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Article

Regulating Sustainable Production

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Abstract

Zoning that supports urban manufacturing may offer new opportunities to promote sustainability benefits ranging from improved job accessibility to reduced waste and resource use. However, industrial uses in urban areas face displacement from competing and conflicting uses. While the process of industrial gentrification is well documented, little work has examined how planning strategies and regulations affect urban manufacturing and its potential contribution to sustainable economic development. Drawing on a review of planning documents and interviews with food and beverage manufacturers, we examine how planning regulates the sustainability potential of manufacturing enterprises in Melbourne, Australia. In doing so, we contribute a deeper understanding of the ways that zoning affects urban manufacturing and the obstacles, tensions, and trade-offs urban planners face in creating a more sustainable local manufacturing base.

Keywords

Australia; beverage manufacturing; economic development; food manufacturing; industrial districts; land use; Melbourne; sustainability; urban manufacturing; zoning

Issue

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1. Introduction

Principles of sustainability and sustainable development have been increasingly centralised in urban planning strategy and policy since the 1990s, coupling economic development with environmental and social benefits (Gunder & Hillier, 2009; John et al., 2015). However, despite decades of sustainability efforts, urban planning has largely ignored the role of urban industry and industrial land in achieving sustainable development outcomes (Leigh & Hoelzel, 2012). Instead, cities have rezoned industrial land for mixed-use areas that exclude industry to meet their sustainability goals, allowing market processes to drive redevelopment (Chapple, 2015; Leigh & Hoelzel, 2012). This is problematic because while compact, mixed-use places may offer a more sustainable approach to urban development than single-use suburban sprawl, they likewise catalyze speculative invest-

ment, can amplify social inequalities, and potentially create larger carbon footprints (Grodach & Limb, 2020; Quastel et al., 2012; Rice et al., 2020).

Rezoning industrial land and relaxing zoning standards may also price out or regulate out the potential sustainability benefits of productive activity. This includes an economic role through contributions to a diverse economic base and quality jobs, supporting social equity through job accessibility and support for underemployed groups, and environmental contributions such as reliance on and retrofit of existing industrial building stock over new greenfield supply and the promotion of sustainable resource use in production (e.g., recycling and reuse, energy conservation, shared resource, and energy sources).

While the market processes behind rezoning and industrial gentrification are well-articulated in the literature, little work has examined the potential sustainability

contributions of urban manufacturing and industrial land or how planning strategies and regulations may affect productive activity. This article investigates these issues through a case study of food and beverage manufacturers in Melbourne, Australia. We begin by examining key planning and regulatory documents to establish the policy context and intent. We document how the pervasive language of sustainability in strategic planning overlooks the potential of urban manufacturing and industrial land and highlight how use separation and other industrial zoning standards may inadvertently hinder sustainable production. We then present the results of interviews with 31 food and beverage manufacturers to better understand their experience with policy implementation on the ground, concentrating on sustainability practices related to location choices, supply networks, and energy and waste management. We find producers offer potentially overlooked sustainability benefits, yet some are also dependent on gentrifying markets. Further, start-up and hybridised businesses that do not easily fit industrial zoning categories can trigger complex approval processes where more conventional and often unsustainable industry is allowed. These findings contribute to a deeper understanding of the ways that zoning affects urban manufacturing and the obstacles, tensions, and trade-offs urban planners face in supporting a more sustainable local manufacturing base.

2. Literature Review: Zoning and Urban Industry

Urban planning scholarship is pushing back against the long-held assumption that productive activity is incompatible with other land uses and the largely absent consideration of industrial activity in urban sustainability discourse. In many cities, a significant share of manufacturing now consists of small firms that require little space, employ clean production processes, and have a low impact on neighbours. As a result, some argue that manufacturing may co-exist in mixed-use, transit-oriented places and thereby contribute to more sustainable urban outcomes by “keeping blue collars in green cities” (Dierwechter & Pendras, 2020, p. 1). Further, localised manufacturing clusters have the potential to strengthen circular economies through shared skills, reduced transport emissions, and industrial symbiosis processes that localise resource flows and reduce waste (Hatuka & Ben-Joseph, 2022; Hill, 2020; Prendeville et al., 2016; Tsui et al., 2020). Manufacturing also contributes to more sustainable and equitable development because it supports a high share of middle-wage jobs (Chapple, 2015). It includes a diverse set of industries and occupations, which provide economic resilience compared to the high- and low-wage services employment characteristic of mixed-use places (Grodach & Guerra-Tao, 2022).

This reality is rarely considered in contemporary urban policy, which predominately plans for industrial activity in low-density outer suburban areas even as it aims to support innovation-led advanced manufacturing (Grodach &

Gibson, 2019). It also contradicts the notion of the “post-industrial” city. Literature documents that spaces of production endure even in finance and tech centres like New York, London, and San Francisco (Curran, 2010; Ferm & Jones, 2017). This is partly because the knowledge economy still requires localised manufacture and distribution of key supplies and services. It is also because cities will always require certain industrial activities to function such as food production and waste processing.

This combination of factors has led to emergent work, which seeks to reimagine spaces of production and weave industry back into the city. Attention has focused on advanced manufacturing firms and processes, small-scale maker enterprises, and those that link to cultural product industries (Grodach et al., 2017; Hatuka & Ben-Joseph, 2022; Hill, 2020; Wolf-Powers et al., 2017). This encompasses a diverse set of manufacturers that employ varied production techniques from rapidly advancing digital fabrication to handmade craft production that has changed little over decades. Producers often engage in small-batch production for high-end and local consumer markets. Some rely on other local manufacturers for components and supplies or support waste reduction through the use of recycled and recovered materials (Gibson-Graham et al., 2019; Prendeville et al., 2016). These characteristics mean many manufacturers are highly dependent on the urban environment. This reflects the benefits of physical proximity long documented in economic geography (cf. Piore & Sabel, 1984), but also highlights the overlooked sustainability potential of small-scale manufacturers.

Proponents call for more flexible regulatory environments that go beyond conventional industrial use separation to support the reintegration of manufacturing into the city (Hatuka & Ben-Joseph, 2022; Hill, 2020; Lane & Rappaport, 2020; Roost & Jeckel, 2021). They argue that proximity is important for redistributed forms of manufacturing that can minimise environmental impact and engender circular economies through localised supply chains and digitised production (Prendeville et al., 2016; Tsui et al., 2020). However, attempts to allow production, consumption, and residential spaces to co-exist also face the realities of real estate speculation and conflicting uses. This may price out or regulate out the productive activity and their potential sustainability benefits. Research has documented industrial gentrification where the introduction of higher-value commercial and residential uses results in a loss of productive space and the displacement of industry (Curran, 2010; De Boeck & Ryckewaert, 2020; Ferm & Jones, 2017). Additionally, intra-industrial gentrification is on the rise in which specialised manufacturers and those that blend production and consumption on-site like breweries may displace other production and repair activities on ever-dwindling industrial land (Grodach, 2022; Mathews, 2022; Walker & Fox Miller, 2019).

Planning approaches must navigate tensions between protecting industrial areas and alternative

zoning that risks gentrification and displacement. Industry advocates have long argued for the preservation of industrial land to shield industry from rising rents and conflicting uses (De Boeck & Ryckewaert, 2020; Lester et al., 2013). This typically takes the form of strict codes prohibiting virtually all nonindustrial uses in an area. However, recent work finds that while industrial preservation zones slow industrial displacement, they may not help grow manufacturing (Davis & Renski, 2020). In part, this may be due to comparatively large floor spaces and tight restrictions on use, which create challenges for small urban manufacturers.

Other work considers alternative zoning and space arrangements that aim to integrate productive activity with commercial, residential, and institutional uses. This includes design explorations of flexible or vertical mixed-use buildings that support production (Lane & Rappaport, 2020; Love, 2017). However, these projects frequently face conflicts with noise, smell, access, and proximity to residential uses (Ryckewaert et al., 2021). Theoretically, these issues may be addressed in project design, but zoning and building codes often do not permit them or require special amendments. In response, some cities have revised zoning codes or implemented “micro-zoning” strategies that allow high flexibility around lot size, building heights, and permitted ratios of office and retail to production uses to encourage a mix of industry with other land uses (Grodach, 2022; Hatuka & Ben-Joseph, 2022; Hill, 2020). Finally, cities may adapt industrial symbiosis strategies to establish more sustainable, closed production systems through shared infrastructure, utilities, and waste recycling (Chertow, 2000).

However, mixed-use industrial zones may fail to support the diversity of urban manufacturing sectors—partly due to ambiguous zone language (Bonello et al., 2022). Additionally, the economic viability of mixed-use zones means developers often defer to higher-paying residential and office uses and not manufacturer needs (Ferm, 2016). As such, mixed-use industrial areas are more likely to benefit advanced manufacturing and makers, which may contribute to ongoing gentrification processes by bidding up rents (Grodach, 2022). For example, the growth of breweries that blend production and consumption has caused cities to revise zoning codes hoping to encourage denser mixed-use development yet this results in expanding residential redevelopment rather than supporting urban industry (Mathews, 2022; Nilsson et al., 2018; Walker & Fox Miller, 2019). While breweries often engage in sustainable practices such as adaptive reuse of existing buildings (Mathews & Picton, 2023), their presence may also reduce industrial mix and other potential sustainability advantages.

While the literature has documented the dynamics behind industrial gentrification, little research has analysed how zoning and planning impact urban manufacturing or studied how manufacturers negotiate regulatory environments. Approaches to industrial land including tools like zoning do not seem to be framed

by sustainability, nor integral to how sustainability is embodied in planning practice. Understanding how different types of manufacturers are affected by and respond to planning is important in a context where many cities seek to adapt planning regimes to support sustainable economies. Even under strategic planning visions that aim for a sustainable and circular industry, manufacturers may face outdated codes that do not account for contemporary needs or face an undersupply of appropriate land under new zoning regimes (Grodach, 2022). Planners’ knowledge of urban industry may be patchy or non-existent. Conversely, manufacturers could exploit code loopholes or develop other survival strategies that enable them to conduct their business (Martin & Grodach, 2023).

3. Data and Methods

Our study examines the potential sustainability contributions of urban manufacturers and how planning policies and zoning regulations impact their practices. We focus on food and beverage manufacturing in Melbourne, Australia, concentrating on location decisions, supply chain linkages, and consumer relations. Food and beverage manufacturing is a comparatively large and growing industrial sector with strong ties to local consumption. Between 2011 and 2021, metropolitan Melbourne’s food and beverage manufacturing workforce grew by over 20% (Australian Bureau of Statistics, 2021). Food and beverage producers are also subject to more stringent planning regulations due to food handling and liquor licensing.

We conducted a document analysis to understand how planning policy positions and regulates urban manufacturing in relation to sustainability objectives. First, we reviewed Melbourne’s two primary strategic industrial plans, Plan Melbourne 2017–2050 (Victoria State Government, 2017) and the Melbourne Commercial and Industrial Land Use Plan (MICLUP; Victoria State Government, 2020). Building on sustainable urban industry literature (e.g., Leigh & Hoelzel, 2012), we looked for references to urban manufacturing’s potential economic (e.g., economic diversity, essential service provision), social (e.g., job accessibility and quality), and environmental (e.g., greenhouse gas emissions, resource flows, and waste management) impacts.

Second, we reviewed the Victoria Victoria Planning Provisions (VPPs) to investigate relationships between strategic objectives and the statutory planning tools available to implement them (Victoria State Government, 2023). The VPPs comprise state-defined statutory planning tools including zones, overlays, and provisions. This provided crucial insight into how planning legislation defines industry and how this translates to land use provisions and permitting processes.

This informed the 31 interviews with owners or senior managers of food and beverage manufacturing firms. We identified food and beverage manufacturers

across metropolitan Melbourne through Google Maps and local business directories. Our interview sample included a majority of firms in industrial zones (65%), reflecting the fact that most food and beverage operations are required to be located in these areas (Table 1). We selected firms from inner (<10 km from the central business district), middle (10–20 km), and outer (>20 km) locations to observe how planning and zoning regulations impacted firm operations and their sustainability potential in high- and low-density urban settings. However, the study concentrated more on inner and middle areas where land use conflicts are most evident. We also included firms in mixed-use zones (35%) to study regulatory impacts in areas that allow commercial, residential, and institutional uses. Food and beverage manufacturers in mixed-use zones are disproportionately located in central areas, which is reflected in our sample. Six of the 15 manufacturers that combined production with onsite sales were located in inner mixed-use zones. This included beverage manufacturers with tasting rooms and bakeries and coffee roasteries with cafés or retail outlets.

In addition to location and zone type, we also considered operational characteristics when selecting inter-

view participants. Characteristic of the diversity within food and beverage industries, our interviewees included producers of 13 product types (Table 2). They also represented firms of varying ages, sizes, and market reach. On average firms were relatively young (average establishment year 2011) and ranged in age from a confectionary manufacturer founded in 1989 to a pastry business started in 2020. Employment size ranged from a sole trader coffee roaster to a long-life milk manufacturer with 90 employees and a brewery with 166. The majority (55%) serve the metropolitan market, while a third supplied nationally and a 10th exported internationally.

We asked interview participants about their supply chains, workforce, market geography, location decisions, and built environment needs to understand their potential sustainability impacts. We then asked about experiences with planning processes and how this influenced locational and operational decisions.

4. Melbourne’s Industrial Planning Policy

The Victoria State Government provides strategic direction on industrial land use planning through the metropolitan strategic plan Plan Melbourne (Victoria

Table 1. Firms by location and zone type.

	Inner	Middle	Outer	Total
Industrial zones	7	9	4	20
Industrial 1	4	7	3	14
Industrial 2	—	—	1	1
Industrial 3	3	2	—	5
Mixed-use zones	9	1	1	11
Capital City 1	1	—	—	1
Commercial 1	1	—	—	1
Commercial 2	4	—	1	5
Mixed-Use	3	1	—	4
Total	16	10	5	31

Table 2. Main product.

Main product	Number of firms	%
Beer	6	19.4
Coffee	6	19.4
Prepared meals	4	12.9
Bakery products	3	9.7
Spirits	3	9.7
Smallgoods	2	6.5
Chocolate	1	3.2
Commercial kitchen hire	1	3.2
Confectionary	1	3.2
Lifelong milk	1	3.2
Non-alcoholic beverages	1	3.2
Pasta	1	3.2
Spice blends	1	3.2
Total	31	100

State Government, 2017) and the MICLUP (Victoria State Government, 2020). This is implemented through state-defined statutory planning tools (e.g., zones) via the VPPs and applied to local planning schemes. We evaluate how these plans and provisions frame the role, location, and regulation of manufacturing and industrial activity.

4.1. Planning for Sustainable Industry?

Plan Melbourne is structured around seven outcomes intended “to drive Melbourne as a competitive, liveable and sustainable city” through higher-density neighbourhoods and employment clusters within integrated transport networks to capture “the social, economic and environmental benefits of creating a more compact, sustainable city” (Victoria State Government, 2017, p. 3). Manufacturing and industry are not part of this sustainability framing. However, the plan identifies the role of new manufacturing industries and processes in transitioning to a low-carbon economy, noting that industry is the largest source of greenhouse gas emissions in Victoria.

The plan’s primary economic development objective is for Melbourne to be a “productive city that attracts investment, supports innovation and creates jobs” (Victoria State Government, 2017, p. iii). It identifies priority sectors ranging from medical technologies and pharmaceuticals to “food and fibre” (p. 20) and concentrates on “knowledge-based” service industries as growth drivers. It establishes “places of state significance” designed to “create a series of interconnected learning, working and living precincts across the city” (Victoria State Government, 2017, p. 20). These include the central business district, major urban renewal precincts (many formed through rezoning industrial land), and national employment and innovation clusters (NEICs), which overlay industrial zones and are intended to promote knowledge-based industries including advanced manufacturing. The high-level sustainability objectives in strategic plans for Melbourne in relation to these areas do not encompass industrial uses, outside of aspirations toward knowledge-based and advanced industries.

Concurrently, Plan Melbourne includes traditional industrial development strategies focused on freight networks and protection of priority industrial areas, including five state-significant industrial precincts (SSIPs) located in Melbourne’s outer suburbs. While Plan Melbourne celebrates the potential of “advanced” forms of production, industrial planning also maintains a traditional focus on monofunctional industrial parks in outer suburbs.

Sustainability is, in turn, largely absent from the planning frameworks for industrial areas. MICLUP’s scope is to ensure an adequate supply of commercial and industrial lands in suitable locations and is primarily concerned with the protection and expansion of large outer suburban SSIPs. Like Plan Melbourne, MICLUP seeks to man-

age Melbourne’s future economy as it “transitions away from one based on manufacturing, to a more service and knowledge-based economy” (Victoria State Government, 2020, p. iii); yet MICLUP also suggests that “demand for industrial land remains high for uses such as logistics and advanced manufacturing” (p. iii). According to MICLUP, manufacturing is expected to “see very little change in job numbers” with future demand for industrial land driven by wholesale trade, transport, postal, and warehousing sectors that “typically gravitate to industrial areas where large and affordable sites are available” (Victoria State Government, 2020, p. 15).

MICLUP establishes a hierarchy of industrial lands and offers zoning guidance. Of primary importance are the SSIPs—monofunctional industrial precincts intended to minimise land use conflicts. In addition to SSIPs, regionally significant industrial precincts offer more local flexibility and “can provide for, or transition to, a broader range of employment opportunities” (Victoria State Government, 2020, p. 34) including for commercial and residential development. Local industrial precincts are designed to “support local communities and other businesses operating in the local area” (Victoria State Government, 2020, p. 35). These two lower tiers allow for local discretion and flexibility but may introduce non-industrial uses and competition.

The VPPs have limited focus on the role of industry in urban sustainability beyond minimizing impacts on neighbours (e.g., Victoria State Government, 2023, Clauses 17.02–17.03) or maximising access to freight and port terminals, mostly “in places of state significance” (including SSIPs and NEICs; Victoria State Government, 2023, Clause 11.01–1R).

4.2. Zoning Mechanisms for Industrial Areas

Victoria’s local planning schemes provide the statutory basis to implement strategic plans. Planners assess proposed land uses or developments against the state-standardised zoning provisions and against MICLUP. Industrial land use and development are subject to planning schemes, incorporating state-defined strategic directions and state-defined statutory planning tools (zones, overlays, provisions, and definitions) based on the standardised VPPs and applied to local contexts. Victoria’s system is characterised as strategy-based discretion, meaning proposed land uses or developments are assessed both against the zoning provisions and against the strategic framework including Plan Melbourne and MICLUP.

The definition of industry is critical: land use definitions determine which zones permit, prohibit, or allow activities under specific conditions. “Industry” in the VPPs includes manufacturing, waste processing, excavation, dismantling, laundering, and repair services (Victoria State Government, 2023, Clause 73.03). It also covers ancillary uses including storage, amenities, and wholesale trade, and specifies “uses with an

adverse amenity potential” that require additional zoning exclusions and buffer requirements (Victoria State Government, 2023, Clause S53.10). This includes some food and beverage.

Zones specify uses that are allowed as of right, subject to permit, or prohibited. The designation of the strategic precincts described above, such as NEICs, is more broadly defined. State government only provides general boundaries for NEICs and they overlay other existing employment areas, particularly industrial zones. Half of the total NEIC land area is currently zoned industrial or within 100 meters of an industrial zone (Grodach & Guerra-Tao, 2022, p. 5).

Victoria has three industrial land use zones, which reflect a hierarchy based on potential amenity impacts (through transport, appearance, noise, or emissions) and avoidance of conflict. Industrial 1 is the standard industrial zone and the primary zone used in SSIPs. The purpose of the Industrial 1 zone (Victoria State Government, 2023, Clause S33.01) is “to provide for manufacturing industry, the storage and distribution of goods and associated uses in a manner which does not affect the safety and amenity of local communities.” Within this zone, “industry” as a land use is section 1—permit not required. This is, however, subject to conditions and exclusions, as a result of which many industrial land uses—and associated developments such as new buildings or changes to car parking—are discretionary uses, subject to a planning permit assessment normally by a local council. Industrial 2 is for heavy industry and prioritises uses with amenity impacts (Victoria State Government, 2023, Clause S33.02). Industrial 3 primarily supports service industries like laundries and auto repair and requires a permit for other industries “to avoid inter-industry conflict” (Victoria State Government, 2023, Clause S33.03).

Industrial uses are prohibited from nearly all other zoning categories. Limited light industry is allowed in Mixed-Use and Commercial 2 and 3 zones. However, it requires a permit and strict assessment around potential neighbourhood amenity impacts (Victoria State Government, 2023, Clause S32.04). Additionally, the range of uses allowed as-of-right in these zones tends to price out most rent-sensitive industrial firms.

New industrial businesses or those with changes to operations will trigger a planning permit process. For example, Industrial 1 zones require industrial uses with an amenity impact to apply for a permit, including large-scale beverage production and food roasting (Victoria State Government, 2023, S53.10). They must also meet threshold (buffer) distances from residential and other uses (Victoria State Government, 2023, S53.10). In Industrial 2 and 3 zones, nearly all new uses of land for industry or warehousing require a permit, along with information on the proposal and its likely emissions (Victoria State Government, 2023, Clauses S33.03–S33.02). Ancillary retail and office uses require assessments and trigger traffic and off-street parking assessments (Victoria State Government, 2023,

Clause S52.06). Uses requiring a liquor license, including breweries and distilleries, also trigger planning permits (Victoria State Government, 2023, Clause S52.27). Zones and other provisions combine in complex ways, with local discretion through which local councils assess planning permit applications against local and state strategy. In practice, a significant portion of businesses trying to establish or change an industrial business will likely trigger a planning permit assessment process.

Critically, while many new industrial uses trigger planning permit assessments, existing use rights protect the ongoing use of land irrespective of impacts. Hence, legacy industries that are potentially noxious and unsustainable are not subject to the same regulatory processes as new uses. Moreover, the process of matching permit assessments to strategic objectives requires a high degree of local discretion. This creates uncertainty for businesses that do not clearly fit existing definitions or established practices, including manufacturers with retail or on-site consumption.

In summary, manufacturers in Melbourne operate in a context where strategic planning seeks to promote a sustainable, compact, and productive city through knowledge-based industries, including advanced manufacturing. However, the approach to zoning upholds conventional separation in dedicated industrial zones and imposes strict limitations on mixed-industrial development. Beyond this, new industries can encounter a complex range of planning permit triggers that require planners to understand and assess specialised industrial operations and their possible impacts. This discretion can create uncertainty that may constrain nascent industrial sectors with sustainable supply chains and operating practices.

5. Regulating Food and Beverage Manufacturing

We found that zoning ordinances and other regulatory measures provide important support, but also create challenges for Melbourne’s food and beverage manufacturers. Below, we examine the sustainability attributes of food and beverage manufacturers, concentrating on their location decisions, supplier networks, and energy and waste management initiatives. We then turn to analysing how regulations affect firm operations and their sustainability potential.

5.1. Food and Beverage Manufacturing: Sustainability Potential

Food and beverage manufacturers predominately selected their location based on factors tied to affordable rent and various features associated with physical proximity. While sustainability principles do not directly explain location decisions, the tendency for food and beverage manufacturers to cluster in relatively close proximity—often enabled by industrial zones—creates a number of indirect sustainability benefits. These

include reduced transportation costs, building reuse and retrofit, smaller building footprints, and promotion of local consumption, albeit primarily in higher-end consumer markets.

Affordability was a primary location factor for firms in industrial zones, which keep rents lower than surrounding areas by regulating competition from higher-paying uses. Despite this, some firms reported rising rents and increasing competition for industrial space due to building conversions. As a food wholesaler in a central industrial area explains:

[There are] little warehouses that are popping up or being converted....Lots of people buy them and put their cars or their toys and stuff like that in there....There's a building three buildings up from us, that basically, they tore it down and they've built, I think, six little warehouses...and across the road from us, they were building apartments.

Location choices are also determined by an area's reputation and the marketing advantages associated with a concentration of like firms. As a distillery owner describes:

In the street, we've got a bakery, we've got three coffee roasters...within walking distance of us there are three breweries and there's another distillery. There's chocolatiers, there's cheesemakers, there's everything...as you get further out there's less density of those sort of businesses....So it amplifies your marketing.

This type of destination was important for many firms because on-site sales are a key component of the business model. About half of the manufacturers operate hybrid production/consumption businesses and depend on customer foot traffic. As a result, some have opted to trade the protection that comes with an industrial zone for sites in commercial or mixed-use zones. Finally, transport accessibility is a consideration in a firm location both in terms of customer access and proximity to the workforce with over two-thirds of interviewees citing degrees of public and active transport access as either a significant benefit or drawback to their location.

The tendency to locate near the workforce and customers encourages more sustainable adaptive reuse of older industrial spaces. All but four firms opted to move into existing buildings and retrofit the space to suit their production requirements (three of the four firms in new buildings located in a new industrial development marketed by developers as a food manufacturing hub). Adaptive reuse ranged from minor improvements of spaces previously housing similar operations to an A\$45 M retrofit of an old hangar space for long-life milk production. Firms report that older industrial spaces offer more flexibility to accommodate changing production requirements and growth. However, the scarcity of industrial lands means they also struggle with secur-

ing larger floorplate buildings in central locations. Older buildings often require retrofit to accommodate truck access and larger equipment and lack appropriate utilities, as discussed below.

Interestingly, firms did not report that concentration engendered direct collaboration among businesses in the same industrial district. However, it did support untraded relationships. A coffee roaster located in a new food manufacturing precinct chose their location in part because "they're all businesses like us...it's building a nice network of like-minded people...to have conversations with, people who, you obviously all make different things, but [share] the growing pains, etc."

Traded relationships are more common at the metropolitan level where supplier and labour networks have important economic and environmental implications. Food and beverage producers typically adopt a dual-sourcing strategy that blends global and local supply chains. For example, a pasta maker sources lower-cost flours from overseas but works with local packaging and printing firms to enable quick turnarounds on custom orders. Similarly, breweries may import yeast and grain but rely on local packaging manufacturers. Distilleries source malt and botanicals locally including orange peels and other fruit by-products and ferment in recycled Australian wine barrels. However, they import glass bottles because local bottle manufacturers have large minimum orders they cannot meet.

Most interviewees seek out local suppliers. This is driven in part by product branding but also has functional benefits that can reduce environmental footprints. A wholesale bakery aims "to make sure that we're using things like Australian flour and local products where we can. It's not always cost-effective, but it's something we really pride ourselves on doing and it's a great selling point to our customers." Local supply chains also provide more predictability and give producers tighter quality control over material and labour sourcing than those overseas. Firms increasingly look to local sources in the face of ongoing supply chain insecurity following Covid-19 and the war in Ukraine. Tight local networks enable manufacturers to respond quickly to changes in demand. A distillery finds that "you can call people directly and say, 'We need this in two weeks'....What's the chances of getting that turnaround overseas?...Even if they [shipped] it that week [if it] sits on a ship for six months, it's not much help." Close relationships are particularly important for start-up firms: "The only reason we probably got off the ground was because [our suppliers] were supporting us and giving us credit at the beginning...you support local, they generally give back to you as well."

In addition to using local ingredients and working with local suppliers, many firms seek to directly engage in more sustainable production processes through waste processing and energy consumption. Food and beverage manufacturers often have large amounts of organic waste, which they compost or provide to regional

farmers for fertiliser or animal feed. Packaging waste is significant and typically recycled. Breweries cite a move to cans from bottles to reduce breakage waste and shipping costs. In one instance, a prepared meal service takes food scraps to a local packaging company that recycles them into food packaging. However, these initiatives are not universal and often difficult to maintain. One coffee roaster that processes six to 10 tons of coffee beans each week found programs to compost used grounds often fail because the grounds go mouldy quickly. This has prompted them to work with other firms on recycling coffee grounds into road and building materials.

Many firms have significant power requirements, but face difficulties transitioning to more sustainable energy sources. Interviewees ranging from wholesale bakeries to breweries are concerned with sufficient energy supply and rising costs and have installed or intend to install solar panels on their buildings. However, many struggle with outdated utilities and buildings. Older buildings in central areas often need power upgrades for coffee roasting, baking, and brewing. They also have lower roof heights and/or asbestos making expansion or retrofit for solar panels challenging. Conversely, newer spaces in outer industrial zones are often designed for logistics operations and lack suitable utilities for manufacturing.

5.2. Planning Systems: Implications for Sustainable Production

The planning system has a significant effect on manufacturing operations and their sustainability potential. Strategic planning policy supports industry development and food is among the targeted high-value sectors in Plan Melbourne. Sustainability objectives are central to strategic planning policy, however, little connection is made with industrial uses. In the implementation mechanisms of zoning ordinances and other regulatory measures, sustainability is largely absent in relation to industrial activity. The statutory planning system places greater scrutiny on new and changing uses, which is not always proportionate or easily navigated by small and start-up firms. New businesses may require a planning permit for the new industrial use of land, for secondary uses like retail, and for building expansions, parking variations, and liquor licenses. Uses that have specified threshold distances (including food and beverage manufacturing) have additional controls on zoning and location. By contrast, existing use rights protect ongoing use of land, irrespective of most impacts. As a result, the planning system may inadvertently support ongoing and unsustainable industrial land uses while making newer and potentially more sustainable operations difficult to implement.

Food and beverage producers in industrial zones gain important protections that enable the potential for sustainable operations. Industrial zones shelter firms from competing uses that can bid up rents and create use conflicts. However, such mechanisms are not always equipped to support contemporary operations.

The focus of industrial zones is to separate industry and its potentially negative amenity impacts on surrounding uses as well as restrict “incompatible” uses including retail and hospitality. Planning regimes are caught between protectionist industrial zoning, which concentrates on managing amenity impacts, avoiding use conflicts and, by association, constrains land value and more flexible approaches that can nurture a changing and often hybrid manufacturing base. Hybrid business models that blend production and consumption are typically not allowed as-of-right in industrial zones, creating challenges for many contemporary food and beverage manufacturers. As a brewery explains:

Council doesn't seem to really get behind [us] because we're not really in column A or column B. We're not fully industrial. We're not fully commercial—We're somewhere in between. And most of the zoning is not really flexible to share both.

Conversely, mixed-use commercial zones allow such activity but have considerably higher rents and competition for space. Firms near targeted high-density residential areas may benefit from a larger local market base but also may struggle to afford area rent even in industrial zones.

Respondents across the board expressed concerns about the significant risk, uncertainty, and unanticipated costs associated with obtaining planning permit approvals. Firms had to lease their premises for months or even years before opening while they waited for planning approvals. This prefigured into location decisions with some businesses trading off more direct customer access for less planning-related risk. A coffee roaster wanted:

To find a location that gave me the best chance of success quickly....There were no residences within a kilometre of here...all of the cafe density is sort of within that 8 km ring of the city, all of the quality ones, so I wanted to be within that zone....Like all of those sorts of spaces [near residential] I knew would be permit challenging....[But] there's no foot traffic so there's no opportunities to serve coffee in a cafe sort of environment. I can't really make a cafe space here.

Firms particularly face challenges with permit processes for new uses or use changes on site (e.g., adding retail). Delays were significant when planners assessed whether operations would impact neighbourhood amenities. Many change-of-use permits are triggered by businesses seeking to adapt or upgrade their property. For example, firms that seek to install bar or retail operations in an Industrial 1 zone require noise, traffic, and odour assessments. This creates long delays with requirements often more onerous for new uses (and start-ups with limited planning experience) than for as-of-right businesses with potentially greater impacts.

Mixed-use zones, which allow hybrid manufacturing and retail business, do not necessarily make change-of-use processes easier. Some respondents in mixed-use zones experienced delays in adapting their premises for ancillary hospitality. In one instance, a coffee roaster had to rework their business model after eleven months without trading reduced their capacity to hire staff, and permit restrictions limited the number of people allowed on-site due to the available parking.

Parking requirements were an issue affecting all businesses to varying extents. When a pureed food producer in an industrial zone expanded their building, the local council “made us put in even more car parking spaces....We’ve got 90 car parking spots but we only have 20 employees. Now, the maximum this factory can hold will be 50 employees.” At the same time, this respondent pointed to “problems with our trucks...turning into our facility because the road has cars parked on it” from employees at smaller and older factories with over-spill parking.

In industrial zones, three firms faced issues with establishing customer-facing uses despite their manufacturing operations being allowed as-of-right. One distiller reported commissioning nearly A\$80,000 in traffic, acoustic, and odour surveys over a 15-month period to set up their production facility and tasting room. They attributed this to the lack of planning officer knowledge about the distillation process and the lack of precedent in their council area:

Because we’re one of the first [distilleries with a tasting room], they literally went through every single thing that they could possibly think of that could cause an issue. Fortunately for others who’ve now come into the area, it’s a bit more streamlined....They had no precedent.

Firms that worked with knowledgeable planners and/or local councils with experience around specific industry regulations (e.g., dangerous goods storage, noise, and odour restrictions) for specific food and beverage industries reported better experiences.

Consequently, it often falls to local planning departments and individual officers to bend old codes to support new industries. This creates significant variation and means that businesses often work with planners with varying levels of knowledge responsible for their cases. To illustrate, while the distiller above spent nearly two years and significant money on regulatory approvals, another distiller in a different council area leased their premises and began trading later that year:

When [the planner] asked questions about “how are you going to do this or that” we had explanations, which they had no objection to....They didn’t have any understanding of the distillation process. So one of the things they said was, “Oh, you can’t have a plaster roof because of the steam...it will break and fall down.”

I said to them, “Well, if we’re losing steam, we’re throwing our product away.”

Where councils and planners were open to learning about businesses and willing to negotiate, respondents reported a more positive experience with the planning process. A spice wholesaler and manufacturer used parking spaces to store pallets because they had outgrown their facility. Although the planning permit required use for parking only, the council planner “saw the problem and the issue and worked with us, which was great because sometimes [they] can get a bit of a negative rap. But he was very understanding and so it was good, win-win.”

6. Conclusions

This study examined the potential sustainable economic development contributions of food and beverage manufacturers in Melbourne, Australia, and how planning policies and zoning regulations may influence sustainable industry. The aim was to identify if and how planning frameworks support the potential for urban manufacturers to develop sustainable practices related to their location, supply networks, and energy and waste management initiatives. The findings contribute new empirical research on the sustainability potential of urban manufacturing and highlight the obstacles, tensions, and trade-offs involved in supporting sustainable production in the planning system.

Based on our interviews with 31 food and beverage manufacturers, we found ripe potential for encouraging sustainable production, but also extant challenges for firms. Those located in denser urban areas contribute indirect sustainable benefits through firm clustering and a focus on local supplier networks and ingredients. At the same time, firms simultaneously face cost pressures and introduce intra-industry gentrification processes with a focus on higher-end markets. Businesses also practice sustainable production processes through waste processing and energy consumption, but face challenges in retrofitting buildings to support this.

However, while the language of sustainability pervades Melbourne’s strategic plans, there is little effort to incorporate manufacturing in a more sustainable city. Moreover, statutory planning tools have significant trade-offs that may run counter to broader sustainable planning goals. Industrial zoning codes maintain a traditional focus on use separation to protect industry from the encroachment of other uses and to protect other uses from industry amenity impacts. This approach helps constrain the land price impacts of mixed-use development and industrial gentrification. However, the complex landscape of planning requirements and permit triggers creates time, cost, and knowledge burdens for applicants. These are compounded for new and hybrid business types and impact disproportionately on smaller firms.

Conversely, mixed-use zoning, which is core to sustainability directives, allows for greater flexibility

important to small, diverse, hybrid, and emerging sector firms. Yet it does not account for the price and use conflicts inherent in higher-density environments. In tension here is the fact that many hybrid uses, especially those with increased focus on direct retail and hospitality may both value and feed an amenity premium in industrial precincts while others are negatively impacted via the increased competition for real estate and attention to amenity impacts.

In general, there is also significant variation in the approvals process depending on the understanding of local planning officers and the existence of local precedent. Businesses diverting from established norms are likely to attract higher scrutiny, resulting in delays and costs. While local planning departments and individual officers have a degree of flexibility in adapting codes to support new industries, the results suggest a more systematic failure in the planning framework to adequately balance scrutiny of industrial business activity with support for industrial innovation and growth as part of a sustainable economy. Future research should extend this work by engaging directly with urban planners to understand their motivations and perceptions of challenges around sustainable production and industrial zoning.

In conclusion, the study points to the need for greater strategic planning recognition of manufacturing diversity and the potential to contribute toward sustainability objectives. It requires regulatory reforms that engage with new and emerging forms of manufacturing, alongside a continued focus on protecting industry and regulating amenity impacts. Our findings also highlight that the implementing environment is as critical as the underlying policy strategy. With coordinated planning officer education and mechanisms for sharing knowledge and experience, planners will be better placed to support sustainable urban industry.

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Conflict of Interests

The authors declare no conflict of interests.

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