

CONCEPTUALISING JUSTICE IN TRANSIT-ORIENTED DEVELOPMENT (TOD): TOWARDS AN ANALYTICAL FRAMEWORK

Marquis K.F. Yip; Samira Ramezani; Louise Meijering;
Taede Tillema; Jos Arts
University of Groningen

1. INTRODUCTION

1.1 Research gap and aim of the paper

Transit-Oriented Development (“TOD”) – mixed-use, high-density, walkable and compact neighbourhoods centred around transit stations (Calthorpe, 1993) – is a well-known planning concept frequently implemented around the world (Curtis & Renne, 2016; Padeiro et al., 2019). Not surprisingly, the visions, objectives, design principles, and development scale of TOD all vary greatly around the world (Cervero et al., 2004; Renne, 2020; Thomas & Bertolini, 2020). In recent years, although the justice implications of TOD are receiving greater recognition and interest (Ibrahim et al., 2022; Padeiro et al., 2019; Shatu et al., 2022; Sun et al., 2022), a broader framework to analyse and position justice concepts and issues within TOD is lacking – how do injustices arise and relate to TOD, and where should we direct our efforts to examine them?

In this review-based conceptual paper, we aim to show the importance to consider both process and outcome aspect to analyse justice in TOD. We also aim to formulate an analytical framework to analyse justice in TOD holistically.

1.2 Background – justice concepts

While justice is often seen as a somehow “unknowable” concept that eludes consistent definition (Barkan & Pulido, 2017), a useful starting point is the fundamental interpretation of justice comprising fair (i) *procedures to determine the allocation of cost and benefits* and (ii) *actual distribution itself* (Cook & Hegtvedt, 1983). This distinction between process and outcome justice is often used in academic fields (Tyler, 2000), including urban geography and planning (Fainstein, 2010; Harvey, 1996; Soja, 2010), as we briefly visit below.

Process justice

Geographers have long stressed production processes as important factors of justice – summing up justice as “just production justly arrived at” (Harvey, 2009, p. 98). One should have the right to co-determine how a city develops (Marcuse, 2011), and a basic starting point is the communicative planning model (Fainstein, 2010), calling for open platforms, wide representation, flat hierarchy, and pluralistic democratic participation (Achmani et al., 2020). However, some have cautioned that these principles are important but no guarantee of justice in the end-outcome (Fainstein, 2010), for example by overlooking systematic distortions (Neuman, 2000). The stream of critical geography emerged from this basis, focusing on how oppression and domination were maintained over, and

which justifies the analysis of both process and outcome justice in TOD. In Section 4, we formulate an analytical framework of justice in TODs, adopting (i) the Institutional Analysis and Development (“IAD”) model developed by Polski & Ostrom (1999), a tool intended for understanding institutional interactions in public resources and policies, to analyse *process justice*; and (ii) 5Ds of the built environment (i.e. Density, Diversity, Design, Destination Accessibility, and Distance to Transit), which originates as a set criteria to determine success of a TOD, to analyse *outcome justice*. To conclude, we discuss the operational usage, significance and limitations of the analytical framework.

2. METHODOLOGY

To better understand the main justice issues in TOD, we conducted a thematic review of academic literature related to justice concepts, issues and impacts in TOD. We chose the databases of Web of Science, Scopus, and SAGE Journals, which are considered the main large-scale bibliographic databases to access TOD academic literature (Ibraeva et al., 2020). The search terms adopted are (“justice” OR “equity” OR “equality”) AND (“Transit-oriented development” OR any of its variants: “TOD”, “transit-oriented communities”, “transit village”, “mobility hub”, “hub development”, “station development”), to return results that relate to both justice and TOD. We limited the search to articles which are peer-reviewed journal articles in English, published on or after 2000, and belonging to relevant fields of social science, geography, planning, urban studies and transport. The initial results came to 202 articles, revised to 165 after removing the duplicates. Afterwards, we further screened the articles by examining their titles, abstracts and conclusions to determine whether they really fit our review, leading to 50 articles finally included in the review. Details of the article selection process are shown at the Notes² for reference.

Among the papers finally included, the vast majority are empirical papers (n = 46) using mostly quantitative methods (e.g., sensitivity and factor analysis, predictive models, statistical tools) but also some qualitative (e.g. institution analysis, interviews and focus groups). There a few review papers (n = 3) and conceptual paper (n = 1). This is not a perfect categorisation, as most papers straddle across these groups, but it highlights the dominance of empirical studies and relatively limited engagement of TOD and justice conceptually. As in the results of the bibliometric analysis by Shatu et al. (2022) on TOD literature, the majority of the papers (n = 23) examined cases in the U.S., followed quite distantly by Canada (n = 4), China and India (n = 3 for both), Taiwan and Hong Kong (n = 2 for both), then 11 other places each covered by one paper. A summary of the 50 papers reviewed, including their types, study locations, objective and key findings, is available upon request for reference.

From the review, we have synthesised and formulated the three main justice issues of TOD as: (1) transit-induced gentrification; (2) neglect of the livelihood and well-being of disadvantaged groups; and, (3) poor inclusion and representation of stakeholders.

3. REVIEW FINDINGS – KEY JUSTICE ISSUES OF TOD

3.1 Transit-induced gentrification

Almost half of the papers reviewed (n = 24) focused on or alluded to transit-induced gentrification, which refers to TOD raising the surrounding property values, attracting influx of wealthier residents, increasing living costs and displacing lower-income population (Padeiro et al., 2019). It is frequently studied - from displacement of low-income refugee residents in Canada (Jones & Ley, 2016), comparison of socio-demographic changes between different types of U.S. TODs (Dong, 2017), to impact on residents' travel behaviour in Thailand (Matsuyuki et al., 2020), and increasing proportion of private residences at the expense of social housing in Hong Kong (He et al., 2018).

Transit-induced gentrification creates outcome injustices in many ways, from pushing disadvantaged groups to further “catchment areas” of the TOD (Deka, 2016), loss of affordable housing (Peng & Knaap, 2023), to new intersectional challenges faced by ethnic minorities in gentrified areas (Chava et al., 2018) and discrimination by new residents (Zuñiga & Houston, 2022). TOD exacerbates gentrification because of its reliance on capitalising on the increased land values over a whole area (Padeiro et al., 2019). Paradoxically, TOD brings better accessibility but also higher rents which drive away disadvantaged social groups, such as low-income families, who are most dependent within the society upon accessible destinations and public transport offered by the TOD (Dong, 2017; Zhu & Diao, 2022). On the other hand, the higher-income ‘gentrifiers’ are not necessarily avid public transport riders, sometimes still retaining their entrenched habits of using automobiles, for example in TOD in Asia (Matsuyuki et al., 2020).

Furthermore, gentrification also involves issues in process justice. Lung-Amam et al. (2019) argued that public advocacy and participation in the inception and planning of TOD are important points to assess gentrification. Shortcomings in the TOD planning process that could lead to gentrification include inflated power and freedom of property developers compared to conventional urban development (Jones, 2020), limited involvement of local businesses and existing residents (Baker, 2020), and lack of focus on addressing gentrification-induced hardships faced by disadvantaged groups (Zuñiga & Houston, 2022). Gentrification, therefore, relates to both outcome and process justice.

Interestingly, not all studies cast gentrification from TOD in a negative light, especially in greenfield new developments, since some have found that compared to an “ordinary” train station, TOD still offers better access to public transport that benefit people of different income (Nazari Adli et al., 2020). Even with some signs of gentrification, TOD as new development holds potential to support lower-income groups by creating economic opportunities (Zuñiga & Houston, 2022) and improving their mobility (Wang & Woo, 2017), especially in high-capacity TODs such as regional train stations (Tran & Draeger, 2021). The key lies in effective measures to mitigate the harmful effects of gentrification while capitalising on the promises of TODs (Pendall et al., 2012), for example, by setting robust requirements for affordable housing (Fainstein, 2010).

3.2 Neglect of livelihood and well-being of disadvantaged groups

Another common justice issue identified is the comparably worse livelihood and well-being of the disadvantaged, deprived and marginalised groups in TOD neighbourhoods, an issue studied by over half of the papers reviewed (n = 28). This relate to various social groups and aspects, such as TOD features that don't suit older adults (e.g., poor walking environment) (Chen et al., 2023), inadequate to needs of families with children (e.g. affordable housing with accessible schools and day-care facilities) (Bierbaum & Vincent, 2013), lack of designs that safeguard vulnerable groups, such as women facing harassment and special needs of the disabled (Malik et al., 2020), disproportionate defunding and cancellation of railway projects that predominantly serve certain ethnicities (McFarlane, 2021) and TOD potentially exacerbating transport expense burdens of lower-income groups due to relocation of affordable housing. (Wu et al., 2020). Though somewhat overlapping with transit-induced gentrification, this issue's focus is on the actual poorer well-being of certain groups, which could or could not be due to effects of gentrification.

This is a major issue of outcome justice in TOD. While TOD can potentially attract development opportunities and investments, such as better public transport and more shops and services (Kim, 2020), they are not always distributed fairly among different people living there (Luckey et al., 2018; Trudeau, 2018; Wey et al., 2016). Specific needs of disadvantaged groups, such as older adults (Chen et al., 2023) and families with children (Bierbaum & Vincent, 2013) may be overlooked. Worse still, gentrification and displacement could harm their welfare through breaking social ties and raising housing and transport costs (Lung-Amam et al., 2019; Wu et al., 2020). Those who are already well-off are more likely to reap greater benefits, while those who started off as disadvantaged continue to receive smaller shares of benefits (Fainstein, 2010), sustaining or exacerbating structural injustices stemming from commodification of housing (Slater, 2009).

3.3 Poor inclusion and representation of different stakeholders

Furthermore, TOD sometimes suffer from inadequate and ineffective inclusion and participation of stakeholders in the planning process, to which a significant number of papers reviewed (n = 16) relate. For example, in Johannesburg, South Africa, Harrison et al. (2019) reported strong community frustration and criticisms towards the city government already making key decisions before engaging in the participation process of its 'Inclusionary TOD'. Baker (2020) found that in the TOD projects of St. Louis, the U.S., black, lower income and transit-dependent residents were overlooked in the planning process dominated by real estate developers. In a similar vein, Sandoval (2018) found that failure to meaningfully include communities of ethnic minorities in the planning process of TOD led to their resistance in later completion stages.

The above illustrates how the TOD planning process, often driven by economic considerations (He et al., 2018), can fail to provide a fair platform for all interested and relevant stakeholders to participate. Landowners and developers frequently command dominating power and at the expense of

stakeholders such as existing lower income and ethnic minorities residents (Abdi & Lamíquiz-Daudén, 2022; Sandoval, 2018). Furthermore, even stakeholders of more comparable power (e.g., planners, city officials, public transport agencies) also suffer from poor communication, lack of collaboration and competing goals in the TOD planning process (Tridib Banerjee et al., 2018), such as between different levels of public actors like national strategy-forming, provincial planning and local implementation (Mittal & Shah, 2021).

This is not to mention that the most vulnerable and transit-dependent groups, such as the lower-income and the disabled, are often inherently less able to participate because of their literacy in planning matters, political power and social influence (Young & Allen, 2011). Yet we see that public actors may be inclined to limit planning participation to professionals (Baker, 2020), and only conduct “token participation” of public engagement that fails to involve interested parties meaningfully (Harrison et al., 2019), or attaches limited importance on certain stakeholders’ input by consistently overruling them, such as on budgetary grounds (McFarlane, 2021). These shortcomings are detrimental to creating process justice.

4. A PROPOSED ANALYTICAL FRAMEWORK

The three key TOD justice issues are closely related and straddle both outcome and process justice, requiring both perspectives to analyse them. Therefore, to conceptualise and analyse justice in TOD, we propose in Figure 2 below an analytical framework that captures both process and outcome justice –

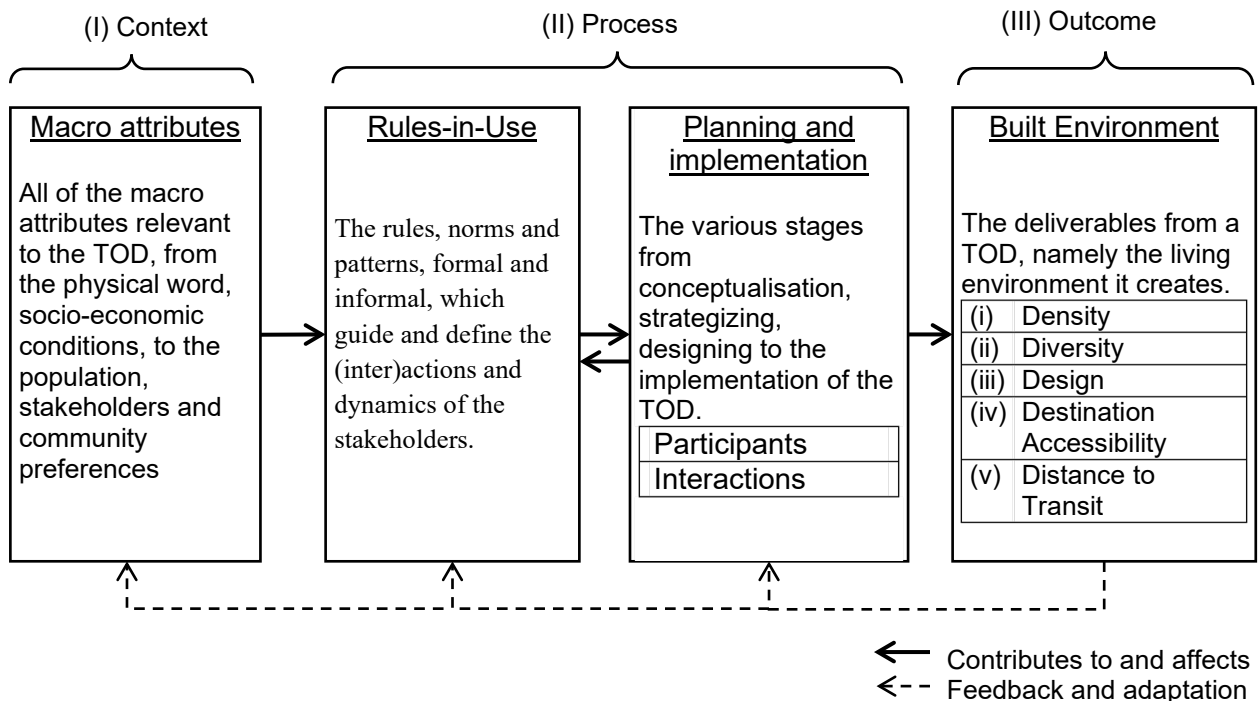


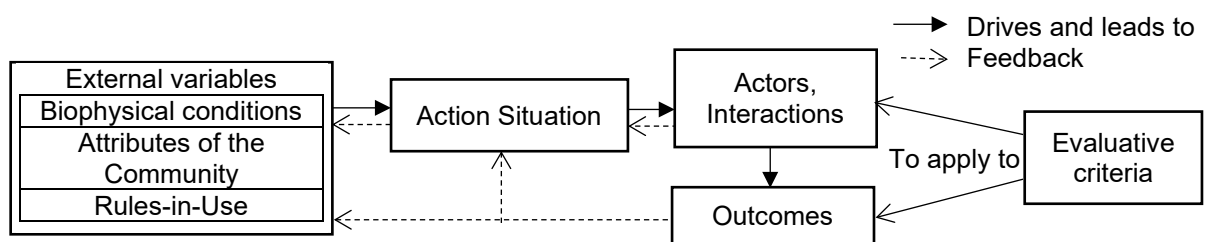
Figure 2. A proposed analytical framework to examine justice in TODs

The framework’s overall structure is based on the *IAD model* developed by Polski and Ostrom (1999), and is composed of three main parts: (I) Context, (II)

Process and (III) Outcome. (I) Context contains the social, economic and other macro attributes that relate to and drive the need for TOD. These background factors affect and contribute to the (II) Process, which refers to the planning and implementation process of TOD, in which the Rules-in-Use governing the interaction of stakeholders is the key in understanding process justice (explained later). Eventually, the (III) Outcome of TOD is realised in the form of the built environment, including elements of housing, facilities, public transport, etc., which can be analysed through the *5Ds of the built environment* originating from Cervero & Kockelman (1997). However, it doesn't stop there – the built environment gradually provides feedback to the earlier components of (I) Context (such as by changing the population structure, housing needs, community preference) and (II) Process (such as making certain stakeholders more powerful and changing the Rules-in-Use for them). In the following, we explain the framework in greater detail by exploring the two models that form its backbone – (i) the IAD model and (ii) the 5Ds of the built environment.

4.1 The IAD model

The IAD model is a systematic method to comprehend the work of multiple actors in public policy and resource allocation (Polski & Ostrom, 1999). It has been found useful in breaking down complex interactions of multiple stakeholders to achieve a common goal, outcome or policy, such as Achmani et al. (2020) adopting it to understand spatial inequalities in land management interventions. Likewise, we consider it well-suited for TOD, which typically involves various parties with diverse and conflicting targets and interests over valuable resources like land, housing and public transport (Ibrahim et al., 2022). Figure 3 below outlines the IAD model, followed by discussion on how it is incorporated in our framework.



Adopted from: (Ostrom, 2005)

Figure 3. The IAD model

(a) Action Situation, Actors and Interactions

The IAD model centres on the *Action Situation* where participants interact, exchange information, make decisions, cooperate and dominate one another (i.e., Interactions) in order to achieve the target Outcomes (Ostrom, 2011). In our analytical framework, the Action Situation translates to *Part (II) Process*, namely the TOD policy formulation and planning process. Also important is to identify the Actors embedded, which should include every party (individuals, groups, institutions, etc.) that is interested in, relevant to, or connected with the Action Situation, regardless of their actual participation (Ostrom, 2011).

(b) Biophysical conditions and Attributes of the Community

Next come the External Variables, which are the contextual factors that inform and drive the Action Situation (Polski & Ostrom, 1999). The first two components – namely biophysical conditions (geographical, economic, demographic conditions) and attributes of the community (social capital, values, preferences, norms) – are grouped together as *Part (I) Contexts* in our analytical framework. It is because while relating to the need or motivation for TOD, they do not form the core of our examination of justice.

(c) Rules-in-Use

The remaining component of “Rules-in-Use” is of much greater interest to understand process justice. They are often implicit, hidden systems (even to the Actors themselves) that dictate the participation, interaction and decision-making of Actors in the Action Situation (Polski & Ostrom, 1999). Rules-in-Use, formal and informal, “concentrate on the operating rules that are commonly used by most participants and on the source of these rules, rather than on well-articulated but not widely observed rules” (p. 23). They are divided into seven types as set out in Table 1 below.

Table 1. The seven Rules-in-Use in the IAD model

Rules-in-Use	Action verbs	Description
(a)Boundary	Be (not) involved	Which parties are admitted in the planning process? Who is rejected? Why is it so?
(b)Position	In charge of, be responsible for	What is the role of the parties in the planning process? Can the roles change in the process and how?
(c)Authority	Able to do	What are the actions and decisions that each party is able to make? What gives them this power?
(d)Information	Send and receive	What information is shared and what is held secret? What information is sought and received, and what is not received? How is this information used?
(e)Aggregation	Decide jointly, by one self	How are the deliberations, considerations and decisions made, jointly or individually? In joint efforts, who leads? Why is it so?
(f) Scope	Have jurisdiction, control over	What are the outcomes that the parties can affect and influence? What are the goals and vision of the parties?
(g)Payoff	Bear cost, earn profit	How are costs and benefits allocated?

(Ostrom, 2011; Polski & Ostrom, 1999)

As noted by Blomquist & deLeon (2011), the IAD model identifies Rules-in-Use as the key element to make sense of the patterns and manner of Interactions in the Action Situation. Ostrom herself placed great importance and dedicated

much effort to develop and refine the seven Rules-in-Use (Cole, 2017). They guide, influence and delineate the Action Situation, which in turn shape existing or create new Rules (Polski & Ostrom, 1999). Given their seminal role, we have adapted them in *Part (II) Process* of the analytical framework as the metrics of analysing process justice in TOD, which we will discuss rule-by-rule below.

4.2 Evaluative criteria of Process Justice in TOD

(a) Boundary

The main principle of “Boundary” is that all stakeholders who are relevant or interested in the TOD should be able to access and participate in the planning process. Ideally, this should be formalised in legislation for certainty, though it is equally important that legislation is not used to ring-fence the process to exclude certain stakeholders (Cascetta & Pagliara, 2013), for example, a fixed panel of officially selected and appointed “representatives” serving as the same token of public engagement for every project (Bryan et al., 2007).

Furthermore, it is also critical to actively identify and represent disadvantaged population – e.g., older adults, the disabled and (ethnic) minorities. They may be less aware of changes (including TODs) that could affect them, face language, cultural barriers and knowledge gaps in public participation (Sandoval, 2018), and have specific challenges and needs to be catered to (Lung-Amam et al., 2019). Therefore, dedicated efforts should be made to ensure that their interests, concerns and welfare are represented.

(b) Position

In terms of “Position”, the government usually holds the dominating power (Ibrahim et al., 2022), with national, provincial and local governments setting strategies, developing plans, and implementing projects, respectively (Mittal & Shah, 2021). Landowners and developers may also wield substantial power given their heavy resource involvement (He et al., 2018). Public transit operators provide the essential component of ‘T’ in TOD, though their power may be limited to operational levels with little influence on strategic decisions (Cascetta & Pagliara, 2013). Other parties, such as consultancy firms, advocacy groups, NGOs, residents and commercial actors, may play periphery positions of giving suggestions and comments (Zuñiga & Houston, 2022).

To deliver process justice, the “Position” rule should ensure that all parties of similar roles, goals and interests occupy the same positions so they may engage, compromise and interact on an equal footing. For example different potential and existing residents (of various income, ethnicity, social groups, etc.) should be able to interact and be engaged by other stakeholders fairly (Sandoval, 2018). No party should take up favourable positions its peers because of its financial capital, political power, historical precedence, etc.

(c) Authority

Similar to “Position” rules, overarching “Authority” of deciding the overall strategy, development parameters, project timetable, etc. of TOD usually falls to a government (Mittal & Shah, 2021). Beyond these, different parties may hold authority over their respective spheres, such as operators on public transport, commercial developers on office and retail spaces, and housing associations on residential development.

It is important that the exact power of parties with substantial authority, e.g., the government, be clearly and formally defined, such as who to seek input, agreement or consult in its work (Humphreys, 2012). Ideally, there should be a balance of authorities between groups of competing interests. For example, in deciding the use of a piece of land, all interested stakeholders (e.g. housing organisations, retail corporations, private developers) should start with the same opportunity, and have the same means to give input and influence the planning process (Wagner, 2013). Meanwhile, there should be some positive discrimination in favour of the disadvantaged groups to safeguard their interests and welfare, such as by identifying advocacies groups that represent their voices (Lung-Amam et al., 2019). On the other hand, there should be oversight to ensure that powerful and established stakeholders do not use their inherent advantage to exert their influence beyond their roles and responsibilities, such as retail mall developers also designing and controlling infrastructure like the train station and public areas (Al-Kodmany et al., 2022).

(d) Information

“Information” can have a broad coverage in TOD, from the broad strategies, population targets to architectural and street designs. Information that is important and widely affects the interests of different stakeholders should be made openly available and easily accessible (Fainstein, 2010). These could include the overall zoning plans, design rationale and principles, and development stages and timeframe of the TOD. Stakeholders should receive these key pieces of information in a timely and accessible manner, so that they may assess the information effectively, weigh its significance, give feedback and make decisions (Hossinger et al., 2004). Once again, for highly technical information, there should be special attention to assist the disadvantaged groups and often the public at large (Wagner, 2013). Workshops and demonstrations may be useful for the public to grasp planning and technical information, and to give comments (Pojani & Stead, 2015). For the disadvantaged groups, advocacy groups may be useful in helping them receive and digest the relevant information, and react appropriately to safeguard their welfare (Lung-Amam et al., 2019).

(e) Aggregation

“Aggregation” concerns how decisions are made, collectively or individually (Ostrom, 2011). While democratic decision-making is often regarded as best taking into account the interests and welfare of everyone (Fainstein, 2010), it is not always practical – not every decisions can simply be put to voting or

'majority rules', given the great variety and complexity of decisions involved in TOD planning (Humphreys, 2012). Further still, democracy is no guarantee of justice – given our imperfect information, self-interested nature and preference for short-term over long-term gains, decisions made democratically may still harm justice by reducing overall societal well-being and neglecting the disadvantaged groups (Fainstein, 2010; Neuman, 2000). Therefore, though important, open democratic planning should not be seen as an unyielding rule.

“Aggregation” becomes particularly important in significant decisions that involve critical resources and competing interests (such as use of central land-plots in the TOD). In this scenario, a disinterested party (e.g. an independent planning commission) consisting of a broad spectrum of members should host an open and accessible platform for all relevant stakeholders to express their views, make suggestions and provide justifications (Cascetta & Pagliara, 2013). Disadvantaged groups should be given special help to have their interests represented. The disinterested party should make decisions with a good balance of interests while safeguarding the disadvantaged. Its deliberations and reasoning should be clear and transparent for all to view, question or challenge.

(f) Scope

“Scope” somewhat overlaps with “Authority”, though “Authority” relates more to exercising power and making decision, and “Scope” concerns the end-product, namely the ultimate goals and visions of the parties (McGinnis, 2011). Justice in “Scope” can be interpreted as the respect and fair treatment of every parties’ goals and visions, and the discrepancies between the envisioned and actually controllable goals of a stakeholder.

For example, the goal of a private property developer is to maximise profits (Marcuse, 2011), which translates to obtaining the most desirable plots (closest to the train station), developing them and selling them at a premium (He et al., 2018). This will often be at odds with the scopes of other stakeholders, such as social housing whose aim is to provide affordable accommodation and accessible public transport for low-income residents. If the most suitable lands are all purchased by private developers, then a discrepancy would be created between the vision of social housing for the needy and the reality of unaffordable land plots. We can evaluate justice by comparing whether the scopes of different parties are fulfilled, or whether great discrepancies exist between the vision and reality of certain stakeholders (Wagner, 2013).

(g) Payoff

Broadly speaking, we may evaluate “Payoff” by examining who bears the costs in the planning and implementation of a TOD, and then who reaps the benefits. ‘Payoff’ could also include non-financial items like housing and services.

Firstly, we examine how the costs are allocated to the stakeholders, such as construction costs of the train station, utilities, infrastructure and facilities. Given the variety in TOD, there are various cost allocation mechanisms, such as Build-Operate-Transfer agreement² (Al-Kodmany et al., 2022) and leasing

arrangements³ (Matsuyuki et al., 2020). Then, we compare the distribution of benefits among different parties – who gains the use of land, transport and infrastructure? Do certain stakeholders receive a greater share of benefits (such as expensive residences occupying all of the desirable plots close to the train station)? One must recall that the vision of TOD is to create sustainable and equitable communities, not only to drive economic development (Jamme et al., 2019). Therefore, it follows that not only economic benefits should be considered but also social returns, such as the number of residents of different income level housed. To this end, it is important to devise and implement ‘Payoff’ rules at the beginning of the planning process, such as a balanced mix of housing and development types in the early strategic plans (Fainstein, 2010).

4.3 5Ds of the built environment

Having dealt with *process justice* through the IAD model, we now turn to *outcome justice* via another model – the 5Ds of the built environment, namely (a) Density, (b) Diversity, (c) Design, (d) Destination Accessibility, and (e) Distance to Transit (Thomas & Bertolini, 2020), which trace their origins back to the 3Ds developed by Cervero & Kockelman (1997) as the criteria in creating successful TODs as equitable and inclusive communities. Nowadays the 5Ds are often formulated as the essential elements of the built environment delivered by a TOD (Hrelja et al., 2020; Jamme et al., 2019). Table 2 below outlines the key definition and some commonly used indicators of the 5Ds.

Table 2. Key definition and commonly used indicators of 5Ds

5Ds	Definition and meaning	Commonly used indicators
Density	Density refers to the agglomeration and concentration of housing, businesses and other functions. In the original U.S. context, it refers to a <i>minimum</i> density that ensures a critical mass of passengers to generate sufficient travel demand for public transport in the TOD.	Population density, housing density, employment density
Diversity	Diversity refers to the availability and variety of different functions and land-uses, from residential, commercial to social and leisure facilities. Diversity is one of the key promises of TOD, creating walkable-sized communities that could satisfy various needs of different people.	Jobs, services, shops and social services to housing ratio, distribution of use-functions (entropy-based land use mix index)
Design	Though it could be very widely defined, Design focuses on various characteristics of the built environment, from street furniture and connections to public spaces and infrastructure that facilitate walking and travelling within the TOD area, particularly by the more disadvantaged groups such as older adults and the disabled.	Network of walkways and bicycle paths, accessible designs and facilities, inclusive infrastructure (e.g., protected walkways, lifts)

Destination Accessibility	Destination Accessibility refers to the ease for people to reach their destinations, including workplaces, schools, shops, places for leisure, etc. The destinations could be within the TOD neighbourhood and further away in other locations outside of the TOD.	Number and variety of destinations in the area, distance from home to workplaces and other destinations, average time spent travelling per day
Distance to Transit	Initially referring to the physical distance to the train station, we can interpret “Distance to Transit” in an extended sense to cover the availability and ease to reach and use different public transport options. This includes both the train station but also other shuttle and supplementary services, such as local buses and on-demand personal transport that run within the TOD neighbourhood.	Distance and journey time from homes and workplaces (and other destinations) to the train station, local transport (e.g., bus) network, catchment and usage of public transport services

(Barbour, 2019; Calthorpe, 1993; Cervero & Kockelman, 1997; Chen et al., 2022; Liu et al., 2020; Niu et al., 2021; Thomas & Bertolini, 2020; Zhang et al., 2014)

By describing the deliverables of TOD structurally, we find the 5Ds apt for developing the evaluative criteria of outcome justice in TOD. We aim to assess and compare different neighbourhoods and places around a TOD through the 5Ds, in order to examine whether the TOD brings just outcomes for everyone.

4.4 Evaluative criteria of Outcome Justice in TOD

(a) *Density*

Studies have revealed that given the choice, very-high density dwellings are generally unpopular, and that population density and satisfaction in an urban setting are negatively related (Yin et al., 2019). On the other hand, preferences for moderate or low densities are harder to predict, with different studies of satisfaction yielding contrasting or insignificant results (Smrke et al., 2018).

From the supply-side, we may assess justice by comparing whether the densities of different neighbourhoods around a TOD show marked discrepancy. In other words, are there particular neighbourhoods that are much denser than others (e.g., social housing vs. private residences) which potentially affects the residents' quality of life? Correspondingly, on the demand-side, given the variation in an individual's preference towards density (Smrke et al., 2018), we may also compare the subjective satisfaction of different residents towards the densities of their living environment in different neighbourhoods of the TOD.

(b) Diversity

A varied mix of housing, retail, services and facilities – i.e., a high functional diversity of land use, is an important determinant of residents' satisfaction (Chen et al., 2022; Tridib Banerjee et al., 2018), and is also one of the key promised benefits of TOD (Thomas & Bertolini, 2020). We may view “diversity justice” in TOD first from the supply-side: Are there the same levels of diverse shops, services and facilities in different neighbourhoods, or is diversity focused on certain areas only? We can also reaffirm this from the demand-side – are different residents satisfied with the functional diversity in their neighbourhoods? A lack of diverse and local shops and services limits the choice of residents and harms their living satisfaction (Baker & Lee, 2019), but conversely, excessive diversity may indicate an overcrowded living environment which negatively affects life satisfaction (Chen et al., 2022).

(c) Design

Design involves network, facilities and infrastructure designs which could contain many elements, with some of them relatively less quantifiable (Jamme et al., 2019; Niu et al., 2021). In the contexts of justice, we may assess and compare the living environments between different neighbourhoods, such as Appleyard et al. (2019)'s comparison of neighbourhoods in different TOD stations. Are they designed to foster pleasant, safe and convenient walking, cycling and travelling within the neighbourhood to reach destinations and public transport? More importantly, are there dedicated designs that cater to those with greater challenges and specific needs, such as older adults and the disabled? These questions can be answered from both the supply-side (i.e., intentions and achievements of the planners and designers) and the demand-side (i.e., satisfaction and perception of residents, particularly the disadvantaged groups).

(d) Destination Accessibility

Accessibility to destinations provides economic, social and leisure opportunities, and contributes to quality of life (Appleyard et al., 2019; Deboosere et al., 2018; Vecchio & Martens, 2021). In terms of justice, we can compare the Destination Accessibility between different neighbourhoods, namely the availability of various destinations, such as shops and leisure facilities (somewhat overlapping with Diversity), and how easy it is to reach them (to which Design is relevant). Do more well-off social groups enjoy greater Destination Accessibility because they live in better locations? Furthermore, we should also pay attention on disadvantaged residents and their needs, such as older adults and the disabled – their desired destinations, from grocery shopping, community spaces, to social and healthcare services, often differ from mainstream commuters for which TOD are designed (Chen et al., 2023).

(e) Distance to Transit

Accessible public transport has always been a promising advantage of TODs (Thomas & Bertolini, 2020). Therefore, an important aspect of outcome justice

pertains to whether certain groups of residents disproportionately enjoy greater access to public transport than others. For those living in neighbourhoods further away from the train station, local transit becomes even more important, either to reach the train station or to their destinations directly. Also, lower-income and disadvantaged groups (e.g., older adults and the disabled) are often more dependent on public transport (Matsuyuki et al., 2020; Tao et al., 2022), which makes “Distance to Transit” even more relevant to them.

5. CONCLUSION

5.1 Key takeaway points

Based on our review, we synthesised three key justice issues in TOD: transit-induced gentrification; neglect of the livelihood and well-being of the disadvantaged groups; and poor inclusion and representation of stakeholders. They are inter-related and straddle both outcome and process justice, showing the importance to include both to analyse justice in TOD. Thus, we devised an analytical framework that integrates the IAD model and the 5Ds of the built environment which address process and outcome justice in TOD, respectively. In furtherance, we offer below some guidance on how to operationalise the analytical framework for research or practical use.

5.2 Operational use of the analytical framework

Firstly, to reiterate, *Part (I) Context* include a variety of macro attributes from population properties, socio-economic conditions, and community preferences. While not fitting exactly into our focus of justice, they help establish the rationale, motivation and objectives of the TOD, which could be helpful to explain *Part (II) Process* (e.g., the interaction patterns of stakeholders) and *Part (III) Outcomes* (e.g., the capacity and zoning of the built environment). These macro attributes could typically be obtained from academic literature, government publications, or conducting one’s own data collection.

The core analysis of justice takes place as we proceed to *Part (II) Process* and *Part (III) Outcome* of the framework. Since it is intended to fit the vast variety of TOD, to both ex-ante (before the event – e.g., a TOD project in the planning stage) and ex-post (after the event – e.g., a TOD in the process of or after implementation), the discussions and evaluative criteria (discussed in Section 4.2 and 4.3 above) are necessarily more generic. To help operationalise them for practical and research use, Table 3 offers some suggested questions that could guide practical analysis work using our framework.

Table 3. Suggested guidance questions to analyse justice in TOD using the framework

Component	Suggested guidance questions
<i>Part (II) Process</i>	
Boundary	<ul style="list-style-type: none"> • What parties are involved in planning process (from planners, developers, public transport operators, to commercial actors, advocacy groups and residents)? • Who else is not involved but are interested and relevant, especially less powerful stakeholders? • Who decides what parties are involved, and where is this specified and formalised? • Are there dedicated efforts to identify and include disadvantaged stakeholders who are relevant and affected by the TOD? • Is it possible to change who is involved during the planning process? How is this done?
Position	<ul style="list-style-type: none"> • What are the roles and functions of the different parties in the planning process? • How are different parties positioned in the planning process? • Who determines the position of different parties? • Do parties of similar roles (e.g. different groups of residents) occupy similar positions? • Are there dominating positions and who occupy them?
Authority	<ul style="list-style-type: none"> • What is the power of different parties in the planning process? • What are the sources of power of these parties (e.g. legislation, convention, practical constraints)? • What are the mandates and goals of different parties? • For parties that hold conflicting mandates and goals, are their power comparable and equal? • Are there safeguards to facilitate and maintain the influence of disadvantaged stakeholders?
Information	<ul style="list-style-type: none"> • What is the key relevant information in the planning process? • Who creates, controls and distributes the key pieces of information? • Are these pieces of information available to the public, only to some parties, or held in confidence? • Is there information that parties deem important and relevant to them but are unable to obtain? • Is the information understandable without technical background or expertise?
Aggregation	<ul style="list-style-type: none"> • What are the key decisions to be made in the planning process? • How are these decisions made (e.g. individually, in consultation with others, collectively, etc.)? • Who is involved in the making of these decisions? • For decisions involving competing interests, who makes the final decisions?

	<ul style="list-style-type: none"> • How do(es) the said decision maker(s) take into account various interests and views? • How are the welfare of disadvantaged groups safeguarded in the key decisions?
Scope	<ul style="list-style-type: none"> • Who specifies the overall visions and strategy of the TOD? • How do different parties influence the planning process? • What are the envisioned and actually controllable targets and goals of different parties? • Are there discrepancies between the two? • Whose visions and goals play a greater role or influence the planning process more? • To what extent are the visions and goals of disadvantaged groups taken into account in the planning process?
Payoff	<ul style="list-style-type: none"> • Who bears the costs of the TOD project? • Are the costs borne mostly by public money or private capital? • How is this cost allocation decided? • What are the expected benefits and profits (financial, social, and otherwise) upon completion of the TOD? • How will these benefits and profits be enjoyed by and allocated to different parties? • Who decides on the costs and benefit distribution?
<i>Part (III) Outcome</i>	
Density	<ul style="list-style-type: none"> • What are the densities of different neighbourhoods in the TOD? • How do the densities of similar functions (e.g. different types of housing) compare around the TOD? • How satisfied are the residents with the densities of their living environment? • Are there perceived overcrowding and congestions? In which neighbourhoods around the TOD do they occur?
Diversity	<ul style="list-style-type: none"> • Where are shops, services and facilities located in the TOD? • How diverse are these destinations in different neighbourhoods of a TOD? • How satisfied are the residents with the choices and variety of shops, services and facilities in their living environment? • Are there certain shops, services and facilities that residents want to see more/less in their neighbourhoods?
Design	<ul style="list-style-type: none"> • What are the designs and features of the various neighbourhoods in the TOD that facilitate walking, cycling and travelling within the area? • Are there specific designs and features that cater to the needs of disadvantaged groups, e.g. older adults and the disabled? • How satisfied are different social groups of residents with the designs of their living environment? • What are the inadequacies identified by the residents?
Destination Accessibility	<ul style="list-style-type: none"> • Where are the destinations located in a TOD, from workplaces and offices, markets and shops, to parks and leisure spaces, and social services and care facilities?

	<ul style="list-style-type: none"> • How accessible are these destinations in various neighbourhoods? • Do residents find it easy to reach the destinations they want to go? • What are the challenges they face in reaching destinations?
Distance to Transit	<ul style="list-style-type: none"> • What occupies the plots closest to the train station, and those further away? • How do residents from different neighbourhoods access the train station? • Are local transport options available for travelling in the TOD area? • How satisfied are residents with travelling to the train station and within the TOD area respectively?

5.3 Significance and challenges of using the analytical framework

We believe the analytical framework holds certain significance in its function to analyse justice in TOD. Firstly, it helps raise awareness for justice implications in TOD by identifying the various aspects and components in the planning and outcome which could lead to injustices. Public awareness and involvement is an important first step in driving political changes and action to pursue justice in TOD (Harrison et al., 2019). Secondly, it helps us better incorporate and address justice concepts when planning and implementing TODs. Given that justice is often among the main objectives of TOD today (Shatu et al., 2022), the framework provides a more structured roadmap to keep it in view while taking forward TOD projects and initiatives. Finally, the framework also helps us evaluate the justice implications of TOD more systematically. As an example, for the three common justice issues of TOD we identified in our review, we can use the analytical framework to unpack and position their causes and effects, e.g., in a transit-induced gentrified neighbourhood, we may examine the planning process to uncover the power dynamics of stakeholders that act as contributing factors, and appraise the outcome to discover how such gentrification actually affects the living environment of different residents.

Naturally, there are certain challenges in using the analytical framework. First and foremost, the framework is intended as broad guidance and does not offer specific indicators. As such, one still needs to develop specific questions and indices to suit the contexts concerned in line with the principles of the analytical framework, as illustrated in Table 3. Second is the broad coverage and usage of TOD itself, which could refer to matters from national strategies, regional plans, to local development and neighbourhood projects (Hrelja et al., 2020; Jamme et al., 2019). This makes it harder to delineate the “Process” and “Outcome” of TOD for analysis consistently, especially when it comes to comparing multiple cases. Nevertheless, by breaking up and translating process and outcome justice into core elements, we believe the framework still holds great promise for comparative studies, for example whether there are certain components in a TOD that strengthens or inhibits process or outcome justice, which can be avoided or learnt by others. Thirdly is the long duration of TOD initiatives and projects, commonly lasting years from strategy formulation to move-in of residents. In that time changes often occur – plans are revised,

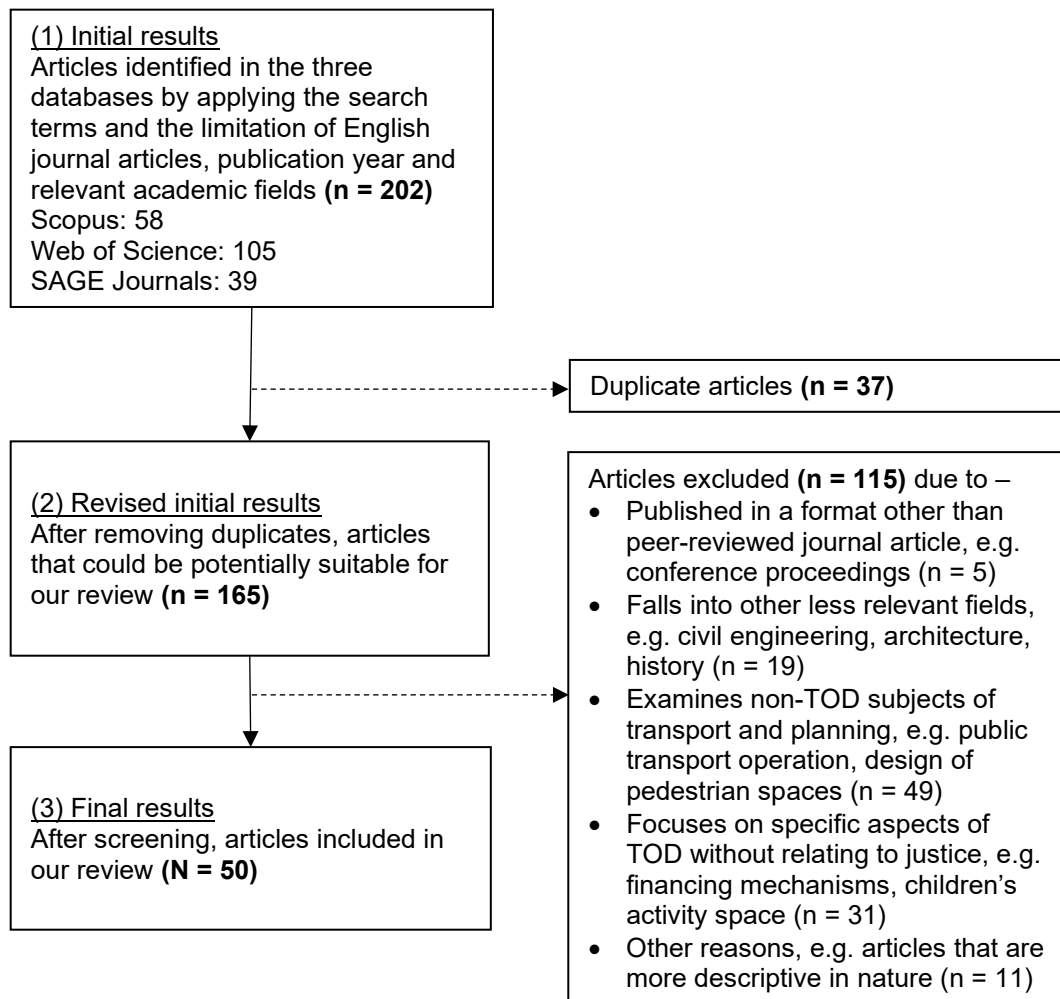
stakeholders join and exit, buildings are redesigned (Ibrahim et al., 2022). It is thus difficult to full capture the whole process to outcome stages of TOD.

Yet, we believe the analytical framework still provides a flexible yet comprehensive structure that could guide future academic, policy and practical efforts on justice and TOD. Such a framework can be used, for example, to study and compare how institutional settings and stakeholder changes in the TOD planning process (the seven Rules-in-Use and their changes over time) in different contexts have led to different results in terms of justice in the TOD outcome (relating to the 5Ds). In the other direction, future research could also investigate the sets of 5Ds in different neighbourhoods that best reflect outcome justice in TOD, and assess the corresponding planning process that have contributed to this outcome. We believe TOD holds great promise to create just, liveable, sustainable communities, as in its original vision – and we hope that the framework can contribute to its advancement in this regard.

NOTES

¹ Such a right of freedom of speech, of assembly and of participation in civil affairs also relate to process justice. Here the right to speech, to assemble or to participate in the process are framed as benefits to be fairly distributed to everyone, thus within outcome justice.

² The selection of articles for the thematic review is illustrated in the flowchart below -



³ In a Build-Operate-Transfer agreement, private developers fund and build the infrastructure as per the government’s specifications, owns the exclusive right to receive fares and toll for a specified duration, and at the end of said duration transfers ownership of the infrastructure back to the government.

⁴ For example, in a lease arrangement for a new railway line, the government funds and builds the railway infrastructure, then allow transit operators to use them for regular lease payments.

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