a communal urban farm. From its inception, ECUF was designed and built with input from local residents and partners. Its goals include promoting urban agriculture, enhancing food access and nutritional health, providing nutrition education, encouraging community gardening, fostering entrepreneurship, enhancing green infrastructure, and offering education and demonstration opportunities on the above topics. Despite being situated in an urban area, ECUF is the consequence of peri-urbanization. Peri-urbanization is the process of turning rural regions into urban areas. This transition affects the area’s physical, economic, and social characteristics and results in a place that is only partially rural and increasingly urban. Peri-urban zones are always open to change. Change results from the development process but may be controlled by sustainable development strategies [58]. Using co-creation and co-design, the Urban Greenhouse Challenge sought to fundamentally reshape not only the ECUF site but also its surrounding neighborhood. This involved using more robust, sustainable, and inclusive design principles. The ECUF is a model for future development that addresses food insecurity and other socioeconomic issues locally with urban agriculture serving as a catalyst for workable solutions.



**Figure 11.** Different views of East Capitol Urban Farm, UDC CAUSES [60].

#### 2.4. Data Collection—Three Competition Elimination Phases

The challenge included webinars on sustainability, business model approaches, and inclusive design practices. Each of the three elimination phases (milestones) had design criteria for jurors to identify the teams that contributed to (1) social impact that results in social equity and inclusion, (2) food production for healthy consumption, (3) business modeling, which promotes economic development, (4) food distribution that is scalable, (5) urban design for underserved communities, and (6) sustainability to lessen waste, increase health, wellbeing, and quality of life [59]. The challenge criteria during each phase included four categories for the jurors, as shown in Table 1.

**Table 1.** Team scorecard: challenge criteria.

Total Concept	Spatial Concept	Design Detail	Context Analysis
Co-creation	Functional	Cultivation (food) system	Socioeconomic factors
Co-design	Attractive	Environmental impacts	Site and users
Local context	Scalable/adaptive	Business model	Social impact

The total concept criteria have the potential to create social impact through a convincing and coherent design that is relevant to the local context and surrounding communities for co-design and co-creation. The spatial concept, including an artist impression developed a functional and attractive design solution that was adaptive and scalable locally, regionally, and globally. A design criterion defined the correct selection of cultivation techniques and crops for food production, as well as the use of solutions that minimize negative and increase positive environmental factors, which were clearly developed through a comprehensive business model that suited the overall objective. Lastly, the context analysis category of the challenge criteria analyzed socioeconomic aspects and the impact of environmental influences that would benefit its location and users (community) that would create social impact through equality and inclusive design approaches. As the competition progressed, the scorecard criteria became more stringent to identify qualifying teams meeting the above comprehensive plan and design requirements.

#### 2.5. Part Two: Case Study Method—Transformation as a Leadership Value and Judicial Equity as Fourth Dimension to Social Equity

The second part of the qualitative study explored whether architectural solutions promote social impact through the VID model, which recognizes people, co-creates the built environment in collaboration with the community, and provides access to resources and opportunities [61]. In a first step, indicators for transformation and judicial equity were established to assess the VID model on the basis of the literature and contextual factors. Construct validity for social equality was confirmed during the three elimination rounds of the WUR competition, and the indicator judgments contributed to dependability. The themes and indicators behind ‘transformation’ and judicial equity were examined in the data and reflected in the top three proposals. Using the four categories (Table 1) as a baseline, the data were reviewed without bias or presumptions using the scores and feedback from the jurors to determine which teams successfully exercised traits from each

dimension of equity (recognitional, procedural, and distributional). The three elimination phases used the same criteria; however, more emphasis was placed on the development of each category and how well each team incorporated them into their final design. The case study examined the population of competing teams and the three elimination phases resulting in the top three made by different sets of jurors. The community added reliability to the study.

#### 2.6. Assessment Tool—Planning and Design Development Proposal

On the basis of the VID model, an assessment tool was developed to judge WUR design proposals and their potential social impact on the communities of Ward 7. Table 2 provides a crosswalk of jury judgments and the proposal for evaluating ‘transformation’ and ‘judicial equity’.

**Table 2.** Planning and development for proposal.

WUR Competition—Planning and Design Development				Proposal
<b>Social equity constructs</b>	Recognitional equity recognizing people	Procedural equity Co-create the built environment with communities	Distributional equity access to resources and opportunities	Judicial equity Scalable, globally transferable
<b>Social equity values</b>	(1) Identity embracing diversity)	(2) Placement (visibility)	(3) Accessibility (equal distribution) (4) Empathy (understanding)	(5) Transformation—novel, innovative, changing meaning
<b>Jury judgments (milestones)</b>		Business model	Design	Value-inclusive design observations (case study) based on value-inclusive design framework
<b>One</b>	Social impact	Urban food production	Sustainability	
<b>Two</b>			Food distribution	
<b>Three</b>				

As noted in Table 3, 20 competitive international team proposals were generated as participants in the Wageningen University and Research’s (WUR) Urban Greenhouse Challenge #3, the social impact edition, were compared to the VID model to determine if the value of transformation and fourth social equity dimension (judicial equity) were integral to the framework. From November 2021 until June 2022, teams, through three competition phases (milestones), explored innovative ideas for urban farming with an indoor production facility aimed at creating social impact and inclusion, equity, and resilience. The scorecards represent the most comprehensive designs.

During the grand finals, it was discovered that the three equity themes and four leadership values were present in many of the teams. Final deliberations to determine the top three design proposals included meeting with the final jury, 1 min video pitches, presentation boards, and models to display each team’s concept. The teams that moved forward in the competition identified the community’s needs but, more importantly, demonstrated the constructs of social equity (recognitional, procedural, and distributional) and the proposed judicial equity in their proposals. The teams displaying the social value of transformation rose to become one of the top three winners of the challenge. However, the teams who failed to advance or continue in the competition needed help grasping the social, economic, and geographical context of the communities in Ward 7, particularly the region closest to the location of the East Capitol Urban Farm. In addition, many teams still needed to provide a comprehensive business model for food production, distribution, and economic development, and promote social impact.

**Table 3.** UGC elimination phases (milestones) and team scorecards.

		Milestones 1 and 2 (x = 1), (X = 2)												Jury Assessment		
		Total Concept			Spatial Concept			Design Detail		Context Analysis		Jury Assessment				
Teams		Co-Creation	Co-Design	Local Context	Functional	Attractive	Scalable Adaptive	Cultivation (Food)	Environmental Impacts	Business Model	Socio-Economic Factors	Site and Users	Social Impact	Score	Results	Elimination
		1	Team A	0	1	1	0	0	0	0	2	0	1	1	0	6
2	Team B	2	2	2	2	2	1	1	2	2	3	2	1	22	Good	
3	Team C	4	4	2	4	4	2	2	3	3	2	3	2	35	Best	
4	Team D	0	0	2	0	0	0	0	2	0	0	0	0	4	Least	x
5	Team E	2	2	3	2	2	1	1	2	1	1	2	1	20	Good	
6	Team F	1	1	3	2	3	3	1	1	3	2	1	1	22	Good	
7	Team G	3	3	3	4	4	2	2	2	4	3	2	2	34	Best	X
8	Team H	1	1	3	3	2	2	1	1	3	1	2	1	21	Good	X
9	Team I	2	2	4	5	4	2	2	2	4	2	3	2	34	Best	
10	Team J	3	3	3	4	5	2	3	3	3	3	2	2	36	Best	
11	Team K	3	3	2	4	5	2	3	3	3	3	2	2	35	Best	X
12	Team L	1	1	1	2	2	0	0	1	0	1	1	0	10	Least	X
13	Team M	1	2	2	2	1	1	2	1	1	1	2	1	17	Good	X
14	Team N	0	0	0	0	0	0	0	0	0	0	0	0	0	Least	x
15	Team O	1	1	1	1	2	0	1	1	1	1	0	0	10	Least	
16	Team P	0	0	2	1	1	1	0	1	1	1	2	0	10	Least	X
17	Team Q	0	0	2	3	3	1	2	2	3	1	2	1	20	Good	
18	Team R	1	1	1	1	1	1	1	1	1	0	0	0	9	Least	X
19	Team S	1	1	1	1	2	0	0	1	0	1	2	0	10	Least	X
20	Team T	2	2	2	3	3	1	1	3	1	1	2	1	22	Good	X
21	Team U	1	1	1	2	3	1	1	2	2	1	2	1	18	Good	X
22	Team V	2	2	4	4	4	1	2	2	4	3	2	1	31	Good	

Scorecard breakdown: total concept (10 points max), spatial concept (10 points max), design detail (10 points max), contextual analysis (5 points max); total score value = 35 points [35–25 best; 25–15 good; 15–0 least]; limitations include limited access to data and time constraints.

#### Grand Finals

1	Team A	3	3	3.25	3	3	1	6	7	7	4	4	1	45.25	Least	X
2	Team B	3	2	2.75	4	5	1	4	6.5	5	3	4	1	41.25	Least	X
3	Team C	3	3	4.75	5	4	3	8	8.5	6.5	4.5	5.5	3	58.75	Best/Top	
4	Team E	4	4	3.75	5	4	1	8	8	5	4	4	1	51.75	Least	X
5	Team F	3	3	4.25	4	3	1	6.5	6.5	8	4	4	1	48.25	Least	X
6	Team I	3	3	4.75	5	4	1	8	8.5	6	4	5	1	53.25	Least	X
7	Team J	4.5	4.5	4	4	5	3	9	7.75	8	7	7.5	3	67.25	Best/Top	
8	Team O	3	3	3.75	4	4	1	6	6.5	6	3	3	1	44.25	Least	X
9	Team Q	3	3	2.75	3	3	1	7	4.5	8	4	4	1	44.25	Least	X
10	Team V	3	3	3.75	4	5	3	8	8.5	8	6	7	3	62.25	Best/Top	

Scorecard breakdown: total concept (15 points max), spatial concept (15 points max), design detail (25 points max), contextual analysis (20 points max); total score value = 75 points [75–55 best; 55–0 least]; limitations include limited access to data and time constraints.

It became evident that the winning teams' perceived value met local, regional, or global scalability and adaptation for co-creation and co-design, resulting in resilient communities transformed by socially equitable design solutions, as shown in Table 4. The calculations result in the teams that demonstrated the social value of 'transformation' and construct of 'judicial equity'. The names and results of the team proposals have been assigned a letter to protect their identity. However, the scores of all designs indicate that the teams succeeded in taking the social and sustainability criteria of the competition into account in their submissions.

**Table 4.** Assessment of the dimensions of social equity, constructs, and values.

Top 10 Teams		Recognitional Equity	Procedural Equity	Distributional Equity	Judicial Equity
1.	Team A	No	Yes	No	No
2.	Team B	Yes	No	Yes	No
3.	Team C	Yes	Yes	Yes	Yes
4.	Team E	No	Yes	No	No
5.	Team F	Yes	No	Yes	No
6.	Team I	Yes	No	No	No
7.	Team J	Yes	Yes	Yes	Yes
8.	Team O	Yes	Yes	No	No
9.	Team Q	No	Yes	Yes	No
10.	Team V	Yes	Yes	Yes	Yes
<b>Judicial Equity</b>					
	Regeneration of communities	2,3,5,6,7,8,10	1,3,4,7,8,9,10	2,3,5,7,9,10	3,7,10
	Community-based participatory	3,5,7,9,10	1,2,5,7,8,10	2,3,4,6,7,10	3,7,10
	Open public space (equal access)	2,3,5,6,7,8,10	1,3,4,7,8,9,10	2,3,5,7,9,10	3,7,10
	Economic development (model)	3,5,7,9,10	1,2,5,7,8,10	2,3,4,6,7,10	3,7,10
	Resilience (preservation/adaptation)	2,3,5,6,7,8,10	1,3,4,7,8,9,10	2,3,5,7,9,10	3,7,10
	Impact (local and global ecosystem)	3,5,7,9,10	1,2,5,7,8,10	2,3,4,6,7,10	3,7,10
<b>Inclusive Leadership Values</b>					
	Identity	3,5,6,7,8,10	1,3,4,7,8,9,10	2,3,5,7,9,10	3,7,10
	Placement	1,2,4,5,6,7,9,10	1,2,5,7,8,10	2,3,4,6,7,10	3,7,10
	Accessibility for all	3,5,6,7,8,10	1,3,4,7,8,9,10	2,3,5,7,9,10	3,7,10
	Empathy	1,2,4,5,6,7,9,10	1,2,5,7,8,10	2,3,4,6,7,10	3,7,10
<b>Transformation</b>					
	Civic contributions for human-centered design (co-creation)	3,6,7,8,10	2,3,5,6,7,8,10	2,3,5,7,9,10	3,7,10
	Proprietary engagement within communities	3,6,7,8,10	2,3,5,6,7,8,10	2,3,5,7,9,10	3,7,10
	Opportunity (capital, labor, and resources)	3,6,7,8,10	2,3,5,6,7,8,10	2,3,5,7,9,10	3,7,10
	Aesthetic factor (co-design)	3,6,7,8,10	2,3,5,6,7,8,10	2,3,5,7,9,10	3,7,10
	Improve the quality of life	3,6,7,8,10	2,3,5,6,7,8,10	2,3,5,7,9,10	3,7,10
	Innovation for social values and social impact	3,6,7,8,10	2,3,5,6,7,8,10	2,3,5,7,9,10	3,7,10
	Perceived value	3,6,7,8,10	2,3,5,6,7,8,10	2,3,5,7,9,10	3,7,10

### 3. Results

#### 3.1. Observations of the Top Qualifying Teams

The competition results from three different juries were reviewed to confirm that the indicators used in the review process were properly recognized, understood, and communicated. The Urban Greenhouse Challenge comprised three phases (milestones), resulting in impressive conceptual design solutions that promote and foster social impact in an underserved community. The teams' first concepts were inspired by specific cultivation techniques or interests in specific technologies [62] that could improve the quality of life for Ward 7 residents. After 8 months, three final teams were selected. All three teams had to demonstrate their understanding of a business model and how to implement sustainable solutions and strategies to combat food insecurity that would reduce food apartheid in Ward 7 and the surrounding community. Team C, won third place as well as the 'local resident's award' with their living lab greenhouse and communal area, while Team V, came in second with a fresh food production and mobile distribution market. Team J's 'block-by-block' modular mosaic proposal won first place [62]. The organizers and the jury were amazed to see the students' commitment and investment in learning, expanding their knowledge base, and creativity in seeking the best solution for the Urban Greenhouse Challenge #3. Participating in such competitions allowed the students to unlock professional opportunities for their future. The developed concepts and innovations will potentially serve as prototypes and inspiration for affordable, sustainable, and urban-resilient design. East Capitol Urban Farm would be a catalyst for the inclusive design model.

After assessing each team using the VID model to measure the values of judicial equity and transformation, the data validate architectural solutions promote social impact through value-inclusive design.

Three of the 20 potential designs from the third iteration advanced to the finals [62]. Each team presented a concept that transformed meaning (two types of innovation in architecture—changed meaning or technological epiphanies): sustainable, affordable, and inclusive. Findings indicated that all three equity themes and four leadership values were inherent to the top three proposals. It was observed that the top proposals were unique in that they addressed ‘judicial equity’ as an additional dimensional construct and ‘transformation’ as another essential value to the value-inclusive design model. The top proposals outlined innovative urban prototypes that were scalable for local communities and could be implemented across the globe, having the potential to change meaning for society. The top three scoring teams incorporated the following elements into their holistic designs:

- Global/community impact, flexible, straightforward solution.
- New business concept, mobile systems approach for outreach.
- Community impact, sustainable food production, and site design that defined the community.

### 3.2. Value-Inclusive Design Instrument and Method

The Urban Greenhouse Challenge developed value-inclusive design-oriented transactions that translated into social equity, confirming that VID takes an inter-transformational position on human-centric design, context, and interaction, resulting in equal distribution of social equity in inclusive design thinking and practices. The VID model used indicators (Table 5) as a checklist to evaluate qualitative themes and characteristics for each team proposal.

- Elimination phase one—twenty teams were selected to move forward; two teams were eliminated according to criteria.
- Elimination phase two—ten teams were selected to move forward; ten teams were eliminated according to criteria.
- Elimination phase three—three top teams were selected as winners; seven teams were eliminated according to criteria.

**Table 5.** Evaluation: value-inclusive design indicators.

Indicators	Team Proposal 1	Team Proposal 2	Team Proposal 3
Milestone/phase 1	Top	Middle	Top
Milestone/phase 2	Top	Middle	Top
Grand finals/phase 3	Top	Top	Top
<b>Judicial equity</b>			
Regeneration of communities	Yes	Yes	Yes
Community-based participatory	Yes	Yes	No
Open public space (equal access)	Some	Some	Yes
Economic development (model)	Yes	Yes	Some
Resilience (preservation/adaptation)	Yes	Some	No
Impact (local and global ecosystem)	Global	Regional	Local
<b>Transformation</b>			
Civic contributions for human-centered design (co-creation)	Yes	Yes	Yes
Proprietary engagement within communities	Yes	Yes	Yes
Opportunity (capital, labor, and resources)	Scalable to the community	Retail/commercial	Education/restaurants
Aesthetic factor (co-design)	Transformative	Equitable access	High sense of place
Improve the quality of life	Yes	Yes	Yes



Innovation for social values, social equity, and social impact	Scalability: scale up-scale down site based on communities needs	Mobility: mobile market to access the community	Flexibility: living lab operable 24/7–365 days for the community
Perceived value	Global	Regional	Local

As summarized in Table 5, the three top winning teams captured critical indicators for the proposed fourth dimension of ‘judicial equity’, and the design and business models presented the social value construct of transformation. The next section depicts the intersection of design with value-design values, confirming the construct validity of the model, as well as its application to create social impact to address food insecurity and food production in underserved communities.

### 3.3. Application of Value-Inclusive Design Values—Intersection of Design/Top Three Teams

Unlike other editions of the Urban Greenhouse Challenge, the social impact edition was marked by the participation of members in Ward 7 in the selection process. From the beginning, Advisory Neighborhood Commissioner and the Deanwood Citizens’ Association President were part of the local selection committee, one of two committees designed to judge student submissions on several criteria [62]. For them, this meant evaluating the potential for social impact in their community and awarding the ‘local residents’ prize’ to a qualified team. ‘What I most look for in a proposal is a strong city symbol that shows the transformation in Ward 7 and simultaneously brings job opportunities, benefits local entrepreneurship, and generates economic development’, said Commissioner Holmes [62]. When asked what she expected from her involvement in this Challenge, the Deanwood President mentioned, ‘We do the best to give them (the students) local context, and it is amazing to see what they can come up with’. When justifying the choice to award the first place to Team J, the final jury acknowledged this proposal as the most holistic and comprehensive design to encapsulate inclusivity. Team J believed that ‘communities are the real architects’ because the proposed modular urban farming concept can be tailored to their needs. More importantly, the winning concept derived a globally scalable design solution that could be replicated in other communities within the most diverse socio-economic contexts, empowering communities block by block (Figure 12) [62].



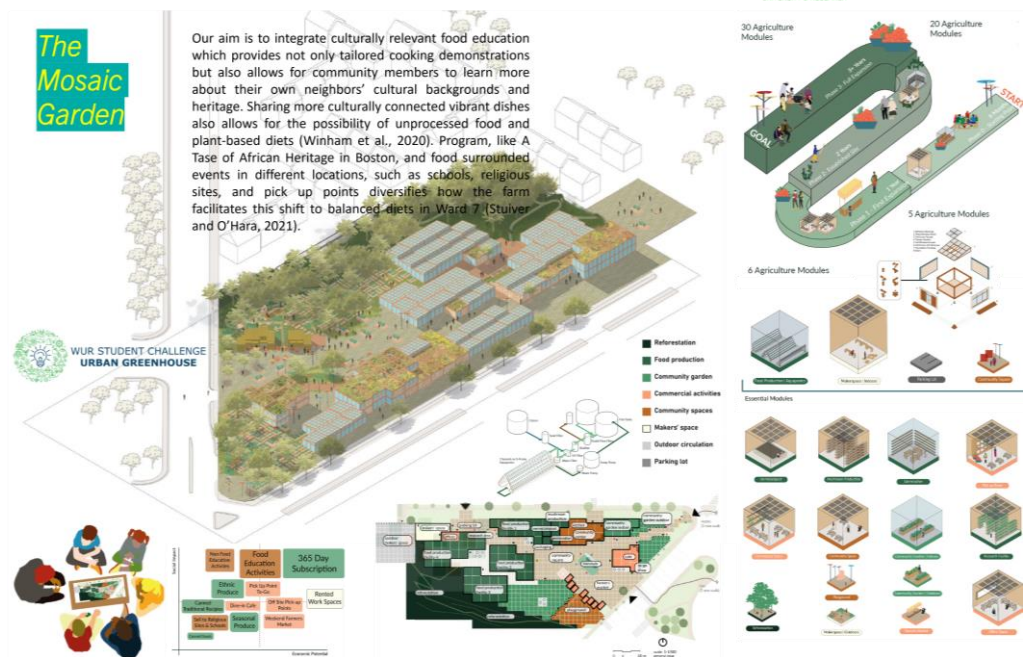
**Figure 12.** First place winning design concept in the Urban Greenhouse Challenge #3 [62,63].

#### 3.3.1. Team J—The Mosaic Garden, First Place

To tackle Ward 7’s challenges as a neighborhood with poor access to food, education, and economic opportunities, Team J (Figure 13) proposed a mosaic urban farming concept that is scalable to the necessities of the community [62].



## Applying Inclusive Design Values: The intersection of Design Building Communities and a Garden Block by Block



**Figure 13.** First place winning design team of the Urban Greenhouse Challenge #3 [63–65].

The strategy used by winner Team J allowed for local involvement during conception, creation, modification, and expansion [62], which was achievable via configurable modules for the site's functions: food production, community engagement, education, and employment. In their concept, functions were proposed to be incorporated at various stages of community development as they grew financially to achieve long-term objectives for urban farming. Their design included a symbiotic, dependable, year-round aquaponic food production system that is adaptive to the required scale of operations and different crops. Mushrooms and fish provided year-round healthy protein to supplement leafy greens and tomatoes. Culturally connected produce can be grown in the indoor community garden and hydroponic research facility. The food production system was supported by a business model that serves and employs community members through strategies including a year-round subscription service, small stalls, and partnering with local organizations for distribution. Modularity enabled the community to finance the first few modules entirely from government funds and incentives. Circularity on site was realized by recycling all primary waste that flows into the food production chain. Rainwater harvesting and solar energy generation will further increase the site's self-sufficiency. At the same time, the site, as a biodiverse green space, served as a buffer against floods and heat, thus contributing to its resilience and surroundings. Educating for the future, members will be engaged through the community garden, square, playground, and market. The site also facilitates education for all age groups. On-site agricultural and sustainability techniques were highlighted in an interactive learning path that is available to anyone. The site comprised an extended UDC workforce development and lifelong learning division campus, focusing on employment upskilling and personal development workshops. As a team, they acknowledged the current local governance efforts to address the challenges of Ward 7 and the efforts of local community members. Their design aims to create programs that safeguard the current and future vibrant character of Ward 7 by empowering communities block by block [62]. Importantly, this proposal was transformational and globally transferrable, and it offered changed meaning for communities to make decisions on farming, education, and greening their environment.

### 3.3.2. Team V—Stack Smart Farming, Second Place

In addressing food insecurity and promoting wellness in Ward 7 and beyond (Figure 14), the issue is about “something other than building more grocery stores and growing produce”. Instead, it is about “building a more innovative network for food distribution and positively redefining the relationship consumers maintain with their food suppliers”, according to Team V [62].

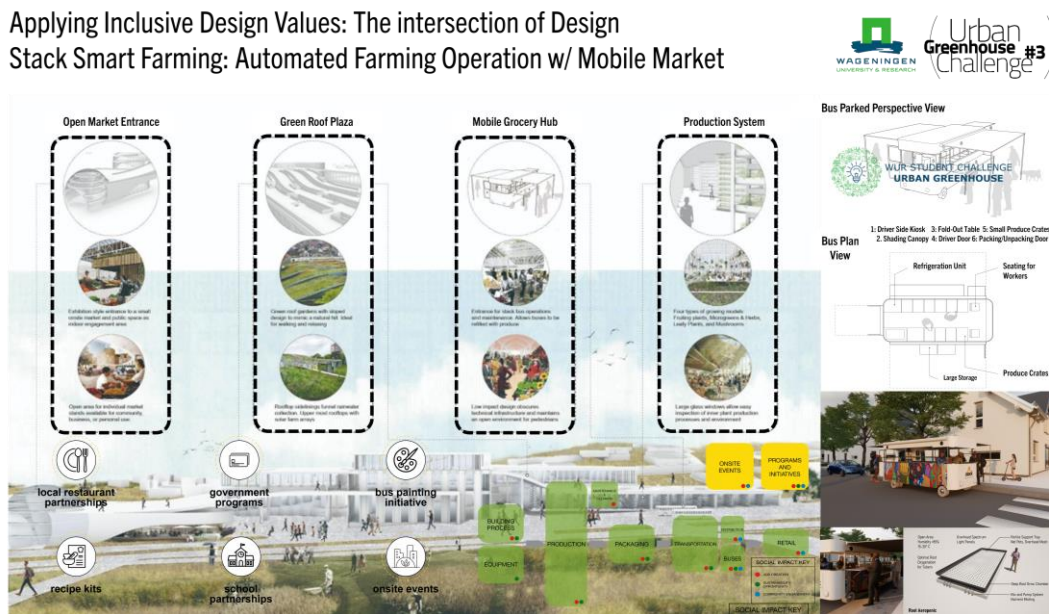


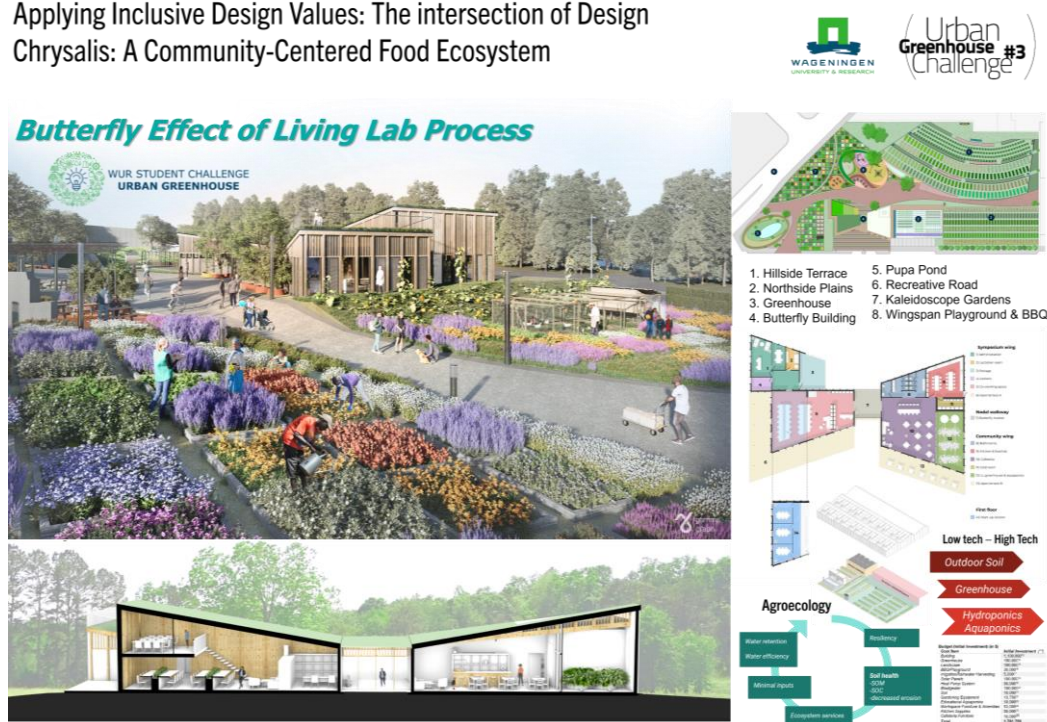
Figure 14. Second place winning design team of the Urban Greenhouse Challenge #3 [63].

Team V’s concept ‘Stack Smart Farming’ established numerous jobs and long-term career prospects, which focused on food production, agritech operations, green energy generation, and a large-scale mobile grocery store company, which included automation and machine learning agents, combining intelligent farming and a market and supply chain ecosystem. Team V’s stack smart farming ensured the development of first-layer distributional infrastructure in Ward 7 and a platform to develop a healthier food supply chain while maximizing opportunities for community engagement, empowerment, and long-term growth [62], which was achieved by utilizing the proven scalability of our product delivery business models and leveraging their triple-bottom-line approach. Due to inadequate transit infrastructure, buying fresh and healthful produce in specific communities is disproportionately more expensive and complex than in other areas [62]. This is especially true in areas with limited access to food. Thus, their approach focused on food production, distribution, and education to address the core problem effectively. It must promote active participation and investment from the community and its stakeholders. Team V’s stack smart farming was created with the three following verticals in mind: (1) the total distribution capacity of our products, (2) the creation of empowering employment opportunities, and (3) capturing high-value produce markets. In order to do this, Team V proposed a ‘mobile market model’—a novel paradigm for scalable food delivery and community participation. As a result of not having to construct expensive, inefficient physical storefronts, stack smart farming can provide the community with improved accessibility and a far more pleasurable shopping experience. They described their concept as a “grocery store on wheels”, although it was designed to fit far more land than the three-acres they were given. Since much more local land would be set aside for plant cultivation, the farm’s output and profitability as a standalone enterprise would rise. This proposal was crucial because it offered strategies for eradicating food apartheid and ensuring everyone had access to food while illuminating local challenges.

### 3.3.3. Team C—Chrysalis, Third Place

This design was proposed to develop a sense of community through an adaptable, self-sufficient urban farm that provides local food security and economic sustainability, infrastructure durability, and meaningful public space (Figure 15) [62].

#### Applying Inclusive Design Values: The intersection of Design Chrysalis: A Community-Centered Food Ecosystem



**Figure 15.** Third place winning design team of the Urban Greenhouse Challenge #3 [63].

Taking third place in the Urban Greenhouse Challenge was Team C, whose design focused on creating social impact in communities experiencing food apartheid. They proposed a convincing and coherent design that offered innovative solutions to people's everyday needs. The team presented an attractive, functional design promoting a sense of belonging. Due to its unique design, the butterfly structure would constitute a landmark, earning Team C the 'local residents' prize' for their creative qualification. This resulted in a holistic concept design incorporating agricultural, economic, social, spatial, and organizational elements necessary to create an innovative, self-sustaining urban farm facility that increases food accessibility and social equity in Ward 7 of Washington, District of Columbia. Their overall concept embodies the metamorphosis of a caterpillar to a butterfly, and the core of their mission is to preserve and support community spirit. Their community-centered design draws from Team C's 'Living Lab' approach, bringing research into society-wide implementation by incorporating co-creation by different disciplines and stakeholders. Team C considered five topics to be their unique differentiators, integrating community needs and challenging outcomes with the UN Sustainable Development Goals (SDG) [62], as a universal call to action to illuminate food apartheid, sustain the planet, and improve the quality of life for all people by 2030. Through an internal integrated design framework (IIDF), an interdisciplinary strategy used to design exterior experience, Team C paired their living lab approach with year-round food production, circularity and sustainable design, organizational structure, and economic planning. Lastly, they drew inspiration from urban farms in the US and state-of-the-art innovations developed in Amsterdam. Their proposed combination of SDG alignment, interdisciplinary high-tech proposals, and global inspirations increases access to fresh produce, meaningful public space, and economic opportunity, thus improving the quality of life [62]. Importantly, this team demonstrated the importance of civic contributions to provide food in the local



community and create a nature-based environment. The proposed concept design successfully applied inclusive design values and intersections through a community-centered based ecosystem that is sustainable and resilient for DC residents.

#### 4. Discussion

Limitations of the study included access to the site and residents of the community, impacting the effectiveness of the participating teams' design solutions. Other limitations include access to data and time constraints to meet the competition's deadline for completion. The teams received indirect input from the community by posting questions and receiving answers; the population was  $\leq 20$  people. Without first-hand knowledge, the difficulty of designing for a targeted demographic due to cultural, societal, and political differences was noted by the competitors. Understanding transformative events impacts translating qualitative themes into design concepts, despite cultural, socioeconomic, and political barriers. Interdisciplinary training encourages not just excellent design but also practical design solutions. According to the competition results, a close relationship was observed between equitable and equal approaches to inclusive design values. These values recognize and respond to the community's needs, explicitly addressing food insecurity, economic disparities, and the adverse effects of gentrification. The VID framework investigated and analyzed these concerns to create and propose architectural solutions that improve social impact. Concepts and innovations created are prototypes and sources of inspiration for inexpensive, sustainable, rural, peri-urban, and urban resilient design. The WUR Challenge encouraged social and inclusive design while challenging social equity theory. On this premise, the study advocated 'transformation' and 'judicial equity' as essential concepts for VID. The outcomes of the Urban Greenhouse Challenge 3, social edition, contribute to the social value of 'transformation' and construct of 'judicial equity' by enhancing resilience locally or regionally and globally.

An international jury was tasked with determining the challenge's three winners. After hearing the proposals during the competition's final, the Founder and CEO of Vertical Harvest, the Program Director of Sustainable Urban Delta, an International Society of Horticultural Science (ISHS) Board member, and a Wageningen Ambassador selected proposals from three excellent teams [62]. The Urban Greenhouse Challenge presented straightforward design solutions for complex social issues. Each winning concept inclusively demonstrated how to improve access to affordable and nutritious food which included robust and resilient year-round sustainable food production in an urban context and were stunning initiatives supported by a robust business model that may turn East Capitol Urban Farm into a notable landmark location. The winning design proposals contributed to social impact in Ward 7 of Washington, DC, which included (1) fostering social equity through a new type of food economy, (2) eliminating food apartheid, (3) promoting education and food preparation, (4) creating employment and generating income for economic development, and (5) serving as a prototype for affordable, sustainable, and urban resilient design. With the exception of Meerow et al. [2] and Zallio and Clarkson [33,35], few studies have attempted a holistic approach to expanding education which promotes social equity and building community resilience, theoretically, and practically. There is a lack of definitive standards or guidelines in research that must be addressed, and the results of the design competition correlated with need for the social value of 'transformation' and construct of 'judicial equity', confirming that there is a gap in the literature, and that the proposed model would further develop many of the theoretical frameworks of 'value' in the built environment and architectural education and foster social impact.

Expanding architectural education and practice through value-inclusive design creates a gateway between old philosophies, theories, and procedures through transformational occurrences. Those occurrences promote innovation and social change to the status quo by building a more inclusive and equitable society. The new VID model is a change in thinking to promote opportunity through recognition, health, wellbeing, and the equitable distribution of resources. Knott suggests that architects 'focus on metrics that

demonstrate the creation of capability by measuring progress in four dimensions: team (leadership and development), domain coverage (guidance), change coverage (delivery method), and governance (decision-making and communications)' [66]. Social science information may be a great asset to architecture since it can confirm or refute intuitions and reveal previously unnoticed details. The basis for a design based on knowledge rather than personal conviction is, thus, provided by the social sciences, resulting in an architecture that is more adapted to the demands of its users [43]. A new social atmosphere must be created to achieve social fairness and inclusion. The ongoing process of developing solutions that consider the perspectives, experiences, and circumstances of individuals not previously considered is known as inclusive design [67]. In collaborative design processes, this study evaluated the adoption of values influencing social equity and how these values translate to designing socially equitable communities that promote opportunity. Applying the VID model to architectural education and practice was proposed to achieve social equity and inclusion. The effectiveness of the new model and how well the new dimension satisfies the anticipated value received in terms of needs met and experiences satisfied by the values of (1) identity, (2) placement, (3) accessibility, (4) empathy, and (5) 'transformation' are anticipated to be measurable.

It was discovered that the Urban Greenhouse Challenge Case Study supports the value-inclusive design framework and its impact on social equity and community resilience. There is ongoing discussion among Ward 7 residents, shareholders, and community leaders to revitalize East Capitol Urban Farm in Washington, DC as a means of social impact. Sustainably feeding the future's growing population will require a global transition of our food systems, especially in urban areas. In order to make these metropolitan regions' food robust in the face of present demand and supply-chain volatility, food must be produced close to where people live. Urban farming is one of many promising solutions to the urban food challenge [67], guaranteeing the sustainability of society, culture, economy, and feeling of community. As a result, anyone attempting inclusive green design would face difficulties brought on by antiquated designs built on exclusion from outmoded ideas and ideologies. A key aspect of inclusive design is getting rid of these discriminatory areas. These might be temporary, long-term, short-term, physical, or emotional. Race, gender, mobility, and age are examples of physical, permanent, and non-situational factors. Inclusive design cannot create a sole product for everyone to respond to individual and communal needs. The model develops various methods for everyone to engage in an experience and feel a part of it. Therefore, the inclusive design addresses all circumstances [67], rethinking and reworking the current built environment to go beyond its exclusionary features. More study is planned to prove the extended model's usefulness as a fresh paradigm for advancing social fairness via design practice. This includes analyzing the University of the District of Columbia's Master of Architecture Graduate Thesis projects to assess the project's impact on social equity and determine if 'transformation' and 'judicial equity' result in proposals that promote socially equitable communities through regeneration, equal access, and community-based participatory design solutions for sustainability and resilience. Anticipated outcomes of the assessment aim to provide a baseline of current education and practices and propose revisions to the UDC curriculum to meet the social equity and inclusion criterion. The study suggests VID as a new architectural education and practice paradigm to meet new accreditation requirements for social equity and inclusion, as well as expand the breadth of knowledge that exists in the literature, research, and practice.

## 5. Conclusions

A fundamental shift is necessary for how healthy urbanism must address environmental deterioration's widely dispersed health effects and growing demographic disparities, including decisions about designing neighborhoods and buildings. From the design and planning phases to occupancy, the built environment tends to disadvantage or exclude women, children, seniors, people with disabilities, people experiencing poverty,

and other groups, which has preventable social, health, and other implications. Although these ideas are not new, they are quickly becoming research and practice priorities for the built environment without a clear grasp of the related objectives of healthy environments that are sustainable, egalitarian, and inclusive [68]. Combining theory, practice, and education, this article suggested a new paradigm of architectural education and practice based on value-inclusive design, demanding practice roles that actively participate in the co-creation process and co-design for social impact. In addition, co-creation must value ‘transformation’ and take into account judicial equality as another social equality factor. Our communities’ regeneration enhances residents’ quality of life by fostering health, safety, and wellbeing. The social construct of judicial equity through the value of transformation can increase social capital for economic development and provide access to local and global ecosystems. This approach also investigates design options to support social impact for resilience. As part of that exploration, other architects, designers, planners, shareholders, stakeholders, and members of the community are invited to assess this framework to see if the value of ‘transformation’ and construct of ‘judicial equity’ mobilize a community’s quality of living, serve as a model for community planning, promote inclusive green cities and towns, and revive underserved urban areas. This entails expanding architectural education and practice in line with VID principles and fostering ideas in planning that incorporate wellness, equitable resource distribution, social equality, and inclusivity. A fundamental goal for achieving social fairness and inclusion and urban resilience is envisioning a sustainable future. The architecture industry and others can contribute significantly to the body of knowledge with further research on this topic of ‘transformation’ and social construct of ‘values’, as well as engage in policy implementation to increase socioeconomic development.

The VID model proposed in this study makes several important contributions such as promoting social equity in urban planning and design and introducing the social value of ‘transformation’ and construct of ‘judicial equity’ for resilience. It points to the opportunity for improving architectural education/curriculum and practice as the VID framework can examine the outcomes of design work and its impact on community resilience. Future research is needed to examine these concepts facilitated through co-creation and co-design and develop definitive design standards with indicators based on theoretical aspects for value-inclusive design as highlighted in the design canvas. With additional study to substantiate our VID approach, future research proposes to develop a certification process for meeting inclusive design standards in communities, thus promoting social equity and building resilience.

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## Abbreviations

CAUSES	College of Agriculture, Urban Sustainability, and Environmental Science—Multidisciplinary Studies
IIDF	Internal integrated design framework—an interdisciplinary strategy that can be used to design experience inside interiors/exterior
ISHS	International Society of Horticultural Science—leading independent organization of horticultural scientists that study the growth and development of plants and crops, including vegetables and fruit
SDG	Sustainable development goals, also known as the global goals, were adopted by the United Nations in 2015 as a universal call to action to end poverty, protect the planet, and ensure that all people enjoy peace and prosperity by 2030
UDC	University of the District of Columbia—embracing its essence as a public historically black urban-focused land-grant university in the nation’s capital, UDC is dedicated to serving the needs of the community in Washington, DC, and producing lifelong learners who are transformative leaders in the workforce, government, nonprofit sectors and beyond
UGC	Urban Greenhouse Challenge—students from all over the world join forces to work on projects that make a difference to the quality of life: a global design competition.
US	United States—Country in North America
VID	Value-inclusive design—proposed model for social value and construct of ‘transformation’ and ‘judicial equity’ as a fourth dimension of social equity (Meerow et al., 2022)
VCD	Value-conscious design refers to a group of initiatives that promote human and moral values as an essential component of the conception, design, and development of technological artifacts and systems
VSD	Value-sensitive design—value-sensitive design is a theoretically grounded approach to the design of technology that accounts for human values in a principled and comprehensive manner
WUR	Wageningen University and Research—university located in the Wageningen, Netherlands with a focus on Agriculture and Sustainability: creators of the Urban Greenhouse Challenge

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