Failure of Transit-Oriented Development in Bangkok from a Quality of Life Perspective

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Abstract: Urban mass rapid transit-oriented development is increasing in developing Asian megacities. However, there are concerns about whether transit-oriented development attracts and allows transit users to live nearby. This study aims to examine the relationship between quality of life (QOL) and bid rent among socioeconomic groups living near rapid transit stations in Bangkok. The levels of various residential QOL indicators were classified into access, amenity, and safety elements. These indicators and their values by socioeconomic groups were examined in station and no-station areas using data from a questionnaire survey of local residents in Bangkok. The QOL indexes and bids for rent were estimated by socioeconomic group and by residential location. The results showed that low-income residents, who most frequently use mass transit, have higher QOL in station areas than in no-station areas, and high-income residents, who rely more on cars, have the highest bid rent.

Keywords: Transit-Oriented Development, Quality of Life, Bid Rent, Bangkok

1. INTRODUCTION

Land-use transport planning is increasingly required for sustainable development in Asian developing countries, which are facing rapid growth in environmental emissions due to their economic growth (IPCC, 2014). The transport sector is one of the most responsible for the emissions from motorization and urban sprawl in urban areas. Previous studies revealed that environmentally sustainable transport can be realized only if stringent behavioral adaptations and spatial structure changes occur along with extensive technological development (Geurs and Van Wee, 2004; Banister and Hickman, 2013). Such behavioral changes encourage local residents not to rely on cars by developing integrated land-use transport systems in a more transit-oriented manner, which is suggested to be more effective at an earlier stage of urban growth (Nakamura et al., 2013).

Unfortunately, developing Asian megacities have failed to develop sustainable land-use transport systems and suffer from serious traffic congestion in the midst of their urban growth. It is not surprising that they have given much less priority to environmental policies than economic policies. However, their serious traffic congestion issues have caused not only

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environmental problems, but also problems affecting socioeconomic activities. Conventional transport policies have paid more attention to road-oriented development for short-term solutions against traffic congestion, but they have worsened the problem by increasing traffic. Recently, developing Asian megacities have been developing mass rapid transit (MRT) systems, such as urban rail transit, and bus rapid transit (BRT) systems, as a longer-term solution to traffic congestion. As one of the representative examples, Bangkok investors in transit-oriented development have drastically shifted their investment plans from road development to MRT development during the 2000s, which improved traffic congestion from the worst levels experienced in the early 1990s (Wasuntrarasook and Hayashi, 2013).

Nevertheless, land-use planning has been left behind by the pace of growth in Bangkok. Private transit-oriented development has increased in the city center because little attention was given to planning for transit-oriented development around MRT stations. As a result, transit-oriented development has focused on providing large car parks for a car-oriented lifestyle and it is questionable whether this development contributes to transit ridership. This finding might suggest that transit access is not properly valued in transit-oriented development. Accordingly, the policy effectiveness of transit-oriented development needs to be evaluated from perspectives of comprehensive residential quality of life (QOL) and affordability. On the one hand, people with a car-oriented lifestyle may obtain higher QOL from living near stations because of the better amenity facilities in these areas, including large car parks, rather than because of better access to transit options. This may result in more traffic congestion in station areas, which damages QOL. On the other hand, people with a transit-oriented lifestyle living near stations may have higher QOL because of greater access to transit options, but may not be able to afford to live there. These lifestyle differences may depend on socioeconomic characteristics such as income and age. Therefore, QOL evaluation for transit-oriented development may be useful to modify land-use transport policies to enhance QOL for various socioeconomic groups living in station areas and encourage them to use the transit options available.

To evaluate the quality of land-use transport systems comprehensively from the perspective of residents, the QOL index considers various QOL elements, such as access, amenity, and safety (Hayashi and Sugiyama, 2003; Doi et al., 2008). The QOL index is equivalent to the value of a utility function of location choice based on local residents by socioeconomic group, which can be translated into various units of measurement, such as bid rent in monetary terms, as shown by the classic location theory (Alonso, 1964). Although its application has been limited to academic research in developed countries, the application to developing Asian megacities may be able to reveal whether transit users value the residential quality of station areas more than car users do.

Therefore, this study aims to examine the relationship between QOL and bid rent among socioeconomic groups in station areas in Bangkok. The study consists of three parts. The first part summarizes a methodological framework for the QOL index. The second part examines data from a questionnaire survey, including socioeconomic characteristics and residential quality indicators by location. The third part estimates the QOL indices and bids for rent for comparative analysis by socioeconomic group and by residential location.

2. THE QUALITY OF LIFE INDEX

2.1 Theoretical Background

The concept of QOL was developed to evaluate well-being and happiness from multiple
theoretical angles, and is affected by urban policies (Diener and Suh, 1997; Kahneman, 1997, Frey and Stutzer, 2002). QOL indices were initially developed as part of city-based sustainability indices to measure the progress of urban policies by selecting indicators that compose QOL (Besleme and Mullin, 1997; Briassoulis, 2001; MacMahon, 2002). To reflect residents’ subjective priorities comprehensively, another QOL index was created to include both objective QOL domains and individuals’ subjective evaluations for these domains (Felce and Perry, 1995; Diener and Suh, 1997). In transport studies, the objective status of life domains can be measured with levels of satisfaction using the physical characteristics of land-use transport systems (Doi et al., 2008).

The latter QOL index is advantageous for evaluating residential quality of land-use transport systems because it is able to consider various QOL elements and their diverse values by socioeconomic groups. First, a comprehensive and simple range of life domains can be included in the index as QOL elements, such as job, finances, house, health, leisure, and environment (Van Praag et al., 2003; Poortinga et al., 2004; Doi et al., 2008; Senlier, 2009). QOL evaluation for land-use transport systems pays greater attention to the ease of access from residential locations to various opportunities for socioeconomic activities (Lotfi and Koohsari, 2009). Conventional transport studies have focused on access to employment activities, such as commuting, but the QOL index includes access to noncommuting activities (Doi et al., 2008). The contribution of access to QOL can also be compared with other elements of residential quality, such as amenity and safety (Kachi et al., 2005; Nakanishi et al., 2013).

The second advantage of the QOL index is its ability to capture socioeconomic differences in the value of each QOL element. The value difference may be consistent with Maslow’s (1954) hierarchy of needs, such as when basic QOL demands become satisfactory, higher-class demands become more important. Doi et al. (2008) suggested that safety is the most basic demand in the QOL value mechanism, followed by economic opportunity, service cultural opportunities, spatial amenity, and environmental benignity. The value of access to various opportunities may be attributed to this hierarchy of needs, depending on income, time budget, and physical ability by socioeconomic group, which is called social accessibility (Kenyon et al., 2002). As the different socioeconomic group values may generate different needs for sustainable transport (Steg and Gifford, 2005), social accessibility is particularly important for evaluating social exclusion (Preston and Raje, 2007). For instance, people with lower mobility, such as poor and elderly people, have more difficulty in accessing opportunities, which results in mobility-related social exclusion (Kenyon et al., 2002). The QOL indexes by socioeconomic group can identify the level of social exclusion.

However, little is known about social exclusion in transit-oriented development in developing Asian megacities. A comparison of the contributions of access for transit users and amenity for car users should be evaluated using the QOL index in developing Asian megacities. Transit-oriented development may fail if car users have higher bid rent based on their QOL in station areas than transit users do. As the level of car reliance may also depend on income and age, it is important to capture the differences in QOL and bid rent by income and age.

2.2 Quality Indicators

Indicators of residential quality to be analyzed should be minimized to develop a more generic evaluation tool applicable to many cities with easier data collection. In this study, key quality indicators were selected from a list of potentially important factors taken from previous studies (Kachi et al., 2005) by conducting a presurvey evaluation of local residents
in Bangkok. The selected factors were classified by QOL element into access (work, shop, school, and hospital), amenity (house size, streetscape, and green areas), and safety (crime, accidents, flooding, and air pollution). The levels of the indicators for access and house size were measured objectively with time and the percentage of difference from respondent’s current house size, respectively. Factors for amenity and safety were measured with subjective levels of satisfaction taken from a survey.

The selected quality indicators reflect the local contexts of Asian developing countries. In terms of amenity, their large income disparity results in disparities in house and neighborhood quality, such as house size and streetscape. Green areas may be important to moderate the effect of hot weather in the local climate of Southeast Asia. As for safety, flooding is also one of the major problems caused by natural disasters in Southeast Asia. For instance, Bangkok experienced serious flooding in 2011, which damaged many urban facilities and farmland areas, and it took months for the water to drain away. In addition, air pollution caused by rapid economic growth and motorization is another serious problem experienced by many Asian developing cities.

2.3 Analytical Model of QOL

The analytical model for the QOL index was constructed using a linear utility function that consists of the quality indicator levels weighted by their value parameters for local residents. All quality indicator levels were entered into the model as the level of satisfaction, in which the levels of the objective indicators are subtracted by their neutral levels of satisfaction that are explained in the next section.

The QOL index can be measured with various units by standardizing the parameters. Theoretically, the QOL index was developed using the utility of location choice by accounting for a constant term in conventional utility with the various quality indicators. In location-choice modelling, utility is interpreted as bid rent subtracted by actual rent, which is called the location surplus (Tomita et al., 2003). This study measures the bid rent using the QOL index by modelling the influences of the quality indicators on bid rent with their value parameters standardized by the value parameter of rent cost. In the index, the quality indicator levels are subtracted by the average levels relatively. The QOL index is measured by the unit of percentage of willingness to pay for rent compared with household income, and bid rent is thus measured by multiplying the QOL index by household income. Therefore, the models are as follows:

\[
QOL_{s,i} = \sum \beta_{s,l} \cdot (X_{i,l} - \bar{X}_{s,l})
\]  
\[
QOL'_{s,i} = \frac{QOL_{s,i}}{\beta_{s,rent}}
\]  
\[
BR_{s,i} = QOL'_{s,i} \cdot I_s
\]

where \(QOL_{s,i}\), QOL index without unit standardization of residential location \(i\) for socioeconomic group \(s\); \(X_{i,l}\), level of quality indicator \(l\) of location \(i\); \(\bar{X}_{s,l}\), average level of quality indicator \(l\) for socioeconomic group \(s\); \(\beta_{s,l}\), value parameter of quality indicator \(l\) for group \(s\); \(QOL'_{s,i}\), QOL index with the unit of percentage of willingness to pay for rent to household income of location \(i\) for group \(s\); \(\beta_{s,rent}\), value parameter of rent cost for group \(s\);
$BR_{i,s}$, bid rent of location $i$ for group $s$; and $I_s$, household income of group $s$.

### 2.4 Value Parameters

The value parameters are estimated using stated preference (SP) data from a questionnaire survey about local residents’ location preference choices between two hypothetical residential area options with different quality indicator levels. The advantage of the SP analysis is that it considers how local residents’ values influence their location choices, compared with conventional location behavior analysis using revealed preference (RP) data. First, SP analysis can comprehensively capture the value structure by socioeconomic type by explicitly identifying all the value parameters, while the RP behavioral analysis can only find the limited parameters that are reflected by the behaviors. Moreover, another advantage is a flexible analysis of the potential preferences for various land-use transport systems, including those that are less frequently experienced by local residents. This is particularly important for Asian developing countries because their local residents are yet to become familiar users of MRT.

Parameters were estimated with a binary logit model using the maximum-likelihood method. In the questionnaire design, the two hypothetical options are set by differently combining good and bad cases of each quality indicator for conjoint analysis (Table 1). The quantitative indicator of access is set to represent a reasonable range of time for local residents. In the QOL indexes, the neutral satisfaction levels are set using the existing average time of all the socioeconomic groups in the study area by activity purpose taken from the survey. Because the qualitative indicator levels may be hardly quantified, they are introduced as dummy variables to represent the subjective satisfaction levels, which sets 1 for good quality and 0 for poor quality. Thus, 0.5 is the neutral level of satisfaction.

In this study, a questionnaire survey was conducted through interviews. In the survey, local interviewers first explained each indicator choice to local resident respondents in Thai. The respondents were asked to choose one of two hypothetical residential area options. Around 10 choice pairs selected from an orthogonal array were provided to each respondent to test the range of the trade-off relationships between the indicators. Due to limited available time for on-street interviews, this study split the questionnaire into three parts to ask about the

**Table 1. Quality indicator levels for hypothetical residential areas in the questionnaire**

<table>
<thead>
<tr>
<th>Element</th>
<th>Indicator</th>
<th>Good case</th>
<th>Bad case</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access</td>
<td>Work</td>
<td>40 minutes</td>
<td>60 minutes</td>
</tr>
<tr>
<td></td>
<td>Shop</td>
<td>30 minutes</td>
<td>60 minutes</td>
</tr>
<tr>
<td></td>
<td>School</td>
<td>15 minutes</td>
<td>45 minutes</td>
</tr>
<tr>
<td></td>
<td>Hospital</td>
<td>15 minutes</td>
<td>45 minutes</td>
</tr>
<tr>
<td>Amenity</td>
<td>House size</td>
<td>15% larger</td>
<td>15% smaller</td>
</tr>
<tr>
<td></td>
<td>Streetscape</td>
<td>Good</td>
<td>Poor</td>
</tr>
<tr>
<td></td>
<td>Green</td>
<td>Good</td>
<td>Poor</td>
</tr>
<tr>
<td>Safety</td>
<td>Accident</td>
<td>Good</td>
<td>Poor</td>
</tr>
<tr>
<td></td>
<td>Crime</td>
<td>Good</td>
<td>Poor</td>
</tr>
<tr>
<td></td>
<td>Flood</td>
<td>Good</td>
<td>Poor</td>
</tr>
<tr>
<td></td>
<td>Pollution</td>
<td>Good</td>
<td>Poor</td>
</tr>
<tr>
<td>Cost</td>
<td>Rent</td>
<td>15% of income</td>
<td>25% of income</td>
</tr>
</tbody>
</table>
indicators for access, amenity, and safety, respectively. All value parameters in the three parts were integrated through the rent parameter. The rent indicator is included in all questionnaire parts to standardize the unit of the QOL index by dividing the value parameters of the other indicators by the value parameter of rent, as in equation (2). As a result, these three questionnaire parts have the same QOL unit, which can be integrated as the sum of them. Although there might be differences in the values of each part of the questionnaire from different respondents, this approach can sufficiently capture the value characteristics by socioeconomic group, which is the focus of this study rather than the individual value differences.

2.5 Comparative Analysis

This analysis estimates and compares the quality indicator levels, the value parameters, the QOL indexes, and bids for rent by residential location and by socioeconomic group. Based on the current residential locations of respondents taken from the survey, the quality indicator levels are compared between station areas within 1 km from MRT stations, including Skytrain, Blue Line Metro, and Airport Rail Link, and outside no-station areas. Although 1 km is longer than the normal walking distance, this study considers it as an expanded catchment area for MRT because of popular paratransit services, such as motorcycle taxis and minibuses.

The comparison is made not only for the quality indicator levels, but also for the value parameters among socioeconomic groups because they may live in different types of houses and locations, and have different values for them. The value parameters may differ by factors attributed to behavioral habits, such as residential locations and primary transport modes. However, this study focuses on the differences between socioeconomic groups for simplification of analysis. This study classified these respondents into simpler socioeconomic groups by income and age, considering prospective socioeconomic trends of economic growth and aging. This classification was made to reflect the socioeconomic characteristics of Bangkok residents through discussion with local researchers. As a result, respondents were divided by household income into more than 100,000 baht/month for high-income residents, less than 20,000 baht/month for low-income residents, and the remainder for middle-income residents. They are also divided by age, depending on whether they are working age, younger than 60 years (<60 years), or older (>60 years).

3. QUESTIONNAIRE SURVEY

3.1 City Case Study

We conducted a SP questionnaire survey from November 26 to December 1, 2012 in Bangkok as a case study of developing Asian megacities. In the 1960s, city planning in Bangkok designed a car-dependent city based on American-style development by constructing wide roads, and mostly ignoring rail development. However, despite extensive road development, the road network capacity could not meet the growth of traffic demand. As a result, traffic congestion became so serious that the average speed of cars drastically decreased from 15 km/h to 7 km/h from 1986 to 1993 (Hayashi et al., 2011). Recently, MRT development in Bangkok started with Skytrain in 1999, Blue Line Metro in 2004, and Airport Rail Link in 2010. This development has created approximately 80 km of rail mass-transit corridors. This is a different transport situation from those in developed cities where people are already familiar with mass-transit use. While MRT development has increased the mass-transit
ridership in Bangkok, there remains a strong preference for car use.

However, there is an increase in private residential development around MRT stations in inner Bangkok, which are is likely to be designed for higher-income residents, such as gated condominium developments with large car parks and high-quality amenity facilities in the city center. Sanit et al. (2013, 2014) suggested that there is an increasing demand for accommodation by middle-income residents who move to station areas and shift their travel modes to MRT. Nevertheless, they also pointed out that the quality of residential properties may be more important for the location choices of high-income residents than convenient access to MRT stations. City planning has hardly intervened in such private transit-oriented development.

3.2 Socioeconomic Characteristics

The survey interviewed 180 respondents for each part of the questionnaire, with 540 respondents in total. The sample covered the diversity of socioeconomic characteristics of respondents and collected data from different types of income and age groups. Various locations for the interviews were chosen, such as business areas for high-income residents, public offices for low-income residents, shopping areas for young people, and public parks for elderly people. To avoid the spatial bias of respondents, the survey was conducted in central business district areas, such as Pom Prap Sattru Phai, Silom, and Lumpini, and in suburban areas, such as Thawi Watthana. The socioeconomic distribution of respondents comprised high-income residents (7%), low-income residents (19%), and residents aged >60 years (12%). These respondents have a similar socioeconomic distribution to official statistics for Bangkok, which is 6% of high-income residents and 11% of residents aged >60 years, although the share of low-income residents in the survey is not as high as the official statistic (43%).

Figure 1. Residential location and car ownership of the survey respondents
The socioeconomic characteristics of residential location and car ownership for respondents’ households are summarized in Figure 1, which clearly shows that car ownership, defined as the number of cars in each household, increases as income increases, which results in a significant gap in car ownership between low- and high-income residents. This may suggest that, while low-income residents use transit most, high-income residents use cars most. Although the differences by age are less significant, higher car ownership is shown for older people up to 60 years old. The share of residents in station areas does not show a clear pattern according to income and age. Car ownership in station areas is not so different from that in no-station areas. This might suggest that residents in station areas may not necessarily behave in a transit-oriented way.

3.3 Quality Indicator Levels

3.3.1 Access

Respondents were asked about their quality indicator levels in their current residential areas in the questionnaire survey. In terms of the access indicators, the survey asked respondents about their average travel time by purpose. Figure 2 shows the access indicator levels by socioeconomic group and by residential location, which shows that higher-income residents travel longer for shopping and school. In the middle-income group, people aged >60 years travel longer for shopping, school, and hospital visits than people aged <60 years. These results suggest greater travel demands related to nonwork activities as residents age and earn more.

While low-income residents in station areas travel shorter distances than do those in no-station areas, higher-income residents in station areas have longer travel times for work,

Figure 2. Levels of access indicators by residential location
shopping, and hospital visits. This may reflect residents’ different cost budgets for travel related to their income. On the one hand, low-income residents with smaller cost budgets can save time and costs with better transit services by moving closer to stations. On the other hand, higher-income residents with larger cost budgets can enjoy better mobility by living in station areas, but travelling longer. Nevertheless, it is questionable how often high-income residents use MRT instead of cars. If station areas attract high-income residents who do not become mass-transit users, their longer travel times may only result from more traffic congestion in station areas.

As for the age differences in the middle-income group, while travel time for work is shorter in station areas despite their age, people aged >60 years travel longer for shopping and hospital visits. This difference may be attributed to time budgets for travel. Elderly people are less engaged in work-related activities and spend more time on nonwork-related activities, including travel. This travel pattern is more prominent in station areas with higher mobility. In this way, we find that the location of residences in station areas does not necessarily lead to shorter travel times for all socioeconomic groups.

3.3.2 Amenity and safety

Figure 3 shows the level of satisfaction for amenity and safety indicators by socioeconomic group and by residential location. As for the indicator of house size, high-income residents and middle-income residents aged >60 years have larger houses. Nevertheless, the indicators of amenity and safety are not necessarily higher for them. The satisfaction levels of streetscape and safety are rather low for high-income residents. This may suggest that high-income residents demand higher levels of satisfaction, which may result in more difficulty in being satisfied with them.

While middle-income residents aged <60 years have smaller houses in station areas than
in no-station areas, middle-income residents aged >60 years and high-income residents have larger houses in station areas. This may reflect characteristics of private residential development around MRT stations that does not necessarily compromise floor space.

While low-income residents and middle-income residents aged <60 years in station areas have lower levels of satisfaction with streetscapes and green areas than those in no-station areas, high-income residents have higher levels of satisfaction. This may suggest that the increasing number of private residential development in station areas provides them with quality facilities and open spaces in gated condominium developments.

The safety levels are lower for all socioeconomic groups living in station areas than in no-station areas. High-income residents in station areas have a particularly low level of safety. As high-income residents are targeted more by criminals, they may expect a higher level of safety in station areas.

4. ESTIMATION OF QOL AND BID RENT

4.1 Value Parameters by Socioeconomic Group

The value of quality indicators was analyzed by estimating the value parameters with the survey data. The results are statistically significant with the sufficient levels of a likelihood

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Low-Income</th>
<th>Middle-Income Under 60</th>
<th>Middle-Income Over 60</th>
<th>High-Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Work</td>
<td>0.40</td>
<td>0.32</td>
<td>0.18</td>
<td>0.29</td>
</tr>
<tr>
<td>Shop</td>
<td>0.31</td>
<td>0.32</td>
<td>0.25</td>
<td>0.42</td>
</tr>
<tr>
<td>School</td>
<td>0.14</td>
<td>0.18</td>
<td>0.26</td>
<td>0.21</td>
</tr>
<tr>
<td>Hospital</td>
<td>0.22</td>
<td>0.28</td>
<td>0.42</td>
<td>0.49</td>
</tr>
<tr>
<td>Rent</td>
<td>0.50</td>
<td>0.42</td>
<td>0.39</td>
<td>0.31</td>
</tr>
<tr>
<td>L-ratio</td>
<td>0.30</td>
<td>0.22</td>
<td>0.21</td>
<td>0.29</td>
</tr>
<tr>
<td>Samples</td>
<td>333</td>
<td>1047</td>
<td>237</td>
<td>275</td>
</tr>
<tr>
<td>Amenity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>House size</td>
<td>0.22</td>
<td>0.27</td>
<td>0.32</td>
<td>0.56</td>
</tr>
<tr>
<td>Streetscape</td>
<td>0.18</td>
<td>0.36</td>
<td>0.39</td>
<td>0.56</td>
</tr>
<tr>
<td>Green</td>
<td>0.15</td>
<td>0.36</td>
<td>0.36</td>
<td>0.44</td>
</tr>
<tr>
<td>Rent</td>
<td>0.79</td>
<td>0.68</td>
<td>0.65</td>
<td>0.50</td>
</tr>
<tr>
<td>L-ratio</td>
<td>0.56</td>
<td>0.41</td>
<td>0.37</td>
<td>0.39</td>
</tr>
<tr>
<td>Samples</td>
<td>354</td>
<td>1212</td>
<td>170</td>
<td>110</td>
</tr>
<tr>
<td>Safety</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accident</td>
<td>0.12</td>
<td>0.38</td>
<td>0.38</td>
<td>0.54</td>
</tr>
<tr>
<td>Crime</td>
<td>0.29</td>
<td>0.45</td>
<td>0.50</td>
<td>0.47</td>
</tr>
<tr>
<td>Flood</td>
<td>0.44</td>
<td>0.77</td>
<td>0.73</td>
<td>0.78</td>
</tr>
<tr>
<td>Pollution</td>
<td>0.14</td>
<td>0.34</td>
<td>0.49</td>
<td>0.49</td>
</tr>
<tr>
<td>Rent</td>
<td>0.68</td>
<td>0.38</td>
<td>0.36</td>
<td>0.28</td>
</tr>
<tr>
<td>L-ratio</td>
<td>0.58</td>
<td>0.60</td>
<td>0.59</td>
<td>0.71</td>
</tr>
<tr>
<td>Samples</td>
<td>287</td>
<td>1083</td>
<td>149</td>
<td>109</td>
</tr>
</tbody>
</table>
ratio (L-ratio), showing the different value by socioeconomic group (Table 2), which understandably reflects the context of developing Asian megacities. The table parameters are estimated for the levels of quality improvement from the bad to the good cases in Table 1.

### 4.1.1 Value parameters by income group

The value parameters among low-income residents, middle-income residents aged <60 years, and high-income residents are compared. The value parameter of rent cost is higher for lower-income residents, which may reflect their greater cost burden. Moreover, access to work is valued higher by lower-income residents, but the value parameters of access to shopping, schools, and hospitals are higher for higher-income residents. This result may suggest that higher-income residents care more about nonwork-related activities, which is consistent with the previously shown pattern of the quality indicator levels.

However, it is interesting that the value parameters of safety indicators are higher for higher-income residents. Because safety is supposed to be a more basic demand in the hierarchy of needs, low-income residents are expected to value it more highly. There may be a number of possible interpretation of these results. First, Bangkok has been sufficiently developed for low-income residents to secure the minimum level of safety. Moreover, higher-income residents may be more vulnerable to safety problems. Driving cars may have higher risks of traffic accidents than riding on buses. Higher-income residents are more likely to be the targets of burglars. Floods may cause more economic damage to owners of larger properties. There is also another possibility that some of the safety indicators, such as flooding and pollution, are more related to the environment, which is suggested to be a greater concern for higher-income people (Doi et al., 2008). Furthermore, these environmental problems are not easily expectable unless people experience them. This is explicitly reflected by the much higher value for flooding than the other indicators because of the incident in 2011.

### 4.1.2 Value parameters by age group

We also compared the value parameters by age in the middle-income groups. On one hand, the value parameter of access to work is higher for people younger than 60 years. On the other hand, the value of access to hospitals is particularly high for people aged >60 years because they may need more medical care. They also value amenity indicators higher.

As for the safety indicators, people aged >60 years care more about pollution and crime. As people age, they have more difficulty in dealing with these safety problems because of their deteriorating physical abilities. Elderly people may not be able to escape from burglars. Pollution might cause more serious damage to their health. Nevertheless, flooding was valued higher by working-age residents, which may be because of their higher concerns about flood-related damage to their work activities.

### 4.1.3 Overall value structure

The value levels of the quality indicators were integrated to be comparable among ones for access, amenity, and safety factors. The value parameters were first divided by the parameter of rent cost, which represents the equivalent level of rent saving to an improved level of quality indicators. Then, to clarify the overall value structure by socioeconomic groups, the parameters of the indicators, including that of rent cost, were divided by their total among all of the indicators. This represents the contribution of each quality indicator to the QOL index.
While flooding is valued highly by all residents, the value parameters of the other indicators clearly vary by socioeconomic group. Low-income residents value cost (rent) and access much more than the others. While middle-income residents value access to work and safety, higher-income residents value access to nonwork-related activities, safety, and amenity. The value parameters for people aged >60 years are between the value parameters for middle- and high-income residents, who highly value access to hospitals. These results may suggest that, according to increases in income and age, residents’ values shift from work-related activities to nonwork-related activities. This may be consistent with the hierarchy of needs, but the value of safety is more complicated, which can be not only valued as a basic demand, but also revalued more highly by a higher-income residents.

4.2 QOL and Bid Rent Levels

Using the quality indicator levels and their value parameters, the comprehensive quality levels of station areas were estimated using the QOL index and bid rent. The QOL level of station areas is perceived differently by socioeconomic groups because each quality indicator contributes differently to their QOL levels. Figure 5 shows the contributions of access, amenity, and safety to the QOL indexes by comparing station areas and no-station areas. The contribution to QOL can be negatively evaluated because the relative quality indicator levels are used, subtracted by the average levels, in which the average level of the qualitative indicators is set as 0.5. Middle-income residents aged >60 years and low-income residents have higher levels of QOL in station areas than the other socioeconomic groups. Only low-income residents have much higher QOL in station areas than in no-station areas.

On the one hand, the high QOL of low-income residents is attributed to their different values for quality elements. For low-income residents, the level of access is high for them in
station areas and a high level of access contributes most to the high QOL in station areas. This may suggest that low-income residents value access to mass transit in their location preferences because they have the greatest demand for mass transit. Although the slightly positive contribution of access is made to QOL in station areas for middle-income residents aged <60 years, transit access is not positively valued for middle-income residents aged >60 years and high-income residents, who are more car-reliant.

On the other hand, for middle-income residents aged >60 years, who have the highest QOL, safety and amenity contribute more to their QOL. Safety and amenity significantly contribute to QOL for middle- and high-income residents, according to their value structure. Safety contributes more to QOL in station areas for middle-income residents and amenity contributes more to QOL for high-income residents. This may reflect the hierarchy of needs, in which amenity is a higher-class need. Particularly, while the contribution of safety to QOL is lower in station areas for middle-income residents aged >60 years and high-income residents, the contribution of amenity is higher for them in these areas. This may suggest that increasing private residential development around MRT stations is designed for higher-income people, equipped with high-quality amenity facilities, despite the advantages of transit access.

However, bids for rent, estimated using income by socioeconomic group and by residential location, show a different pattern from the QOL indexes (Figure 6). The estimated bids for rent are within a reasonable range of actual rent reported in this survey, which is from around 2,500 baht/month to around 15,000 baht/month. Bids for rent depend more on income. The result shows that low-income residents have high bids for rent in station areas, but high-income residents have much higher bids for rent in these areas. It can account for a problem that, although low-income residents, who demand better access to mass transit, have a greater preference for station areas for their residences, the station area is more frequently occupied by high-income residents, who are more car-reliant and demand better amenities in high-quality residential developments in these areas.
5. CONCLUSIONS

This study examined the relationship between QOL and bid rent among socioeconomic groups in station areas in Bangkok as a case study of developing Asian megacities. The characteristics of station areas with the levels of indicators of residential quality were identified, and found to be different between socioeconomic groups. Shorter travel times, which are commonly suggested to be one of the advantages of transit-oriented development, may not be enjoyed by all of the socioeconomic groups in station areas. While low-income residents travel shorter in station areas, high-income residents and elderly have longer travel times. However, although the satisfaction level of safety is low in station areas, high-income residents and elderly people are happier with the higher amenity levels in station areas because of high-quality private residential developments around MRT stations.

Moreover, the results of this study showed that people value different residential quality indicators according to their income or age. As larger income and time budgets allow greater opportunities for activities, the value of access to nonwork activities and amenities is higher for higher-income residents and elderly. Moreover, while safety is suggested to be most basic demand in the hierarchy of needs, they also value it more highly than younger or lower-income residents. This may suggest that different socioeconomic groups care about different safety problems, which cannot be easily solved by increasing income and age.

Furthermore, the estimation of QOL and bid rent in station areas was made to account for an existing problem of transit-oriented development in Bangkok. Although only low-income residents, who demand better access to mass transit, have higher QOL in station areas, it is less affordable for them to live there because of much higher bids for rent by higher-income residents. The highest bids for rent for high-income residents and elderly people are attributed to the higher contribution of amenities to their QOL in station areas. This may suggest that the current private residential development around MRT stations does not contribute to transit-oriented development to promote transit ridership, and pays more attention to quality development for car-reliant high-income residents.

These findings imply the necessary direction of transit-oriented development to realize sustainable transport systems in developing Asian megacities. Although recent MRT developments in Bangkok may contribute to QOL improvement in station areas, transit-oriented development needs city-planning interventions, such as promotion of transit use and control of car use, to make a greater contribution to transit ridership. Moreover, socioeconomic changes in developing Asian megacities may change the values of local residents by changing their socioeconomic structure. These socioeconomic changes are not
only driven by economic growth, but also by prospective aging. Accordingly, transit-oriented development faces big challenges to ensure that high-income residents and elderly people in station areas are less car-reliant. Further research is required to apply QOL analysis to evaluating planning policies to ensure the success of transit-oriented developments in developing Asian megacities.

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REFERENCES