Communication

What Does Urban Transformation Look Like? Findings from a Global Prize Competition

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Abstract: Different disciplines are grappling with the concept of 'urban transformation' reflecting its planetary importance and urgency. A recent systematic review traces the emergence of a normative epistemic community that is concerned with helping make sustainable urban transformation a reality. Our contribution to this growing body of work springs out of a recent initiative at the World Resources Institute, namely, the WRI Ross Prize for Cities, a global award for transformative projects that have ignited sustainable changes in their city. In this paper we explain the competition-based approach that was used to source transformative initiatives and relate our findings to existing currents in urban transformation scholarship and key debates. We focus on one of the questions at the heart of the normative urban transformation agenda: what does urban transformation look like in practice? Based on an analysis of the five finalists, we describe urban transformation as encompassing a plurality of contextual and relative changes, which may progress and accelerate positively, or regress over time. An evaluative approach that considers varying 'degrees' and 'types' of urban transformation is proposed to establish meaning within single cases and across several cases of urban transformation.

Keywords: urban; transformation; urbanization; research; interdisciplinary; transitions; systemic change

1. Introduction

There has been a lively debate among urban scholars and practitioners about the potential and mechanisms of 'urban transformation'. However, there is still limited agreement on what exactly sustainable urban transformation looks like in practice and how (and even whether) it can be achieved. While there is widespread agreement among urban scholars that 'radical' transformations are needed, cities are complex systems and urbanization is not a linear and simple process. Given the fast pace of urban expansion [1,2], how to spark and sustain sustainable urban transformations is one the most important development questions of our time. Answering it is essential for achieving the change needed for safe, inclusive, resilient and sustainable cities [2–4].

However, this question is remarkably difficult to answer. Real world examples of deep urban transformations are hard to come by. Study after study finds little evidence of radical changes happening in cities [3,5]. In fact, scarce empirical evidence in the academic literature leads some scholars to diagnose an "implementation gap" between theoretical concepts and claims about the nature of sustainable urban transformation. While far-reaching, radical, cross and multi-sectoral transformations are needed, the evidence of the practical performance of projects and initiatives is at best partial, sector-based and incremental [4,5]. Therefore, there is a need to surface good examples of urban transformation that can help build a knowledge base that responds to the complexity of urban challenges and sparks a pragmatic movement around progressive urban agendas that practitioners can use to transform their cities [6].

This paper is set in the context of an 'emergent epistemic community' on urban transformation that is attempting to do exactly that. An interdisciplinary field with open boundaries, at the intersection

of complex systems studies and urban studies [7], it has been forming around a normative framing of urban transformations to sustainability [6]. There are several things to note about this, according to two recent systematic literature reviews [6,7]. For one, the term itself ('urban transformation') has been used heterogeneously for the last six decades. It has mostly been applied outside of the 'sustainability' debate, to issues as diverse as rural–urban migration, post-socialist transformation, and changes in the built environment or in urban cultures [6]. The approaches that do focus on the need for "sustainable" urban transformation are a small—albeit growing—subset of the larger body of research. Second, there is internal diversity within this subset, with publications covering a variety of sustainability goals, including low-carbon cities and adaptation, efficiency and innovations in urban infrastructures and services, and systems of consumption. Third, despite internal diversity, there is concentration in terms of a focus on higher income cities (in particular, Western Europe) and megacities, which are published within a relatively small radius of academic publications [5,8], and a larger sphere of grey (often not peer-reviewed) publications.

Our contribution to this emerging community of practitioners is aligned with a recent call for strategic extensions and alternative research methods to complement and push the horizon of the existing empirical knowledge base and methodological repertoire [8,9]. It is also responsive to cautions surrounding the 'elasticity' in how the concept of 'transformation' is used, having entered policy and practice without consensus and empirical grounding, and little guidance for implementation in all three spheres of practice, research and funding [10–12]. Our research is informed by an initiative at the World Resources Institute, namely, the WRI Ross Prize for Cities (hereafter, 'the prize'), a global award for transformative projects that have ignited sustainable changes in their city. Between February 2018 and April 2019, we carried out an evaluation of almost 200 submissions to the first edition of the prize. We developed and implemented a process to source, evaluate and help select one winning submission from a diverse pool of sectors, countries, organizations, types of activities, project sizes, types of transformation and impacts.

In this context, we found it useful to contrast transformation with another concept, namely that of 'transition'. The relationship between these two concepts has received attention in the academic literature, with a focus on whether there is a qualitative distinction between 'transformation' versus 'transition' [9,13]. While sometimes used interchangeably [7], our experience validates the etymological distinction that links transition to a meaning of 'going across', while transformation relates to a 'change in form' [13], indicating a relative and contextual shift that is knowable as the difference between two points in time.

In Section 2 of this paper we explain the competition-based approach that was used to source and evaluate transformative projects and initiatives and describe in detail the evaluative framework and process. We argue that this approach helped select high impact examples of urban transformation—a significant achievement, given the aforementioned dearth of real-world examples of deep urban transformations. Section 3 introduces the five finalists. Basing our analysis on the five high impact initiatives, in Section 4 we reflect on a basic, yet still underexplored, question at the core of the normative urban transformation agenda: what does urban transformation look like in practice? In Section 5 we draw conclusions relating to implications arising from the research.

2. Description of the Competition-Based Methodology

In recent years there has been a rise in the number of competitions, challenges and other prize-based approaches to source new ideas and solutions to public problems [14]. This trend cuts across sectors—public, private, and philanthropic—and topic areas, health and international development [15], smart cities [16], urban innovation [17], and local sustainability awards [18]. Within this broader context, the WRI Ross Prize for Cities [19] is the largest global award celebrating and spotlighting transformative projects that have ignited sustainable changes in their city. Set within the organizational context of WRI (a global research organization and 'do tank'), it is an explicit objective of the prize to surface real world instances of deep urban transformation, and to learn

from them about what makes initiatives successful, ultimately to help catalyze and inspire other transformative initiatives.

The use of evaluative approaches as a way of establishing the strength of a phenomenon is a generally well-established practice, however it has not been systematically used to understand 'urban transformation'. We propose to take an evaluative framework, such as ours, as a 'strategic extension' to the existing repertoire of research designs and methods [7]. The methodology was designed to source and evaluate submissions in terms of the extent to which they were "transformative projects igniting citywide change" (the adopted tagline of the prize). A key requirement was to have a methodology that would attract high-quality submissions and that would help us compare between entries from different sectors, countries, organizations, types of activities, project sizes, transformation and impacts. The competition-based approach had the following phases, set out in Figure 1: Preparation, Submissions, Evaluation, and Selection.
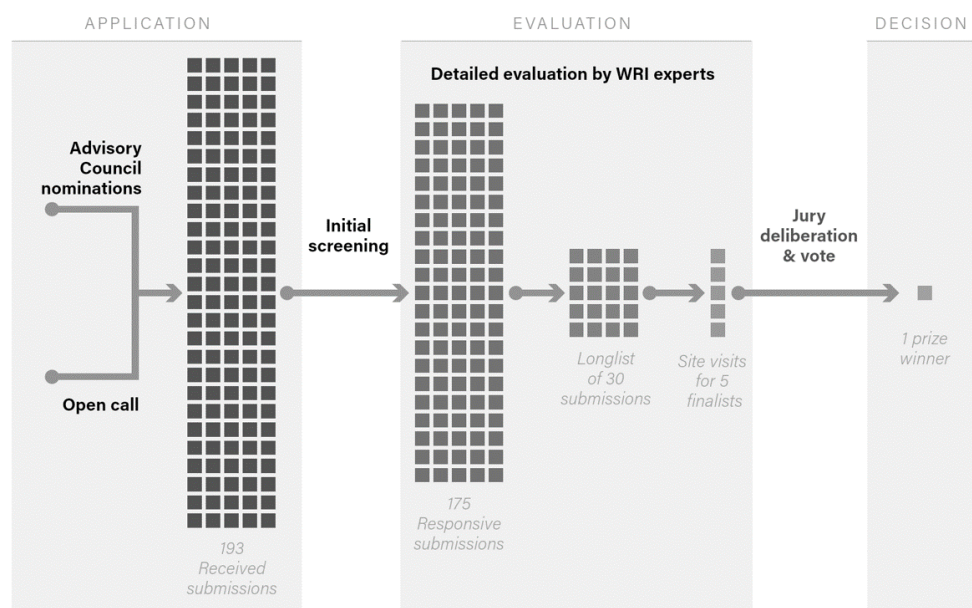

Figure 1. Sequence of the evaluation.

During the Preparation phase, an evaluation approach was developed, which was subsequently used to assess submissions to the prize. Through consulting the prevailing literature in transformation and urban studies, and adapting existing insights to the specific requirements of the prize, a six-criteria, five-point evaluation scale was constructed. This covered the following three dimensions of transformation, as relevant to the prize (for a full evaluation matrix, see Appendix A):

1. **Reach of impact:** Given a focus on 'city-wide' transformation, it was important for us to assess whether the intervention had substantially changed the project site and surrounding areas, and that it could be demonstrated that positive impacts were sustained over time and could increase further still.
2. **Balance of impact:** Given a focus on 'sustainable' urban transformation, we were interested in identifying initiatives that had had positive impacts in three categories—social, environmental, and economic—and whether these were large relative to the size of the projects and their resources.
3. **Catalytic nature:** Given our focus on initiatives that 'ignited' deep transformations, we were concerned with identifying initiatives that deliberately targeted an important problem the city faced and contributed to tackling this problem, and whether the intervention was reproduced elsewhere.

In the Submission phase, entries were solicited from two sources: through an open call advertised through the World Resources Institute's and partners' various communication channels, as well as

from a purposefully recruited Advisory Council, a network of more than 50 thought leaders in urban affairs. Over 90 recommendations were submitted by the Advisory Council, from over 30 countries. The importance of the Advisory Council is clear when considering that four of the five finalists were advisor-recommended (including the cash prize winner), and over one-third of recommendations ended up applying (a relatively high conversion rate). By the submission deadline, 193 submissions from 120 cities in 41 countries, across six continents were recorded in the system.

The Evaluation phase consisted of a successive narrowing of the pool of submissions, culminating in site visits to the five finalist sites. Of 193 submissions, 175 passed the initial screening, meaning that they met the formal eligibility criteria according to the Terms and Conditions and had submitted complete information through the application form. In the first round of the evaluation, a 13-person evaluation team rated 175 submissions, and based on this, a longlist of 30 submissions was produced (narrowed down from 175). In the second round, this was narrowed down to only five finalists. The creation of the long and short lists used a combination of the following decision-making rules:

- "Minimum threshold": a defined set of criteria that every submission needs to meet (e.g., minimum average rating of 3, lowest rating in any single criteria not below 2).
- "Best in class": top submissions in each category of geography and project type.
- "Evaluators choice": if a particular submission was not picked up through the former two rules, then there was room for discussion within the evaluation team to include the submission if it was deemed worthy by the majority (this affected two submissions in the pool, neither of which eventually became a finalist).

The eventual selection for the longlist was discussed and endorsed by a majority vote from the evaluation team, while the finalist shortlist concluded after additional research and due diligence had been carried out. This involved site visits to each finalist location. Site visits had the principal objective of completing and validating the understanding of the urban transformation case, and involved a tour of the project site(s), an extended meeting with the project team, and interviews with beneficiaries and key stakeholders. For additional due diligence, the team consulted a range of additional sources, as available, including official reports and evaluations, anecdotes, testimonials, press releases, and media and social coverage.

The Decision phase consisted of the selection of one finalist to receive the cash prize through a deliberative process by an external jury of 11 high-profile leaders in urban affairs, including architects, financiers, developers, business leaders, and philanthropists. The jury was briefed through a document containing a write up of each finalist and notes from the site visits. Ahead of the jury meeting, jury members submitted an initial ranking. Another vote took place on the day, following a three-hour deliberation, revealing the recipient of the cash prize. The voting method was the Borda count, a simple method in which voters rank candidates according to their preferences, and the least favorite receives one point, the second least favorite two points, and so on until the top candidates receives the topmost points (five, in this case). The candidate with the most points wins. The Borda count was seen as preferable to alternatives, such as Instant-runoff voting or the Combs method, as it does not exclusively focus on voters' top (or bottom) choices, but takes into account the entire ordering. It was also appropriate, given the jury's high degree of knowledge of all five candidates.

It is important to note that the winner selection was not an 'evaluative' process in which shared criteria were applied and does not indicate that the cash prize recipient was necessarily a 'better' or more impactful initiative than the other finalists. Rather, jury members were asked to determine 'prizeworthiness' based on which of the finalists should be elevated before a global audience through receiving the cash prize. Importantly, the jury deliberation offered an opportunity to surface opinions and views about urban transformation from leading thinkers and practitioners in the field.

Finally, it is important to note several limitations and challenges. Methodologically, this is uncharted territory. Developing markers of transformation, impact and attribution, and managing comparability (across sectors, countries, organizations, activities, and time frames) were key aspects

of this methodological challenge. We were able to draw on the emerging scholarship on urban transformation and to learn from operational aspects from peer-prize initiatives. However, there are no accepted methodologies for evaluating urban transformation or transformative initiatives. In fact, in the literature, there is a lack of agreement on some of the basic terminology and concepts of urban transformation, and there are only limited efforts to relate these to practical real-world instances (e.g., [12]). In addition, information availability and verifying the accuracy of the information provided was also a factor. Submissions to the prize were self-reported, sometimes incomplete, and additional information was not always readily available. Initiatives applied with their statement of impact and the WRI's evaluators assessed to what extent this impact qualified as urban transformation, as defined in the evaluation matrix. For a smaller subset of submissions (finalists and top-ranking contenders), self-reported impacts were verified during deep desktop and site visit research.

We, the authors, were involved in a leadership and support function in the evaluation process, which means we developed the evaluation methodology and led the team through the process; however, we did not take part in rating submissions or subsequently deciding the winner. In addition, we developed several measures for bias control across the evaluation team and for dealing with inconsistencies between ratings. On the one hand, we recruited a large interdisciplinary team of more than ten experts with different technical and geographical expertise; on the other hand, we ensured that almost all (98 percent) of submissions were seen by at least three evaluators in each round. Where variance between average ratings exceeded a value of 1, submissions were inspected individually to understand the source of divergence. In fact, evaluators disagreed very little. Most submissions had a variance of less than 1, and we found no significant effect of geography or type of initiative based on a simple 'distance from average' calculation (see Figures 2–4). Where variance exceeded 1, we inspected individual submissions to look for explanations of disagreement. We found these related to, for example, one evaluator unearthing negative reports through additional desktop research, and disagreement about whether it was 'too soon to tell' the degree of transformation. In the second round, more than two-thirds of submissions were rated between 4.25–4.5 average (out of 5), and 100% of submissions had a variance of 1 or lower, implying substantial agreement between evaluators.
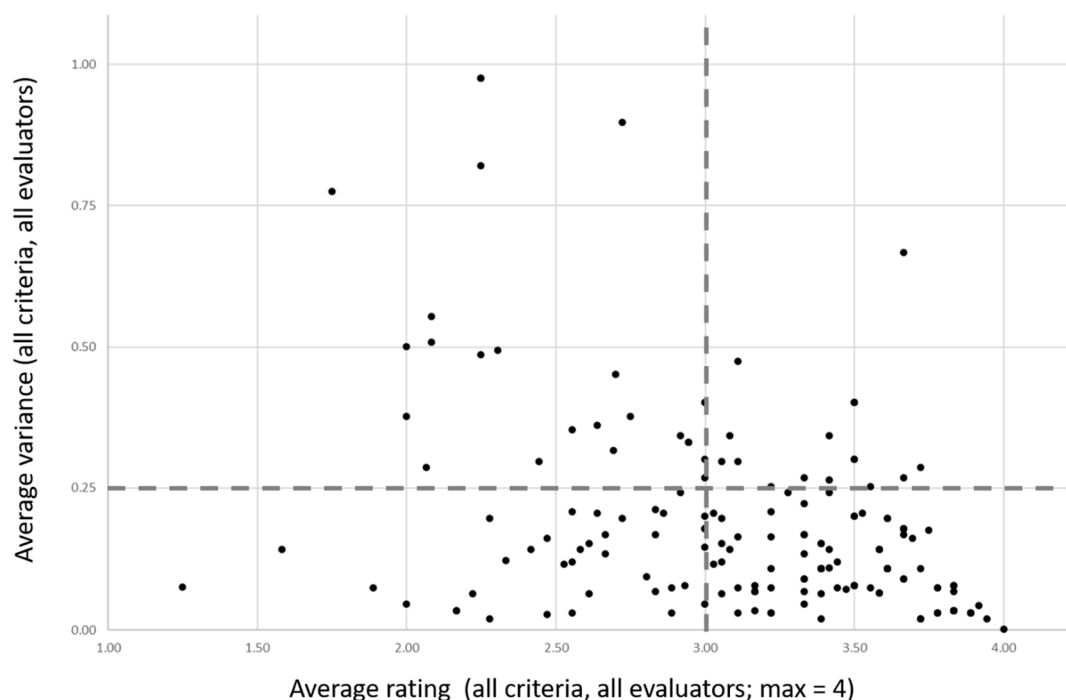

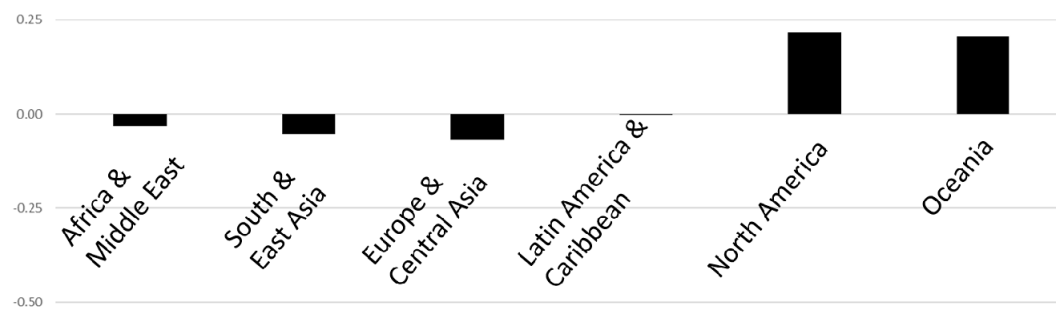**Figure 2.** Average rating and average variance for Round 1 of the evaluation (175 submissions).

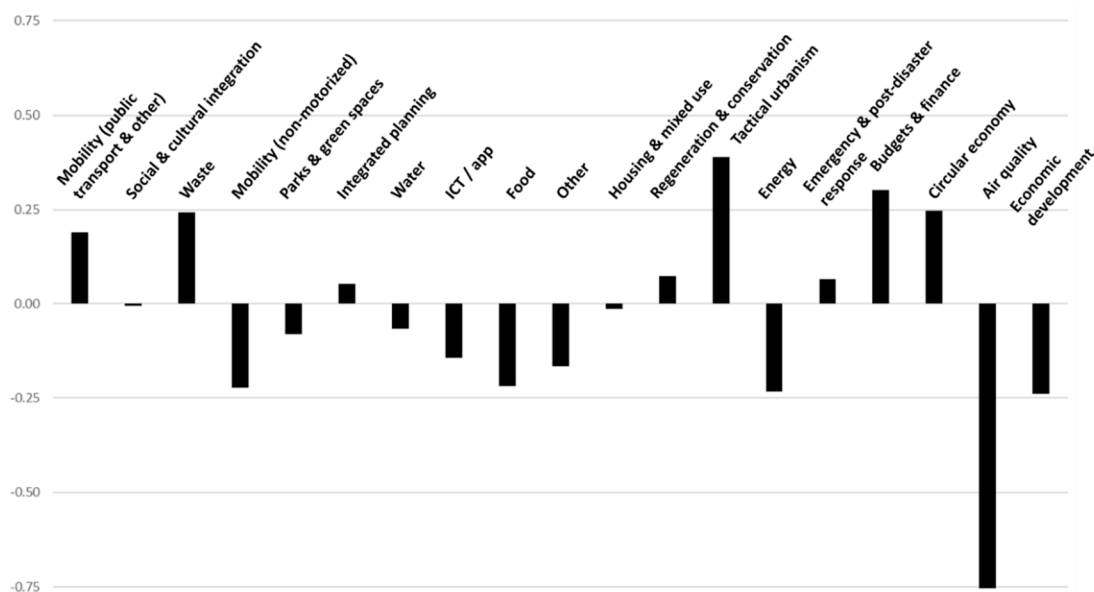**Figure 3.** Round 1 'distance from average' calculation on 175 submissions.

Figure 4. Round 1 'distance from average' calculation on 175 submissions.

3. The Finalists

This section provides a brief introduction to each of the five finalists before discussing what they tell us about what urban transformation looks like. It is noteworthy that while each of the finalists respond to local problems that the city in question is facing, these can be seen as localized manifestations of global problems. This is reflected in the strong relevance that the finalists have in presenting solutions aligned with several of the Sustainable Development Goals, including 1 (poverty), 3 (health and wellbeing), 6 (water and sanitation), 8 (decent work), 10 (inequality), 13 (climate action), and perhaps most of all 11 (sustainable cities and communities) [2]. Beyond specific contexts, the finalists contribute to a global perspective on urban sustainability, because local and global problems coexist at different scales. They also illustrate the urgency and extent of change required, indicating the desire and need for transformative effects that are beyond sustainable urban development 'as usual'. Understanding transformation in their local contexts can deepen knowledge about dealing with crisis and inertia, evolving existing institutions and power structures, mobilizing community and creating new agency for transformative change.

3.1. School Area Road Safety Assessment and Improvement (SARSAI), Dar es Salaam (Tanzania)

Dar es Salaam, Tanzania's major business and industrial center, is one of Africa's fastest growing cities, on track for 20 million residents by 2050 [20]. For the city's children, getting an education is directly linked to their future prospects, and while local governments across Tanzania invest almost half of their budgets in education, much less attention is paid to the dangerous journey children must face before getting to the classroom. The lack of safe routes for pedestrians in Dar and other big cities

in sub-Saharan Africa means that children must navigate a chaotic mix of fastmoving vehicles. As a result, many children are killed in road crashes while others are injured, causing them to miss exams or key parts of their education or, in the case of severe injuries, keeping them out of the classroom permanently. With motorization rates on the rise, public authorities are struggling to keep up with safety demands related to road infrastructure development and the rapid increase in the number of vehicles, which is exacerbated by a lack of data on road traffic injury rates.

In 2014, the non-profit Amend set out to reverse the tide with its School Area Road Safety Assessment and Improvement (SARSAI) program [21]. Starting in Dar es Salaam but quickly spreading to more than a dozen countries, the approach is attractively simple and low-cost: In each of their target cities, Amend partners with the local government; identifies schools with the highest rates of injury and death; implements safety infrastructure such as gates, sidewalks and pedestrian crossings; and works with students to teach them safer ways of crossing the street. The SARSAI program has helped 70,000 primary school students get to and from school more safely. Amend is changing mindsets by putting children's road safety on the political agenda, while also helping kids understand that their safety, mobility and freedom matters. Increased attention on this issue can be seen in the World Bank's Tanzania Strategic Cities program, which has partnered with Amend to improve road safety in eight cities across the nation.

3.2. Metrocable Line K, Medellín (Colombia)

Medellín experienced a period of rapid, uncontrolled and largely informal urban expansion associated with industrialization from the 1950s to 1970s, which continued into the 1980s, even as the city experienced industrial decline. Due to the rapid growth of population and urban boundaries, the city was plagued by lawlessness, particularly in the peripheral zones that spread up the sides of the Aburra Valley and remained essentially outside the reach of state institutions. Physically getting from these communities to the city center was a complex, lengthy and expensive journey. Political disputes over land and drug-related criminality characterized residents' interactions with the municipality, resulting in low levels of trust between communities and the local government. State institutions, including the police, were absent. In this context, drug-related crimes and violence reached a crisis point in 1995 with a homicide rate of 225 murders per 100,000 residents, the highest in the world [22].

The inauguration of Metrocable's first line in 2004, is widely seen as a key turning point in Medellín's fortune and reputation for drug and gang-related crimes. Metro de Medellín, the transit agency, and the municipality of Medellín first introduced the possibility of using an aerial cable car to integrate the hillside communities with the existing metro system in the 1998 Land Use Plan for Medellín [23]. Using an aerial cable car for mass transit was an innovative proposal, as such a technology had never been used before in a transit system. Once constructed, Metrocable connected institutionally neglected and geographically isolated communities with the city center, enabling the establishment of local public institutions, and undertaking public space investments. The new transit infrastructure coupled with public investments is associated with (above average) reductions in crime rates around station areas. It also cut daily travel by two-thirds, it dropped the costs of commuting, and attracted new businesses and investments, redefining residents' conception of the city's borders [24]. It is said to have provided a powerful symbol of inclusion and integration of marginalized populations into a modern city, and has served as a model for other Latin American cities.

3.3. Co-Creating Warwick Junction, Durban (South Africa)

In the mid-1990s, Durban's central transit node and market was becoming a congested, crime-ridden and neglected no-go zone, following years of apartheid-era segregation and marginalization of informal traders and vendors [25]. Under apartheid planning, Warwick Junction was deliberately designed and surveilled to discourage free flowing movements of people. As rules began to loosen in the lead up to the end of apartheid, increasing numbers of street traders began to cause congestion and overcrowding in the hub, which became associated with crime and unsanitary

conditions. The end of apartheid marked a period of high enthusiasm for change and cooperation, combined with the political and administrative restructuring of local government. But by 2008, optimism had dimmed, replaced with practical questions of how to move development forward in an inclusive way.

In 2008, two officials from the local authority created a non-profit organization, Asiye eTafuleni (AeT), which translates from Zulu to "a seat at the table". The goal of AeT is to integrate the informal economy into formal city decision-making processes, such as budgeting and planning. By combining research, advocacy, outreach and education, it works with both workers and the municipality to shift urban design and planning practices to be more inclusive. Over the years, the inclusive approach to urban design, and the legal advocacy and skilling of street vendors has improved residents' access to transit and affordable goods in the city, and improved the livelihoods and capacities of street vendors, while shaping a local authority to be more responsive to its residents, local traders and businesses [26]. It has influenced other cities where street markets and public spaces are a backbone of local commerce to find an inclusive path to a modern hybrid economy.

3.4. SWaCH Coop, Pune (India)

Pune, as with many of India's fast-growing and industrializing cities, faced a looming public health crisis in the 1990s. Solid waste was largely unmanaged, done primarily through open roadside dumping, leading to unsafe conditions, pests and high levels of landfilling. Following a landmark public interest case filed in the Supreme Court of India in 1996, the national government issued the country's first Municipal Solid Waste Management Rules in 2000. The rules mandated local government door-to-door waste collection, promoted waste segregation at the household level, and waste diversion from landfills. Few cities were in a position to implement these changes. In Pune, only about 7% of households were covered by door-to-door services [27]. However, the city's waste pickers, though marginalized and frequently harassed due to their jobs and class, were unusually organized, led by the Kagad Kach Patra Kashtakari Panchayat (KKPKP) union.

KKPKP began piloting the effort that would become Pune Seva Sahakari Sanstha (SWaCH) in 2005, with the support of the Pune Municipal Corporation's municipal commissioner. SWaCH is a member-owned cooperative that specializes in waste management services in Pune, India. It is the first cooperative in India wholly owned by waste pickers. From 2005–2007, 1500 waste pickers moved out of the landfills to collect and segregate waste directly from 150,000 households on a daily basis [28]. Nowadays, SWaCH has more than 3000 members, most of whom are women and Dalits (formerly known as "untouchables"). SWaCH has turned previously marginalized itinerant waste pickers into respected service providers in order to efficiently bridge a municipal service delivery gap, thereby improving livelihoods for informal workers and improving the quality of life for residents through door-to-door waste collection, including for slum households that previously had no viable collection system. Members collect more than $6.8 million USD in user fees each year and recycle more than 110 million pounds of waste, cutting as much greenhouse gas emissions as taking 32,000 passenger vehicles off the road. This has provided a viable alternative to centralized waste collection and has not only changed perceptions of a major marginalized population, but influenced local and national policy change.

3.5. Eskişehir Urban Development Project, Eskişehir (Turkey)

Many cities worldwide struggle with declining industrial activity, including job loss, population shrinkage and decreased livability. Eskisehir, the 11th largest city in Turkey, experienced rapid population growth during the early 20th century, driven by its location on the new Berlin–Baghdad Railway and cement, iron, rail, mining, automotive and aviation industries [29]. Unmanaged and uncontrolled expansion of land use resulted in traffic congestion and contamination of its main waterway, the Porsuk River. Industrial and domestic waste turned the river into a foul-smelling open sewage way. By the time the city was struck by an earthquake in 1999, industrial activity had declined,

leaving behind a city that had become congested with private motor vehicle traffic and choked with environmental pollution, and could not offer residents a high quality of life or prospects for change. The earthquake also exposed the fragility and decay of some of the city's most critical infrastructure elements: the pedestrian and vehicle bridges that connect the city's northern and southern halves.

The Eskisehir Urban Development Project is a three-part investment package financed by the European Investment Bank. It is widely regarded as the catalyst that initiated a remarkable city-wide turn-around. The project interweaves green and grey infrastructure with a new electric tram network to create a modern, nature-based city. Parks along the river have helped improve water quality and control flooding, while also spurring new commercial growth and pedestrian traffic [29,30]. The project improved accessibility to economic and leisure opportunities for all residents, including the disabled, elderly, children and families, while significantly boosting local business. Catalytic investments unlocked a virtuous cycle for the city, shifting residents' and visitors' perception of Eskisehir from decay and neglect, to an inclusive and modern city.

4. What Does Urban Transformation Look Like?

Across the literature, transformation—urban or otherwise—is commonly described using adjectives such as deep, far-reaching, radical, long-term, persistent [6–8,31,32] and sometimes also as systemic and structural [7,33,34], irreversible [31], non-linear [32,35], non-incremental [12], complex (multi-scale, multi-actor, multi-level) [6,32,36], and inherently contextual and political [37]. However, despite broad convergence around these abstract descriptors there is considerable 'elasticity' [10,38] with respect to how transformation is used across different disciplines and in spheres of policy, practice, and science. This has been noted by various publications that map the term's conceptual and methodological diversity (e.g., [10,12,38]). The growing convergence towards a broad paradigm of 'transformation' indicates a shared recognition and desire for more fundamental changes [39], which are needed, given climate and development imperatives. However, the lack of grounding has important implications because transformation is becoming increasingly institutionalized within the discourses of agenda-setting bodies such as the Intergovernmental Panel on Climate Change (IPCC), the latest World Social Science Report, and the Future Earth collaborative initiative [38]. Risks that have been noted are that too much diversity results in vagueness (and therefore a lack of rigor and effectiveness), and that the term could be co-opted by incumbents seeking to maintain the status quo.

This section aims to address the lack of systematic efforts to relate abstract concepts to concrete situations. Our intention is to help bring to life what urban transformation can look like in practice, in order to stimulate discussion and debate, rather than provide the definitive answer to this question. We are doing so by focusing, in particular, on the set of five finalists to the prize, since they provide us with good examples of urban transformation that many—advisors, evaluators, and the jury—agree on.

4.1. Tackling Deep-Seated Urban Problems

Drawing across the five prize finalists, we gain a picture of urban transformation as the outcomes of change processes in which large parts of cities changed in fundamental ways. In each case, this involved overcoming inherited patterns of exclusion, neglect or risk across the various social, technical, and natural systems that make up the city. For example, Durban's Asiye eTafuleni grew out of a conviction that decades of racist apartheid-era urban design must be dismantled, and that those who suffered most from past injustices are key to reversing disinvestment and neglect. Pune's waste picker cooperative, SWaCH, challenges the stigmatization and chronic undervaluing of a marginalized group that is nevertheless serving an important function for the city. In Dar es Salaam, the non-profit Amend places the most vulnerable and disempowered road users—school children—at the heart of urban design.

The diversity of finalists indicates that there can exist many pathways to urban transformation, involving diverse actors, goals, and strategies for pursuing and achieving change across many geographies. Amend creates corridors of safety around school zones, connecting these with settlements

where schoolchildren live, so that they can reach school safely. SWaCH, on the other hand, is a waste collection service, which covers apartment buildings, individual dwellings, commercial properties and slums across the city. Eskisehir's transformation encompasses the land and river-based transport networks, as well as large amounts of green spaces. Warwick Junction redefines the city through its gateway, its main transit hub through which the majority of commuters enter the city on daily basis. Similarly, Metrocable in Medellín transforms through connecting the peripheral areas to the main city. Across diversity in physical form and entry points, in each instance the impact that was achieved reversed a preexisting, unjust or otherwise harmful social and environmental situation.

The plurality of ways of tackling urban problems was a striking feature in the entire submission pool, but particularly in the top ranked submissions. It included variety in key protagonists, normative goals, entry points, influence strategies, and specific metrics of success. Leading protagonists ranged broadly and included transit agencies, private for profit and not for profit non-governmental organizations, and public sector administrations. Specific normative goals pursued by submissions included social inclusion, infrastructure upgrades, environmental degradation, disaster recovery, resilience, and climate mitigation, among others. There were also many different sectoral entry points (waste, energy, sanitation, transport, food, resilient infrastructure, etc.) and strategies, often used in some combination (policy change, infrastructure investment, legal advocacy, capacity and training, community organizing, entrepreneurship, etc.). This diversity resonates with the findings of recent reviews [6]. Given the broad meaning of sustainability, it is perhaps unsurprising that we would argue, that, given the range of sustainability challenges faced by cities across the globe, it is important to accommodate the diversity through which cities can transform. Future studies of urban transformation could explore these points in more depth, investigating whether there is a pattern in terms of geographical effects and city types, and the kinds of urban transformations underway.

4.2. Non-Linearity

An analysis of the prize finalists surfaced several different ways in which 'non-linearity' takes place in practice. While sometimes equated with processes of scaling or acceleration, we found non-linearity manifested in ways that were not always progressive and positive. Triggers, such as when administrations change, natural disasters strike, and policy deadlines loom, can bring about accelerations as well as regressions. Triggers can constitute changes in pressures or enabling conditions, and it is also important to note that change always happens in incremental ways all along, but may become most noticeable at particular points of inflection.

For Eskişehir, a trigger point that resulted in accelerated positive change happened when an earthquake struck the city in 1999, killing almost 40 people and damaging the city's infrastructure. The mayor and his new administration used the crisis momentum to mobilize a broad base of civil society groups, non-government organizationsand business leaders. Importantly, leading up to this moment, the city had already endured many years of decline and decay. The earthquake was a trigger that sparked activity and brought together stakeholders who previously had not felt a shared sense of urgency. A similar window of opportunity opened up in Pune for the SWaCH cooperative. In 2006, the Maharashtra state government introduced a policy deadline for door-to-door waste collection in every city. This provided the urgency for addressing a problem for which SWaCH provided a viable solution. The first memorandum of understanding between SWaCH and the municipal corporation was signed only one year later. Importantly, there had been many milestones leading up to this event (growing policy support for waste pickers, a pilot of the SWaCH model, and a decade of self-organizing by waste pickers), however the deadline imposed by the state provided the moment for SWaCH to establish itself as the vehicle to deliver on the policy mandate.

In contrast, Asiye eTafuleni's experience in Durban illustrates how trigger moments may not always accelerate progress. The founders of Asiye eTafuleni (AeT)—former municipal officials themselves—left their municipal postings to uphold the vision they had for Warwick Junction, involving the inclusive governance of public space. They did so as the mood towards informality in

Durban's city center was changing within the local administration. When the city suddenly announced plans to demolish a section of Warwick Junction in the lead up to South Africa's 2010 World Cup, the vision and approach that had begun to take root came under threat. To preserve the market, AeT pivoted towards community organizing, legal education and advocacy to preserve the market, a necessary step before resuming efforts to redesign the area. The events surrounding the World Cup were a trigger that heralded a regressive phase, with complicated implications for the transformative impact of the initiative. This finalist's experience illustrates the importance of taking into account both positive and regressive directions of change when seeking to understand the importance of individual events, initiatives, and other larger forces.

4.3. Contextual and Relative Shifts

Rather than marked by transition, in the sense of a 'threshold' that is clearly crossed [13], the finalists illustrate urban transformation as a deeply relative and contextual phenomenon that involves the aggregation of multidimensional changes. While there is no universal agreement in the literature, explicitly or implicitly, transitions manifest as a measurable 'transitional' threshold of change that can apply in equivalent ways across several instances. For example, transitions are often technological in nature and include major societal changes in which clear inflection points occur, such as the transition from cesspools to sewers in the 19th century [40], or the evolution of gas and electricity networks [41] and water supply [42]. To illustrate the contrast with transformation, one could think of a transition to renewable energy technologies in two countries. Using a threshold of reaching 50 percent generation capacity in the energy mix as a marker for transition would in itself not indicate the magnitude of the contextual shift that has taken place. Whether reaching 50 percent constitutes a large transformation would depend on the starting point—if the energy mix was already at a 40 percent at the outset, this would imply a smaller transformation than if the starting point was 15 percent. In our view, transformation and transition are not mutually exclusive terms, but they do point to different ways of marking change.

In our experience, transformation became knowable by considering the difference between two points in time and space that act as reference points. For example, in the case of the Eskişehir Urban Development Project, the points in time are 1999 (pre-earthquake) and 2018. The big transformation that took place in this period was to turn a city suffering from post-industrial decline and decay into a bustling university and tourist town visited by local and foreign tourists and students, over the course of almost two decades. Both a qualitative and quantifiable shift in specific indicators took place during this time—residents' access to low carbon transportation and anchor institutions, green space per capita, reduced travel times and cost, increases in tourist numbers and revenue for local businesses, as well as derivative indicators of municipal financial health. Similarly marked changes, unmistakable to evaluators and jury members, were observed in the other finalists too.

During the evaluation, the criterion of 'problem-solving' aimed to capture this contextual, relative shift—specifically, the extent to which the original problem a city had been facing had been solved. In the case of the finalists, these ratings were high, meaning the initiatives both targeted as well as effectively tackled an important urban problem, such as decline, disinvestment, lawlessness, and crises of waste and road traffic injuries. This can be contrasted with others in the wider pool of submissions. Many either did not address one of the major urban challenges of the city, or had not been effective in addressing and reversing it. For instance, one initiative from North America had received generally high rankings (it had established itself and even grown, and had some environmental, social and economic benefits), however, evaluators expressed doubts as to whether this initiative was in fact targeting and therefore contributing to tackling and reversing one of the key urban problems this particular city was facing. Placing the initiative in its urban context revealed its transformative impact to be relatively low.

In order to effectively analyze transformation, it is crucial to set spatial and temporal reference points, and to collect data on the 'before' picture of an urban area in order to understand the scope of

the problem and contextualize the impacts of an initiative. We used the same principle across the other evaluation criteria. For example, the criterion of 'spatial extent' aimed to capture whether the initiative had had localized impacts on its project site, or impacted several parts of the city, or the city as a whole. Analyzing transformation relative to a baseline situation helped gain a deeper understanding of the relative merits of the submissions.

4.4. Types of Transformation

In seeking to capture the plurality of ways that initiatives can transform in their own deeply contextual and relative ways, we found merit in the use of evaluative approaches such as the scale we developed for the prize. Building on our experience, we further elaborated a framework for capturing different 'types' of urban transformation, continuing the logic of the evaluation scale. This kind of approach helps find meaning and nuance within single examples as well as build bridges across substantially different urban transformation cases. Based on our analysis of the finalists, we derived the following dimensions of transformation in which we observed changes (see Table 1 for a detailed analysis):

- **Physical environment**—changes to land use, the built and/or natural environment of cities, including new infrastructure and/or public spaces, the upgrade and maintenance of existing structures, and changes in externalities (e.g., reduced GHG emissions, waste collected and processed).
- **Institutional structures and routines**—changes to institutional arrangements, practices, and laws, including new and strengthened governance structures and enterprises, planning approaches, agenda setting on new priorities, and standards, data, legal reform and precedents.
- **Financial money flows**—changes to the type, origin, and destination of money flows, including public and private finance, such as municipal finances, market-rate and concessional funding and finance, land values and property prices, investment incentives for desirable activities; and household level impacts on financial inclusion, and the cost of living (housing, commuting, food).
- **Behaviors and daily life**—changes in patterns of behavior in daily life, such as commuting and transportation patterns, consumption practices, access to economic, social, and recreational opportunities, increases in public safety (traffic, violence), and service coverage.
- **Perceptions and mental models**—changes that could affect a range of stakeholders, such as local business owners, residents, visitors, public officials, community members and leaders, youth, in their attitudes towards social issues and self-perceptions, including awareness and support for new agenda and policy priorities, new social and public narratives.

Table 1. Assessment of changes in physical environment, institutional structures and routines, financial money flows, behaviors and daily life, and behaviors and daily life.

INITIATIVE	PHYSICAL ENVIRONMENT	INSTITUTIONAL STRUCTURES AND ROUTINES	FINANCIAL MONEY FLOWS	BEHAVIORS AND DAILY LIFE	PERCEPTIONS AND MENTAL MODELS
ESKIŞEHIR URBAN DEVELOPMENT PROJECT	• A total of 13 km of river rehabilitated • A total of 9.5 km of irrigation canals renewed • A total of 24 bridges renovated • A total of 39 km tram network established • Pedestrianization, extended several times • Natural infrastructure increased by 215% per city resident • Otherturkish cities learned from and emulated the tram network	• Nation's first sustainable mobility plan implemented • Disabled-friendly urban planning embedded in projects • New local enterprises founded and operational • Urban planning process expanded to marginalized groups, such as the disabled	• Loans secured from major financial institutions • Businesses saw increased footfall and revenue • Diversified and strengthened municipal revenue base • Property prices increased 200% around tram stations	• More than 130,000 people shifted towards public transport and walking • More than 1 million people began using cultural, social, and recreational facilities • Domestic tourism increased 430%, international tourism, 820%	• Residents and businesses requested extension of pedestrianization zone which they had previously contested • Residents and visitors began viewing thecity as bustling, thriving, disabled friendly, clean, women empowered (compared to previous image of polluted, congested, industrial)
METROCABLE LINE K	• Three stops of Line K serving low income population built • Additional 40,000 square meters of public spaces and recreational facilities constructed • Atmospheric emissions from 1.7 million gallons of diesel fuel avoided • Cities in Colombia and Latin America replicated Metrocable • Construction caused a small number of people to be relocated close by in higher quality dwellings	• Transit agency's decision-making changed to focus on matching low income areas to transit technologies • A total of 35 new businesses opened in the first three months of Line K • New technical standards, laws and regulations were passed for Metrocable's implementation • Local presence of public and financial institution increased	• Land values around Line K stations increased by 50% • Local business saw increased footfall and revenue • Integration with metro reduced travel costs by 65% • Follow up investments made for four more Metrocable lines	• Street life and use of recreational, cultural, financial increases • More than 150,000 low income residents began using the first Metrocable line • Station areas experienced above-average decline in homicide rate • Average commutes decreased from 90 to 30 min	• Increased trust in the justice system • Increased social cohesion • Positive outlook developed, relating to sense of belonging to the city, hope and opportunity

Table 1. *Cont.*

INITIATIVE	PHYSICAL ENVIRONMENT	INSTITUTIONAL STRUCTURES AND ROUTINES	FINANCIAL MONEY FLOWS	BEHAVIORS AND DAILY LIFE	PERCEPTIONS AND MENTAL MODELS
SARSAI	• Improved infrastructure around 60% of Dar es Salaam's highest-risk schools • SARSAI is being implemented in eight more sub-Saharan African cities	• Municipal engineers safe design principles into new road projects • Built up baseline data on road traffic injury incidence in data poor environment • Put road safety on the political agenda within cities and countries	• Embedding safety principles in major infrastructure investment programs for eight Tanzanian cities	• Prevents estimated seven child fatalities and 500 severe injuries annually • Benefits more than 37,000 primary school students and more than 500,000 other residents • Cut traffic speeds in school zones almost 60% • Reduced injury rates by over 35% • Changed children's experience of the city	• Community members aware and actively support children's road safety • Children understand that their safety, mobility and freedom in the city matters • Mindsets change among public officials and motorists
SWACH COOPERATIVE	• Cleaner roadsides maintained, as the city now has among highest levels of solid waste segregation in the country (52–54%) • 161 tons of waste diverted, and 50 million kg solid waste recycled annually (eq. to GHGs of 32,000 passenger vehicles) • Elements of the SWaCH model are being replicated in other Indian cities • Public spaces reserved for sorting/storage	• Helped establish municipal Solid Waste Management Department with exclusive waste management focus • Influenced local and national laws to improve waste pickers' rights	• Estimated to save the municipality approx. $13 million USD in 2018Increased financial inclusion among 700 SWaCH members • SWaCH members earn approximately $6.2 million USD from user fees each year • Slum subsidy earmarked by municipal authority	• More than 2 million residents began participating in doorstep collection, and segregating dry and wet waste at source • More than 450,000 slumdwellers began receiving service • Waste pickers changed from itinerant picking practice to reliable service • More than10,500 family members began indirectly benefitting (income, health care, social status)	• Social perceptions of waste pickers changed, now seen as valued service provider rather than nuisance • Self-perception of waste pickers improved • Local elected representatives began including waste and waste pickers in their election pledges

Table 1. *Cont.*

INITIATIVE	PHYSICAL ENVIRONMENT	INSTITUTIONAL STRUCTURES AND ROUTINES	FINANCIAL MONEY FLOWS	BEHAVIORS AND DAILY LIFE	PERCEPTIONS AND MENTAL MODELS
WARWICK JUNCTION	• Opened layout of transit hub to be more accessible and free-moving • Created dedicated market areas for different trades • More than 30 tons/day of cardboard collected • Approach applied in other cities in South Africa	• Policy changes and court rulings began recognizing street trading as protected commercial activity • Municipality recognizes markets' organizational structures as stakeholders in policy and proposal development	• Municipality invested significant funds in collaborative re-design and infrastructure • Cardboard seller's revenue increased by 250%	• More than 8000 traders, many women began enjoying improved working conditions • More than 40,000 additional people began benefitting indirectly • More than +0.5 million commuters and shoppers began to access affordable fresh produce and other goods • Traders adapted to comply and actively shape with municipal regulations	• Residents and tourists became more aware of social issues of street trading • Area's "crime and grime" reputation reversed • Market preservation became a symbol that displacement is not a necessary part of modernization

Using an evaluative framework designed to disentangle nuances of types of change provides an analytical approach to capturing the contextual and relative nature of urban transformation, highlighting the multi-dimensional character of 'transformative' change. Table 1 provides a detailed breakdown of physical, institutional, financial, behavioral and perception changes that were identified in the cases. Using these dimensions, and combining them with the characteristics of plurality, non-linearity, and contextual and relative change, gives an increasingly layered picture of what urban transformation can look like. It helps to develop nuance in relation to different ways that cities change, and about how simultaneous changes in several dimensions can build up to a transformation that is larger than the sum of its parts.

However, while the finalists of the prize are deemed examples of 'transformative' changes, not all change is necessarily 'transformative' or 'transformational' [27,28,30] to the same degree. Projects and initiatives—i.e., deliberate and strategic interventions—interact with larger forces shaping the city, such as population growth, technological innovation, and changing employment, housing and investment patterns. As a result, some contextual shifts will be deeper than others. Changes in one dimension may in themselves not constitute deep transformation, however the degree of transformation will be stronger and deeper the more progressed the change between two moments in time is along the degrees. We hope to deepen our analysis of transformative urban initiatives in the future to include a spectrum of 'degrees' of transformation, through an analysis of the broader pool of (non-finalist) submissions, and by drawing on other projects and initiatives beyond the prize. We propose that a fruitful avenue for deeper analysis will be to develop and deepen the approach of working on a spectrum of 'types' and 'degrees' for analyzing urban transformation in practice.

5. Conclusions

Sustainable urban transformations—deep, far-reaching changes in how cities feel and function—are needed. Yet, despite good efforts and intentions, there is still too little empirical evidence of such dramatic changes occurring in practice. Without establishing conceptual markers for urban transformation, there is a risk that the term remains little more than a catchphrase [32]. This is particularly important because a 'transformation' paradigm is beginning to take hold in research, policy and funding practice, often without grounding in sound evidence. More than one billion dollars are already being invested in urban transformation research and implementation [11], and much of the needed urban transformation should occur in regions of the world where evidence is scantest [6,43].

To add to the evidence base on urban transformation, we focused in this paper on one of the questions at the heart of the normative urban transformation agenda: what does urban transformation look like in practice? In answering it, we drew on the full spectrum of the competition-based approach, including the rounds of evaluation, site visits, and jury deliberation, and focused our analysis on the five instances of deep impact that the competition surfaced. The process of running a major competition challenged us to develop an evaluative framework for assessing real world urban transformation, and enabled us to draw on an unusual case selection method for a comparative qualitative analysis of five implementation cases. The competition-based approach for sourcing instances of urban transformation yielded an expert-recommended and crowd-sourced selection of real-world examples of urban transformation. While the pool of submission constitutes a semi-self-selected sample, the multi-round evaluation process provided a reasonable degree of confidence in the quality of submissions as the basis for carrying out an investigation into the question of what urban transformation looks like in practice.

Based on a focus on the five finalists, we propose that it is possible to make meaningful statements about urban transformation. We described urban transformation as encompassing a plurality of contextual and relative changes, which may progress and accelerate positively, or regress over time. To find meaning within single cases and across several cases, an evaluative approach that considers varying 'degrees' and 'types' of urban transformation is proposed, which corresponds with several academic perspectives on evaluating transformative change processes [44,45]. Therefore, a key

takeaway for those seeking to better understand and use the concept of urban transformation is to analyze transformation relative to a baseline situation and identify broad types, degrees and indicators of transformation that can be observed and measured through time and space.

Demystifying urban transformation in the real world is just a first step towards helping different change agents transform cities. While it is important to break ground on such foundational questions, it is even more critical that foundational research is translated into practical resources for designing, implementing and evaluating urban transformation projects, initiatives, programs, and policies. A dedicated focus on translating insights into pragmatic approaches, tools, checklists, diagnostics is needed, which can hopefully be supported by a greater alignment between the language, actions, and funding agendas to help match knowledge needs with research priorities and funding calls. To deliver more effective interventions at a faster pace, it is necessary to enhance the transformative capacity of key actors, including by increasing awareness of what is happening around the world, inspiring and attracting talent into the field, and improving the technical, managerial and coalition-and consensus building skills of potential change makers across the spectrum of potential action.

Appendix A

Table A1. Evaluation matrix.

Category	Sub-Category	Evaluation Question	Rating Scales					
			0	1	2	3	4	5
Balance of impacts	Triple bottom line	To what extent does the project achieve a positive balance between economic, environmental and social impacts?		Project achieves positive impacts in just one dimension only; or negative impacts exceed positives.	Project achieves positive impacts in mainly one dimension, with only small positive impacts in the two other dimensions.	Project achieves positive impacts across two dimensions, and positive impacts outweigh negative impacts.	Project achieves positive impacts across two dimensions, and small impacts in the third dimension, and positive impacts outweigh negative impacts.	Project achieves a balance of positive impacts across all three sustainability dimensions, and positive impacts outweigh negative impacts.
	Outsized impact	What is the extent of the positive impacts relative to the project's own size and resources?		Positive impacts very small relative to size of projects and resources.	Positive impacts relatively small relative to size of projects and resources.	Positive impacts commensurate relative to size of projects and resources.	Positive impacts relatively large relative to size of projects and resources.	Positive impacts very large relative to size of projects and resources.
Catalytic nature	Problem-solving	To what extent has the project solved a problem that the city was facing?		The project has had no discernible impact on a problem the city was facing, or there is no strong link between the project and change that has occurred.	The project has had some limited or indirect impact on a problem the city was facing.	The project has had direct impact on a problem the city was facing but cannot be said to be leading to a potential tipping point in the foreseeable future.	The project has had direct impact on a problem the city was facing and is contributing to potentially reversing the original problem in the foreseeable future.	The project has had direct impact on a problem the city was facing and has contributed to completely reversing the original problem.
	Replication	To what extent has the project demonstrated a replicable approach?		The project impacts have not been reproduced in other locations and the idea has not received interest elsewhere.	The project impacts have not been reproduced in other locations but the idea has initial received interest.	The project impacts have not been reproduced in other locations but the idea has received considerable interest elsewhere.	The project impacts have been reproduced in one other geography based on adaptation of the original idea.	The project impacts have been reproduced in several other locations based on adaptation of the original idea.

Table A1. *Cont.*

Category	Sub-Category	Evaluation Question	Rating Scales					
			0	1	2	3	4	5
Reach of impact	Spatial extent of impact	What is the spatial extent of the project's impact?		The project has not noticeably changed the project site or surrounding areas.	The project has noticeably changed the immediate project site.	The project has changed the project site and had small changes on surrounding areas.	The project has changed the project site and has substantially changed surrounding areas.	The project has changed the project site and is felt city-wide, or even beyond.
	Duration of impact	To what extent did the positive impacts of the project (as described above) outlast the duration of the project?		Positive impacts of the project did not outlast the duration of the project.	Positive impacts of the project outlasted the duration of the project, initially, but have since diminished.	Positive impacts of the project have been sustained over time until now.	Positive impacts of the project have been sustained over time until now and there is indication that they could increase further still.	Positive impacts of the project have been increased over time and are now larger than originally.

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