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# Challenges of delivering TOD in low-density contexts: the Swedish experience of barriers and enablers

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## Abstract

**Background:** Transit Oriented Development (TOD) is key to the success of public transport and for sustainable urban and regional development. Previous research has often focused on delivering TOD in urban areas with high population and building densities. This highlights the need to broaden the scope of TOD approaches to also include less densely populated areas located outside the immediate urban cores as a key concern for policy.

**Purpose:** The aim of this paper is to increase the knowledge of how to deliver TOD in such low-density contexts.

**Methods:** Three case studies of attempts at delivering TOD in sparsely populated areas in three Swedish city-regions are made. The data for the case studies consist of planning documents and 13 interviews with key stakeholders involved in the planning processes of the three cases.

**Results:** The results show that many of the barriers and enablers are rather similar to those identified in research on TOD in much more urban contexts in other parts of the world, but the relationships between them are differently nuanced in low-density contexts. The lack of clear quantified definitions of what TOD is (or is not) allows a more flexible, site-specific understanding of TOD to emerge in this context.

**Results:** It is important that a shared vision of TOD in each location is developed by the organizations involved—and such a shared vision appears to be crucial for the development to have a good chance of being delivered. Informal definitions, and individual perceptions (including those of the public) are important; and in locations that are quite “marginal” for TOD, all enablers must interact together positively for the development to have the maximum likelihood of going ahead as planned.

**Keywords:** Transit-oriented development, Public transport, Sustainable urban development, Low-density, Sweden

## 1 Introduction

The importance of Transit Oriented Development (TOD) to the success of public transport and for sustainable urban and regional development, and a need to understand how to deliver it more often, is the key justification for this article. In addition to the need to better understand how to deliver TOD more often there is a need to better understand how to do this in low-density areas

outside the urban. While there are several different ways to conceptualise TOD [1], in general terms, TOD is typically defined as an integrated approach to transport and land use planning that makes walking, cycling, and transit use convenient and desirable, and that maximizes the efficiency of existing public transport services by focusing development and increasing densities around and or close to public transport nodes [2]. This is one of the reasons why research on TOD often focus on larger cities, for example in North America [3–5], Asia [6–8], and Europe [9–11]. Any conclusions about how to deliver TOD thus need to be adapted when applied in other

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contexts [12, 13]. How this adaptation may be brought about, and how TOD is currently defined by different actors and in different spatial, and institutional contexts, is not well understood [12, 13]. With reference to TOD in areas of differing development densities, Nigro et al., p. 111, write that ‘... very few studies on land use and public transport integration focus explicitly on geographical contexts characterised by medium or low densities of population and activities...’ [12]. With the research gaps described above in mind, the aim of this article is to discuss ways to promote TOD in lower density contexts, in this article exemplified by TODs in Sweden. Based on case studies building on analyses of documents and interviews from three lower density TOD projects in Västerhaninge, Öxnared and Kävlinge (all located in the semi-peripheral areas of the metropolitan city regions of Stockholm, Gothenburg and Malmö) we pose the following research question:

What are the main enablers of and barriers to implementing TOD policy in low-density contexts?

In the following, we will describe previous research on barriers and enablers for TOD. Then, in Sect. 3, we describe the method, in which we also justify the choice of cases and describe similarities and differences between the selected cases. Based on previous research, we identify key categories of barriers and enablers which we then use our empirical cases to analyze more deeply in Sect. 4. In the concluding discussion (Sect. 5), we discuss the most important barriers and enablers in the cases, and we discuss whether these are similar or different from the results from previous research.

## 2 Previous research on barriers or enablers for implementing TOD

There are only a few studies addressing enablers and barriers to TOD in low-density and less urbanised areas. Addressing land-use patterns, a US based study, Ewing et al. [14] shows that demand for parking is significantly lower not only in urban TODs but also in self-contained TODs outside urban cores compared to suburban developments. An example from Freiburg, Germany, Broadus [15] illustrates the potential of TOD in urban fringe locations to counteract car use and increase bicycling by pricing and restrictions on parking. A study addressing the quality of public transport [12], argues that for TOD areas in low-density contexts it is useful to consider larger catchment areas connected with feeder transport, and it is concluded that public transport planning strategies focusing on integration of multiple feeder transport mode have the potential to significantly increase the attractiveness of public transport in low-density contexts. Similarly, a Slovenian example [16], illustrates that modal integration of e-bikes and demand responsive transport

systems could increase use of public transport in smaller towns. As these studies show, barriers and enablers for TODs in low-density contexts overlap with, but also differ somewhat from TODs in urban core areas.

The small number of studies on TOD in low density areas means that one needs to turn to the general research on TOD in order to be able to discuss barriers and enablers that are also of potential relevance in low density areas. Previous TOD research has identified barriers and enablers in at least five different areas: (1) the availability and nature of sites for TOD close to public transport nodes [1, 4, 5, 11], (2) the quality of public transport [17, 18], (3) existing land use patterns that “lock-in” existing travel behaviour [8, 18–20], (4) market conditions for and developer perceptions of TOD, and (5) governance. In the next part of this review of previous research, we focus on two areas: market conditions and governance. We have chosen to focus on these two areas since availability of development land and the quality of public transport is high in all three case study areas (we elaborate on this in Sect. 3). Thus, in these regards the conditions for TOD are assumed to be favourable. This enables us to understand if and, in that case, how, market conditions and governance factors play out as barriers and enablers to deliver TOD in the low density locations selected.

Regarding *market conditions* property developers and investors are a category of key actors involved in the planning and implementation of TOD. There are a number of publications which discuss developer attitudes to, involvement in and experience of TOD, and developers’ perceptions of barriers to it [18, 21–25]. A key finding is that developers often perceive TOD to be expensive and risky. The expense comes from the need to create higher quality urban environments and to build at higher densities. Vertical mixed-use development, especially, entails higher development costs, since such development requires unique solutions for which standard cost models are more difficult to apply [22–24]. Developers may also perceive TOD to be something of a niche market, and not of mass appeal to investors and the public [24, 25]. Another barrier, found to be fundamental, was a general lack, among developers, of understanding of the TOD concept [24]. One reason for this could be lack of exposure to the concept by another actor, e.g. a municipal planning department. Attributes that characterise developers with high capacity for TOD include: vision, willingness to take risks, patience, and ability to work in partnership with the municipality, but Feldman et al., found that developers with such characteristics are rare [24].

An important prerequisite for TOD is that its delivery requires the involvement of many actors: national railway

**Table 1** Enablers and barriers considered

Enablers and barriers considered in our review	Enablers and barriers not considered
Multi-agency multi-actor nature of TOD planning Actor relations mediated through formal and informal institutions Regional planning Shared definitions of TOD Developer perceptions of TOD as different, expensive and risky	Quality of public transport Site availability Land use patterns that lock-in existing behavior

authorities, public transport authorities (PTAs), organisations involved in land development around transport infrastructure, e.g., private developers, local authorities, and private companies contracted to provide transit services. Regarding *governance*—here understood as the planning dynamics created by the organizations involved in TOD planning, the institutional setting in which these organizations manoeuvre and the character of instruments steering actor interactions [26]—previous research highlights the complexity of these actor relations within TOD [8, 27]. This complexity may create tensions and conflicts, and one way to handle conflicts could be, according to Mu and de Jong [8], to build common understandings of goals and motivations between the actors involved in planning.

Several authors also highlight either the importance of a regional land use planning organisation as an enabler to TOD, and the difficulties in achieving a more regional approach to planning [2, 11, 13]. One example of this is how in many countries there is a lack of statutory regional planning, and in some countries a lack of any form of regional planning organization [28]. Achieving a regional approach to TOD is also claimed to rest on the ability to achieve collaborative approaches. Thomas and Bertolini [2] define a number of critical success factors in TOD implementation including political stability at the national level, relationships between actors in the region, interdisciplinary teams used to implement TOD, and public participation. The same authors draw the conclusions that very good relationships between municipal actors, at a regional scale, e.g., and actors willing to experiment with new policies, practices, and tools are important success factors. In addition, Thomas and Bertolini, p.559 found “that land use and transportation planners seem to be familiar with TOD concepts and ideas, but less familiar with ‘softer’ transferable lessons that consistently play a role in successful TOD implementation, such as good actor relationships, the support of the national government, the need for a multi-disciplinary approach and active public engagement” [29].

To conclude, then, the existing literature on TOD has identified a wide range of barriers to TOD delivery.

Complex governance structures are among the most often reported barriers to TOD. Additionally, definitions of TOD are often vague, which may create governance challenges if actors involved in planning processes have different and conflicting goals and perceptions of what type of TOD to deliver. Moreover, investments in TOD is perceived by many developers as risky because of the higher investments costs of TOD compared to conventional suburban low-density development. This perception of risk is also compounded by the multi-party multi-actor context of TOD sites; there are in reality frequently additional development costs as TOD sites are often under complex ownership.

In many cases, the enablers of TOD are found to be the converse of the barriers, such as good actor relationships, shared goals and a common understanding of TOD as a concept etc. Another conclusion that can be drawn from previous research is that one needs to see the planning of TOD as evolving through complex governance structures where actors with varying resources, capacities and interests interact. In other words, TOD planning should be understood as a situated practice that not only evolves through formal institutions of government, but also very much through informal governance processes.

How actors define TOD in different cases is in previous research sometimes described as being part of market and sometimes as governance barriers or enablers. A lack of understanding and knowledge of the TOD concept among developers, for example, is, according to previous research, potentially a barrier, as it risks making it harder to build a common understanding of goals and motivations between the actors involved in the planning. Because of the importance of definitions and TOD policy, here understood as actors’ definitions of TOD and the implication of this for planning, we will in the results treat definitions and policy as a separate analytical theme in addition to market and governance conditions. All these points are summarised in Table 1, below.

Based on this view of TOD planning, and by building on previous research, we will in the results section focus the analysis on the following themes and questions:

**Table 2** Cities and plans analysed

City	Regional plans	Local plans
Öxnared	Regional development strategy (2013) [34], Public transport provision plan (2021) [35]	Comprehensive plan (2017) [36]
Kävlinge	Regional development strategy (2020) [37]	Comprehensive plan (2010) [38] Densification strategy (2017) [39]
Västerhaninge	Regional development strategy (2017) [40]	City development plan (2018) [41]

- Market conditions—how did the property market conditions, and differing perceptions of it, interact with and affect TOD planning?
- Definitions and policy—how did actors define TOD in the different cases, and what were the implications of this for TOD planning?
- Governance processes—how did the actor interactions influence planning?

### 3 Method

#### 3.1 Case selection and data

The analysis builds on qualitative case studies of TOD planning in low density locations. The cases were selected through a process of deliberation between the research team and representatives of three metropolitan regions who participated in a reference group associated with the project of which this article is a part. The representatives of the three metropolitan regions were asked to provide examples of TOD in their respective region that in their opinion illustrated important aspects of working with TOD. Through this process we arrived at a long list of potential cases. From this long list we made a first selection of cases of specific interest, based on information about the type of municipality and TOD development within it, the mode share for public transport, and the range of actors involved. Regarding type of municipality, we not only focused on low-density contexts in general, but *peri-urban* and *semi-rural* locations.<sup>1</sup> After closer inquiries some cases were dropped due to different circumstances, such as inability to find interviewees willing to talk to us, because the planning process was at a sensitive stage, or simply due to lack of time to do an interview. In the end, we settled for three cases: Västerhaninge

and Kävlinge TOD projects, which are peri-urban cases, and the Öxnared TOD which is situated in a semi-rural location.

The chosen cases differ in terms of the number of housing units planned for, market conditions, and the actors involved. For instance Västerhaninge, the case in Stockholm, is characterised by high land values, and hence different market conditions compared to the other cases, due to its proximity to Stockholm. This shows that what counts as a low-density context in a region is relational and context dependent. The selection of cases thus makes it possible to identify potential differences between the cases, which still belong to the same population of cases.

The material is qualitative and consists of documents and interviews. The ambition with the selection of documents was to find project-related documents; documents that describe the project in its a local urban development context; and documents that provided wider regional visions for transport and the development of the built environment. The documents comprise comprehensive and detailed development plans, planning policies and reports relevant to the understanding of the planning context of the TOD projects within the respective municipalities (see Table 2). Such documents are used to understand how TOD was defined in the project and whether there were supporting local–regional plan structures for TOD.

Semi-structured interviews with thirteen officers, based on an interview guide, were carried out with staff from the relevant local (spatial planning), regional (public transport planning) and national authorities (the Swedish Transport Administration) and with developers (see Table 3). All the interviewees have been involved in the planning processes for the TOD projects analysed. Interviewees were primarily selected based on their roles in the planning processes, with the aim of eliciting their perspectives and experiences of the main enablers and barriers to TOD. Many interviewees have for example been acting as project managers and planners in the cases concerned. The ambition was also to interview people from different organisations such as local and regional authorities but also from property developers (if they have been involved in the planning). The questions asked touch mainly on the following themes and drew inspiration

<sup>1</sup> There are several ways of defining areas in terms of urbanity and rurality and official classifications vary within countries as well as between countries. We base our two categories on the classifications used by the Swedish Agency for Economic and Regional Growth. Our two peri-urban cases are located in municipalities with less than 20 per cent of the population living in rural areas and that are adjacent to a municipality with a population above 500,000. Our semi-rural case is located in a municipality where less than 50 per cent live in rural areas and where more than 50 percent of the population are located less than 45 min from a town with more than 50,000 inhabitants. See [30].

**Table 3** List of interviewees per case

Descriptor	Case	Organisation	Role/title
Interviewee 1	Öxnered	Västtrafik (operator owned by the public transport authority)	Planner
Interviewee 2	Öxnered	Vänerns borg municipality	Development planner
Interviewee 3	Öxnered	Vänerns borg municipality	Comprehensive planner
Interviewee 4	Öxnered	Swedish Transport Administration	Regional planner
Interviewee 5	Öxnered	Swedish Transport Administration	Planner
Interviewee 6	Öxnered	Real estate consultancy	Real estate evaluator
Interviewee 7	Kävlinge	Real estate company	CEO and Business Manager
Interviewee 8	Kävlinge	Kävlinge municipality	Planner
Interviewee 9	Kävlinge	Kävlinge municipality	Project Manager
Interviewee 10	Västerhaninge	Haninge municipality	Planning architect and Project Manager
Interviewee 11	Västerhaninge	Haninge municipality	Development engineer
Interviewee 12	Västerhaninge	Region Stockholm/Public transport authority	Strategic planner
Interviewee 13	Västerhaninge	Real estate company	Project Manager property developer

from an earlier project research review on barriers and enablers, as described in Sect. 2:

- *Roles and perspectives of organizations* (e.g.: How would you define TOD, and how would you describe the interests of the various public and private actors which you encounter in your job when it comes to TOD?):
- *Questions about TOD in general* (e.g.: which aspects of TOD are most difficult to realize? What are the main obstacles and success factors for TOD?):
- *Questions about the 'project' and the planning process* (e.g.: What market demand do you see there is for the new housing development at this location? Have there been any particular challenges during specific times in the planning process?, To what extent do regional and local plans (regional, comprehensive plans, and detailed plans) support TOD in the project?).

The interviews were conducted during the Corona Pandemic, and were therefore conducted through Zoom. Each interview lasted for roughly 1–1.5 h. The interviews were recorded, with the approval of the interviewees, and transcribed verbatim.

The material was analyzed stepwise based on the questions and themes described in Sect. 2: market conditions, definitions and policy, and governance processes related to the specific geographical contexts in focus. First, all documents of potential relevance were identified and read. The analysis of the documents was made, beside on the basis of the themes and questions of market conditions, definitions and policy, and governance processes, on how they described the TOD project in relation to

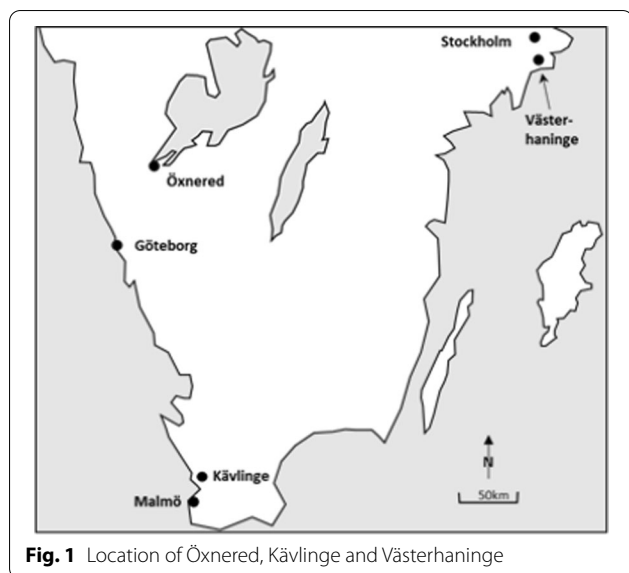
municipal and regional goals for the development of public transport and the built environment. A selection of the analysed plans is used in the results section (these are listed in Table 2). Interviews were then made in a second step. The analysis of the interviews took place by reading through all the interview transcripts case by case, and those parts perceived as containing important data from the interviewees was marked. Themes, here understood as recurrent regularities in the material [31], were identified by reading the transcripts several times. Differences between the interviewees' experiences was also identified in this way. The analysis is in the result section illustrated by quotes from the interviews and the documents.

The results cannot, as in all qualitative studies, be used to make statistical generalizations. Instead, the empirically based analytical lines of reasoning from the studied cases serves as the basis for discussions of general analytical relevance [32, 33]. The analysis of the three cases provides empirically based examples of the challenges of delivering TOD, with the ambition of using the cases to understand and develop an analytical understanding of barriers and enablers in low-density contexts. This is done by discussing our results in relation to previous research, and in particular to the barriers and enablers that have been identified in previous research (Sect. 2).

## 3.2 Cases of TOD

### 3.2.1 Öxnered

The peri-urban TOD site Öxnered is located in Vänerns borg Municipality in western Sweden about 100 km north-west of Gothenburg (see Fig. 1). The municipality has a total population of 40,000 of which 32,000 live in "urban" areas occupying 6.5% of land. Öxnered is located at a railway junction where two national main



**Fig. 1** Location of Öxnared, Kävlinge and Västerhaninge

lines intersect. The trip to Gothenburg takes about one hour by train (with trains every half hour), and in closer proximity there are other regional centres. A monthly unlimited ticket on all regional public transport (including into Gothenburg) is 170 Euro. In the initial discussions with regional representatives about potential cases they argued that Öxnared was interesting since from a regional public transport perspective it has excellent accessibility, and there are ongoing plans for developing the areas in proximity to the existing station.

The original detailed plan comprised the development of 25–30 terraced houses and 150–170 apartments in the area—whilst this seems modest in scale, it is more “urban” than the market alone would have provided, as there is a greater demand for new single-family housing in the municipality. During the public consultation process for the site development plan, the original ambition was altered and current plans comprise the development of fewer terraced houses and apartments, all located at more than 500 m from the railway station.

### 3.2.2 Kävlinge

The town of Kävlinge (about 9,800 inhabitants)—in [Kävlinge Municipality](#) (31,700 inhabitants)—is located along the Swedish west coast main railway line, from Malmö to Gothenburg, and is 10–25 min train ride from major regional employment locations in Malmö, Lund and Helsingborg. There is much vacant land around the train station. The municipality and the property developer Midroc are developing the station area under the brand “Stationsstaden” (The Station City). Stationsstaden is a brownfield development transforming a former

slaughterhouse and food industry area closed down in 2008. Midroc Property Development AB, a major developer, acquired the area through a wholly owned subsidiary, Centrumfastigheter i Kävlinge AB, with the intention of redeveloping it as a housing area.

In 2018 works on supplying the area with technical infrastructure began and currently construction of housing is underway. The development plans encompass approximately 1300 housing units for around 3200 inhabitants as well as premises for shops and services.

### 3.2.3 Västerhaninge

Västerhaninge (about 15,000 inhabitants) is located in the southern part of Haninge Municipality, 6 km from Haninge center and approx. 25 km from Stockholm’s inner city. Västerhaninge has very good access to public transport in the form of a commuter train and bus terminal. The commuter trains run to and from Västerhaninge towards Stockholm City with four trains per hour from early morning until just before midnight, reducing in the night hours. The core of the district is the city centre facilities and the commuter train station, and it is around these locations that the re-development of the area is planned to take place, through densifying the existing built environment but also by improving the quality of the public space. Today, there are both commercial and public services within and close to the area. In the case studied for this research, the municipality and private property developers are planning for an additional 1000 apartments and 18,500 m<sup>2</sup> of public and commercial space including 5000 m<sup>2</sup> for an indoor swimming pool.

## 4 Results

### 4.1 Market conditions

The market conditions of the three cases observed are clearly influenced by their respective public transport accessibility and location in relation to the main centres in the regional labour market. Västerhaninge and Kävlinge are located within 30 min of major employment centres of Stockholm; and of Malmö, Lund and Helsingborg, respectively; and rail frequencies for these journeys are four trains per hour or more. Öxnared has an excellent rail service considering its location, but it is still one hour from Gothenburg with a half-hourly service. In the following, we describe the market conditions and their influence on the business model for TOD in each of the locations, based on the interviewees’ experiences.

The essential business model of these TOD projects—and therefore, according to the interviewees, a key financial enabler is that people working in the metropolitan region, but who cannot afford the most central areas, move to a TOD development that they can afford, either

from outside the region, or from more central areas of the region if they are seeking a certain quality of life at a lower price. Actors' differing perceptions of the quality of life sought have a major impact on their understanding of the market for TOD. Moreover, the proximity of the site to high quality public transport drives up land values sufficiently that it becomes profitable to build at higher densities. In this, there is little difference between the experience of these sites from others in other countries reported in the literature. However, the essential business model is nuanced in all three of our cases due to different market conditions. Of the three cases, two—Västerhaninge and Kävlinge—have according to interviewees market conditions more supportive of TOD than the third, Öxnered. Here, it is not clear that the market conditions are sufficient to support more urban type development despite its high public transport accessibility. As interviewee 2 from the municipality said:

*... if you really follow what the comprehensive plan says, it should mean that we build apartment buildings close to the station and a lot of housing within walking distance ... But at the same time, the question is whether there is a market for it. And what we really need has been self-build housing plots."*

Unlike in the other cases, no developer was associated with the TOD plans in Öxnered; rather, this is a location where small building companies build suburban type single-family houses. Interviewees 2, 3 and 6 argued that current market conditions here mean that there is a demand for a suburban rather than urban quality of life in Öxnered. The (perceived) lack of demand for TOD, and thus a lack of interest from development companies niched towards such development, is a key barrier here.

In Kävlinge market conditions are slightly better due to the proximity to Malmö and a changing property market: the type of buyer/renter who is seeking housing there is changing, as interviewee 7, the developer, commented:

*A lot of people are moving out of large cities such as Malmö and Helsingborg. We notice that for our customers, security is something that is highlighted very often, not least in Kävlinge. The big cities are starting to get insecure and maybe big and impersonal and expensive. People value other things than to live in the middle of the big city, and you can maybe get away a little cheaper, so you have been able to value these surrounding municipalities in a different way and also if there are important public transport close by, you might even be able to sell a car. We notice that there is a different [type of] demand for the more peripheral locations than before.*

These market perceptions are also picked up in the planning documents which emphasise the importance of preserving a "small town character" in Kävlinge (we will elaborate on this below). Thus a key enabler—and one which may enable TOD in more locations like Kävlinge in future—may be that a different type of buyer is prepared to consider such locations, but bringing with them more "urban" lifestyle preferences and therefore a willingness to live in denser environments than buyers and renters moving there a decade ago would have been less willing to do. This is also due to perceived quality of life (for example, security) in competing locations in the urban centres, for example those close to Kävlinge, and also to increasing property prices as in the case of Stockholm and Västerhaninge.

Another aspect of TOD market conditions concerns the land ownership situation. In Kävlinge, the developer—a major one—reported that they saw market opportunities in this location long before other developers did and were thus able to make a strategic land acquisition in terms of price and location (interviewee 7). This, and the fact that the developer owns a large share of the TOD land, also appear to be enablers.

#### 4.2 Definitions and policy

In all three of the cases, formal planning instruments—local (municipal) land-use plans and detailed plans—were supportive of TOD. For example, the comprehensive plan in Öxnered states that: *"In addition, planning should take as a starting point that space should be provided for many dwellings within walking and cycling distance from the station"* [36], p. 70]. The Municipality of Haninge's development plan [41], p. 38] states that:

*Correctly utilised, public transport can be a powerful tool for urban development. High quality public transport can increase land values and so generate investment in increased densities. Increased densities can in turn encourage more people to walk, bike and use public transport for their daily trips.*

In addition, Kävlinge Municipality has produced a comprehensive plan and a Densification Strategy, specifically to achieve denser and more urban type development, yet while preserving the municipality's 'small town character' [38, 39]. The detailed plans for the specific development areas for the three cases are also in line with the broader policy statements from the local plans. That for Öxnered, for example, is clear that development close to the station should be of higher density, although it does not give a strong justification for this, beyond referring to the quote in the municipality's comprehensive plan cited above [36].

In addition to local plans, in the Kävlinge and Västerhaninge cases, there are regional policy documents that

support TOD development: in the case of Stockholm, the regional planning framework (RUFSS); in the case of Skåne, the non-statutory regional spatial development policy emphasises TOD, and in addition there is specific guidance from the PTA on urban development close to stations [37, 40]. As for the Öxnared case, there is no equivalent regional strategy policy supporting TOD in the Västra Götaland region. However, Region Västra Götaland promotes the building of a strong regional commuter train network and generally, at a strategic level at least, aims for the integration of land-use and public transport [34, 35].

Although there were supporting planning structures, in all cases these lacked clarity and any attempt to quantify what TOD is in terms of minimum densities, distances from public transport stops or minimum levels of public transport accessibility. Interviewees 1–5 highlighted that in the case of Öxnared, the definition of TOD came primarily from the municipality and its planning documents, which proposed the concept of higher-than-normal density development closer to public transport nodes and along public transport corridors, but did not operationalise this with any quantified definition; and this lack of clarity caused uncertainty. Interviewees 1, 2 and 5 felt that this may have contributed to the concerns of existing inhabitants in the area on issues such as perceived lack of road capacity and the fear of development causing safety issues for those crossing the railway line, and parking problems in the area.

In contrast, in Kävlinge both the municipality and the developer, whilst again not quantifying TOD, defined it in clear terms as a form of development more urban and higher density than the largely car-based residential development that has been the norm in Kävlinge up until now (interviewees 7–9). As one of the two interviews from the municipality said when asked to describe the development (interviewee 7):

*The plan structure, the mosaic: there are alleys and pedestrian streets that are a bit winding. The low levels of traffic invites you to walk there or bike there, the children should be able to play on the street, it is a bit more the character that you have sketched for when the plan was made.... It should be more difficult to take the car for every trip. Three parking garages are also planned for, which of course frees up land for other things and you then concentrate the car parking in these parking garages instead of on the streets or large parking areas. ... This makes the area more pleasant.*

In Västerhaninge, the long tradition of TOD in the Stockholm region made it almost unthinkable that the (re-) development of the area would *not* be planned

around access by public transport—this is just the way of doing things here. This aim was shared between all parties, according to interviewees 10–13. However, there was not a wholly unified common vision of the development in Västerhaninge—there were disagreements between developer and municipality about the level of density that should be achieved, whether or not the development should contain a mix of uses, and the amount of space that should be devoted to the bus terminal (we describe this in more detail in Sect. 4.3).

Overall, regarding definitions and policy, it is clear that policy documents can function as an enabler, although in the Öxnared case it is unclear if a regional development strategy that strongly supports TOD could have benefited the TOD planning process. These documents may have legal weight, such as a municipal local plan; or they may not, such as Kävlinge's Densification Strategy [39].

### 4.3 Governance processes

In Västerhaninge, there was disagreement between PTA, municipality and developer on the amount of land that should be given over to the bus terminal—the PTA wanted much land because it wanted to safeguard public transport operations in the future—and also between municipality and developer on the mix of uses in the development. Ultimately, the developer was forced to accept what it viewed as a sub-optimal solution, because the municipality and PTA resolved issues between themselves prior to presenting this to the developer; and also because, as land owner, the municipality was in a powerful position. As interviewee 13 from the developer said:

*You do not want this gigantic area with buses. It takes up a lot of space. Land that could otherwise have become homes that are worth a lot... Although we had presented a proposal that we thought would work, there was never a discussion about what that land is worth and what it should be used for. Yes, it landed in that we had to accept and come up with a proposal then that had fewer homes.*

Yet regarding the same issue, the municipal planner interviewed commented (interviewee 10):

*I think it is important that the municipality and [the PTA] are, as it were, on the same path around what we want before, as it were, letting in too many outside [i.e. private actors]. It is difficult for a property developer to see the value in the bus terminal for the entire municipality.*

In Kävlinge, whilst the working relationship between the municipality and the developer was generally constructive and mutually supportive, there were still some disagreements, primarily regarding how and how much



of the parking demand at the site could be accommodated in different types of parking. However, the relations between actors generally worked well in Kävlinge and there were important processes of collaboration according to interviewees. Municipality interviewees 8 and 9 explained that the municipality and the property developer has worked well together because of a “common picture” of the project that has been developed by jointly producing planning documents that describe the design of the new built environment. There has also been processes of learning that enabled TOD. In Kävlinge, interviewee 7 from the developer, claimed to have acted as something of a “champion” of the development, often providing resources to the municipality to help it to carry out some of its planning processes and to build its competence in planning for more urban type development. This was an enabling factor, although there was arguably also a risk of “stakeholder capture” of the municipality by the developer—that is, of the developer becoming the party that steers the relationship rather than vice versa.

The previous paragraphs show that both formal policies and informal processes existed in these cases and were enablers of TOD, but there were informal processes that acted as barriers and had to be overcome—or, in the case of Öxnered, not overcome. Here, there was opposition from the relatively few current residents close to the station—all of whom live in single family houses—to the municipality’s plans for flatted development to a maximum height of 14 m. As interviewee 3 from the municipality said:

*... the municipality wanted to build taller and denser buildings adjacent to the station. Those already living in the area today they did not agree with us about it so that we have had to sort of reduce the ambitions to satisfy those who already live in the area then. You do not want high-rise buildings that are a full four floors high next to your villa so that we have had to reduce the degree of exploitation and the height of the buildings adjacent. So now the largest buildings in this area, are located as far away as possible from the station really... it is not at all as we had thought from the beginning.*

Overall, regarding governance processes, it is clear that TOD planning in these cases was foremost shaped by actor interactions and negotiations, emphasising that the individuals working with TOD perceptions of what is, or is not, TOD, can both be an enabler and a barrier. Relating to this, an important observation is that local administrations may lack sufficient resources and skills to plan for a more urban type development, where it is not the norm.

## 5 Concluding discussion

The results show that there are some important conditions for TOD in the empirical cases. The regional context of which these projects are a part of is also of key importance. It is the increasing property prices and customer perceptions of quality of life in different parts of the metropolitan region that pushes development to lower density locations well served by public transport. In terms of enablers to the TOD sites considered in this research, some key factors have emerged. These are, primarily, a common vision (or definition) shared between developer and municipality about the nature of the TOD at the site; the involvement of a developer, particularly in locations where TOD is not the norm, and a developer acting as a champion identifying market conditions supportive of denser development; a land ownership situation where the land is not split between several landowners; and the existence of both formal policies and processes (such as supportive regional planning policy) and of effective informal ways of working between the different actors involved.

Barriers to TOD in these areas can often be seen as the converse of the enablers, for instance poor market conditions make it difficult to justify higher densities, which makes it problematic to attract in a sizeable developer to drive the TOD development forward. In such situation, as the Öxnered case illustrates, the local administration might consider planning instead for suburban and less denser development, and thus risk locking in to a spatial structure which may be difficult to densify in the future. In such situation, the lack of a common—and guiding—vision of what the TOD ought to be may be exacerbating the barriers to delivering TOD. The findings also show that market conditions for higher densities, as in the Kävlinge case, does not necessarily entail a demand for mix-use development. Disagreements between key actors about key aspects of the development act as an important barrier; and in one of the cases, it is obvious that a key actor that was not taken into account in drawing up the plans for the area was the public living in the existing housing around the site, and this ultimately made the TOD impossible.

To conclude, the results show that many of the barriers and enablers are rather similar to those identified in research on TOD in much more urban contexts in other parts of the world, but they are differently nuanced in the low density contexts studied here. The lack of clear quantified definitions of what TOD is (or is not), for example, is a potential barrier but it allows a more flexible, site-specific understanding of TOD in that context to emerge. However, it is important that a shared vision of TOD in that location is developed—and such a shared vision appears to be crucial for the development to have

a good chance of being delivered. Informal definitions, and individual perceptions (including those of the public) are important; and in locations that are quite ‘marginal’ for TOD, all enablers must interact together positively for the development to have the maximum likelihood of going ahead as planned.

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Data collection and first analysis of interviews and plans: RH, LO and FPL. All authors contributed equally to the writing of the article. All authors read and approved the final manuscript.

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#### Availability of data and materials

Not applicable.

#### Declarations

#### Competing interests

The authors declare that they have no competing interests.

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