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Addressing Negative Externalities of Urban Development: Toward a More Sustainable Approach

Christopher R. Correia [1,*] and Mark Roseland [2]

[1] School of Resource and Environmental Management, Simon Fraser University, Burnaby, BC V5A 1S6, Canada
[2] School of Community Resources & Development, Arizona State University, Phoenix, AZ 85004, USA; mark.roseland@asu.edu
* Correspondence: christopher@ccorreia.ca

Abstract: The sheer size, growth, and complexity of cities worldwide are creating an ever-increasing burden of negative externalities on society and the environment. This systematic review aims to illuminate the broad range of negative urban development externalities and to analyze them in way that sharpens our ability to perceive, anticipate, and manage them. After finding that negative urban development externalities are more complex and diverse than has been previously articulated in the literature, the paper categorizes a representative sample by type (social, environmental, and economic) and identifies three modes of impact (visibility, emergence, and distribution) that make them extremely challenging to anticipate and mitigate. The most problematic negative externalities are social or environmental, with low visibility, cumulative patterns of emergence, and effects that extend beyond regulating jurisdictions. The analysis then draws on welfare economics to strengthen the case for the proactive management of these negative externalities and analyzes the competencies and capacities of local governments to strategically intervene in order to more effectively achieve sustainable development.

Keywords: cities; externalities; urban development; urban planning; local government

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1. Introduction

Cities around the world are experiencing unprecedented challenges to sustainable development. Already home to more people than at any time in history, cities struggle to accommodate an ever-increasing influx of people, including diverse economic and climate refugees. Burgeoning urban populations increase the complexity of the social, environmental, and economic processes that define city life, both individually and in the interaction between them.

As cities grow, local governments make choices to approve or reject proposed developments with the hope of bringing about net-positive impacts on the community. Ideally, these choices reflect a careful weighing of every potential benefit and negative impact. In practice, rushed, poorly understood decisions often lead to uncontrolled growth, necessitating reforms to establish better policies and mitigate negative impacts [1]. Cities are a major contributor to sustainability problems, but also have the potential to be at the forefront of sustainability solutions [2]. Cities can contribute to local solutions by better tying the potential positive and negative impacts affecting sustainability through small-scale analysis at the parcel level. This, in turn, can impact the global level, as more cities address these problems [3,4].

Sustainable urban development depends on careful consideration of positive and negative impacts, but in practice, this is very difficult. The sheer size and complexity of cities result in limited and imperfect information and a balancing of social, environmental, and economic trade-offs. Set within a mainstream growth-oriented paradigm, this balancing act is inherently skewed towards economic considerations [5–7]. It is further imperiled

by the predominant neoliberal questioning of the value of government regulation [8] or excessive deregulation [9]. The literature reflects local governments' growing awareness of the problems associated with urban development. However, there is limited consideration of how negative impacts play out over time. The attempts of local governments to transform awareness into action are challenged by constitutional limitations in Canada [10], and the preemption of state laws in the US [11]. When an inability to understand how choices are interrelated, an unwillingness to look beyond neoliberal growth-oriented mindsets, or a lack of legislative ability exist, development decisions that favor sustainability cannot be made.

Using the concept of externalities may help address these issues. Economists define externalities in ways that are not always obvious in their applicability to urban development, e.g., Pigou's [12] concept of both positive and negative externalities, or Lai's [13] definition, which examines the effects on those who are not part of the contract. Blais [14], however, offers a relevant definition that defines externalities as, "the impacts of a market decision whose cost is not accounted for within the price used in the market transaction" (p. 44). In the context of urban development, a market transaction (e.g., the sale of land following a rezoning, the sale of a house following the issuance of an occupancy permit), the opportunity for which arises through land use planning and development processes, can be considered a seminal action that creates consequential downstream negative externalities, which would otherwise not occur if not for that seminal market transaction.

We propose that by utilizing the concept of externalities, as defined by Blais, communities can become more adept at perceiving and mitigating the negative externalities of urban development. For example, using the Blais definition, many examples of negative externalities immediately come to mind: decreased housing affordability due to real estate speculation; air pollution associated with wood-heating or manufacturing; greenhouse gas emissions from gas-burning vehicles; road congestion linked to new developments; overcapacity community facilities; undesirable shadows cast by new buildings; and inadequate water, sewage, and storm facilities.

There appears to be no systematic qualitative conceptualization in the literature of the broad range of negative externalities of urban development, much less one that analyzes this range in a way that would sharpen the ability to perceive, anticipate, and manage them. This absence may enable collective blind spots to negative externalities of urban development, and subsequently, to systemic problems in cities around the world. To address this gap in the literature, we first provide a qualitative systematic review of the literature on the range of negative externalities of urban development. Next, we identify those negative externalities that should prompt a deeper consideration of the related sustainability problems. We then draw on economic theory to explore the rationale for internalizing negative externalities, and consider the competencies and capacities required by decision makers to act. Finally, we examine a practical tool that can be used to move toward more sustainable development. Ultimately, we introduce a new, original perspective for perceiving, anticipating, and managing the negative externalities of urban development, a necessary perspective to aid understanding of the full impacts of cities and the consequential impediments to sustainable development.

2. Materials and Methods

To evaluate the knowledge base regarding the negative externalities of urban development, we completed a qualitative systematic review of the existing peer-reviewed literature. This approach was useful for examining the relevant evidence while reducing bias in the data collection process [15]. Further, this approach allowed for comparing findings and forming themes or constructs from individual qualitative studies, thereby supporting the interpretation of phenomena and providing a broader understanding of the issue [16]. We then applied a narrative synthesis to the collected data to enable the summarization of heterogenous data and the identification of patterns [16].

The aim of this review was not to create an exhaustive list capturing every negative externality discussed in the literature, but rather to provide a representative sample of the range of negative externalities of urban development. This approach enabled the distillation of a large quantity of data into a more manageable set, which could then be grouped by a range of defining characteristics. To ensure transparent reporting of the methods employed for this review, we used the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement to inform our approach.

To generate a representative sample of peer-reviewed literature on negative externalities, we searched several databases, including Academic Search Premier, ECONLIT, Environment Complete, GEOBASE, and Web of Science. The search was limited to all English-language literature to the present date. For a more thorough review and to obtain articles in journals that are not indexed by these databases, we also employed a snowball sampling technique—searching reference lists and backward reference searching—and also searched for peer-reviewed literature on Google Scholar. Search terms included externalities, urban development, and tax, as well as several synonymous search terms. A complete list of search terms is provided in Appendix A.

We conducted the literature search and article retrieval process between 20 March 2019 and 27 May 2019; a subsequent retrieval process (to capture current literature) was conducted on 4 April 2021. The database search produced an initial list of 12,110 articles. Searching additional sources (including reference lists and an internet search engine) produced a second list of 48 articles. From these two lists, we removed 2060 duplicate articles. We then further screened the remaining 10,098 articles for relevance, first by title, then by abstract, and finally, using the full text of the article. It is possible that this screening process eliminated potentially relevant articles where search terms or synonyms did not appear in the title or abstract.

During the screening of relevance in the article title, we removed articles whose titles lacked any reference to urban land use processes and externalities (including synonyms). During the screening of abstracts, we removed articles whose abstracts suggested they did not concern all of the following three elements: (1) externalities, forming the paper's main focus; (2) recurrent and ongoing urban land use processes (as opposed to major one-off construction projects, such as airports, subways, waste treatment systems, etc.); and (3) urban land use processes that apply broadly (as opposed to those that are unique to a single locale). Likewise, in the screening of the full text, we removed papers that did not concern the three elements used in the screening of abstracts (listed above), as well as those that offered simulations or inconclusive results, or were review articles. Because we wanted to provide relevance across the spectrum and avoid repetition, we also removed articles that were very similar in scope. This systematic screening process identified 22 articles eligible for inclusion in the analysis (Figure 1).

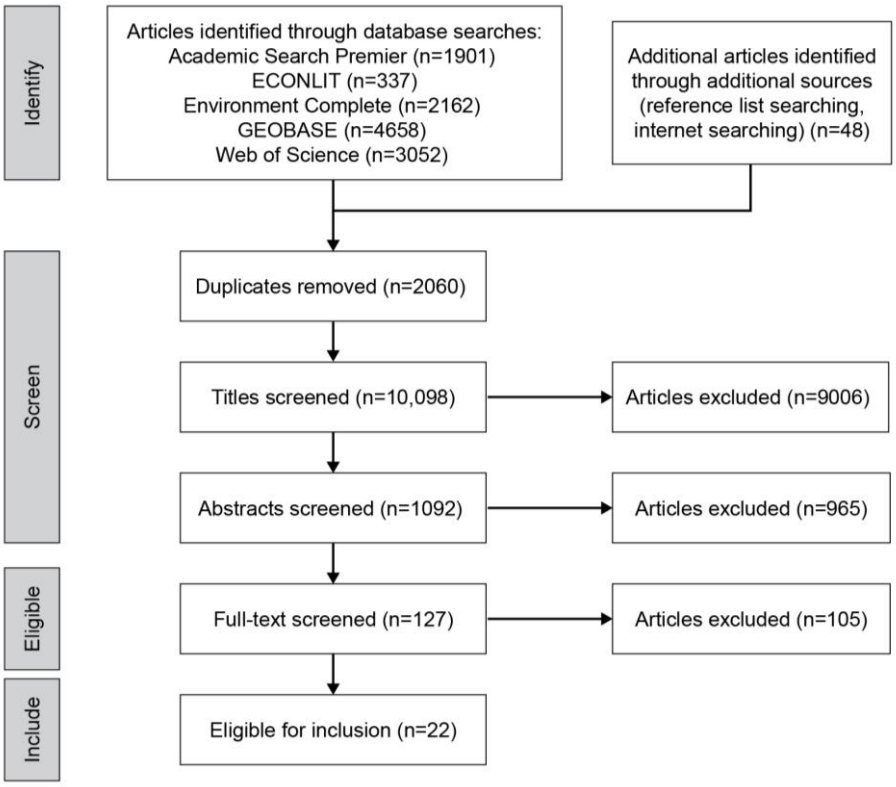

Figure 1. Qualitative Systematic Review Process. The qualitative systematic review process included a search of five databases using terms such as urban development, externalities, and tax (complete list in Appendix A), which initially produced 12,110 articles eligible for analysis. Through additional searching of reference lists and internet searches, 48 additional articles were included. From these, 2060 duplicate articles were identified and removed. The remaining 10,098 articles were screened for relevance, first by title, and then by abstract. This produced 127 articles eligible for full-text screening. The final, full-text screening identified 22 articles for inclusion in the analysis. These 22 articles met a set of content criteria, including a range of broadly applicable negative externalities covered by the sample as a whole.

3. Results

The qualitative systematic review of the literature identified 22 phenomena we characterized as negative externalities of urban development. These included: increased traffic noise pollution; decreased neighborhood satisfaction; decreased personal well-being; increased early mortality; increased slum development; increased ozone and $PM_{2.5}$ exposure; increased surface urban heat island intensity; increased flood risk; decreased social-ecological resilience; decreased agricultural/prairie land; increased greenhouse gas emissions; decreased native and increased non-native plant species; decreased stream water quality; increased soil contamination; decreased species richness and abundance; decreased ecosystem service values; decreased air quality; decreased groundwater table and quality; decreased housing affordability; increased short-term tourist rentals; increased income inequality; and increased road congestion (Table 1).

Table 1. Negative Externalities of Urban Development. The table shows the range of negative externalities of urban development, derived from the sample literature, categorized by primary type(s) and mode of impact. Most negative externalities discussed in the sampled articles could be characterized as less visible, cumulative in emergence, and as having widespread distribution.

Negative Externalities of Urban Development [Source]	Type	Mode of Impact					
		Visibility		Emergence		Distribution	
		High	Low	Immediate	Cumulative	Local	Widespread
Increased traffic noise pollution [17]	Social	•		•		•	
Decreased neighborhood satisfaction [18]	Social		•		•	•	
Decreased personal well-being [19]	Social		•		•	•	
Increased early mortality [20]	Social		•		•		•
Increased slum development [21]	Social	•		•		•	
Increased ozone and $PM_{2.5}$ exposure [22]	Social		•		•	•	
Increased surface urban heat island intensity [23]	Environmental and Social		•		•		•
Increased flood risk [24]	Environmental and Social		•		•		•
Decreased social-ecological resilience [25]	Environmental and Social		•		•		•
Decreased agricultural/prairie land [26]	Environmental and Social	•		•		•	
Increased greenhouse gas emissions [27]	Environmental		•		•		•
Decreased native and increased non-native plant species [28]	Environmental	•			•	•	
Decreased stream water quality [29]	Environmental		•		•		•
Increased soil contamination [30]	Environmental		•		•		•
Decreased species richness and abundance [31]	Environmental	•			•	•	
Decreased ecosystem service values [32]	Environmental		•		•		•
Decreased air quality [33]	Environmental		•		•		•
Decreased groundwater table and quality [34]	Environmental		•		•	•	
Decreased housing affordability [35]	Economic and Social		•		•		•
Increased short-term tourist rentals [36]	Economic and Social		•		•		•
Increased income inequality [37]	Economic and Social		•		•		•
Increased road congestion [38]	Economic and Social	•			•	•	

To further understand these negative externalities, we assigned each to a type—social, environmental, economic, or a combination of these—depending on the pillar of sustainability affected. Some negative externalities, such as decreased air quality, fit neatly into one type; others, such as decreased housing affordability, spanned two. As shown in Table 1, all

negative externalities discussed in this literature sample fell squarely into, or overlapped, the social and environmental spheres—none could be considered purely economic.

To consider each negative externality in more nuanced terms, we further evaluated each one in terms of three variables, introduced here and subsequently referred to as *modes of impact*: visibility, emergence, or distribution. The purpose of identifying these three variables is to sharpen the ability to perceive, anticipate, and manage negative externalities. *Visibility* denotes the degree to which a negative externality could be observed (e.g., low visibility of increased greenhouse gas emissions versus high visibility of increased road congestion). *Emergence* alludes to whether a negative externality emerges at an identifiable point in time, or whether it accumulates over time, even eluding notice (e.g., immediate increased traffic noise pollution versus cumulative decreased groundwater table and quality). *Distribution* refers to whether a negative externality's impact is local (that is, within the jurisdiction that regulates the activity causing it), or widespread (extending beyond a jurisdiction) (e.g., local increased road congestion versus widespread decreased ecosystem service values). Taking cues from each author's discussion of a negative externality, we assigned mode values to the negative externality. For example, we categorized an increase in traffic noise pollution as *low*, *immediate*, and *local*, based on Di et al.'s [17] analysis, while Dolan et al.'s [28] discussion of non-native plant species replacing native species implied a categorization of *high*, *cumulative*, and *widespread*. Most negative externalities in the sampled literature could be described as low, cumulative, and widespread.

A New Perspective to Guide Awareness

The sample literature revealed a breadth and diversity of negative externalities of urban development. While negative externalities can span social, environmental, and economic types, they are largely social and environmental. Further, negative externalities can be qualitatively categorized by visibility, emergence, and distribution—all of which co-exist and influence their complexity. Finally, assuming the sample literature indicates the complexity of different types of negative externalities, those that are low in their visibility, cumulative in their emergence, and widespread in their distribution are the most difficult to address.

Significantly, this illuminates some potential planning blind spots. Negative externalities that are high, immediate, and local may be easier to document and understand, and are presumably more likely to be addressed. Those that are low, cumulative, and widespread may escape notice and thus, be harder to mitigate. Indeed, actors may have a harder time perceiving the existence of negative externalities that result from complex, largely cumulative processes that occur in increments, rather than as the wholly observable result of a unique event.

The perceived existence of some negative externalities potentially causing blind spots, in the determination of impacts should compel decision makers to shift their attention from those that make an immediate impact, toward those that take more time and space to manifest. It is reasonable to assume that the inherent complexity of negative externalities is compounded by their interaction with one another—amplifying or mitigating their individual effects. Perhaps some negative externalities that impact overlooked segments of society and the natural world are being ignored or under-considered in favor of the visible, immediate, and local.

To guide thinking about how negative externalities of urban development manifest themselves through each mode of impact, we propose the graphics illustrated below in Figures 2–5. The first mode is distribution (Figure 2). Negative externalities can be *local*, that is, the impacts are felt relatively close to the source, or *widespread*, where impacts are diffused over a broad area. The concentric circles in Figure 2 show this mode. Distribution determines whether a negative externality can reasonably be regulated within the jurisdiction where it occurs. For example, increased traffic noise pollution is an example of a locally-felt negative externality; decreased housing affordability is an example of a widespread negative externality.

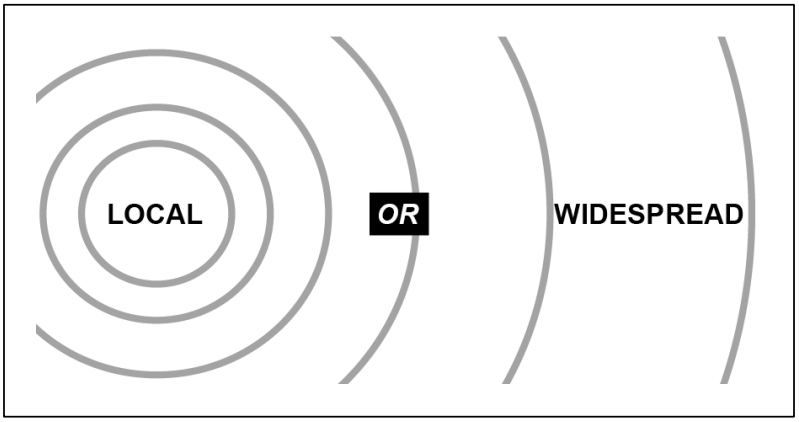

Figure 2. Mode of Impact—Distribution. Distribution is the first mode of impact concerning the negative externalities of urban development. Local distribution (on the left) radiates outward toward widespread distribution (on the right). The concentric circles show the distribution radiating outward from the source, indicating how an impact is felt. An example of a negative externality that is felt locally is increased traffic noise pollution, whereas an example of a negative externality that is felt over a widespread area is decreased housing affordability.

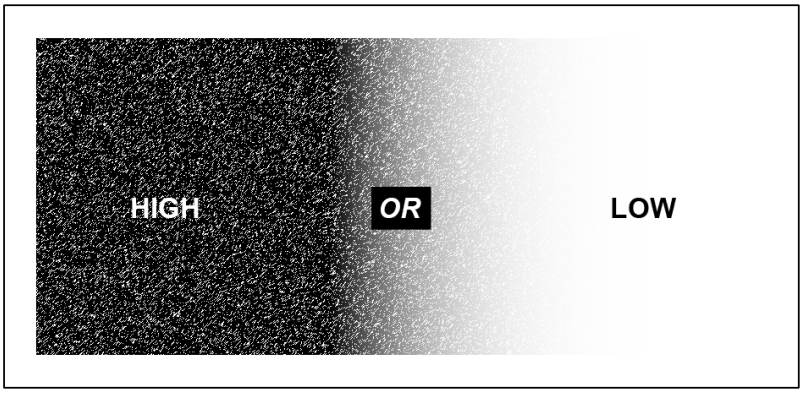

Figure 3. Mode of Impact—Visibility. The second mode of impact is visibility. It examines the degree to which a negative externality is observable and measurable. An example of a negative externality with high visibility is increased slum development; an example of a negative externality with low visibility is decreased groundwater table and quality.

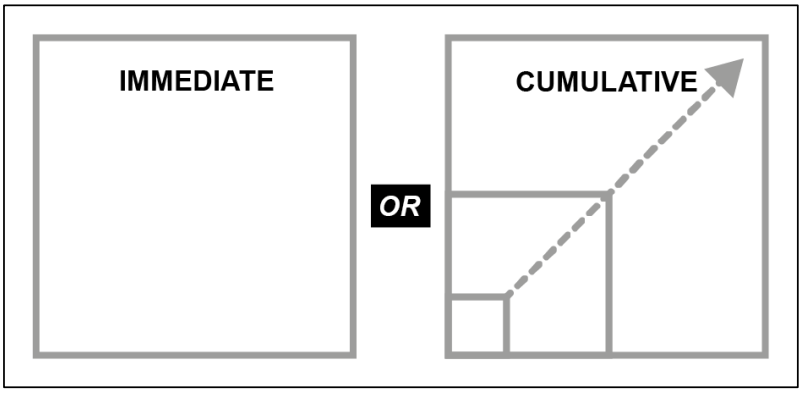

Figure 4. Mode of Impact—Emergence. The third mode of impact is emergence. Emergence examines whether the impacts of a negative externality are felt immediately or gradually, over time. An example of a negative externality that emerges immediately is decreased agricultural/prairie land, whereas an example of a negative externality that emerges incrementally is increased surface urban heat island intensity.

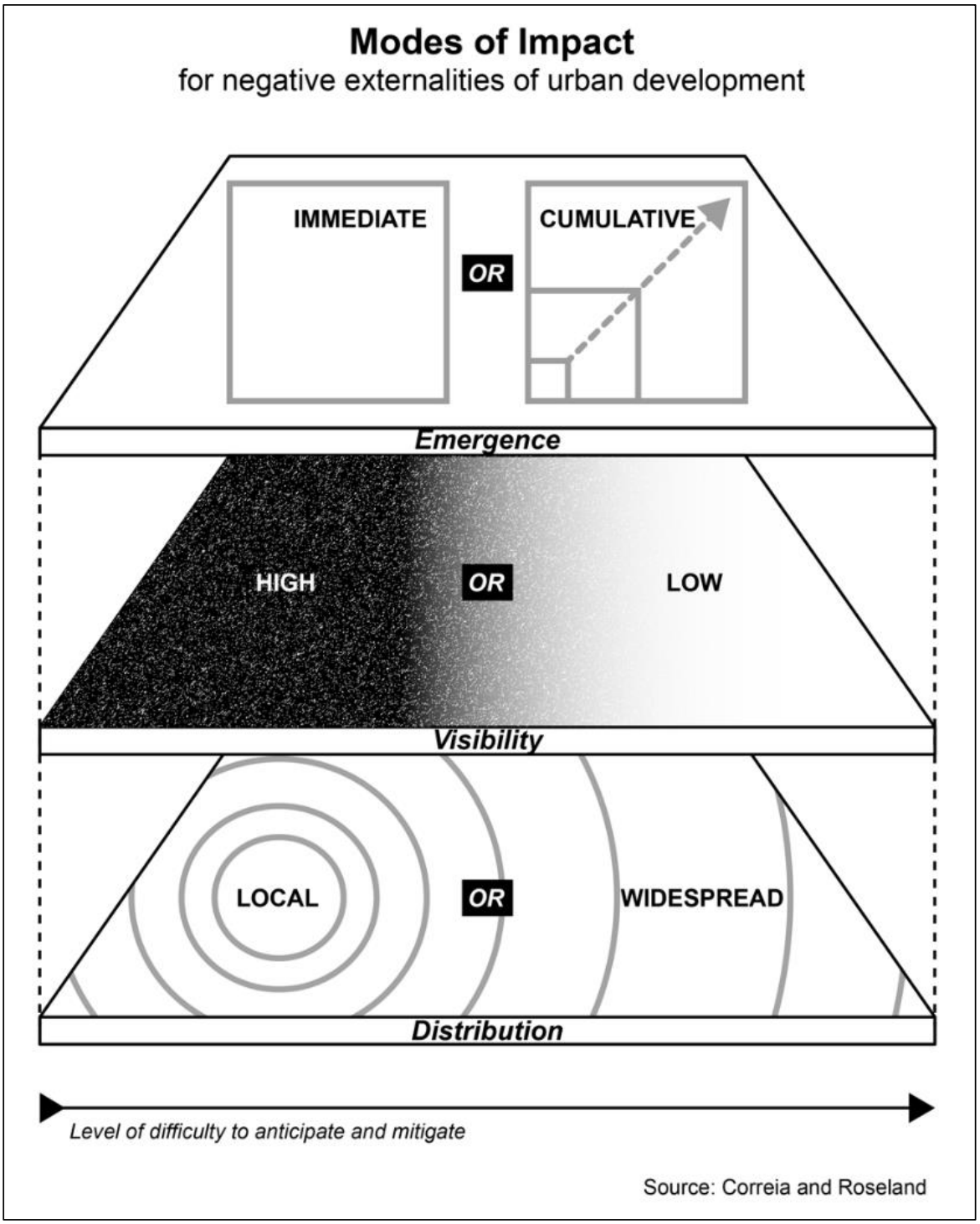

Figure 5. Modes of Impact. Negative externalities can be visualized by modes of impact. While the three different modes exist independently, they occur concurrently in a layered hierarchy. The first mode, distribution, explores whether an impact is local or widespread; the second mode, visibility, determines whether an impact is readily observable and measurable; the third mode, emergence, describes whether an impact is felt immediately or incrementally. For example, increased greenhouse gas emissions would have widespread distribution, low visibility, and cumulative emergence. Judging from discussion of negative externalities in the literature, those with widespread distribution, low visibility, and cumulative emergence (with placement at the far right side of this graphic) are most difficult to anticipate and mitigate.

Following distribution, the next mode of impact is visibility (Figure 3). Visibility explores the ease with which a negative externality can be observed and measured. For example, a negative externality with *high* visibility *is* increased slum development; *an* example of a negative externality with *low* visibility is decreased groundwater table and quality. While both have consequences, a more visible impact may receive more attention.

The third mode of impact is emergence. This layer explores how impacts are felt over time—whether they are felt *immediately* or during a specific time period, or gradually, with their effects *accumulating* over time (Figure 4). For example, a negative externality with immediate emergence is decreased agricultural/prairie land; an example of a negative externality with incremental emergence is increased surface urban heat island intensity.

Individually, each layer highlights the variation in the three modes of impact. Importantly, however, these modes of impact are not felt alone. Rather, they occur concurrently and simultaneously intersect in a layered hierarchy, increasing the mitigation challenge (Figure 5).

As we visualize potential negative externalities in terms of these three intersecting and concurrent modes of impact, we must also be mindful of the insights suggested by Table 1—at any one time, a wide range of negative externalities are being generated by multiple processes, each with their unique modes of impact. As such, any one potential development will likely have many different impacts. These may be marginal or profound and may influence—either contributing to or mitigating—other negative externalities.

Admittedly, this poses more profound and challenging questions for urban development—especially when impacts occur beyond local jurisdictions. Nevertheless, this multilayered approach has the potential to be applied to any parcel in any city. A systematic consideration of the types (social, environmental, economic, or a combination of these) and modes of impact (visibility, emergence, or distribution) can aid in perceiving, anticipating, or managing the negative externalities of urban development. Greater clarity on the negative externalities of urban development can prompt deeper evaluation and even a radical rethinking of what it means to engage in urban development.

4. Discussion

4.1. The Case for Internalizing Negative Externalities: Stronger Than Ever

We turn now to understanding what this new perspective of negative externalities of urban development—the modes of impact perspective—implies for local governments. We explore whether they should take a laissez-faire stance on negative externalities or try to actively prevent or mitigate them. Given the types (social, environmental, economic, or a combination of these) and modes of impact (visibility, emergence, or distribution), the complexity of negative externalities has made them far reaching in their impact and more difficult to address. The case for action on internalizing significant negative externalities seems stronger than ever.

The Rationale for Internalizing Negative Externalities

When a market transaction between actors (e.g., the sale of properties by a developer to end-users) produces negative externalities, economists characterize it as a market failure. As Lai [13] explains, a market failure can be understood as external costs (i.e., negative externalities) imposed by a market transaction on society. The external costs and private costs borne by the actors of the transaction are collectively referred to as the social cost. How market failures should be resolved is the subject of some debate—of which there are two schools of thought: interventionist and non-interventionist.

The dominant position suggests the necessity of government intervention in market failures [12,39–42]. This school of thought posits that governments should mitigate negative externalities associated with market failures. If done adequately, urban development costs (e.g., the price at which developers sell properties to end-users) would fully reflect social costs. In theory, fully addressing negative externalities would result in a Pareto efficient outcome—the theoretical state in which no alternative would make some people (or broadly

speaking, portions of society and the environment) better off without making others worse off. In practice, due to imperfect information and economic actors' limited awareness, the best possible outcome may only be a Pareto improvement—the theoretical state in which at least some people (or broadly speaking, portions of society and the environment) are better off without making others worse off, but where further changes could still be made to produce a greater social benefit.

The minority position maintains that the solution is less government intervention [43]. According to traditional interpretation of the Coase Theorem, if transaction costs are low enough and trade in externalities remains possible, bargaining among economic actors in a free market will continue until Pareto efficient outcomes are reached [44]. However, Slaev [45] criticized that if economic actors experience no incentive to maximize social benefits or minimize social costs, this solution may not work. This non-interventionist position also fails to account for assignment problems (i.e., the challenge of defining responsibility) and hold-out problems (i.e., when the final party to join a proposed multi-party agreement wields an inordinate amount of power). Nor does this position account for actors' perverse incentives to misrepresent the negative externalities, because of the unrealistic expectation that actors would have complete information on transaction costs required to bargain in good faith [44]. Given the number and range of actors involved with the negative externalities of urban development, complexities such as assignment rights, hold-outs, and transaction costs are very difficult to pinpoint and resolve.

Another non-interventionist position implies that negative externalities related to common-pool resources can be managed effectively through arrangements that are made by individual market actors themselves, provided such arrangements embody a specific set of design principles [46]. This theory is based on real-world negative externalities (e.g., mountain grazing and forests, irrigation systems) that are relatively simple, direct, and limited to common resources, locales, and time periods controlled by actors who can self-organize and manage their arrangements. It is not applicable to the complexity of urban settings, where a wide range of negative externalities (e.g., decreased housing affordability, increased surface urban heat island intensity, decreased ecosystem service values) persist and interact.

We suggest that the sustainability of cities is most challenged by negative externalities that defy the non-interventionist arrangements described by Ostrom (see [46]), because they are anything but simple, direct, and limited. Urban sustainability is also fraught with negative externalities with assignment problems (because they are unseen), and hold-out problems that relate to imbalances of power among actors. The manner in which these negative externalities manifest and the challenge of mitigating them provide evidence to reject the simplistic view of government deregulation as the solution [8]. As such, the justification for strategic intervention by local governments to alleviate market failures has never been stronger, as cities continue to grow, along with complex new projects and development-related negative externalities.

4.2. Competencies and Capacities for Internalizing Negative Externalities

The competencies and capacities of elected officials and staff are key regarding taking advantage of the rationale to internalize negative externalities. Competencies refer to the ability or skill to act, whereas capacities refer to the time or legislative allowance to act. Without the competencies or capacities, the rationale cannot be implemented into practice to successfully internalize negative externalities.

Critically, elected officials must be competent in recognizing the existence and importance of negative externalities, and most importantly, in acting to address them [47]. For example, given the political agenda of a government, intervention may deviate from what is objectively warranted to what is politically advantageous [48]. Elected officials' ability to determine the need for effective policies and provide clear direction to staff depends on this competency. Nevertheless, staff may not have sufficient awareness or expertise to fully understand, anticipate, or mitigate the impacts to their respective urban area [49]. For

example, staff may be missing information on the extent of consequences of intervention or on the full range of suitable policy tools. This limitation presents a problem for elected officials reliant on staff to provide sufficient awareness or expertise.

Similarly, staff may not have the capacity to focus on negative externalities. Their resources may be applied to short-term initiatives or to unrelated long-term initiatives [47,49]. Further, accommodating demand for real estate development may override all other concerns. Moreover, staff may not have the capacity to act on addressing negative externalities, given potential legislative restrictions set by state or federal governments [48].

Every local government has specific legislative, legal, economic, and cultural limitations or influences. As such, specific competencies and capacities shift, depending on the local government context.

Considerable policy work would be required by each local government to fully address the range of negative externalities. Ideally, all negative externalities will be concurrently addressed; however, as competencies and capacities differ, local governments should find ways to address the lowest hanging negative externality, starting with those that are most visible, immediate, and local (which may also be viewed by the public as most pressing). Over time and as resources permit, local governments should then work towards addressing negative externalities that are less visible, cumulative, and widespread.

4.3. Tools for Internalizing Negative Externalities

Having established that there is a case for internalizing negative externalities, we now explore the most practical way to achieve success. Local governments use a range of tools, including zoning, development permits, building permits, restrictive covenants, negotiated agreements, transferable development rights, taxes, and subsidies. Given the range of negative externalities, we need to consider a range of tools: one tool may not be appropriate for internalizing every negative externality.

Zoning, development permits, building permits, and restrictive covenants are different types of regulations dictating the land use(s), and the form and character of the building(s) permitted on a site. These have been considered standard regulatory tools to control typical negative externalities (e.g., building shadows and setbacks, incompatible land uses) and for this reason, are in use across Canada and the US. However, their outright inability to effect mitigation of negative externalities that manifest off-site, yet are the direct or indirect result of on-site land uses, means they are unable to control some negative externalities (e.g., increased traffic noise pollution, increased road congestion, increased ozone and $PM_{2.5}$ exposure). These regulations are more appropriate for negative externalities that can be partially mitigated on-site (e.g., decreased groundwater table and quality, increased surface urban heat island intensity, decreased native and increased non-native plant species).

Negotiated agreements involve the local government engaging with community-based organizations to understand their views on perceived negative externalities caused by proposed development. The government's objective is to provide the community with mitigation solutions to offset a development's potential negative externalities. For example, in Toronto, Ontario, Section 37 agreements [50], and in Los Angeles, California, Community Benefits Agreements [51,52], both local governments negotiated with the developer to provide tailored mitigation solutions to the community. However, this approach has significant challenges, given the power imbalance among parties, organizations' limited accountability to residents, and developers' financial robustness [52]. Nor does this approach ensure a rational correlation between the fees charged and the number of negative externalities generated by a development.

Transferable development rights (TDR) are land development permissions that are traded in a market, between land owners or through an intermediary (e.g., banks); these are predominately used for land preservation [53]. Transferable development rights are used in various US states (e.g., California, Florida, New Jersey, Washington), where a land owner voluntarily reduces or eliminates their land development permissions in

return for transferring those permissions to a receiving site, to be used for additional land development permissions that would otherwise not be permitted [53].

The overarching challenge with TDR is the inability to target and internalize multiple negative externalities, as the only source of (limited) mitigation is through restricting further land development. A questionable or absent correlation exists between the negative externalities created and the singular—mostly unrelated—attempt at mitigation (e.g., land preservation). For example, land preservation cannot address negative externalities (e.g., decreased housing affordability, increased road congestion) that require mitigation solutions beyond the provision of undevelopable land.

One additional tool to internalize negative externalities is for the municipality to simply pay for the needed mitigation costs and then levy (or raise) property taxes across the municipality to recoup the costs. However, this is neither equitable nor efficient, as municipality-wide taxes do not target the party or parties responsible for the negative externalities [54]. A similar approach to supplying funds for mitigation costs is through the provision of subsidies, typically provided by senior governments to local governments. As with levying property taxes, providing subsidies does not target the party or parties responsible.

A practical policy tool to address the problem and internalize the negative externalities (i.e., external costs) is a Pigouvian tax—a charge to the producer (in this case, the developer) that is equal to the marginal external cost [55]. In terms of urban development, Pigouvian taxes go by many names in different jurisdictions, but they are mainly called development charges. Other terms include impact fees, infrastructure charges, development exactions, linkage fees, or development cost charges. In theory, Pigouvian taxes correct market failures and achieve Pareto optimum outcomes by addressing all negative externalities; however, in practice, they achieve something closer to Pareto improvements by effecting improvements on the status quo [41]. Well-designed Pigouvian taxes help shift the market towards an efficient use of resources [42].

Case law in the US enables local governments to address negative externalities with taxes or charges, so long as there is a "rational nexus" between them. In other words, the tax or charge applied to address the negative externality must be proportionate to its purpose [56,57]. The majority of US states allow their municipalities to charge developers for negative externalities, although most states typically only allow negative externalities that are largely more visible, immediate, and local [58] to be addressed. In Canada, legislative systems in some provinces have also provided a mandate to allow local governments to charge developers for some negative externalities [59]. For example, in Toronto, Ontario, their Pigouvian tax policy addresses multiple negative externalities, with rates set to meet current and anticipated increases in mitigation costs [60]. However, as with most US states, most provinces only allow negative externalities that are largely more visible, immediate, and local [61] to be addressed.

Given the variability and complexity of how negative externalities manifest, no single tool is adequate for internalizing all negative externalities. However, based on our analysis of the literature, a Pigouvian tax is a practical policy tool capable of internalizing negative externalities in particular situations. While local governments in Canada and the US typically address some negative externalities using a Pigouvian tax, they are largely more visible, immediate, and local. The key to effectiveness is in maximizing the number of negative externalities applicable to a Pigouvian tax (i.e., including those that are less visible, cumulative, and widespread) and the proximity to which the tax achieves Pareto efficient outcomes.

5. Conclusions

As cities struggle to accommodate a range of sustainability challenges, there is a clear need for better understanding and practical tools to address negative externalities. Our systematic qualitative analysis of the literature is the first to describe the range and diversity of negative externalities that constrain sustainable urban development. This

study's discovery of this range and diversity of negative externalities has led to a new awareness of these issues of urban development. This study offers evidence that negative externalities of urban development, viewed individually and collectively, are far more complex than has been previously articulated in the literature. In addition to playing out simultaneously, as well as interacting collectively, our study found that negative externalities usually span more than one realm (social, environmental, or economic), and they vary significantly in their visibility, emergence, and distribution.

This evidence has given rise to a new perspective on how to address this complexity. We propose a more deliberative perspective—the modes of impact—for perceiving, anticipating, and mitigating negative externalities. By evaluating the range of negative externalities in terms of modes of impact, this research finds that negative externalities generating most concern are those whose effects have low visibility, cumulative emergence, and extensive distribution. Their prevalence in the literature suggests these negative externalities, due to their limited exposure, are more apt to elude notice in urban decision making until they spiral, compound, and generate additional negative externalities.

As urban populations grow, new developments are proposed, and pressures to approve them quickly increase, it will become more important to consider negative externalities with a fuller consideration of environmental and social outcomes and a less narrow focus on economic outcomes. This is especially important in rapidly growing cities and mega city regions, where existing regulatory structures may be largely missing or underdeveloped (see [1]), and in cities left to operate without adequate regulatory structures, resulting from deregulation [7]. With more focused attention on the modes of impact while evaluating development proposals, decision makers can address critical blind spots. Processes that prompt the analysis of negative externalities in terms of the modes of impact will lead to richer data and more creative solutions.

Our reflection on welfare economics also provides justification for local governments to allocate time and resources to anticipate and manage negative externalities. Equipped with a sharper understanding of negative externalities' essential properties, local governments can eschew less effective management tools, such as property tax hikes, that fail to alleviate assignment or hold-out problems. Local governments can strategically apply the Pigouvian tax principles that are embodied in a tool such as development charges. This taxing principle is already well used, legally justified, and expected by actors; the challenge is to refine and use it better by applying it to a fuller range of negative externalities, including those that have escaped attention due to low visibility, cumulative emergence, and extensive distribution. While a Pigouvian tax may not be the best approach in every situation, it is one strategic way for local governments to work within their limited legislative power to advance progress towards mitigating significant negative externalities. Through widespread use of this practical, accessible tool, there is power to achieve global development improvements by leveraging the power of cities to support global sustainability [3]. The modes of impact perspective and the Pigouvian tax can take us towards a more sustainable approach. City by city, this has important implications, both locally and globally. This analysis and perspective can provide practical guidance for decision makers at the local level to respond to the unprecedented challenge of sustainable development.

Future Research

The results of this study invite us to think differently about negative externalities of urban development, and they generate additional questions:

- How do we continue to improve the prediction, detection, and measurement of negative externalities that affect less visible populations, play out more gradually, and extend beyond regulators' jurisdictions?
- Can the professional and academic fields gain from furthering the theoretical contributions made by the modes of impact perspective?
- How can we operationalize thinking about negative externalities in a way that is more probing, balanced, and perhaps more analogous to the triple bottom line approach?

- Can we borrow from approaches that assign values to ecosystem services to quantify the values of social conditions?
- Are some tools better suited for internalizing specific negative externalities?
- Do negative externalities change as we transform from growth to development, and does this affect our assessment about the kind of development we want—that is, sustainable development?

While these questions are intriguing, future research should focus first on these two items: (1) best (current) practices for internalizing negative externalities, and (2) understanding the factors that lead to the creation of best practices.

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Appendix A

Terms used in the Academic Search Premier database search are provided below:

(DE (sustainable development OR sustainable communities OR metropolitan areas OR urban planning OR urban growth OR urbanization OR urban community development OR urban land use)) AND (DE (impact fees OR impact fees – law & legislation OR administrative fees OR user charges OR environmental impact charges OR pigovian tax OR pricing OR market pricing) OR DE ("externalities (economics)" OR ecological economics OR welfare economics OR environmental economics OR market failure OR public goods OR transaction costs OR pareto optimum OR urban impact analysis OR urban planning & health OR urban planning & the environment OR urbanization & the environment OR real estate development & the environment OR land use & the environment OR economic development & the environment OR environmental quality))

Terms used in the ECONOLIT database search are provided below:

(KW (Cities OR urban OR urban growth OR urbanization OR planning OR land use OR sustainability)) AND (KW (tax OR environmental tax OR pricing OR market pricing OR land markets) OR KW (externalities OR environmental economics OR market failure OR public goods OR transaction costs)))

Terms used in the Environment Complete database search are provided below:

(DE (sustainable development OR sustainable communities OR metropolitan areas OR urban planning OR urban growth OR urbanization OR urban community development OR urban land use)) AND (DE (impact fees OR impact fees – law & legislation OR administrative fees OR user charges OR environmental impact charges OR pigovian tax OR pricing OR market pricing) OR DE ("externalities (economics)" OR ecological economics OR welfare economics OR environmental economics OR market failure OR public goods OR transaction costs OR pareto optimum OR urban impact analysis OR urban planning & health OR urban planning & the environment OR urbanization & the environment OR

real estate development & the environment OR land use & the environment OR economic development & the environment OR environmental quality))

Terms used in the GEOBASE database search are provided below:

((((({sustainable development} WN CV) OR ({metropolitan area} WN CV) OR ({urban planning} WN CV) OR ({urban development} WN CV) OR ({urban growth} WN CV) OR ({urbanization} WN CV) NOT ({developing*} WN KY)) AND ((({impact fees} WN KY) OR ({user charges} WN KY) OR ({administrative fees} WN KY) OR ({pigovian tax} WN KY) OR ({pricing policy} WN KY)) OR (({externalities} WN KY) OR ({market failure} WN KY) OR ({pareto optimum} WN KY) OR ({ecological economics} WN CV) OR ({welfare economics} WN CV) OR ({environmental economics} WN CV) OR ({public goods} WN CV) OR ({transaction cost} WN CV) OR ({urban ecosystem} WN CV) OR ({environmental quality} WN CV))))) AND (({ja} WN DT) AND ({english} WN LA)))

Terms used in the Web of Science database search are provided below:

(TS=("sustainable development" OR "sustainable communities" OR "metropolitan area*" OR "urban planning" OR "urban growth" OR "urbanization" OR "urban land use" NOT "developing*")) AND (TS=("impact fees" OR "administrative fees" OR "user charges" OR "environmental impact charges" OR "pigovian tax*" OR "pricing" OR "market pricing") OR TS=("externalities" OR "ecological economics" OR "welfare economics" OR "environmental economics" OR "market failure" OR "public goods" OR "transaction costs" OR "pareto*" or "environmental quality"))

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