Towards a Conceptual Framework for Understanding the Attractiveness of Rail Transit-Oriented Shopping Mall Developments (TOSMDs)

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Abstract Transit-oriented development (TOD) links residential, retail, commercial, and community service developments to frequent, accessible rail transit services to stimulate sustainable development in the form of decreased land use and transport integration. A mixed-use shopping mall can be developed as a TOD with moderate to high density with diverse land use patterns and well-connected street networks centred around and integrated with a rail transit station. Shopping mall developments are now considered as the retail, social, and community centres of their communities. Therefore, understanding their services' mixed impact on nearby transit stations will provide further insight into the success of the TOD approach. As a result, this study aims to review and link the recent literature on attractiveness factors of shopping malls and the design factors of TOD and report the researchers' analytic observations (themes) clarifying transit-oriented shopping mall developments' (TOSMDs) attractiveness factors. The review systematically synthesises 208 guiding articles. It uses the elements of the extended service marketing mix (product, price, place, promotion, people, physical evidence, and process) and the five factors related to TODs (density, diversity, urban design, destination accessibility, and distance) as an indicator system for the factors determining the attractiveness of TOSMD. The review outcome is utilised to establish a conceptual framework for the attractiveness of rail TOSMDs. The study revealed fragmented causes of attractiveness factors of rail TOSMDs. It contributes to further understanding of TOD as it cross-reviews retail and urban design literature findings. The resultant conceptual framework will also inform and potentially enhance the existing rail transit station passenger forecasting models and increase the economic sustainability of rail transit networks.

Keywords Attractiveness factors · Shopping mall · Transit-oriented development · Rail · Design factors · Service marketing mix

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1 Introduction

The concept of transit-oriented development (TOD) is a relatively recent development design approach that links frequent and accessible rail transit services to residential, retail, commercial, and community services [1]. The TOD concept was first proposed by an American architect Calthorpe [2] in the 1990s. It was seen as a response to rapid

urbanisation and traffic congestion and emphasised the greater use of public transport and a reduction in private car use. The TOD approach potentially has significant implications concerning future patterns of development and land use planning in particular, and the understanding of the impact of associated developments such as shopping malls on supporting rail transport planning.

Hence, many researchers have investigated TOD as a planning strategy [3–6]. Generally, transit-oriented developments (TODs) are located within a radius of about 600–800 m of a rail transit station, as outlined in Fig. 1. This distance is considered an appropriate scale for pedestrians walking to and from the station [7–10]. Handy [11] postulated that TODs would serve as a "catalyst" for conserving land use and increase the density of nearby developments, including shopping malls.

With their origins in the USA over half a century ago, shopping malls have brought together multiple retail outlets and facilities within a single complex. However, the function, size, and popularity of shopping malls have changed dramatically over time. As a consequence, many researchers have attempted to shed light on the attractiveness factors of shopping malls to understand the needs of the customers, improve patronage, and increase their turnover [3, 12, 13].

The major elements of shopping malls can include retail stores, food courts, restaurants, cinemas, children's play areas, interactive entertainment, social areas, relaxation spaces, and promotional areas [14]. It was conceived that mixed-use developments such as shopping malls could increase pedestrian activity, as shown in Fig. 2, where people can easily walk to places where they can shop, eat, and play [15]. A mixed-use shopping mall can be developed as a transit-oriented development (TOD), where shoppers drive their cars less and ride nearby mass transit

[16]. It is characterised by the creation of a mix of land use and residential density development around rail transit stations to attract customers, with access mainly by foot rather than by cars [17].

A lack of planning and vision has led to poorly designed, accessed, and located developments and to marketplace congestion [18]. The level of human congestion is also likely to be higher due to the wider assortment of services and products provided by shopping malls [3]. Also, the development of shopping mall facilities can contribute to making a rail station area more attractive and potentially increase the potential customer base for the shopping mall [19]. Therefore, in order to better understand and plan for the future demands of TODs that incorporate shopping malls as a key component of the infrastructure, there is a need to consider the attractiveness or "pull" factors of these shopping malls as part of a TOD. The attractiveness factors of transit-oriented shopping mall developments (TOSMDs) are not specifically addressed in the literature. The majority of researchers distinguish between attractiveness factors of shopping malls and design factors of TODs. They are studied separately in retail and urban planning literature, respectively. Therefore, a literature review of both types of factors was essential to identify the attractiveness factors of TOSMDs and establish a conceptual framework for TOSMD attractiveness. The proposed framework will lay the foundation for understanding the extent of shopper passengers using a rail transit station near a TOSMD and potentially enhance existing forecasting models used to estimate the number of passengers using a rail transit station.

Therefore, this study is structured and organised as follows. Section 2 of the paper presents a literature review and findings in the fields of attractiveness factors of shopping malls and design factors of TODs. Section 3

Fig. 1 A basic structure of the TOD community. Adapted from Mingqiao et al. [5]
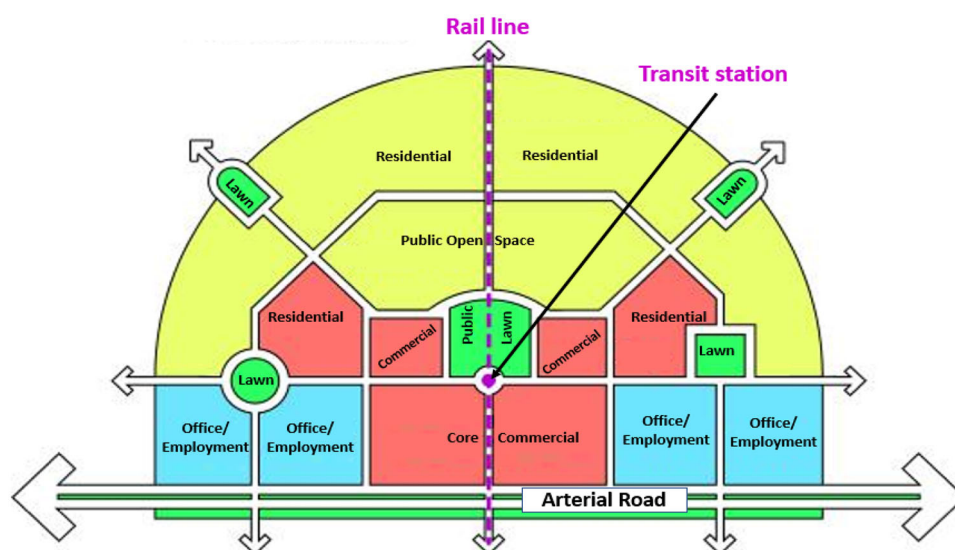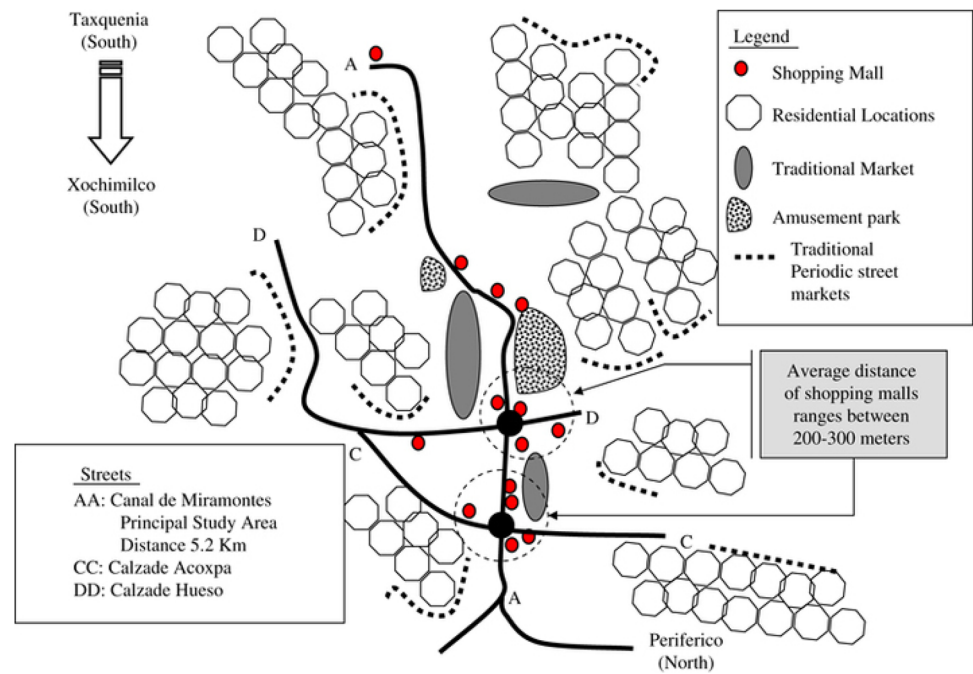
Fig. 2 Example of residential walkways to shopping malls in a TOD community. Adapted from Rajagopal [3]

proposes a conceptual framework for the attractiveness of rail TOSMDs based on a thematic analysis. Section 4 presents a discussion on the application of the framework of rail TOSMDs' attractiveness. Finally, the paper concludes by summarising the major findings from the review, the conceptual framework for the attractiveness of rail TOSMDs, and the implications and limitations of its use.

2 Methods and Literature Review

We took the literature elements of the extended service marketing mix and the TOD concept in order to understand the varying range of attractiveness factors related to shopping malls and the design of TODs, as shown in Fig. 3 to establish a conceptual framework for the attractiveness of rail TOSMDs.

The authors systematically performed an online review of the attractiveness factors of shopping malls and design factors of TODs under the retail and urban land use planning literature. We identified the studies through the search procedure adopted by Busse and Siebert [20]. Using a deductive approach in our search, we limited the literature search to English empirical journals and conference proceedings after 2007. The search summary results are shown in Table 1.

Next, an iterative search of the identified articles resulted in reviewing 208 related articles to identify rail TOSMDs' attractiveness factors. The identified factors were analysed and thematically reclassified using the generic extended service marketing mix (product, price,
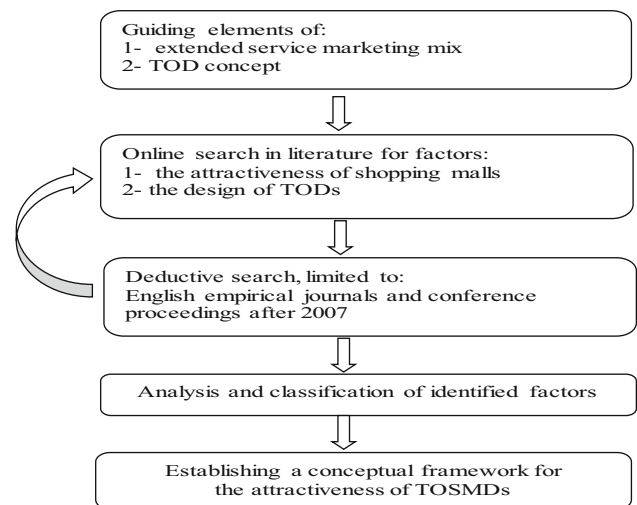

Fig. 3 Research method

place, promotion, people, physical evidence, and process) and the 5 Ds (density, diversity, urban design, destination accessibility, and distance) of TOD [21] to establish a conceptual framework for the attractiveness of rail TOSMDs.

2.1 Attractiveness Factors of Shopping Malls

According to Feinberg and Meoli [22], shopping malls emerged in 1907 in Baltimore, Maryland, USA, where a group of stores established off-street parking. In 1922, a group of stores only accessible by car was built in suburban Kansas City. The first enclosed shopping mall was

Table 1 Statistics of journals and conference proceedings

Search dimensions of TOSMDs	Search identifier	Number of journals and conference proceedings	Limiters
Shopping mall attractiveness factors	(("shopping mall") OR ("shopping centre") OR ("shopping center")) AND ("attractiveness factors")	127	English and after 2007
Transit-oriented development factors	("Transit Oriented Development") AND ("factors") AND (("shopping centre") OR (("shopping center") OR ("shopping mall"))	81	English and after 2007

developed in a suburb of Minneapolis in 1956. A shopping mall can be a separate complex of shops, department stores, services, and entertainment which simultaneously meet different needs [14]. Shopping malls are now the retail, social, and community centres of their communities. Attractiveness factors of shopping malls have been studied for different reasons, such as predicting and optimising mall patronage [23, 24], identifying the optimal mix of

Table 2 Studies in different cities on attractiveness factors of shopping malls

| Author (Ref.), location	Sample	Identified attractiveness factors of shopping malls
González-Hernández and Orozco-Gómez [31]; Guadalajara, Mexico	1500 consumers	Mall essence; popularity and promotional programs; personal service; recreational options; internal atmosphere; external atmosphere
El-Adly [26]; UAE	404 university members	Comfort; entertainment; diversity; mall essence; convenience; luxury
Farrag et al. [14]; Alexandria, Egypt	502 mall visitors	Safety; bargain hunting; convenience; entertainment; freedom; appreciation of modernity; self-identity
Larsen et al. [32]; USA	515 college students	Product and stores assortment; perceived management efficiency; centre maintenance; cleanliness; attitudes and behaviour of the staff
Ke and Wang [30]; Wuhan, China	68 shopping centres' data	Closeness to metro line station; being in the central commercial area
Prashar et al. [33]; Raipur, India	263 shoppers	Mall distance; attractive façade; climatic control; cleanliness; rest benches
Bilková et al. [34]; Bratislava, Slovakia	11,389 shopping customers	A larger selection of the offered goods; higher quality; leisure activities; opening hours; parking possibilities
Singh and Sahay [35]; Delhi national capital region, India	200 shoppers	Ambience; physical infrastructure; marketing focus; convenience; safety and security
Tandon et al. [28]; New Delhi; Kolkata; Chennai; and Mumbai, India	400 shoppers	Tenant management; facilities management; atmosphere; entertainment
Arslan et al. [24]; Bursa, Turkey	621 young consumers	Retail environment; comfort; secure environment; accessibility; leisure
Anselmsson [36]; Lund, Sweden	770 persons	Atmosphere; merchandise selection; refreshments; promotional activities; convenience; salespeople; merchandising policy; location
Ahmad [37]; Jeddah, S.A.	600 shoppers	Product variety; aesthetic; convenience; accessibility; entertainment; service quality
Teller and Reutterer [38]; Vienna, Austria	1073 shopping mall users	Tenant mix; atmosphere
Singh, Prashar and [39]; Dubai, UAE	200 shoppers	Ambience; physical infrastructure; marketing focus; convenience; safety
Gilboa and Vilnai-Yavetz [40]; Israel	725 mall visitors	Convenience; accessibility; parking; security; tenant mix
Tsai [41]; Tokyo, Japan	298 mall shoppers	Entertainment; atmosphere; product arrangement; service; mall image; special events; refreshment
Tsai [41]; Sydney, Australia	216 mall shoppers	
Tsai [41]; London, UK	324 mall shoppers	
Tsai [41]; New York, USA	392 mall shoppers	
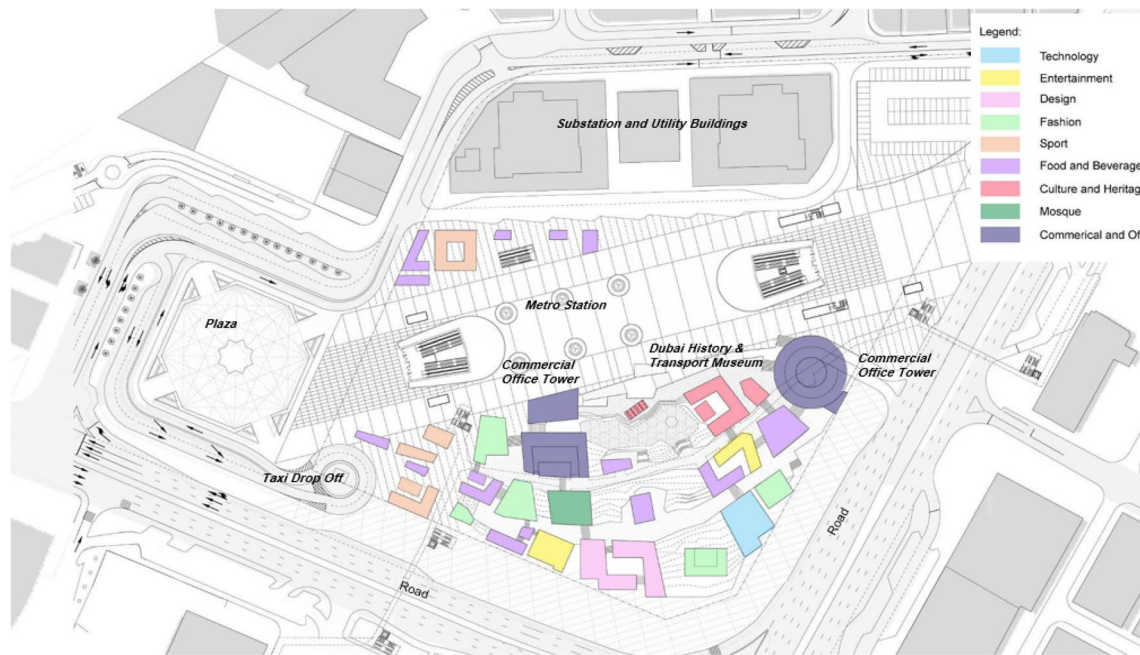
Fig. 4 Universal mixed land use TOD project design drawing and its proposed pedestrian walkways

activities in shopping malls, developing retailing strategies [25–28], understanding socio-spatial dynamics [29], and determining the malls' rent [30]. Attractiveness factors of malls can change from one context to another. The case studies in Table 2 highlight a range of attractiveness factors of shopping malls in several places.

The majority of studies on attractiveness factors of shopping malls focused solely on internal mall characteristics and their impact on mall patronage. Other studies such as Golias et al. [42] and Rajagopal [3] referred to the interrelationship between shopping malls and external context, i.e. habitation pattern, and transit system. For example, the place of a shopping mall is affected by the proximity to areas with increased population. As a result, the commercial growth in some areas led to a reduction of housing and industrial areas as land was converted to shopping malls [43]. However, the current literature does not specifically integrate internal shopping mall characteristics and its external TOD context to adequately explain factors of attractiveness of a shopping mall (pull factors) in a TOD context. We see the general characteristics of products, facilities, and the physical evidence of shopping malls were commonly identified as attractiveness factors. Table 2 shows the diversity of mall attractiveness factors in different places. Although it outlines these factors in different locations, these factors cannot solely explain the attractiveness of shopping malls. Therefore, we argue that other factors relating to the external surrounding context also need to be considered in understanding the attractiveness of a shopping mall (shopping malls pull factors), particularly in a TOD context. Therefore, the external

design factors of TODs are considered in the following section to characterise this contextual surrounding environment impacting the attractiveness of shopping malls.

2.2 Design Factors of TODs

The term TOD became a common modern planning term when Calthorpe published The Next American Metropolis in 1993 [44]. A TOD is widely defined as a compact, mixed-use community, centred around a rail transit station that, by design, invites residents, workers, and shoppers to drive their cars less and ride mass transit more [16, 45]. It includes dense and pedestrian-friendly elements [6] and emphasises the creation of residential density and the mix of land use to attract trips, with rail transit station access mainly by foot rather than a car [17]. Figure 4 depicts a universal mixed land use TOD project and its proposed pedestrian walkways for illustration, as shown in Fig. 5.

A mixed-use shopping mall can be developed as a TOD, where shoppers drive their cars less and ride nearby mass transit [16]. TOD is an innovative sustainable solution for high-density urban planning and development [17]. By creating "activity nodes" linked by rail transit, as outlined in Fig. 6, TOD can provide mobility choices in congested areas.

TOD can increase public safety for pedestrians and rail transit users [46], increase transit ridership, reduce rates of vehicle kilometres travelled, and increase households' disposable income. This income increase is a result of the freed-up cash from reducing the need for a car and the travelling cost. It can also reduce air pollution and energy consumption rates, conserve valuable land and open space,
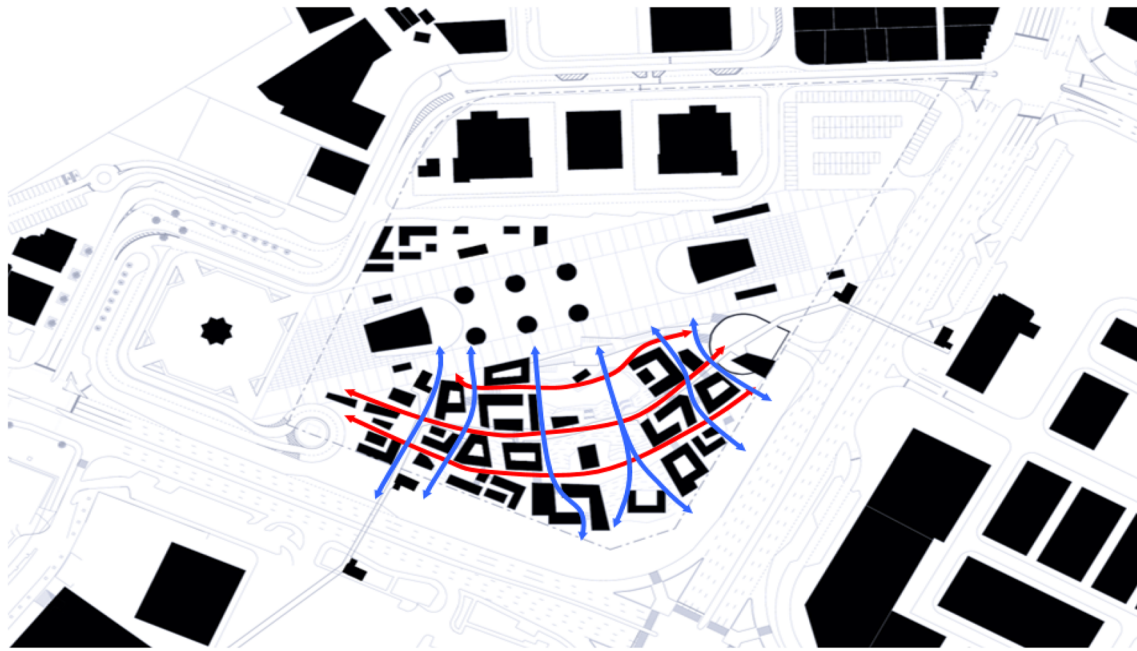
Fig. 5 Universal mixed land use TOD project proposed pedestrian walkways

Fig. 6 Mall of the Emirates' inside link to Dubai Metro

resulting in less land used for urban developments. Consequently, it can improve economic development through transit network sustainability and neighbourhood revitalisation, and contribute to affordable housing with the compact growth pattern and the decrease in infrastructure cost [47].

Design factors of TOD have been studied for different reasons, such as assisting rail transport planners to improve transport sustainability [48], leveraging benefits and quality of urban design [17, 49], urban city policymaking and encouraging the use of public transport [6, 50, 51], optimising investments schemes around transit stations [52], and rail transit ridership forecasting [53]. The effective design factors of a TOD can change from one context to another, e.g. zones [54]. There are case studies in different cities showing a range of effective TOD design factors, as can be seen in Table 3.

The review of the literature identified that urban design of the area, transport characteristics, and the distance between a development and rail transit services were commonly identified TOD factors. Table 3 shows a range of effective TOD design factors in different geographic locations. Therefore, TOD factors reflecting the surrounding context of a particular shopping mall can impact its attractiveness and the number of shopper passengers using a nearby rail transit station.

Table 3 Studies in different countries on effective design factors of TODs

Author (Ref.), location	Sample	Identified effective design factors of TODs
Searle et al. [49]; Melbourne, Sydney, Brisbane—Australia	8 interviewees and an online survey	Location within larger activity centres, for commercial development at smaller-scale TODs
Yap and Goh [6]; Malaysia	103 respondents	Location; future value of the property; traffic congestion in peak hours; safety; cost of living; accessibility; available alternative travel modes; affordability of properties; amenities; availability of private transportation; convenience of public transportation; time-saving
Zeng [55]; China	478 surveys	Location close to workplace; public transport; shopping centre
Loo et al. [53]; Hong Kong, China	79 stations in Hong Kong	Land use; station characteristics; socioeconomic and demographic characteristics; inter-modal competition
Loo et al. [53]; New York, USA	406 stations in New York	
Olaru et al. [17]; Perth, Australia	509 respondents	Physical features; social dimension; proximity to transport facilities; facilities in 5-min driving distance; facilities in 5-min cycling and walking distance
Taehyun et al. [56]; Seoul, South Korea	The Seoul field survey data on pedestrian traffic volume and metro ridership in 2009	Walking on wider streets, whereas narrower streets were preferred in areas further from the metro station; street connectivity; mixed land use
Sun et al. [57]; Beijing, China	495 surveys	Connectivity; pedestrian-friendly designs; higher building coverage ratio around the metro station
Kamruzzaman et al. [58]; Brisbane, Australia	1734 census collection districts (CCDs) data	Node connectivity; frequency and diversity of transport services; walkable distance; number of residents in the areas; workers degree of land-use diversity
Zemp et al. [59]; Switzerland	Swiss Federal Railway's (SBB) railway station database and an earlier study by Reusser et al. [60], 1700 passenger train stations density	Location of railway tracks; centrality of the station; size of catchment area; concentration; access to railway station; customer types distribution; proximate urban density; reputation of vicinity; cultural heritage and historical reference management; connection frequencies; network density; interconnection quality; reputation of public transport; relative attractiveness of private transport
van Lierop et al. [61]; USA	5 interviews with professionals	Physical design; transportation; environment; economy; collaborations; accessibility
van Lierop et al. [61]; Canada	2 interviews with professionals	
van Lierop et al. [61]; Netherlands	6 interviews with professionals	

Therefore, we argue that, in identifying the attractiveness factors of rail TOSMDs, there is a need to consider both the shopping mall attractiveness factors and the TOD design factors jointly. There is also the potential to thematically outline these factors, which have been partly identified in this section and will be discussed in Sect. 3 to establish a conceptual framework for rail TOSMD attractiveness. The conceptual framework will lay the foundation to support the forecast of the number of shopper passengers using a rail transit station near to a TOSMD and potentially enhance existing mobility forecasting models of the number of passengers using the rail transit station near the shopping malls.

3 The Conceptual Framework for TOSMD Attractiveness

The objective of this study is to clarify the attractiveness factors of rail TOSMDs and establish a conceptual framework explaining the attractiveness of TOSMDs. Existing literature does not comprehensively integrate attractiveness factors of shopping malls and design factors of TOD into a single framework that could help to explain rail TOSMD attractiveness, although both shopping mall attractiveness factors and TOD design factors jointly impact the number of shopper passengers using a nearby rail transit station in a TOD context. Section 2 identified
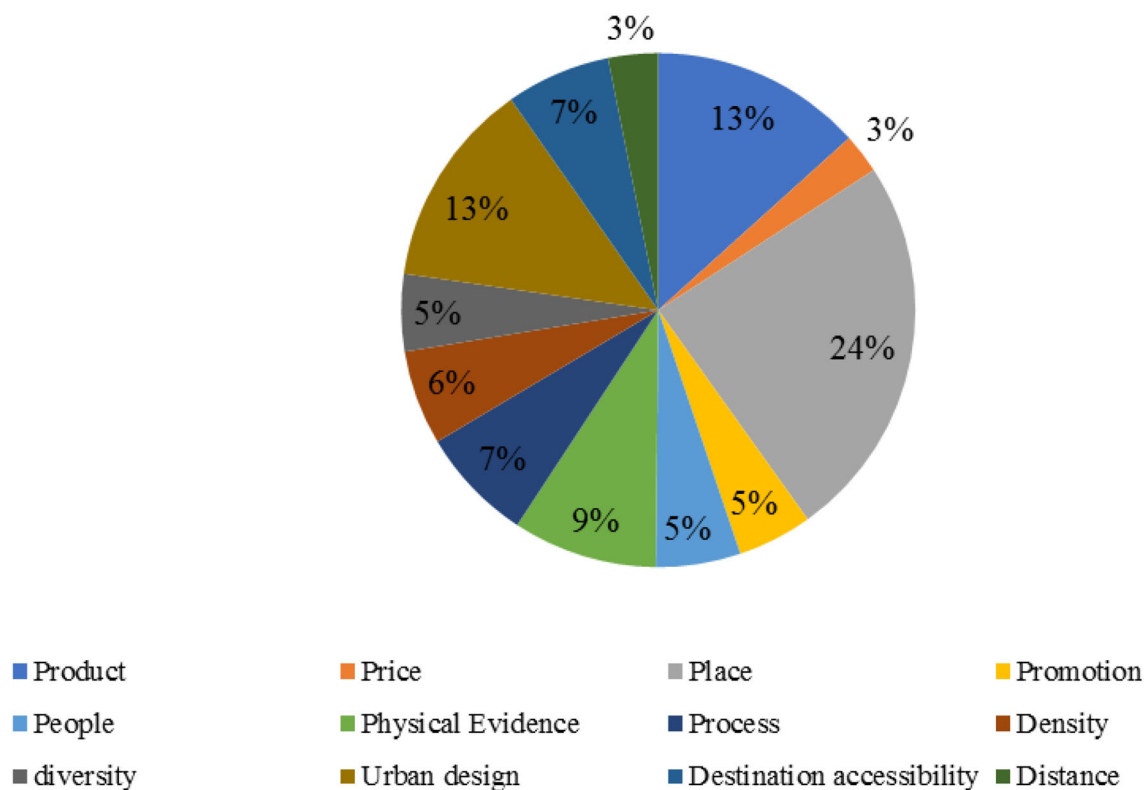
Fig. 7 Indicative weight percentages of the above themes from the study-reviewed cases

the diverse factors underpinning and resulting in shopping mall attractiveness and TOD effective design. Therefore, a generic theoretical framework was used to combine all the literature-identified factors of shopping mall attractiveness and TOD design using the generic extended service marketing mix [62] and the five dimensions (5 Ds, density, diversity, urban design, destination accessibility, and distance) of TOD [21] to establish the framework for rail TOSMD attractiveness. Both types of factors identified in Sect. 2 are thematically presented.

Firstly, the attractiveness factors of shopping malls can be viewed across the following seven dimensions:

|	
Product	It relates to the shopping mall product attributes, in the form of shop types [26, 63], quality [37], variability, and availability [31, 37], the provision and characteristics of mall products [3, 31, 64, 65], and activities [26, 41, 63]. Activities could be leisure and entertainment, cultural activities, cinemas, or game parlours
Price	It relates to the shopping mall pricing attributes, in the form of competitive prices and discounts given at groups of shops in a particular mall. Examples are factory outlet malls [66], bargains [14, 28, 38], price payment options [27], and pricing strategies. Pricing strategies vary from everyday low pricing (EDLP) and promotional pricing (hi-lo pricing) [67]
Place	It relates to the shopping mall place attributes, in the form of mall space [35, 68] mall stores and
	facilities [41, 63, 64], and mall location [30, 31, 36, 37, 40]
Promotion	It relates to the shopping mall promotional activities, in the form of the mall's promotional campaigns and events [26, 35, 39], incentives and loyalty programs [31, 64], and the mall's advertising [26, 36, 41]
People	It relates to the shopping mall personnel interaction attributes, in the form of the mall's staff helpfulness and friendliness [36, 41, 69], their extended working hours [3, 27, 36], their services offered [14], and the mall's crowdedness [14, 28, 63]
Physical evidence	It relates to the shopping mall exterior and interior environment, in the form of the tangible mall's servicescape [14, 28], internal facilities, and service facilities [14, 26, 28, 35]
Process	It relates to the elements and issues associated with the shopping experience in the shopping mall. It could be in the form of ease of the mall's search process for products and stores [14, 27, 70]. Another form could be in the mall's service offering process, such as home delivery [27, 37, 64, 70]. Also, an additional form could be in the mall's management process, such as crowd management, space management, and freedom [28, 63]
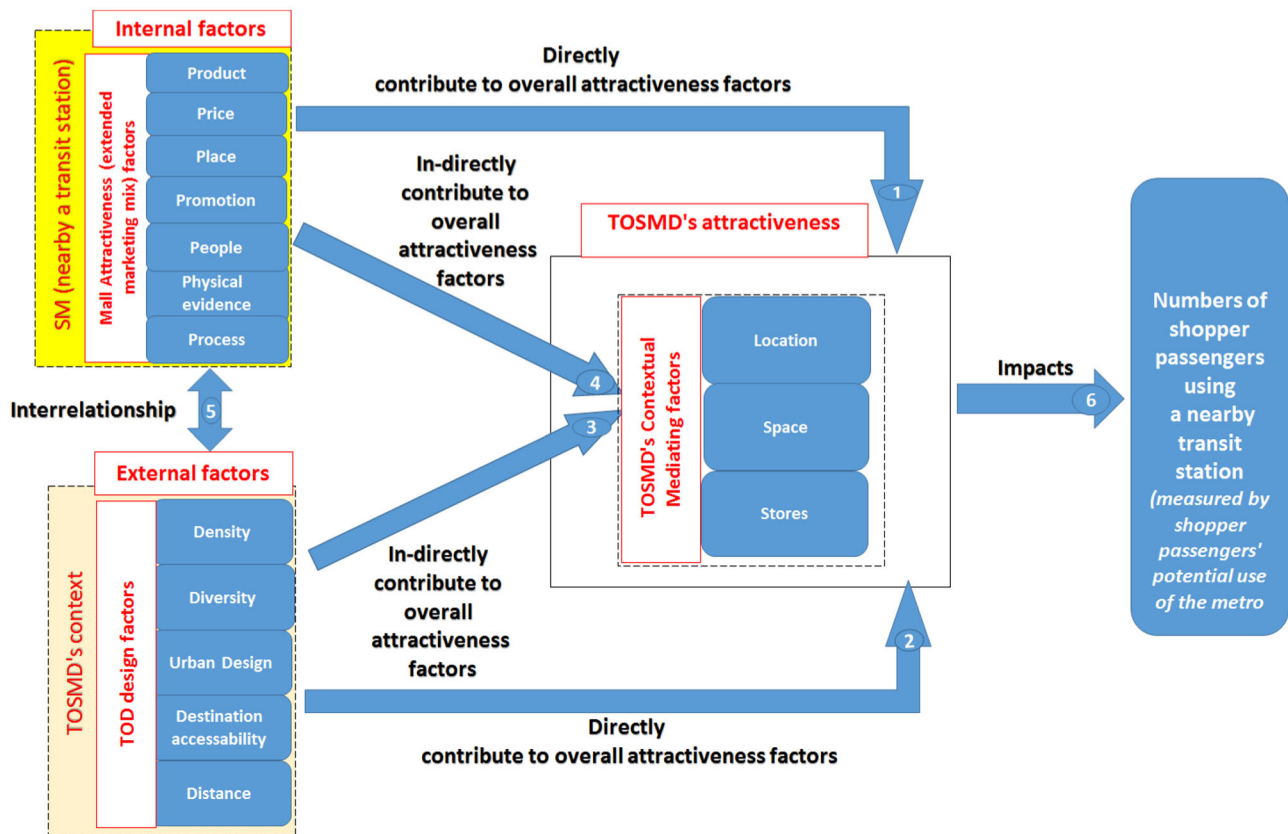
Fig. 8 The proposed conceptual framework for TOSMD attractiveness

Secondly, the design factors of TOD can be considered across the following five dimensions:

Density	It relates to agglomeration and the number of business establishments in a given area [71], built-up area and floor area ratios [57, 72, 73], and population [60, 61, 73]. Hence, it was divisible into a node (e.g. rail transit station) and place (e.g. neighbourhood) components [59]. The idea is that a development with high population density is an indication of high travel demand, possibly high transit ridership, and hence high TOD levels in the area of the development [74]
Diversity	It relates to mixed-use developments' attributes; such as the presence of shops, services, and facilities [17, 57, 75]. It also relates to diverse environment measures, such as the presence of scenic and recreational areas [17, 61, 75], socioeconomically diverse neighbourhoods [72], and land-use homogeneity and dissimilarity [76, 77]
Urban-design	It relates to walkability, such as increasing alternative walkways [6, 57, 58, 78], and walk-encouraging design such as reduced parking areas [61, 75]. Walk-encouraging design could also be applied to environment and landscaping [61, 75], buildings [43, 61, 75], business places [61, 75], and connections [57, 72, 75]. It also
	relates to cycling-encouraging design, such as cycling ways and cycling areas [6, 17, 60]
Destination-accessibility	It relates to the destination's availability of parking supply and proximity to transit. Destination accessibility could be in the form of walking access [43, 56, 75], facilities access [43, 57, 58, 79], and transport access [17, 60, 61, 75]
Distance	It relates to proximity to transport, the location of rail and bus stations, transport-related service facilities, travel time, and mass rapid transit [17, 61, 73]. TOD, by definition, invites walking for 5–10 min, which is approximately 400–800 m [6]. Studies show that beyond this walking distance, access trips increasingly use cars. Car usage increases as distance increases from the transit station [47]. This increased car usage results in deteriorating traffic conditions and creates the need for parking spaces.

Using the elements of the extended service marketing mix and the 5 Ds of TOD, the study developed a conceptual framework for rail TOSMD attractiveness. The above themes can attract different weights in different contexts. Although a large number of studies related property value and rent. i.e. in a shopping mall to the distance from a

Table 4 Pros and cons of association between TOD factors and attractiveness of a TOSMD

TOD factors	Pros of association between TOD factors and attractiveness of a TOSMD	Cons of association between TOD factors and attractiveness of a TOSMD
Density	It could optimise the prospective number of shoppers, as high population density is an indication of high travel demand and also possibly high patronage [74]	It could increase congestion [18] and eventually make the mall and the area less attractive to some shoppers
Diversity	Commercial growth in some areas led to a reduction in housing and industrial areas as land was converted to shopping malls [43]	The question is what mixtures will optimise effective mixed-use TOSMD [72]
Urban design	It could potentially optimise the attractiveness of a TOSMD. It is common to see metro stations connected with a nearby TOSMD via a walking bridge to encourage and facilitate coming to the mall via public transport and walking from the station to the mall	We showed earlier that some studies showed a negative impact of increased crime, noise, and vibration (as a result of train movement), which in turn could cause shopping malls near a transit station to be less preferred [47, 83]
Destination accessibility	Mall developments could benefit from accessibility by a transit system. In addition to a higher number of prospective shoppers, it could lead to greater tenant occupancy and rent [30]	Attractiveness is not always the case for TOSMDs with accessibility by a transit station. We showed earlier that this could negatively bring crime and noise pollution to the mall
Distance	It was explained earlier that the short walking distance encourages prospective shoppers. Therefore, it optimises attractiveness of a TOSMD [58]	Attractiveness is not always the case for TOSMDs with a near transit station. Similarly, it could negatively bring crimes and noise pollution to the mall

transit station [80–82], other studies showed the negative impact of crime, noise, and vibration (as a result of train movement) increase, which in turn caused properties near a transit station to be less preferred and cheaper [47, 83]. However, this is not the case in all TODs. Mu and Jong [7] argued that density is considered important for TOD, but it is not critical, as it is well known that there are many American and European cities that do not possess density levels as high as those of Asian cities, and they have successfully become transit-oriented metropolises, but it is not the case in all TODS. Figure 7, however, shows indicative weight percentages of the above themes from the study-reviewed cases. It shows place and urban design as being highly identified factors impacting the attractiveness of TOSMDs.

The conceptual framework for the attractiveness factors of TOSMDs is depicted in Fig. 8. It is based on two concepts. Firstly, the context-based station classification of Zemp et al. [59], where differing surrounding contexts impact the attractiveness of TOSMDs. Secondly, the node-place concept [84, 85], where a TOSMD impacts the number of shopper passengers using its nearby rail transit station (the node). The conceptual framework combines the elements of the extended service marketing mix and the 5 Ds of TOD. The framework-independent variables of a shopping mall's attractiveness factors (internal factors) and TOD design factors (external factors), and the mediating variables of location, space, and stores (TOSMD's mediating factors) are used in determining TOSMD attractiveness without any particular weight as it varies in different contexts according to the study review. As it can be seen in

Fig. 8, there is an interrelationship between the internal shopping mall attractiveness and the external TOD. Furthermore, TOSMD attractiveness is closely linked to the number of shopper passengers using a nearby rail transit station. This number is measured by shopper passengers' potential use of the rail transit station near the shopping mall. The arrows indicate the causal links among the elements of the framework in Fig. 8.

The basic elements of the framework are as follows. Firstly, the attractiveness factors (product, price, place, and promotion) of a particular shopping mall (internal factors) impact and determine the attractiveness of a rail TOSMD. However, the extended service marketing mix factors (people, physical evidence, and process) of a particular shopping mall near a transit station also have a direct impact on the rail TOSMD's attractiveness, as shoppers tend to use tangible TOSMDs' servicescape cues to assess the intangible quality of the received services of the TOSMD. This relationship is depicted by arrow 1.

Secondly, TOD design factors (external factors), reflecting the surrounding context of a particular TOSMD, have a direct impact on TOSMD attractiveness. For example, a high-density TOD could make a TOSMD less attractive due to human congestion in the vicinity of the TOD context. This relationship is depicted by arrow 2. The study's conceptual framework addresses the one-way impact of TOD measures on TOSMD attractiveness, the "pull effect" (refer to Sect. 1).

Thirdly, TOD design factors also have an indirect impact on TOSMD attractiveness. They determine the mediating contextual factors of location, space, and stores

Fig. 9 Illustrative example of service disruption. Adapted from Kasmi [87]

(internal and external environment distinguishing mediating factors), such as the location of the TOSMD's outdoor dining and events areas, parking space available, and access to the TOSMD. Proximity to a rail station and other facilities determine the location-mediating factor attributes of a TOSMD. High population density can increase TOSMD's shopper numbers, impact the space and store attributes of a TOSMD, and make it more attractive. The stores mediating factor attributes of a TOSMD are impacted by the mixed use of the TOSMD's context (diversity) and the agglomeration of other businesses (density). The relationship between TOD design factors and the TOSMD's mediating factors of location, space, and stores is depicted by arrow 3.

External TOD factors of density, diversity, urban design, destination accessibility, and distance could have a positive or negative impact on the attractiveness of a TOSMD, as explained in Table 4.

Fourthly, the shopping mall attractiveness factors indirectly impact TOSMD attractiveness. They determine the attributes of the TOSMD's mediating factors of location, space, and stores, and could optimise the shopper numbers and retail strategies of a particular shopping mall (that is, near a transit station). This relationship between the attractiveness factors of a shopping mall and the TOSMD's mediating factors of location, space, and stores is depicted by arrow 4.

Fifthly, the interrelationship between the internal shopping mall attractiveness and its external TOD factors is depicted by arrow 5. The interrelationship among the different factors varies in different contexts, as we mentioned earlier in this section.

Sixthly, the TOSMD's attractiveness factors impact the numbers of shopper passengers using a nearby rail transit station (node). This number can be measured by shopper passengers' potential use of the metro station near the shopping mall. This relationship is depicted by arrow 6.

4 Application of the Conceptual Framework

The conceptual framework in Sect. 3 presented the relationships between shopping mall attractiveness factors and TOD design factors and their impacts on the attractiveness of TOSMD (refer to Fig. 8). These relationships impact the number of shopper passengers using a nearby rail transit station. Both shopping mall attractiveness (internal) factors and TOD design (external) factors directly impact the attractiveness of a TOSMD. These internal and external factors indirectly impact the attractiveness of a TOSMD via the TOSMD's contextual (internal and external environment distinguishing) mediating factors of location, space, and stores of the TOSMD. These mediating factors identify and clarify the TOSMD's context.

In order for the conceptual framework to be applied, it requires the collection of a range of data. A quantitative data collection approach is considered to be the most appropriate as it is typically used in generalisable causal relationships [19, 86]. In the conceptual framework, the attractiveness of a TOSMD is clarified using the shopping mall attractiveness factors (internal factors) and the TOD design factors (external factors). The independent variables are considered to be these internal and external factors. The first dependent variable is the TOSMD attractiveness. The

framework identifies that location, space, and stores are mediating variables of the external and internal factors' impact on the attractiveness of a TOSMD. The framework also identifies that the dependent variable of TOSMD attractiveness is, in turn, a mediator for the impact of the internal and external factors on the second dependent variable of the number of shopper passengers using a nearby metro station.

Critical data at various levels will be required to operationalise the framework. First, at the rail transit station level, the required data would include the station's design details and its connections with other modes of transport. At the mall level, data to support the framework would include the mall's size, daily shopper numbers, and mall design details. At the surrounding TOD area level, data would be required for the station and its immediate surrounding area design details, demographic and statistical details of the population around both the station and the TOSMD, the distance between the TOSMD and the nearby rail station, and the geographical and urban characteristics of the TOD area around the rail station. Next, at the passenger level, daily passenger numbers in the station near the shopping mall, including characteristics of shopper and non-shopper passengers, will support the framework. Finally, data regarding the shopper passengers' attitudes, including factors driving shopper passengers' views of the attractiveness of a TOSMD near a transit station, will be necessary. These levels of data might be sourced from multiple sources, including the relevant transportation authority and passengers coming from the TOSMD to the nearby transit station.

The literature review in Sect. 2 identified that the attractiveness factors of a TOSMD impacting the number of shopper passengers at a nearby rail transit station could change from one context to another. Therefore, the study's conceptual framework of TOSMD attractiveness could potentially be utilised to lay the foundation for informing and potentially enhancing a rail transit station's passenger forecasting models. It could be applied by (a) offering mall developers and managers a basis to distinguish and classify TOSMDs, and (b) clarifying the interrelation between the number of shopper passengers and the usage of the rail transit stations near TOSMDs. The enhancement of passenger forecasting models could better direct government spending to where the best effect would be achieved when building or improving metro stations and increase the economic sustainability of rail transit networks.

Hence, the study's conceptual framework is considered useful for cities with large numbers of shopping malls and cities growing their mall developments and connecting them with nearby rail transit stations. Rail transit stations near TOSMDs could reach their capacities in a shorter period than other stations further away from malls.

Reaching a transit station's capacity can result in costly upgrades and disruption to the rail transit service and passengers, as illustrated in Fig. 9.

The conceptual framework has limitations in that it is proposed to be applicable to clarify rail TOSMDs within a walkable distance of about 600–800 m of a rail transit station. It does not consider the reverse impact of attractiveness of TOSMDs on its surrounding TOD context as it is beyond the purpose of this study. It also does not consider the other factors of ridership impacting the rail transit station, such as level of rail transit service, intermodal connections, external connectivity, and other modal choice behaviours of shopper passengers. Furthermore, this study has a limitation that it is based on a literature analysis approach, and its sampling strategy was determined by the trade-off between breadth and depth of the analysis included in the study. Despite these limitations, the research contributions of this study remain valid in synthesising the literature on retail and transit urban planning into a conceptual framework for the newly introduced term of rail TOSMD pattern of development.

5 Conclusion

This study thematically analysed 208 guiding research articles to clarify the attractiveness factors of transit-oriented shopping mall developments (TOSMDs). It informed the creation of a conceptual framework to comprehensively explain the impact of rail TOSMD attractiveness on the demand of shopper passengers using a rail transit station near a TOSMD for potential optimal TOD effectiveness, patterns of mall development, transit urban planning, and transport policymaking. It laid the foundation for potentially enhancing existing rail transit station's passenger forecasting models.

In the literature reviewed, the term TOSMD did not exist. For this reason, the study clarified it as a shopping mall (SM) near a rail transit station in a TOD context, where both shopping mall attractiveness factors and TOD design factors impact the number of shopper passengers using a nearby rail transit station. The literature review on attractiveness (pull) factors of shopping malls focused solely on internal mall characteristics. The general characteristics of products, facilities, and physical evidence of shopping malls were commonly identified as attractiveness factors. It also emphasised the TOD design, transport characteristics, and distance as common TOD design factors. Although different factors attract different weights in different contexts, the study provided indicative weight percentages of the attractiveness factors of TOSMDs. However, it does not consider the reverse impact of attractiveness of TOSMDs on its surrounding TOD context

as it is beyond the purpose of this study. The proposed conceptual framework for TOSMDs' attractiveness was outlined in Fig. 8. It was based on synthesising the attractiveness factors of shopping malls (internal factors) and TOD design factors (external factors), using the generic extended service marketing mix elements (product, price, place, promotion, people, physical evidence, and process) and the 5 Ds of TODs (density, diversity, urban design, destination accessibility, and distance) as an indicator system for the factors determining the attractiveness of TOSMD. Location, space, and store attributes were identified as contextual (internal and external environment-distinguishing) mediating factors of TOSMD attractiveness. The conceptual framework also showed that the attractiveness of TOSMDs is, in turn, a mediator for the impact of the internal shopping mall attractiveness and external TOD design factors on the number of shopper passengers using a nearby metro station (node). Applying the conceptual framework to a case study will require data at the levels of the rail transit station, shopping mall, surrounding TOD area, station passengers, and shopper passengers' attitudes. The conceptual framework provides an opportunity to better refine existing passenger forecasting models by understanding the attractiveness or demand for rail TOSMDs. It can offer mall developers and managers, urban policymakers, and rail transit urban planners a basis to (a) distinguish and classify TOSMDs, and (b) clarify the number of shopper passengers using a transit rail station near a TOSMD. It is considered useful for cities that have an existing or growing number of shopping mall developments and would like to sustainably apply an effective TOD approach to their transit rail networks and shopping mall patterns of development.

Compliance with ethical standards

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