

Una revisión sistemática de categorías para la evaluación de la planificación y el diseño urbano orientado al transporte público

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Resumen

Debido a las valiosas experiencias globales realizadas en Desarrollo Orientado al Transporte Sostenible (DOTS)', una estrategia sensible al contexto es inevitable actualizar la planificación e incluso las imperfecciones posteriores al desempeño, a las que se podría seguir reforzando los nuevos planes urbanos. Este estudio pretende resaltar las dimensiones más importantes para la planificación urbana orientada al tránsito en todo el mundo. Para ello, las investigaciones cualitativas relevantes se revisarán sistemáticamente a través de un estudio de meta-síntesis cualitativa (QMS). La búsqueda de 17 artículos revisados por pares y bases de datos complementarias de mayo a agosto de 2018 dio lugar a 6522 registros, de los cuales 23 cumplieron con los criterios de elegibilidad y la evaluación de calidad para estar en la lista final. Usando el análisis de contenido cualitativo, los resultados se interpretaron, y por una clasificación, se elaboró un modelo impulsado por el desarrollo como temas generales de planificación de DOTS, a saber, Desarrollo del desarrollo, Desarrollo de políticas, Desarrollo de procesos y Desarrollo sostenible. Con respecto a los hallazgos del estudio, se enumeran 30 dimensiones de planificación relevantes para DOTS. Los resultados ayudarán a recuperar y recopilar las dimensiones actualizadas y a interpretar los cambios.

Palabras clave

Desarrollo Orientado al Transporte Sostenible, planificación urbana, revisión sistemática, meta-síntesis

Abstract

Due to valuable global experiences regarding Transit Oriented Development (TOD) as a context-sensitive strategy, updating the planning dimensions and even post-performance imperfections is inevitable by which reinforcing new urban plans could be dramatically pursued. Therefore, the present study aimed to highlight the most significant dimensions of transit-oriented urban planning all over the world. To this end, relevant qualitative studies were systematically reviewed through a Qualitative Meta-synthesis study. A total of 17 peer-reviewed articles and complementary databases searched during May-August 2018 led to a number of 6522 records among which 23 cases met the eligibility criteria and quality appraisal for inclusion in the final list. Then, the results were interpreted by using qualitative content analysis and a development-driven model was drawn by a classification as the general TOD planning themes including place development, policy development, process development, and sustainable development. Based on the results of the study, 30 planning dimensions pertinent to TOD were listed. The results helped retrieve and collect the up-to-date dimensions and interpret the changes appeared during the decades of planning.

Keywords

Transit-oriented development, Urban planning, Systematic review, Qualitative meta-synthesis

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Introduction

It is an article of faith that the idea was originally designed by Peter Calthorpe, an American architect in the U.S. His primary idea was formed based on the interaction between movement and urban form which was closely connected with development strategies such as Smart Growth and New Urbanism in notion (Xu, Guthrie, Fan, & Li, 2017; Dunphy & Porter, 2006). These strategies pinpoint providing a set of new urban settlements in order to recite the story of promotion against being dependent on the cars and its hostile impacts (Shibley, 1998; Goetz, 2013). In fact, after ample suburbanization and increased car-oriented movements during post World War II, more urban road construction and growing car travel demand led to congestion, energy shortage, negative societal outcomes, as well as the posed costs on people, cities, and the environment (Banister, 2005; Xu, Guthrie, Fan, & Li, 2017). Accordingly, high-quality public transit, as well as the high level of local accessibility was totally regarded in cities and placed on the agenda in order to decrease the need for car use. Investments on urban rail infrastructure with regard to new development around its station reshaped the future city structures once more. Therefore, the links between transport and land use and public policies established the basic fundamentals of the Transit-Oriented Development (TOD) concept in the United States (Aston, Currie, & Pavkova, 2016). However, different global communities have already applied various TOD proposals in their planning process (Xu, Guthrie, Fan, & Li, 2017). Staricco and Vitale Brovarone (2018) refer to TOD as “emerging European-style planning in the USA”. For instance, proposals such as Garden city movement in the late 1890s (Hall, 2002), Linear city by Arturo Soria y Mata (Sung & Choi, 2017), Copenhagen finger plan in 1947 (Knowles R. K., 2012), Toronto in the 1950s (Kenworthy, 1991; Cervero, 1986), Stockholm master plan (1952), Development plan of Paris in 1965, Rosario Plan for Seoul in 1980 (Sung & Choi, 2017) have clearly paid attention to the instrument of movement and development integration in their general concepts.

On the theoretical side, modern TOD studies were practically initiated by the New urbanism idea in the 1980s in the U.S., and then the Calthorpe’s seminal book appeared including the main idea. General principles, methodology development, implementation mechanism, the comparison of real-world successful previous cases were highlighted by a majority of primary studies for a few years (e.g., Cervero R., 1998; Boarnet & Crane, 1998; Calthorpe, 1993; Van der Ryn & Calthorpe, 1986; Freilich, 1998; Cervero R., 1986; Delsohn, 1989; Girling, 1993). In this regard, addressing the main challenges of American cities, as well as the advantages of the lessons related to integrated transport/land use in the framework of pedestrian pockets was emphasized to indicate a new trajectory for redesigning the urban areas.

Over the last decades, researchers from various knowledge backgrounds have increasingly developed new facets of TOD studies. Interestingly, this subject connects highly divergent interests. Reviewing previous literature reveals a number of TOD-related studies regarding various areas such as Equity, Gentrification, and Displacement (e.g., Saldaña & Wykowski, 2012; Rayle, 2015; Dong, 2017; Deka, 2016; Chava, Newman, & Tiwari, 2018), Green Urbanism and Environmental Protection (e.g., Hua Liu, Te Pai, & Lin, 2018; Motieyan & Mesgari, 2017; Cervero & Sullivan, 2011), Investment, Value Capture, and Employment Pattern (e.g., Yang, Quan, Yan, & He, 2016; Nilsson & Delmelle, 2018; Zhong & Li, 2016; McIntosh et al., 2017; Knowles & Ferbrache, 2015; Yang et al., 2016), Physical Activity and Active Travel (e.g., Chriqui et al., 2016; Thrun et al., 2016; Fenton, 2012), Environment Health and Energy Consumption (e.g., Chester et al., 2013; Seo, Kim, & Kim, 2013; Kimball et al., 2013; Hasibuan et al., 2014; Leh et al., 2010), Technical Transportation Dimensions (e.g., Mudigonda et al., 2014; De Vos & Witlox, 2013; Wang et al., 2016; Ewing &

Cervero, 2010), Social Life, Capital and Residents' Desires (e.g., Kamruzzaman et al., 2014; Fernandez Milan, 2016), which are considered as perfect examples in this respect. However, the above-mentioned studies considerably concentrated on the transportation technical side and urban planning issues. This interdisciplinary concern translates TOD into a topic to be widely discussed through diversified subjects and expands the dimension boundary.

Evaluation studies as the third type of TOD studies were developed when the years of TOD experiences provided new kinds of opportunities for and challenges against transit-oriented urban planning and design. In this sense, TOD output measures including travel behavior and the related indicators were diversely reassessed using different methods. Such indicators included VMT, ridership, trip length, travel distance, travel costs, car use and ownership, residential self-selection, mode choice (e.g., Chen et al., 2017; Ewing, Hamidi, & B Grace, 2016; Kamruzzaman et al., 2015; Haifeng Liao 2015; Zhang & Fujiwara 2009; Crowley, Shalaby, & Zarei, 2009; Yang & Pojani, 2017; Cervero R., 1994), as well as TOD-ness and typology (e.g., Lyu, Bertolini, & Pfeffer, 2016; Renne et al., 2016). In addition, this type of TOD study accompanied the appearance of new enthusiastic developing countries which sought a solution for mitigating their numerous urbanization-caused problems by grabbing the general ideas (e.g., Zhang M., 2007; Pongprasert & Kubota, 2017; Rangwala et al., 2014; Wey, 2015; Alwehab & Abdul Ghafoor Al-Ani, 2016; Gilat & Sussman, 2003; Babalik-Sutcliffe, 2013), leading to an agreement among TOD professionals in which TOD is a context-sensitive instrument in urban planning by which decisions and policies concerning transportation and development integration could vary for each community (DeVos, Van Acker, & Witlox, 2014; Tan, Bertolini, & Janssen-Jansen, 2014).

In general, a variety of these studies, in all kinds and periods, diversely discussed a set of dimensions as critical-neglected ones which have successful transit-oriented planning or as general prerequisites. Further, the diversity of studies in different contexts provides a number of academic and applied resources for testing and adapting in other urban contexts. In this sense, the growing number of developing countries as the newcomers tends to pursue TOD proposals while no explicit and up-to-date list of dimensions exists for testing by the other studies in different contexts. That is why the present study attempted to fill the gap by answering the question "What are essential dimensions for TOD planning as general prerequisites?". For this purpose, various aspects of urban planning and design for a community should be adaptively reconciled to TOD core idea, which ranged from socio-demographic, technical, financial, governmental and political, economic to environmental aspects. This trend has already been perused in global studies during the recent years. Although it may differ from one city to another in all of the above-mentioned aspects, previous studies and practical experiences can effectively provide a comprehensive database about the subject in order to generate the whole image of the dimensions. Therefore, the current study benefited from a systematic review approach to synthesize the findings of previous studies. After following several steps, the approach yielded a categorized list of dimensions for planning the TOD. All the steps are explained based on a meta-synthesis method.

1. Method: Framing a qualitative meta-synthesis (QMS)

Meta-synthesis as a qualitative and interpretive method originally arose from nursing and has been extensively applied in fields such as health, social work, along with organizational studies which focus on evidence-based policies and practice (e.g., Walsh & Downe, 2005; Kim, 2018). By a secondary analysis, this method structures a basis for future investigation and helps in understanding the progress of a discipline (Thorne & Paterson, 1998). Furthermore, it can be

formed based on a new research question or technique which involves breaking down the results of other qualitative studies on a specific subject, examining their features, and finally, combining their results into an integrated body (Moeller, Copes, & Hochstetler, 2016; Bowman et al., 2018).

Although a limited number of studies have been conducted with respect to the urban issues, QMS can make a holistic reinterpretation for dealing with the ongoing urban issues. Additionally, the integrated transport and development in urban studies has been the subject of a large body of earlier research during recent decades. Different qualitative studies have attempted to draw definition, general principles, implications, as well as planning and the design dimensions of transit-oriented Development (TOD) since 1990. The systematic review and meta-study are highly probable to withdraw up-to-date dimensions for transit-oriented planning. Employing QMS, the present study aimed to describe the integration paradigm in the framework of TOD by blending the study findings into the primary list of TOD proposals. A QMS study, formed based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses statement (Moher et al., 2009), can be categorized into a number of stages.

1.1. The meta-synthesis query and eligibility criteria

The QMS question is related to the overall aim of the research which seeks to present transit-oriented dimensions of urban development. So, finding planning and design dimensions would be the primary concentration of this meta-study.

Some criteria were needed to be predefined for including and excluding the studies related to the subject before initiating the search process. The resources were sorted into two general types (Figure 1). Concerning the inclusion criteria, English peer-reviewed qualitative studies were globally encompassed, which mainly emphasized TOD planning and design dimensions in their results and were published after 1990¹. Conversely, quantitative studies published before the above-mentioned date, as well as those only related to transport (or land use) were systematically excluded from the study. To include complementary resources, the grey literature including academic and institutional reports, guides, documents, and applied projects were the case in which TOD planning, design, and implementation dimensions were part of their proceeds. The incomplete records were not welcomed.

¹ Although the phrase of transit-oriented development was introduced in 1993, it tends to be the first time in which the general concept of the integrated approach, along with other similar terms including New Urbanism, was recognized in urban scholarship.

	Articles	Complementary resources
Inclusion	<ul style="list-style-type: none"> • English • Worldwide • Peer-reviewed • Published or in press • Qualitative studies • Focused on TOD planning and design dimensions in the results • Focused on up-to-date planning dimension 	<ul style="list-style-type: none"> • English • Report, project, document and official guide • Scientifically confirmed • Worldwide • Focused on TOD planning, design, and implementation facets as part of their proceeds
Exclusion	<ul style="list-style-type: none"> • Report, document, guide, applied project, book, thesis, etc. • Similar but dispersed concepts like DOT², TAD³, TJD⁴, and other given forms • Focused on only transport or land use (development) without reciprocal integration • Focused only on basic TOD dimensions (like 3Ds, 5Ds) 	<ul style="list-style-type: none"> • Peer-reviewed journal and conference researches • Collected data without analyses • Incomplete publications • Records which only investigated current status quo of a case/site • Book/book chapter/book reviews/ thesis

Figure 1. Predefined inclusion and exclusion criteria.

Source: Author

1.2. Information resources and systematic audit

A large number of studies have focused on the dimensions of transit-oriented urban planning and design since 1990. Academic studies, as well as practical institutional reports and development guides have already provided a set of fluent datasets. In fact, ignoring these experiences is not acceptable while relying only on routine journals and electronic database search. Therefore, other complementary resources including documents, applied reports, and guides were systematically reviewed during the process.

Totally, 12 articles and 5 complementary databases were queried in different disciplines ranging from urban studies to environmental science (Figure 2). Apart from routine search of electronic databases, the data were exclusively hand-searched through the related journals concerning similar contents as *Transport Reviews*, *Journal of Transport Geography*, *Transport Policy*, *Urban Rail transit*, *The Journal of Transport and Land Use*, *Land Use Policy*, *Journal of the Transportation Research Board*, *Transportation Research Part A, B, and E*, *Journal of Public Transportation*, *Journal of Urbanism*, and *Urban Policy and Research*. Then, their titles and abstracts were screened manually. As regards the complementary resources, available electronic documents, published by well-known agencies and institutions and involved in transportation and development practice and studies such as *ITDP*⁵, *Reconnecting America*, *CTOD*⁶, *VTPI*⁷, *NPA*⁸, *USHSR*⁹, Smart Growth America, and *APA*¹⁰, were additionally reviewed to cover a wide variety of records containing the relevant data.

² Development-oriented transit

³ Transit-adjacent development

⁴ Transit-joint development

⁵ The Institute for Transportation and Development Policy

⁶ Center for Transit-Oriented Development

⁷ Victoria Transport Policy Institute

⁸ National Parking Association

⁹ US High Speed Rail Association

¹⁰ American Planning Association

Type	Peer-reviewed articles													Complementary resources				
	Report/ Applied project/Document/Guide																	
Discipline	Interdisciplinary: Transportation; Regional and urban planning, Urban design, Architecture, Public health, Governance and political science, Finance, Energy and Environment, Geography																	
Database	Web of Knowledge	Green file	Scopus	TRID	IEEE	Sage	Taylor & Francis Online	Springer Link	Pubmed	Emerald	JSTOR	EconPapers	Hand searching	Slide share	Scribd	Hand searching	TRID	eBooks and Text Archives
Number of records	519	24	663	1713	102	673	792	827	33	174	282	198	92	34	252	41	77	26
Number by category	6092													430				
Total number	6522																	

Figure 2. Information resources, databases, and number of records.

Source: Author

1.3. Literature Search

The keywords were collected by reviewing primary studies on transit oriented development (TOD) before starting the QMS process. In addition, a number of former related studies including the reviews were initially screened to choose and set appropriate keywords for the main search. Review studies provided considerable help to the author in this way. The searched terms included “*transit-oriented development*”, “*pedestrian pocket*”, “*transit village*”, “*transit-oriented urban planning*”, “*transit-oriented community*”, “*transit-friendly design*”, “*transit-supportive development*”, “*transit-based development*”, “*transit-rich development*”, “*rail-oriented development*”, “*traditional communities*”, “*transit communities*”, “*compact city*”, “*smart growth*”, “*new urbanism*”, and “*land-use and transportation*”. The above-mentioned keywords included nearly other synonyms of TOD which were used in previous resources and somehow related to the concept of TOD.

Through a breathtaking search process, the keywords were then linked with “OR” aiming at obtaining a wider range of proper studies. However, using the Boolean operators was impossible in some complementary databases. Accordingly, each keyword was separately queried and then the results were summed together for obtaining the highest number of possible qualified records. All search and selection procedures were conducted during May-August 2018.

1.4. Studies selection procedure

Four-stage study exclusion reinforced the selection process (Figure 3) ranging from title screening to quality appraisal. Although 6522 records were identified surfing the databases and other complementary resources, the final list gradually decreased to 23 records and contained 20 peer-reviewed articles and three applied projects and reports. Further, the references and bibliography of the selected records were multiple screened for relevant studies before the quality appraisal. In this regard, the new records underwent all four phases of exclusion once more. As a result, a total of three records were added to the final list

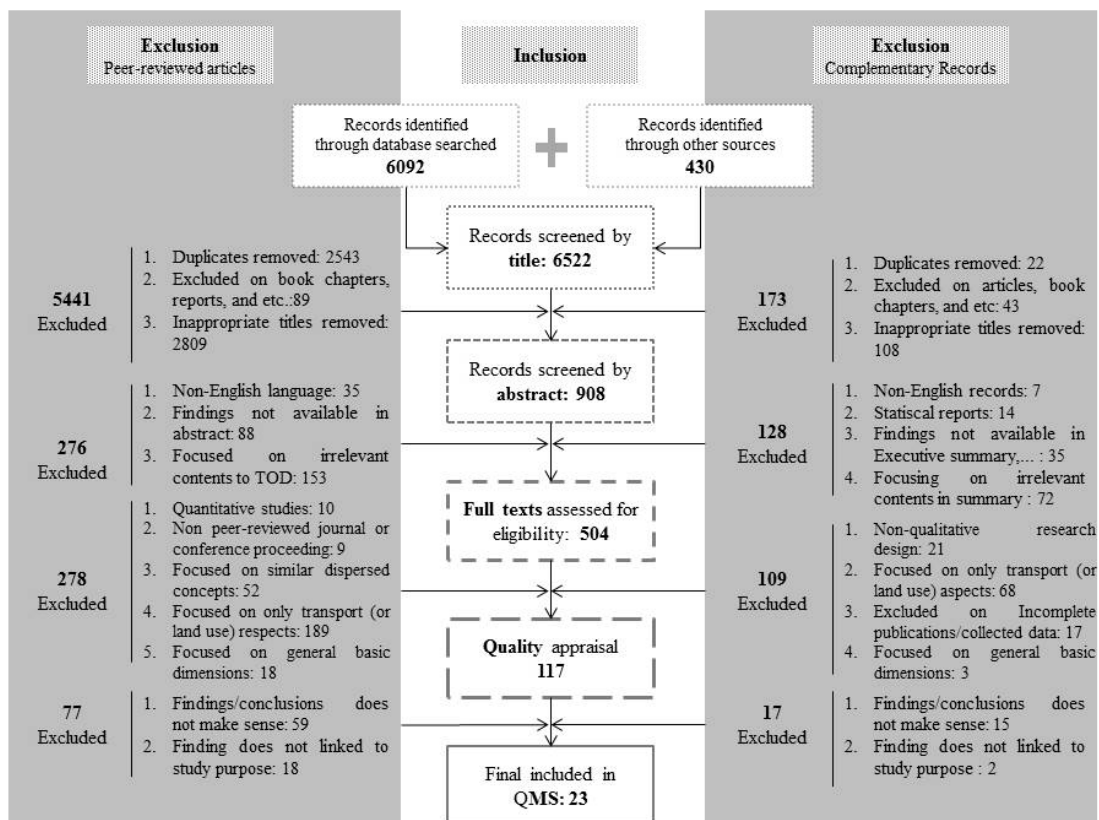


Figure 3. Flow diagram for retrieval of papers

Source: Author

Furthermore, a qualified record was required to pass the quality appraisal for inclusion in the final list. It means that qualitative research should be judged for being convinced that quality studies are included to start off the synthesis process. In the current study, the 18-item method, presented by Spencer et al. (2003) and called “Framework for Assessing Qualitative Evaluations” was pursued to ensure the avoidance of bias risk and to obtain a set of qualified records to reach the valid proceeds. Therefore, among the 117 evaluated records, twenty-three records including twenty peer-reviewed articles and three complementary records met the essential quality.

1.5. Data extraction

The final included records were reviewed several times. At this stage, different sections of the studies such as the *Results*, *Conclusions*, *Recommendations* and *Suggestions*, *Close*, *Epilogue*, *Discussions*, *Future research*, *Limitations*, and *Practical Implications* were exclusively analyzed and then synthesized. Figure 4 summarizes the other data which were extracted in order to make an inter-study comparison. As shown, global studies were welcomed at the final list so that 10 studies were implemented in North America (10), South America (1), Europe (4), Asia (4), Australia (5), and Africa (1) with diverse scales were included ranging from the neighborhood to the country. However, some of these studies used no distinct case study and concentrate on the subject as a qualitative review or multi case-study. It is worth mentioning that diversified aims and methods form the foundation of the selected studies.

#	Author and Date	Type ¹¹	Overall Aim	Case Study	General Methods		Finding Summary (TOD Dimensions)
					Data collection	Data Analysis	
1	Bierbaum & Vincent, 2013	PA	Hypothesizing core connections between TOD, households with children, and schools	San Francisco, California, Bay Area, USA	<ul style="list-style-type: none"> Literature review Secondary data Interview 	<ul style="list-style-type: none"> Document analysis Interview content analysis 	<ul style="list-style-type: none"> Equity and family-oriented TOD Transit connectedness Mixed-income family housing Collaborative and cross-sector partnerships between school districts, transit agencies, and city Daily mode choice Policy mechanisms and financial incentives Climate change
2	Freilich, 1998	PA	Describing the major components of local land-use and zoning controls in TOD	USA	<ul style="list-style-type: none"> Survey Literature, document and policy review 	<ul style="list-style-type: none"> Survey analysis 	<ul style="list-style-type: none"> Policy litigation and legal and constitutional basis Implementation procedure litigation Private resources to transit investment Intergovernmental agreement Regional transportation plan
3	Boon Hui Yap & Goh, 2017	PA	Exploring, the perception of buyers and comfortable walking distance	Klang Valley Region, Malaysia	<ul style="list-style-type: none"> Semi-structured interviews Questionnaire survey 	<ul style="list-style-type: none"> Mixed methods including qualitative and quantitative approaches 	<ul style="list-style-type: none"> Comfortable walking distance Generation cohorts and resident type Residential preference by convenience factors including accessibility, location and amenities Connectivity
4	Lund, Willson, & Cervero, 2006	PA	Exploring the extent to which these transit and station area investments are impacting transit ridership	California, USA	<ul style="list-style-type: none"> Self-administered questionnaire 	<ul style="list-style-type: none"> Questionnaire analysis 	<ul style="list-style-type: none"> Critical policy: highway accessibility, workplace policies, housing density and affordability, and urban design Tax incentive Destination characteristics of trips Parking supply and pricing policies Local site characters Institutional reform Physical characteristics (e.g., pedestrian friendliness, street connectivity, land-use mix Transportation-related policies (e.g., parking pricing and availability, telecommuting and flexible hours at the workplace Regional transportation factors (e.g., job accessibility via the highway Push forces (e.g., automobile usage cost)
5	Li, Luan, Yang, & Lin, 2013	PA	Revealing how a new funding and planning framework has been developed	Pearl River Delta, China	<ul style="list-style-type: none"> Document and project review 	<ul style="list-style-type: none"> Strategy analysis Comparative analysis 	<ul style="list-style-type: none"> TOD-based value capture approach Inter-level (municipal, provincial and national) institutional and policy framework Inter-actors collaboration
6	Sung & Choi, 2017	PA	Exploring the 1980s Rosario plan	Seoul, South Korea	<ul style="list-style-type: none"> Document and policy 	<ul style="list-style-type: none"> Content analysis 	<ul style="list-style-type: none"> Value-capture strategies Intersection of various metropolitan and neighborhood

¹¹ Acronyms employed: Peer-reviewed Article (PA), Peer-reviewed Conference Proceeding (PCP), Complementary Resource (CR)

#	Author and Date	Type ¹¹	Overall Aim	Case Study	General Methods		Finding Summary (TOD Dimensions)
					Data collection	Data Analysis	
			proposal for Seoul and its implementation based on TOD			review	<ul style="list-style-type: none"> scale strategies The 6Ds: "high-density development", "diversity", "design", "distance to transit", "destination accessibility" and "demand management"
7	Thomas, et al, 2018	PA	Exploring how transfer of TOD as a policy concept impacts its implementation in the Netherlands	The Netherlands	<ul style="list-style-type: none"> Workshops, Serious gaming Design charrettes 	<ul style="list-style-type: none"> Qualitative and quantitative methods 	<ul style="list-style-type: none"> Understanding of TOD Ideas Policy transfer by policy learning and adaptation collaborative relationships between actors (actor relationships and information sharing) Consistent policy and plans A long-term vision for transportation/land use A multidisciplinary approach to implementation Detailed, small-scale design Cycling and walking infrastructure accessibility Context-specific TOD solutions Local patterns and behaviours TOD urban design dimensions: scale and density, safety, connections, variety, public space, pedestrian-friendliness, parking, timeframe, public engagement, programming and maintenance Pre-investments Development rights and Contracts
8	Bertolini, Curtis, & Rene, 2012	PA	Reviewing the changing factors driving station area and exploring emerging approaches and TOD practices	European Cities	<ul style="list-style-type: none"> Literature review 	<ul style="list-style-type: none"> Qualitative content analysis 	<ul style="list-style-type: none"> Driving factors to plan TOD Specificity of local context (existing transport and land-use pattern) Public support Opportunities and threats for the TOD strategies adopted elsewhere Interest groups in planning and implementation
9	Hess & Lombardi, 2014	PA	Understanding the effects of public policy and location on TOD and the particular constraints and opportunities of TOD in inner-city	American cities	<ul style="list-style-type: none"> Literature review 	<ul style="list-style-type: none"> Qualitative content analysis 	<ul style="list-style-type: none"> Supportive policies from tax credits to flexible parking standards to the accommodation of pedestrians, transit users, and bicyclists. Public sector commitment Site type Concentrations of residences, jobs, and amenities Access to employment centers Community vision Land assembly and costs Funding Special zoning provisions and Financial incentives Joint development and air rights Economic development TOD leadership
10	Renne J., 2008	PA	Documenting the Cases'	California, New Jersey	<ul style="list-style-type: none"> Policy review 	<ul style="list-style-type: none"> Policy content 	<ul style="list-style-type: none"> Policy framework for communication across agencies

#	Author and Date	Type ¹¹	Overall Aim	Case Study	General Methods		Finding Summary (TOD Dimensions)
					Data collection	Data Analysis	
			approach and highlighting the importance of interagency cooperation and intergovernmental cooperation	(USA) and Western Australia		analysis	and government level in planning <ul style="list-style-type: none"> Financial support Role of state government in coordination Local and state partnership TOD committee Participation among various agencies, governments, and stakeholders Short- and long-term goals Marketing and branding Outcomes monitoring and goal update
11	Thomas & Bertolini, 2017	PA	Identifying critical success factors in TOD implementation	11 cities-regions worldwide	<ul style="list-style-type: none"> Web survey 	<ul style="list-style-type: none"> Meta-analysis Rough set analysis 	<ul style="list-style-type: none"> Plans and policies (policy consistency, vision stability, government support, political stability (national and local)) Actors (actor relationships, regional land use-transportation body, inter-municipal competition, multidisciplinary implementation teams, public participation, public acceptance, key visionaries) Implementation (site-specific planning tools, regional-level TOD planning, certainty for developers, willingness to experiment)
12	Jacobson & Forsyth, 2008	PA	Evaluating existing guidelines for TOD and reformulating a series of “best practices” for urban design	7 American cities	<ul style="list-style-type: none"> Primary data such as maps and photographs 	<ul style="list-style-type: none"> Urban Design Score Sheet, inventory Design Workshops Community Representative Workshops GIS-based Analysis Photographic Visual Assessment 	<ul style="list-style-type: none"> Physical design Transportation environment design Site-specific circumstances Design and development process Place-making approaches Facility design and management
13	Hale & Charles, 2007	PCP	Proposing a step-by-step approach to TOD project delivery	Brisbane, Australia	<ul style="list-style-type: none"> Literature review Survey and interview 	<ul style="list-style-type: none"> Formative Evaluation 	<ul style="list-style-type: none"> Financial appraisal Project appraisal tasks TOD Project delivery process Key success factor: high quality transit, mixed-use development, public space Policy framework Location selection Land acquisition Development permit Manage project revenues, costs, timing and risks
14	Dorsey & Mulder, 2013	PA	Illustrating a number of the challenges involved in TOD planning	Ogden, Utah, USA	<ul style="list-style-type: none"> Secondary data 	<ul style="list-style-type: none"> Empirical analysis 	<ul style="list-style-type: none"> Competing interests between actors Collaboration between stakeholders TOD style zoning and policies Three components of TOD design: mixed use, high density,

#	Author and Date	Type ¹¹	Overall Aim	Case Study	General Methods		Finding Summary (TOD Dimensions)
					Data collection	Data Analysis	
							<ul style="list-style-type: none"> and pedestrian-oriented design Public input and a high degree of transparency Communication between government officials, potential developers, and community activists groups and legislative bodies. Community members' visions and desires in community master plan and localized neighborhood plans Balance between public and private roles and interests in land-use decision making
15	Pojani & Stead, 2015	PA	Illustrating the extent to which "ideal" internationally formulated TOD principles are relevant to Dutch status quo	The Netherlands	<ul style="list-style-type: none"> Design workshop involving key TOD specialists 	<ul style="list-style-type: none"> Workshop analysis 	<ul style="list-style-type: none"> 3 key dimensions and 12 sub-dimension of TOD: Place-making (scale and density, public spaces for human use, safety, variety and complexity, connections), Facilities/Logistics Dimension (Pedestrian/cyclist orientation, transit in the urban pattern, car movement), Process (time frame, public engagement, programming, maintenance) Cultural-specific preferences
16	Cervero & Dai, 2014	PA	Probing the opportunities and challenges of leveraging TOD through BRT investments	Bogota (Colombia), Ahmedabad (India)	<ul style="list-style-type: none"> Literature review Survey 	<ul style="list-style-type: none"> Empirical analysis 	<ul style="list-style-type: none"> City size (smaller and intermediate size cities) Public transit type and Multi-modal connection Affordable public transit system Fundamental change in public officials and city leaders thinking in the developing world Mixed use urban form and Accessibility Proactive strategic planning Linked planning practice and transit investment Pedestrian-friendly urban design Market forces Integrated institutional structures Financial support by international aid organizations and donor agencies Value-capture schemes Income generating and economic returns Public-sector leveraging and risk-sharing
17	Curtis C. , 2012	PA	Examining the extent to which different town planning approaches succeed in implementing TOD	Perth, Western Australia	<ul style="list-style-type: none"> Case study approach Policy review 	<ul style="list-style-type: none"> Policy content analysis development mapping analysis 	<ul style="list-style-type: none"> National and state support Residential density and employment intensity Planning system and planning power of state Local planning and state policy conformance Actors: local government, property market, development industry

#	Author and Date	Type ¹¹	Overall Aim	Case Study	General Methods		Finding Summary (TOD Dimensions)
					Data collection	Data Analysis	
							<ul style="list-style-type: none"> Standards monitoring (e.g., minimum density) Function and role of station precinct Collaborative working (state and local planners) Incentives and disincentives for implementation
18	Bajracharya, Khan, & Longland, 2005	PCP	Examining regulatory and incentive mechanisms to implement TODs	South East Queensland, Australia	<ul style="list-style-type: none"> Policy and literature review 	<ul style="list-style-type: none"> Policy analysis 	<ul style="list-style-type: none"> Integrated regulatory and incentive mechanisms Regional plan and regulatory provisions Local growth management in local planning Land use planning instruments Travel Demand Management (TDM) Parking space provisions Government leadership State and local governments roles
19	Venner & Ecola, 2007	PA	Detailing obstacles to financing that TOD developers face	N/A	<ul style="list-style-type: none"> Sources reviewing 	<ul style="list-style-type: none"> Literature analysis 	<ul style="list-style-type: none"> Financial risk and return Lenders and lending process Planners' attention to developers Community support and participation in visioning Community-planning processes Certainty for the developer Public-sector efforts to incentivize Consumer preference for walkable space Publicizing successful examples of TOD
20	Cervero R., 2013	PA	Linking urban transport and land use in developing countries	South Asia, Southeast Asia, China, India, Africa, and South America	<ul style="list-style-type: none"> Examples review 	<ul style="list-style-type: none"> Examples analysis 	<ul style="list-style-type: none"> Small-to-medium size cities Bus-based forms of smaller-scale TOD Pedestrians and cyclists infrastructure Accessibility and affordability (transit and housing) Pro-poor mass transit strategies Small interventions, e.g., siting basic services Income growth Pro-car governmental policies Special built form dimensions of global south: Levels of monocentricity, densities, roadway designs, and geographic locations of the poor
21	TransitLink, 2010	CR	Highlighting the key attributes of community design	Vancouver, Canada	<ul style="list-style-type: none"> Not declared 	<ul style="list-style-type: none"> Not declared 	<ul style="list-style-type: none"> 6-Ds: Destination, Design, Diversity, Density, Distance and Demand Management
22	California Department of Transportation, 2005	CR	Overviewing and synthesizing of notable past work on TOD best practices	California and other cities throughout USA	<ul style="list-style-type: none"> Literature, policy and Experience review 	<ul style="list-style-type: none"> Literature, policy analysis Experience analysis 	<ul style="list-style-type: none"> Community partnership Walkability in TOD site design Transit stop accessibility Pedestrian-centered design TOD as a catalyst for broader planning aim Local real state market and

#	Author and Date	Type ¹¹	Overall Aim	Case Study	General Methods		Finding Summary (TOD Dimensions)
					Data collection	Data Analysis	
							market force • Long-term view for TOD • TOD teams and experienced leadership • Optimal transit system design • Local and state organization coordination • Planning and finance incentives • TOD demonstration projects
23	Ontario Ministry of Transportation, 2012	CR	Assisting actors in creating transit-supportive environment and developing services and programs	Ontario, elsewhere in North America and abroad	• Experience review	• Experience analysis	• Plan for transit service • TOD Basic: active and street-level mixed uses, housing and employment density, pedestrian and cyclist access, parking management, transit station location and design • Coordination of municipal/regional/planning • Site-specific guidelines • Planning process and implementation • Development permit system

Figure 4. Final included studies and their characteristics.

Source: Author

1.6. Data analysis and literature retrieval

Although diverse analysis approaches have been used so far, the present study followed the interpretative classic approach outlined in Noblit and Hare (1988), by which reading and rereading were emphasized to withdraw the main findings and classify the concepts and themes. Accordingly, the results of the studies were overviewed by a *Qualitative Content Analysis*. New concepts were derived based on translating and integrating explicit and implicit concepts as well. After categorizing through a comparison content analysis, similar contents generated themes and sub-themes based on the general concepts.

2. Results

Table 4 demonstrates the planning dimensions for TOD derived and sorted in themes and sub-themes as the cardinal proceeds of QMS. Four development-driven themes were identified including “*place development*”, “*policy development*”, “*process development*”, and “*sustainable development*”

Themes	Sub-themes	Dimensions	Sub-dimensions
Place Development	Transportation design	Users	Personal travel-related attitudes, travel preferences and values for travel behavior (mode choice)
			User's and transport private companies' demand
			Walk-on, public transit, and car riders' patronage
		Transit	Transit technologies, innovations and industry
			Public transit type (rail, BRT, local bus)
			Public transit service quality
			Multi-modal transit infrastructure
			Transit station location and transport line planning
		Context	Integrated infrastructure management and transport services
			Right-of-way
			Multiple destinations
			Suburban transit service and intercity movements

Themes	Sub-themes	Dimensions	Sub-dimensions
	Physical development	Scale	Regional transportation (Job accessibility via highway) and highway system
			Inter-modal (street, pedestrian and cycling) regional design and connectivity
			Accessibility
		Location	City size (small, medium-sized and metropolis)
			TOD type (station, corridor and region)
			Distance/walking catchment (human-scale design)
		Individual area characteristics	Project location (greenfield vs. infill or suburban vs. inner-city)
			Income geographic location
			Site selection
			Differentiated density and compactness
	Integrated area characteristics	Horizontal and vertical land use diversity (job & housing)	
		Public space design (architecture aesthetic, safety and security, cityscape, climate and noise comfort)	
		Facility design	
	Urban design process	Transit-supportive urban form	
		Pedestrian-friendly/walkable environment	
		(Developable) land availability	
	User-related dimensions	Station design in urban pattern	
		Time/design for change (short and long-term timeframe)	
		Public participation	
		Programming for event and activities in public spaces	
Policy Development	Transport-related plan and policy	Policies on transit actors	(Fiscal) incentive packages and subsidy for public transportation
			Travel Cost
		Plans for and policies on transit context	Auto equalizers, taxation and car ownership & use restriction
			Visioning and goals
			Plan & policy reform (Integration, consistency and clarity)
	Built environment-related plan and policy	Planning goal and motivation	Regional transportation/Sustainable mobility plan
			Minimized road capacity
			Workplace policies/Companies travel plan
		Planning level	Reduced parking standards (supply, pricing and availability)
			Driving forces to plan TOD
Long-term visioning and Short- and long-term goals			
Regional-Level TOD Planning			
Community master plan and localized neighborhood plan (planning and design manual)			
Planning quality		Policy transfer (TOD best practice learning and adaption)	
		Planning system, history and current transport land-use patterns	
	Plan flexibility		
	Integrated policy reform, consistency and clarity		
	Coordinated interagency, intergovernmental, and inter-level (municipal, provincial and national) institutional planning, and policymaking		
	Integrated intervention scale (neighborhood to metropolitan)		
	Supporting planning and design data and method		
Specific land use on TOD policy	Project appraisal (revenues, costs, timing and risks), outcomes monitoring and goal update		
	Development (planning) control and growth management policy		
	Historic preservation and cultural heritage policy		
	TOD style urban regulation, land use and zoning provision		
Process Development	Governance	Institutional framework	Spatial planning and mobility investment policy linkage
			Incentive package and tax credit and abatement (local community & developers)
			Institutional framework, reform and coordinated relationship

Themes	Sub-themes	Dimensions	Sub-dimensions
			Political stable support (national, state and local)
			Inter-governmental arrangement (local state) and bureaucracies
			Urban good governance: public input, transparency, and accountability
		Legal structure	Legislation (statutes)
			Legal and constitutional basis (framework)
			Development permit and right
			TOD policy and implementation procedure litigation
			Contracts
		TOD policy framework	TOD committee and multidisciplinary implementation teams
			TOD leadership
			TOD projects delivery
			Implementation mechanism (timely, gradual, multidisciplinary, participatory and experimental)
		TOD management	Programming and scheduling (timeframe)
			Joint development and private-public partnership
			Land management (land assembly and land banking entity, land leasing)
			TOD demonstration project
	Marketing and branding (of TOD-type location)		
	Financial mechanism	Financial system	Maintenance
			Market forces and trend (mechanism)
			Financial system stability
		Fiscal structure	Investment risk and return
			Lenders and lending process
	Actors (role players)	Actor type	Financial appraisal
			Tax collection system (property tax assessment system)
Actors' desire		TOD value-capture strategy	
		Investors (private, government, community), developers, (public transport and town) planners, researcher, transport agencies, governmental planning agencies, city officials, local council, community activist organizations, legislative bodies, private consultant, local residents, aid organizations and donor agencies, and other interest groups	
		Actors' demands	
Inter-actors' relationship		Actors' willingness	
		Certainty for developers	
		Common definition of TOD: actor's understanding of TOD Ideas, tools, practices and broader concepts	
	Inter-actors' recognition, built consensus, trust, collaboration and information (knowledge) sharing and its policy framework		
Sustainable Development	Society	Conditions for TOD success	Inter-municipal competition
			Public sector commitment
			Profile: Individual characteristics and household (resident) type
		Effects of TOD success	Sociocultural-specific preferences
			Awareness-raising on TOD (local knowledge) and education
			Active transport, physical activity and willingness to walk
	Economy	Conditions for TOD success	Community engagement: participation, social interaction and network, social capital, common community vision, and public support & interest
			Inclusiveness (racial, socio-economic and demographic)
			Residents' demand, local patterns and behaviors
		Effects of TOD success	Equity
			Public acceptance and satisfaction
			Neighborhood (local) identity, loyalty and attachment
	Conditions for TOD success	Affordability (housing & public transit system)	
		Commercial consumers' behavioral factors	
		Firm type, size, diversity and location	
	Effects of TOD success	Entrepreneurship and market demand	
		Employment creation	
		Local economic development, and wealth creation	
			Community incomes growth (property/land value and ownership)

Themes	Sub-themes	Dimensions	Sub-dimensions
	Environment	Conditions for TOD success	Environmental plan, policy, regulation, and technology (solar farm, recycling, biomass, minimal waste, carbon neutral)
			Clean transportation, green travel and car free urban pattern
			Green infrastructure, building designs and sustainable housing
			Climate change responsive and distinctive TOD strategies
		Effects of TOD success	Energy consumption and energy saving (alternative-fueled transit vehicles)
			Environmental performance: air quality, energy usage, noise Natural environment, habitat preservation, green space and recreational, biodiversity, and food-producing management

Figure 5. Four levels of general dimensions for transit-oriented policy, planning and urban design.

Source: Author

3. Discussion and conclusion

Similar to other urban studies, an ample range of transit-oriented strategies connected to diverse multidisciplinary knowledge areas has provided a plenty of supportive studies during the recent decades. Further, it highlighted a vast range of dimensions to be considered when transit-oriented development (TOD) planning action is on the agenda for the urban governments, some of which were most popular among TOD studies. For instance, nearly every record refers to at least one of the dimensions related to the individual area characteristics of the physical development (see Figure 5). Furthermore, coordinated interagency policy-making, institutional framework, inter-actor collaboration, community engagement, inclusiveness, and community income growth were considered among the high rate sub-dimensions in terms of the reference number. Newly-interpreted concepts (i.e., dimensions and sub-dimensions), as well as former qualitative studies, motivated the author to categorize them in a development-driven model in which all of the investigated dimensions have been comprehensively covered so far. As illustrated in Figure 6, all of four TOD planning themes act together in a cycle in order to make it perfect. Developing a process tends to be crucial for implementing the idea by establishing transit-oriented plans and policies. In fact, the process helps to ground a set of transit-oriented places in which pedestrian-friendly environments are on the agenda. As a result, these places lead to more sustainable urban areas in terms of social equity, economic efficiency, and environmental quality, and more interestingly, the idea of sustainability again feeds the transit-oriented policy sides including both transit- and built-environment-oriented plan and policies. In fact, the cycle is initiated by setting a range of policies which are inspired by the idea of sustainability. Therefore, sustainability has several effects on and the strategies for transit-oriented urban planning and design. Additionally, a partly-inverse cycle can be observed in the inter-dimensions relationship by which the policy structure and transit-oriented processes tend to be subsequently redesigned through possible adaptations ahead over the procedure of TOD implementation.

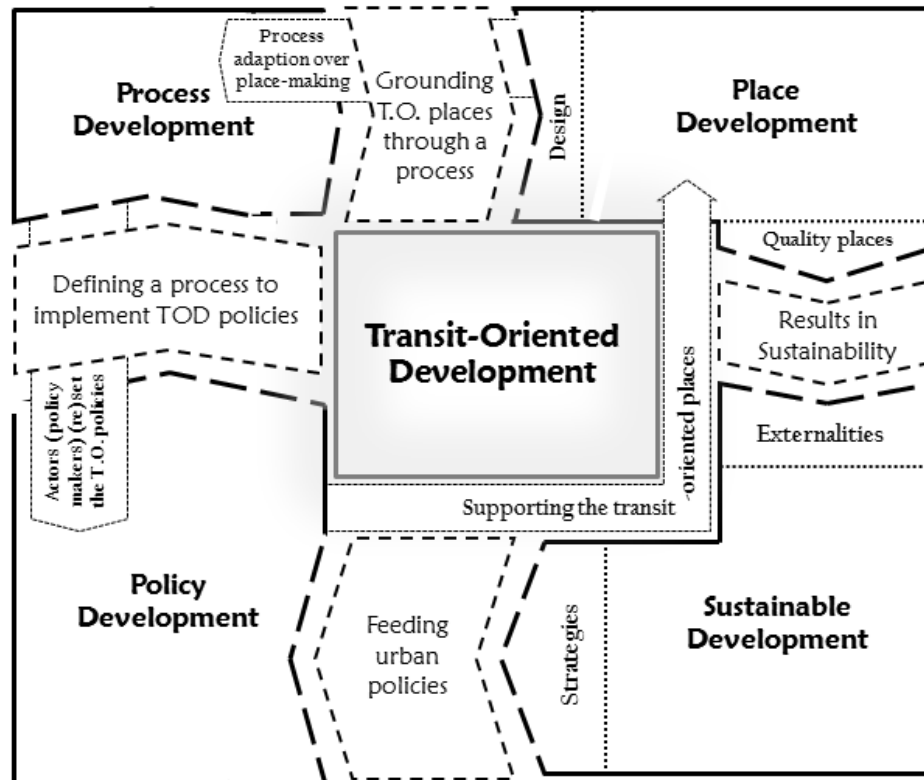


Figure 6. Development-driven model

Source: Author

Among place, policy, process, and sustainability, the sustainability seems to be synthesized for the first time compared to other previous classifications. However, the new idea that planning-specific dimensions for TOD are synthesized and classified in the previous studies (e.g., Thomas & Bertolini, 2017) apparently tends to highlight the successful factors of TOD delivery. Social, environmental, and economic effects of and conditions for TOD planning could be assessed as a new trend in integrated studies. In the current study, screening different TOD studies demonstrated a shift from primary transit-oriented dimensions in order to develop the knowledge such as basic physical urban design characteristics to the second kind of dimensions arising from evaluation studies and other knowledge discipline. For instance, although the environmental quality is considered as a part of a fundamental long-term goal of strategies related to integrated transport and land use, it has increasingly attracted attention in recent studies (e.g., Cervero & Sullivan, 2011).

The local urban context and driving forces play a role in establishing the importance and priority of dimensions. For example, cities in the United States are attempting to facilitate implementation dimensions (i.e., process development) and financial mechanism while developing countries such as India, Malaysia, Vietnam, and some parts of eastern China seek for a set of policy transfer mechanisms and adopt the idea adaptively. Accordingly, post-performance (e.g., in the U.S.) versus pre-performance (e.g., in Iran) TOD dimension planning and design can be smartly distinguished in this regard, which is subject to further investigation.

The number and availability of the studies and databases may reflect the qualitative meta-synthesis (QMS) process. However, systematic reviews are typically conducted by collaborative work among several researchers who simultaneously focus on the subject and thus QMS implementation

only by one researcher can harden the process. In addition, this volume of screened records highly increases the risk of bias and makes the exclusion process difficult at final stages. Further, database availability is limited by organization affiliation or imposes high costs. Therefore, the author was convinced to withdraw the number of unavailable records which were categorized into both types of resources at the first stages. Furthermore, establishing such inclusion criteria as English records demarcated the searching process, which resulted in missing the findings presented by the studies in other languages such as French, Spanish, Japanese, Korean, Chinese, Portuguese, and so forth. Concerning the limitations, the similarity of sub-dimensions and multi-functionality partially contributes to the creation of some confusion in order to make a decision on their classification into sub-themes and dimensions.

A limited number of previous studies failed to review the aspects of TOD systematically. Such studies normally reviewed a major aspect based on the experience of some pioneer communities such as the United States, Asian (Japanese), and European cities and then developed a basis for the future direction (e.g., Jacobson & Forsyth, 2008; Hess & Lombardi, 2014; Bertolini, Curtis, & Rene, 2012; Dunphy & Porter, 2006; Lierop, Maat, & El-Geneidy, 2016). The other conference proceedings initially measured the potential of a city/region to be a transit-oriented community through reviewing TOD dimensions, success criteria, and the challenges (e.g., Hale & Charles, 2007; Bajracharya, Khan, & Longland, 2005; Black, Tara, & Pakzad, 2016). Several quantitative reviews are available in TOD studies (e.g., Xu, Guthrie, Fan, & Li, 2017). Based on its aim, the present study sought to attain the list of planning and design dimensions by a systematic review of a set of qualitative studies. However, the current study, compared to the previous studies, conducted the review regardless of the context and attempted to benefit from the global experiences. Although previous studies considerably reviewed success factors, the present study emphasized the general measures of the QMS and could achieve the prerequisites.

As underscored earlier, transit-oriented proposals are considerably context-specific in relation to local circumstances since it is exaggeratedly emphasized that TOD is not considered as a “one-size-fits-all” solution. Therefore, new upcoming communities intending to transfer TOD strategies are recommended to specialize these dimensions to their local urban status quo as the next step in TOD planning. It can be developed by a set of future supportive case-based studies. Additionally, QMS is found helpful based on the results obtained during this study. Although QMS have not been considerably prevalent in urban studies, especially respecting integrated planning, it can be diversely used to address various urban issues. Future studies focusing on developing communities are then advised to form a QMS regarding the challenges transit-oriented planning and design encounter.

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