Infrastructure Ontario

Performance Measurement of Transit Oriented Communities

Literature Review

LITERATURE REVIEW
PERFORMANCE MEASUREMENT OF TRANSIT ORIENTED COMMUNITIES

Executive Summary

Transit-Oriented Communities are popular in modern urban planning, harmonizing efficient transit with sustainable community growth. This study proposes a phased measurement approach, anchored by the Theory of Change, to assess a TOCs' progress and success across its project lifecycle and beyond. Drawing from a structured literature review, we classify key performance indicators (KPI) into short-term (TOC planning and tendering), medium-term (TOC implementation), and long-term (TOC completion and beyond). The literature review has generated the following key recommendations for performance measurements in TOCs: embrace a phased KPI approach, secure reliable data sources, initiate phase-specific jurisdictional assessments, ensure broad stakeholder engagement, and utilize real-time monitoring dashboards.

1. Introduction

Transit-Oriented Communities (TOCs), also known as Transit-Oriented Developments (TODs), offer a holistic and innovative approach to urban planning and development. These communities typically center around conveniently situated transit stations within close range - generally 800 meters (or half a mile) apart - prioritizing sustainable modes of transportation while simultaneously reducing reliance on cars for residents.1 Initially, the overarching goal of TOCs was to optimize the utilization of public transportation systems to reduce reliance on private vehicles and promote sustainable modes of commuting.[2] Over time, the aim has evolved to build urban environments that are interconnected, fostering ease of movement across residential, commercial, and transit areas, to enhance livability and build a sense of community within compact neighborhoods that are easily accessible by foot (See Appendix A: Historical Context).[3]

As TOCs are gradually created over time and comprised of multiple integrated components, measuring their effectiveness becomes difficult, especially with regards to determining progress and success in distinct stages of development. To address this issue, it is crucial to establish performance indicators or metrics related to processes, outputs, and outcomes in various stages of TOC development. To shed light on this issue, this literature review

aims to provide a comprehensive understanding of the historical context behind the evolving concept of TOCs, highlight how governments have measured and evaluated their success through various phases, and provide recommendations to inform a practical framework for measuring short-term progress to ensure long-term success of a TOC program.

2. Methodology

To conduct a comprehensive yet rapid literature review on TOCs, a systematic approach was adopted. The research began by searching various databases such as Google Scholar, Science Direct, Taylor and Francis Online, Sage Publications, Web of Science, and the Transportation Research Board archive. Keywords used in this search included "transit-oriented development," "transit-oriented communities," performance measurement," and "key performance indicators." For the purposes of this review, literature referencing TODs as TOCs or vice versa, were deemed to concern the same concept.

From the search process, a multitude of relevant peer-reviewed papers and articles (grey literature) emerged. These publications, which span from the late 1980s to the present, primarily focused on North America. The scope of the literature reviewed extended to a wide range of topics concerning TOC concepts, typologies, effects, planning and performance measures, often specific to unique TOC projects.

To categorize the findings, the literature was organized into three stages: policy design, implementation, and evaluation. Furthermore, the references cited within each publication were scrutinized to uncover additional pertinent literature. The grey literature encompassed government reports, private sector reports, discussion papers and conference papers from a variety of sources. Special attention was paid to government reports from transportation authorities and planning organizations. These offered valuable insights into the practical implementation and assessment of TOCs.

3. Performance Measurement of TOCs

To effectively gauge the impact and success of Transit Oriented Communities (TOCs), it's essential to examine them through a phased approach that aligns with the typical lifecycles of major infrastructure projects, especially those common in North America. This literature review introduces such a structure, attempting to map each TOC phase to specific time frames while drawing insights from the Theory of Change. This approach clarifies the relationships between early activities, outcomes, and the long-term benefits of TOCs. It's worth noting, however, that these timelines serve as a general guideline and may vary depending on the specific context and characteristics of each TOC:

- **Short-term (1-3 years):** This initial phase spans from the early planning stages through to project development and transaction. It's characterized by key activities such as stakeholder consultations, obtaining necessary permissions, and hitting planning milestones. Most information and metrics for this phase are found in grey literature, pointing to the evolving nature of early-stage TOC evaluations.
- **Medium-term (3-10 years):** This middle phase covers the construction period and the onset of operations. As TOCs start to become functional parts of the community, the metrics in this phase evaluate how well they align with the initial plans and goals. Information on these metrics comes from both grey and peer-reviewed literature, reflecting a growing academic interest in this stage.
- **Long-term (10+ years post-completion):** By this phase, TOCs have fully established themselves within their communities. The focus of evaluation shifts towards long-term outcomes like sustainability, economic impacts, and improvements in transportation and community life. Most of the metrics for this phase are sourced from peer-reviewed literature, highlighting the academic consensus on their importance.

For each of the time frames proposed, this review presents popular KPIs collected from academic and grey literature, offer potential data sources, and share practical examples, adding perspective on the trajectory KPIs from initiation to completion and beyond.

3.1. Short-term: Process-Oriented Indicators

Process-oriented KPIs focus on the initial planning and preparation stages of TOCs usually concern immediate activities required to set up a TOC. These indicators which often constitute administrative data such as the number of contracts executed or communities engaged, have not been given equal importance in academic research. However, a review of the literature suggests that such indicators are increasingly referenced in government reports, guidelines and publications concerning urban development. To support this, broader urban planning literature suggests that metrics, such as land acquisition, obtaining necessary approvals, community consultations are important determinants of TOC success.[4] With this regard, examples of process-oriented metrics in evaluating progress are outlined below.

3.1.1. Land Acquisition:

Examining the efficiency in acquiring needed lands or properties for the TOC project. This can be gauged by the number of lands acquired, the process duration, and the costs related to these acquisitions. Data for this KPI would typically come from land purchase contracts, property deeds, municipal land records, and financial statements. A suitable case example is found in the Fruitvale Transit Village in Oakland, California where a public-private

partnership model facilitated efficient acquisition of land, transforming an underused parking lot into a vibrant mixed-use district.[5]

3.1.2. Permits and Approvals:

This evaluates the effectiveness and speed of obtaining necessary permits and approvals for the TOC project. This can include planning permissions, zoning changes, and environmental clearances. This KPI can be measured by the number of approvals obtained, time taken to secure permissions, and any associated costs. Relevant information can be obtained through public records, planning department records, and project documentation. To illustrate, the Eglinton Crosstown Light Rail Transit project in Canada provides a useful example. Here, regulatory compliance and progress in permit attainment were successfully achieved through steady collaboration with the city's planning and transportation sectors.[6]

3.1.3. Partnership Establishment:

Assessment in this area involves monitoring the development and establishment of partnerships, including with transit agencies, local businesses, community organizations, and potential investors. This can be measured by tracking the number and quality of partnerships formed, agreements signed, as well as their strategic value and contribution to the project. This might entail the analysis of partnership agreements, joint venture contracts, and stakeholder interviews. Evidence can be found within meeting minutes, public announcements, and formal partnership agreements. Development agreements are a practical manifestation of public-private partnerships. They formalize the obligations of developers and the city government in urban renewal projects. An illustrative example of this can be seen in the Pearl District of Portland, Oregon. Here, the Portland Development Commission fostered a development agreement with Hoyt Street Properties, LLC., a local developer, and other involved parties, which also included a quota of affordable housing units would be constructed as part of the partnership.[7]

3.2. Medium-Term: Output-Oriented Indicators

During the medium-term phase of a TOC's development, the emphasis shifts from planning and preliminary activities to concrete outputs, laying the foundation for the tangible outcomes that emerge in the long term. This phase, roughly spanning a proposed 3 to 10 years from project initiation, is crucial as it bridges the transition from construction to the full integration of the TOC within its community. It's during this phase that stakeholders can observe the construction and implementation of a project, measure the efficiency of current operations, and foresee the trajectory of future success. The indicators in this section are drawn from a mix of grey literature and peer-reviewed sources, underscoring the growing

academic and professional interest in capturing and evaluating these critical mid-stage developments of a TOC.

3.2.1. Construction Timelines

Measuring the progress of building activities against the predetermined schedules can help monitor success of projects during implementation. These can usually be sourced from the project constructor or the planning and project delivery representing the owner. For example, Hudson Yards in New York City is a prime example of a TOC managing construction timelines across complex, phased developments. Each construction stage from the initiation of the Eastern Yard in 2012 to the ongoing planning of the Western Yard has been guided by thoroughly planned schedules.[8]

3.2.2. Budget Adherence

Comparing actual expenditures against the initial budget during the construction phase offers insights into financial management and any potential inefficiencies. Financial reports from development firms or city planning offices typically provide clarity on projected versus actual costs. For instance, the "Transit Oriented Development Financial Analysis Tool" by the World Bank sheds light on this activity.[9] This tool gives a preliminary investment return assessment based on project parameters. It helps control costs, promoting budget adherence by projecting development budget, operating revenues, and identifying potential funding sources. Construction firms or government agencies tend to have their own budget analysis tools to monitor progress.

3.2.3. Securing Compliance

Compliance activities play a crucial role in ensuring that TOCs adhere to various regulations, policies, and standards set at local, state, and national levels. In this stage, it is essential to monitor if the TOC project complies with planning permissions, land use regulations, environmental standards, and building codes. Compliance activities can include regular reviews and audits, reporting requirements, and site inspections. Compliance data can be gathered from municipal records, project documentation, and inspection reports. For example, the "Central Saint Giles" project in London required strict adherence to environmental compliance, such as earning a BREEAM “Excellent” Rating, resulting in the construction of one of UK's most sustainable mixed-use developments.[10] Monitoring these compliance activities in the short term helps to ensure that the project is developing along the planned trajectory and is in line with its intended goals and objectives.

3.2.4 Transit Efficiency

Upon substantial completion transit efficiency measures ensure a TOC is progressing towards its target of increasing transit usage and improving network efficiency. Evaluation can consider transit ridership levels, network connectivity, and service efficiency. This can include reviewing the number of transit users, the reach and connectedness of the transit network, and reliability and frequency of services. Data collected from transportation authorities, ticket sales, transit route details, timeliness, and frequency can serve as effective indicators. For example, the Denver's "Union Station" demonstrated enhanced connectivity and usage due to the various transit options made available while investments in Virginia's "Rosslyn-Ballston Corridor" improved transit services and broadened the transportation network.

3.2.5. Residential and Commercial Occupancy rates

Monitoring the percentage of residential and commercial spaces that are occupied, can speak to the attractiveness and functionality of the TOC. Local property records and real estate data can provide information about occupancy rates. Commercial property brokers or local government property tax records may be used as sources. "Pearl District" in Portland, Oregon makes for an excellent example here. After redevelopment, a marked increase in both residential and commercial occupancy rates was observed. This signaled the successful holistic development of the community living and working in the neighborhood.

3.2.6. Local Economic Activity

To assess a TOC's economic health, one should consider factors like job generation, diversity of businesses, and revenue progression of commercial sectors. Essential tools for this assessment include tax documents, employment data, and business permit records. Furthermore, relevant data on emerging businesses, job vacancies, and tax revenues from adjacent areas are valuable. This data is often obtainable from city or national development agencies and public records. Differentiating between measures for different time periods for economic impacts is crucial; short-term or medium-term measures often relates to immediate expenditures like construction, while long-term examines ongoing business revenues.11 As an example, a report commissioned by the Foothill Gold Line Construction Authority suggests that TOCs close to Pasadena's six Gold Line stations have contributed $2.6 billion in economic gains, upheld around 16,300 positions, and garnered $52.9 million in taxes. Overall, they are anticipated to add another $688.1 million in economic value, facilitating approximately 4,400 additional jobs.[12]

3.2.7. Community Satisfaction

In the medium term, measuring community engagement and satisfaction indicates the extent of resident involvement in community planning, events, and volunteer activities, as well as their satisfaction levels ranging from public transportation performance to access to services and amenities. Community participation, reflected in survey participation numbers, attendance at community meetings, and input on decision-making processes, are crucial indicators of community engagement. Simultaneously, gauging residents' satisfaction rates with their quality of life in the TOC can offer avenues for improvements and policy changes. Methods such as surveys, town hall meetings, and social media are common tools used to measure both aspects. For instance, TOD Coordinating Committee of the State Government of Western Australia noted that residential and merchant surveys, conducted every five years can help evaluate the perception of citizens habituated at or around at TOC. [13]

3.3. Long-Term: Outcome-Oriented Indicators

Research on performance measurement of TOCs has largely focused on evaluating their effectiveness upon completion. Initial research focusing on transit ridership and land use impacts. [14] As understanding deepened, studies expanded to encompass travel behaviors, economic vitality, and social equity.[15] Further, research evolved to examine broader societal consequences, such as employment patterns, housing affordability, and environmental sustainability.[16] Recently, the scope has advanced to consider even longer-term outcomes like alterations in urban form, community resilience, and quality of life, highlighting the maturation of TOC research and its comprehensive, longitudinal perspective on community-wide effects.[17]

Long-term, or outcome-oriented indicators therefore provide a critical assessment of broad impacts and effectiveness once a TOC project has reached maturity. They capture the full-scale effects, reflecting the overall success in meeting the primary objectives of a TOD - namely, promoting sustainable transport, enhancing the local economy, improving the urban quality of life, bolstering community engagement, and achieving inclusive development. These multifaceted indicators provide a comprehensive evaluation, reaching beyond initial projections to reveal the longer-term outcomes and transformative potential of TOC projects.

3.3.1. Sustainable Transport Shift

Measures the percentage of residents who use sustainable modes of transport, aiming to capture the shift away from private vehicle use to public transit, cycling, and walking. This involves measuring the change in modal share towards more sustainable modes of transport like buses, trams, bikes, and walking. Surveys can be used over a period to monitor the change. Data can also be obtained from ticket sales, vehicle registration

records, and other transportation department records. An effective example comes from the community around the Pleasant Hill Bay Area Rapid Transit (BART) station. Here, increased transit usage was seen in the Wayside Plaza and Park Regency living areas, with 55% and 37% of residents, respectively, regularly commuting via BART. This significant shift towards public transit use, as contrasted with the citywide average of 16%, underscores the potential of TOCs to catalyze shift towards more sustainable forms of transport.[18]

3.3.2. Housing Outcomes

Housing supply is a crucial aspect of TOCs which involves not just increasing or maintaining the supply of housing to meet demand, but also improving affordability. Housing outcomes indicate the project's long-term impact on housing affordability, diversity, and quality within the TOC area. Long-term indicators may include changes in housing affordability, diversity of housing types and tenure options, and housing quality or standards maintained in the TOC region. Data needed for evaluating housing supply can often be obtained from local government housing and planning departments, which may keep records on building permits, housing stock, and occupancy rates. Real estate market reports may also provide useful data on housing availability and the diversity of housing types. A Canada Mortgage and Housing Corporation (CMHC) report highlights that notable TOC projects across cities like Vancouver, Calgary, Winnipeg, and Toronto are set to add about 3,500 affordable rental units to Canada's housing market.[19] TOCs can also enhance housing options via "location efficiencies," which helps decrease the need for multiple vehicles, thus alleviating financial burdens on households. Reducing parking need, a significant factor in the cost of a housing unit, further contributes to affordability. These savings on transportation costs make rents more manageable for lower-income families even in high-living-cost cities.[20]

3.3.3. Economic Impact

Assesses overall impact on the local economy, such as job growth rates, property value appreciation, or retail sales growth in the TOC area. Economic impact can be evaluated by assessing changes in property values, business development, employment rates, and economic diversity. Data sources can be local tax records, employment statistics from labor departments, and records of business licenses. For instance, Washington D.C's Union Station facilitated an urban revival, increasing retail sales at an annual rate of 5%, and creating 1,200 to 1,500 jobs at the station.[21] Similarly, Fruitvale Transit Village in Oakland sparked economic rejuvenation in a previously declining neighborhood, reducing the vacancy rate from 40% to less than 1% and adding several hundred new jobs. These examples underscore the significant role TOD can play in economic development.[22]

3.3.4. Cost-Effectiveness

Measuring cost-effectiveness can help determine the extent to which TOCs can capitalize on opportunities to generate additional revenue or cut costs related to private development at or near a station. Such financial gains can come from exploiting air rights or ground leases (e.g., parking lots) for revenue generation. Data points needed to measure this KPI would involve monitoring revenue from joint development activities, cost savings from shared initiatives, and an increase in patronage and subsequent fare revenue as an indirect outcome of joint development. Sources of information might include financial records from transit operators, lease documents, and patronage statistics. This KPI is crucial as it highlights the commercial viability of TOCs apart from their socio-environmental impacts. Given the significant financial investments that TODs often involve, demonstrating this financial return can be critical for winning support from stakeholders and for the long-term sustainability of the development. For example, the Washington Metropolitan Area Transit Authority's (WMATA) serving the Washington D.C. Metropolitan Area, is currently making about $6 million annually from commercial revenues.[23]

3.3.5 Environmental Sustainability

Assesses long-term environmental impacts, such as reductions in greenhouse gas emissions or improvements in energy efficiency in buildings, and overall sustainability of the TOC. Indicators might include air and water quality, energy us age, and waste management metrics. Data is frequently collected by environmental agencies and utility companies. The South Waterfront TOC in Portland achieved significant environmental sustainability, as district heating, energy-efficient buildings, bike lanes, and green spaces, contributed to reductions in greenhouse gas emissions and improvements in energy efficiency.[24]

4. Recommendations

The efficacy of any TOC program hinges on consistent and insightful measurement of progress and success. While the historical and theoretical foundations of TOCs provide context, the immediate requirement for governments and stakeholders is to glean actionable insights that inform real-world applications. Drawing from the extensive literature review and recognizing the stipulated aim of this document, the following section delineates a series of recommendations. These are intended to provide a practical roadmap, enabling stakeholders to measure short-term progress that can eventually connect to the long-term success of a TOC program.

1: Phased Measurement Approach

Embrace a Theory of Change approach when defining and implementing KPIs for the TOC program at each phase of development. Map KPIs to intended and specific program objective. Such a framework aids in clarifying the causal links between activities and long-term objectives, ensuring a systematic and coherent pathway to achieving desired outcomes. Recognize and cater to the distinct phases of TOC development – from planning and design to construction, leasing, and long-term community integration. While TOCs might witness concurrent short-term and long-term measurements due to their expansive scale, it remains imperative to distinguish and adequately measure each phase's unique outcomes.

2: Establish Reliable Data Sources

Before implementing KPIs, clearly identify, vet, and secure reliable data sources to ensure that data collection can be done and measurements can remain accurate and consistent. Consider both traditional (such as governmental records) and innovative sources (like community-based participatory research) to provide a comprehensive data landscape. Strengthen institutional capacity to collect, analyze, and interpret data. This involves periodic training for personnel, investment in data analytics tools, and fostering partnerships with academic or research institutions for rigorous evaluation.

3: Undertake Phase-Specific Jurisdictional Scans

Conduct jurisdictional scans tailored to each specific phase of TOC projects, with a pronounced focus on short-term indicators, given the observed gaps in the literature. By benchmarking against analogous projects or regions, these scans can reveal best practices, potential pitfalls, and validated metrics that have been utilized elsewhere. This will ensure that the TOC program benefits from a holistic understanding, drawing from real-world examples for each phase of the development, thereby ensuring an informed, robust, and resilient monitoring and evaluation mechanism.

4. Stakeholder Collaboration

Prioritize inclusive stakeholder engagement during the formulation and operationalization of the monitoring and evaluation framework. Engage community representatives, developers, policymakers, transit agencies, and other pertinent stakeholders to foster collaborative decision-making and ensure a comprehensive understanding of TOC impacts.

5. Implement Real-Time Performance Dashboards

Leverage technological advancements by deploying real-time dashboards to continuously monitor TOC progress across various phases. Such platforms can provide instantaneous insights, visualizing key metrics and data trends, thereby empowering stakeholders with

actionable information. Dashboards not only streamline the tracking process but also facilitate timely interventions, ensuring alignment with desired outcomes.

A strategic and multi-dimensional approach to measurement and evaluation is pivotal. By integrating both short-term and long-term KPIs, grounded in the Theory of Change framework, stakeholders can better delineate the trajectory from immediate actions to sustained outcomes.

Recommendations highlighted herein not only echo the necessity for methodical, data-driven insights but also emphasize the value of collaborative learning and stakeholder engagement.

As urban centers continue to grapple with the challenges of sustainability, livability, and economic vitality, well-monitored and effectively implemented TOCs stand as promising avenues to harmonize transit with community aspirations, ultimately redefining the contours of future urban landscapes.

Appendix A: Historical Context of TOCs

TOCs emerged as a promising planning concept in the latter half of the 20th century. Designed to efficiently integrate land use and transportation, they aimed to foster sustainable, compact, and walkable communities centered around transit stations [25]. Early literature emphasized the potential benefits of TOCs, such as reduced reliance on private vehicles, enhanced walkability, increased access to public transit, improved air quality, and the promotion of mixed land use and diverse housing options. [26] The '3Ds' – density, diversity, and design, were seen as critical components of successful TOCs, with density promoting efficient land use and supporting public transit ridership, diversity enabling a mix of uses and activities within a short walking distance, and design ensuring safe, attractive, and pedestrian-friendly environments.[27]

As the concept gained traction, definitions, and objectives of TOCs began to vary among different stakeholders, reflecting the evolving discourse surrounding it. Over the years, the understanding of TOCs matured, with definitions and objectives evolving to encapsulate a broader and more multifaceted perspective.[28] While some were keen on the transportation aspect, underscoring reduced car usage and heightened transit accessibility, others pivoted towards the importance of social integration and environmental sustainability. [29] Beyond its physical attributes, the comprehensive benefits TOCs brought to community life and the environment took center stage. Objectives thus broadened to factor in social integration, economic development, and environmental sustainability.[30] Conceptual overlaps were evident, with terms like "New Urbanism," "Smart Growth," and "compact city" being interchangeably used with TOCs, denoting shared goals. Consequently, the realization dawned that TOCs couldn't be pigeonholed into a one-size-fits-all paradigm.[31] While the integration of land use and transport—the cornerstone of TOC—has remained unchanged, the emerging definitions shed light on TOC planning's multifaceted nature, spanning urban design, social, economic, environmental, and policy considerations.[32]

In parallel to the work on benefits and definitions of TOCs, a concerted effort was made to evaluate their effectiveness, with initial research focusing on transit ridership and land use impacts. [33] As understanding deepened, studies expanded to encompass travel behaviors, economic vitality, and social equity.[34] Further, research evolved to examine broader societal consequences, such as employment patterns, housing affordability, and environmental sustainability.[35] Recently, the scope has advanced to consider long-term impacts like alterations in urban form, community resilience, and quality of life, highlighting the maturation of TOC research and its comprehensive, longitudinal perspective on community-wide effects.[36] While research on TOC KPIs has evolved throughout time, there seems to be a gap in short-term indicators. Yet, broadening the scope of literature to urban planning,

municipal planning or government reporting can provide insight into metrics to measure success in the immediate term.

Today, TOCs as viewed as dynamic entities which adapt to societal changes, technological strides, and environmental factors.[37] As a result, each TOC unfolds dynamically, transitioning through multiple stages, each with its distinct characteristics and impacts. This change in perspective suggests that each TOC is unique and greatly impacted by its local environment. To ensure a TOC meets its stated objectives. To holistically assess the performance of TOC projects, it's vital to understand and evaluate key performance indicators (KPIs) tailored to each of these developmental stages.

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