THE EMERGENCE AND TRANSFORMATION PROCESSES OF WATERFRONT COMMUNITY MARKETS IN THA CHIN RIVER BASIN¹

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Abstract

In this study of "The Emergence and Transformation Processes of Tha Chin River's Waterfront Community Markets," the markets that originated generally in the reigns of King Rama V through to King Rama VII have been studied. The objective was to investigate whether or not the transportation networks and the spatial centrality had any association with and transformation the emergence processes of the Tha Chin River's waterfront community markets. The framework of this study includes the research and analysis of transportation networks that affected the spatial

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⁴ Assistant Professor, Department of Urban and Regional Planning, Faculty of Architecture, Chulalongkorn University centrality of the target markets. To assist the investigation, it seems reasonable to assume that the transportation networks and the spatial centrality had a direct bearing on the process of emergence and transformation of the waterfront community market within the Tha Chin River Basin area. Therefore, the study is separated into three periods using maps from the Royal Thai Survey Department as a means to demarcate the three different time zones namely, the first period (2436 BE - 2484BE) which is shown by the map of 2455 BE - 2482 BE, the second period (2484) BE - 2505 BE) which is indicated in the map entitled L7017, and last but not least, the last period (2506 BE -2554 BE) which is illustrated by the L7018 map.

The outcome of this research study indicate the following. The first and the second periods display some similar maximum global integrator value or an accessibility of spatial centrality which is centered on the border area of Suphanburi and Nakhonpatom provinces, which is the hub of the Tha Chin River basin. In addition, it has been found that in these two studied periods, waterfront community markets continued to emerge one after the other in great number. This is because the areas in both periods had a watery based spatial centrality which, in the past, could offer the ease of both transportation and trading connections to other adjacent areas. On the other hand, in the third period, the hub was moved to the east of the target area. This is because the spatial centrality of more recent times changed from watery based centrality to land based one, and this change contributed a great deal to the various later transformations of waterfront community markets.

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In conclusion, this research study offers greater understanding of the emergence and transformation of waterfront community markets which resulted from the relationship of transportation networks and spatial centrality. However, to get an in-depth understanding of the emergence and transformation processes of waterfront community markets in the Tha Chin River basin, one needs to do a further study which is outside the scope of this paper.

Introduction

This study is about the emergence and transformation processes of the Tha Chin River Basin Waterfront Community markets. The river itself is the most important lifeline and is called by different names: Makham Thao River, Suphan Buri River, Nakhon Chai Si River and Tha Chin River. The Tha Chin River Basin area is an extremely large region located in the middle part of Thailand and covers a distinct land area in the provinces of Chainat, Suphanburi, Nakhonpathom and Samutsakhon. The total area of the basin is approximately 19,536 km² and the province that has its largest share in the Tha Chin River basin is Suphanburi, whilst the province that has the smallest share is Samutsakhon. The Tha Chin River basin is adjacent to the Chao Praya and Mae Klong basins. Geographically, these three basins display very little difference in terms of their contours. They are at almost equal heights above sea level and their slope runs continuously from west to east and ends at the Chao Praya River. (Figure 1)

According to historical study of the evolution of the Tha Chin River basin, the surrounding area from the past including general information on the currently studied areas, and the results of the investigation of geographical maps and interviews, it is feasible to divide the time period into three different time zones.



Figure 1: The boundary of the Tha Chin River basin (devised by the author)

The first period was the era of water and land transportation (2436 BE - 2484 BE). In this period, the emergence of the waterfront community markets was recorded and trading activities began. Water transportation was the main means that helped expand the community and facilitated commercial businesses. Most of these markets were mostly connected by water ways especially main rivers such as Suphanburi River and Tha Chin River. Furthermore, if a canal were dug leading certain direction. waterfront in а community markets would follow in the same direction. Therefore, in the past it was hard to find any communication channel that relied on land transportation because at the time road networks were

hard to come by. In places where there was no river, a few land transportation networks have been found in the form of dirt tracks. This feature was prevalent when the Tha Chin River basin first began to develop. There was an expansion of the area where canals could be used as transportation routes and the opportunity for commerce existed. Consequently, digging a lot of canals attracted people in search of employment, and this, in turn, greatly increased residency around the Tha Chin River basin areas. Increasing community markets around these areas indeed led to mobility, comfort, and increased services for those who could gain access to the markets via both water and land routes.

The second period was the expansion era of water transportation (2485 BE - 2505 BE). The physical development in this period happened with the area around the Tha Chin River basin. This was the result of prior development and the plan to develop a transportation network, to construct the canal network, and to facilitate significant development and changes within a wide area around the Tha Chin River basin and its waterfront community markets. Additionally, there was a foundation of a commercial entity in 2485 BE called Suphan Transportation Co. Ltd., which provided boat transportation between Suphanburi province and the Bangkok metropolis. The company's primary location was at Ngew Rai pier and it had other branches scattered around the Chao Praya and Tha Chin River basins. Travelling to Bangkok from Suphanburi province required a public boat service which was operated on the Suphanburi - Samutsakhon route and stopped at Ngew Rai train station, Tha Na market, and Nakhon Chai Sri which was the last station before the service was finally extended to Bangkok. This company monopolized both the transportation and the public boat service. Many new waterfront community markets were established in this period and the waterfront community markets from first period experienced the same kind of expansion.

The third period was the era of land transportation (2506 BE - 2554 BE). There was a lot of change around the Tha Chin River basin in this period primarily development of due to the land transportation by the local and central governments following the guidelines expounded in the National Economic and Social Development plan. This plan affected the commercial system of the waterfront community markets. Once land transportation became more convenient and efficient, the previous benefits of waterway transportation diminished goods prompting the move of transportation from the waterways to the roads. This caused changes and important developments in the land networks around the Tha Chin River basin. For example, new roads and bridges were built across the Tha Chin River and other canals in the region. This campaign aimed to develop the country following in the footsteps of other developed countries. Therefore, the Tha Chin River basin changed through time mainly due to a decrease in the water transportation network. With this, the potential accessibility of the area of waterfront community market was also reduced affecting the development of the waterfront community markets around the Tha Chin River basin.

This study employed two kinds of tools. The theory of the spatial centrality process is used as the principal concept to support the assumptions made previously. It was deemed appropriate to use the Space Syntax technique because it offered the following three solutions. Firstly, it is physically appropriate to analyze the accessibility of all kinds of transportation networks that can reach a target area. Secondly, it can also show the relationship between transportation networks and special centrality. Thirdly, the latter, in turn, can help interpret each transportation network during a particular period which affected the spatial centrality of a particular area. The other kinds of tools are maps that present detailed information: 2455 - 2485 BE maps, L7017 and L7018 maps. All these maps are from the Royal Thai Survey Department.

The emergence and transformation processes of the waterfront community markets involved the study of the river basin. This study aimed at understanding the development and transformation processes of the waterfront community markets which resulted from the spatial centrality and the availability of a transportation network that had an impact on spatial centrality. The objective was to understand the relationship between the emergence and transformation processes of the waterfront community markets, the transportation network and the spatial centrality. The question for this study was "Were the natural physical structure and major transportation networks of the Tha Chin River basin such as cart tracks, rivers, canals and roads the key variables that affected the accessibility and centrality of some regions of the Tha Chin River basin?" and "What kind of relationship did the natural physical structure and major transportation networks of the Tha Chin River basin, such as cart tracks, rivers, canals and roads, have on the emergence and transformation processes of waterfront community markets?".

Theoretical Background

The comprehension of the emergence and transformation processes of the Tha Chin River's waterfront community markets is based on the theory of natural movement, the theory of economical movement and the theory of spatial centrality whose details are described below;

The theory of 'natural movement' (Hillier et al., 1993) is of the continuous stream of movement in associated areas. It is the direct effect of association networks in a community system. The theory of natural movement focuses on the results in different embedded movements from of different densities each natural movement; it also explains the reason why high natural movement areas turned out to be central areas. The natural movement was different because of the different network area position. These different densities reflected an unequal distribution and irregular movement networks; the central area usually having higher natural movement than the others. The characteristics and movement of associated tracks, rivers, canals and roads which were the direct effect of association networks, spread an unequal natural movement that led to unequal accessibility. Based on this theory, the track systems, rivers, canals and roads were crucial to making the natural movement that affected the process of transformation emergence and of waterfront community markets around the Tha Chin River basin.

The theory of 'movement economy' (Hillier, 1996) was developed from natural movement knowledge, the density of activities in the center area that typically happened in clusters at many different locations. The theory of movement

economy explains that high natural movement areas attracted more activity than low natural movement areas because central areas can use the benefits of the frequency of passing customers. We can see that an effective high movement economy market place is never faced with sluggish trading activities. Moreover the theory of movement economy also elaborates that the network movement is an important component which makes different activities emerge in each area like commercial areas that are usually located in a densely populated locale. For all the mentioned reasons, the tracks, rivers, canals and roads which possessed good accessibility and had a high natural movement, had characteristics typical of the variable that contributes to the attraction of clusters of trading and waterfront community markets. as accessibility to transport and commerce became available more than ever.

The theory of 'spatial centrality' is an associated network that affects natural movement. If the networks are associated thoroughly, effectively and are able to move freely, then 'moving through' and 'moving to' activities happened, followed by the mix of people with the variety of their objectives. In the end it begins to complete the public circle. This can be explained by the theory of movement economy where the higher natural movement area attracts more clusters of trading activity than others, furthermore the high trading activities area result from high natural movement that also attracts further higher natural movement. This phenomenon is called the multiplier effect and it generates continuous results with the spaces usage tending to be more intensive so areas are portioned into smaller pieces underlying the increased movement and have finer physical

structures and become configurational attractors Configurational attractors. generate more movement, variety of land utilization and lead to the beginning of central areas with a high density of clusters called the 'process of centrality' and these characteristics are mostly found live centers. (Hillier, 1999) In in conclusion, the process of emergence and transformation of waterfront community markets around the Tha Chin River basin can be explained by the three theories above.

In accordance with the theories, the research made use of a system of measurement and correlation between transportation networks and spatial centrality to get achieve outcomes. The variables considered were transportation networks such as cart tracks, rivers, canals and roads. They were to be analyzed since they affected the spatial centrality at each period of time. In the first period, the era of water and land transportation, according to the natural movement theory, it was indicated that the high level of natural movement around the Tha Chin River basin had a direct bearing on the process of emergence of waterfront community markets and spatial centrality. The second period, the expansion era of the water transportation, was based on the movement economy theory. It was clear that the high level of natural movement and a lot of commercial community contributed to the attraction of people to the waterfront community and it led to space centrality. Last but not least, in the third period known as the era of land transportations, according to the spatial centrality theory, the change of natural movement affected the change of spatial centrality and the status of the waterfront community market unavoidably.

Methodology

The spatial configuration model with the Space Syntax program was adopted to analyze the accessibility of any route in the network by creating an axial map which showed the relationship of transportation network and the level of the spatial centrality that utilized the communication line. It was a sub-unit relationship, arrived at by dividing areas into small pieces, which were called convex spaces. (Figure 2)



Figure 2: The division of public area of Gassin in France, as convex spaces. (Hillier 1996)

From the same concept, a large part of the town area, where the chart of relationship can be created into convex spaces that were able to connect with each other (reachable and visible) was considered. Straight lines then could be drawn to relationship represent the with the minimum and longest lines connecting among the convex spaces. The straight line networking system indicated the relationship between the transportation network and accessibility to the areas of each town. The method was to draw the longest and the least number of lines called 'axial lines' (Figure 3) to connect the convex spaces.



Figure 3: The network of axial lines of Gassin (Hillier 1996)

Next, this method required prioritizing the accessibility of movement areas to find integration values. Integration values are quantitative values that show the relationship of the system through colors, ranked according to the color spectrum from red through to indigo. Red means that the open space has high potential to be used because of its connection with many spaces and hence its high popularity (the most integrated); indigo means that the open space has low potential public usage (the most segregated). It became a necessity for this article to have it printed in black and white color only, hence, tones of color were introduced, from deep black to white, representing the 5 levels of color from red to indigo.

The Tha Chin River basin was divided into 4 parts in accordance with the river flowing paths; namely, the Chainat province path, the Suphanburi province path, the Nakhonpathon province path and finally the Samutsakhon province path where the Tha Chin would flow into the Gulf of Thailand (Figure 4).



Figure 4: The division of Tha Chin River (devised by the author)

Results

The study of "The Emergence and Transformation Processes of the Tha Chin River's Waterfront Community Markets". accounted for 3 time periods according to maps from the Royal Thai Survey Department. The first period was the era of water and land transportation in 2436 BE - 2484 BE, the second period was the expansion era of water transportation in 2485 BE - 2505 BE, the third period was the era of land transportation in 2506 BE – 2554 BE. Taken into the study were mainly cart tracks, rivers, canals and roads around the Tha Chin River basin. The canals around the Chao Praya River are only part of the Tha Chin River basin system. The results explain the transformation network and the level of natural movement which affected the emergence and transformation processes of waterfront community markets. The areas that had good accessibility and spatial centrality also had variable characteristics that attracted the formation of waterfront community market clusters. The maximum global integrator value was found to differ as a result of the increased transportation network. Therefore, when the transportation network increased, the global integrator value also increased. In addition, the maximum and minimum value of the global integrator, the average global integrator value and the standard deviation value would increase also, due to increases in the number of transportation networks. Furthermore, the average value of the global integrator reflected the transportation network found in the period mentioned earlier. As for the standard deviation values. were these the transportation networks for each period of time that could be found from Table 1 as 0.0149, 0.0294, and 0.0461 respectively. It is to be noted that these values of standard deviation shifted away slightly from the Average Global Integrator values. Therefore, it could be surmised that the transportation networks of the three periods had formed a cluster.

According to the analysis of the results from the space syntax model, it indicated the maximum and minimum global integrator value, including the average global integrator value and standard deviation considered, from the level of distribution of information moved out from the average of global integrator value. In addition, the result of the 4 values can be used in each period only. In other words, the value cannot be used in different periods. The coefficient of variation can be used to compare each period. Therefore, the level of information did not differ much between periods. Based on the information, the first and third periods had a coefficient variation of 0.161 and 0.167. However, the second period had the highest coefficient with a variation of 0.236. On the other hand, comparing all periods, it was indicated that the variation coefficient was fairly low meaning that it is reliable and comparable.

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Global Integrator Value	2436 – 2484 BE	2485 – 2505 BE	2506 – 2554 BE
Maximum Global Integrator Value	0.1241	0.1948	0.3877
Minimum Global Integrator Value	0.0521	0.0574	0.1519
Average Global Integrator Value	0.0927	0.1248	0.2764
Standard Deviation	0.0149	0.0294	0.0461
Coefficient of Variation (CV)	0.161	0.236	0.167

Table 1: Global Integrator Value of water and land transportation of the studied areas

The first period, the era of water and land transportation (2436 BE -2484 BE)

In this period, there were a lot of settlements around the water routes that were crucial to their life style and culture. The results from the study of transportation networks and spatial centrality of water and track transportation networks indicated that the central area of the Tha Chin River basin especially the border of Suphanburi province and Nakhonpathom province, at the conjunction area of the Praya Ban Lue and Watthana canals, there Thawi was maximum global integrator value or an accessibility of spatial centrality at 0.1241 (Table 1) as shown in deep black. The digging of the Prava Bun Lue canal from 2435 BE to 2442 BE created a link between Chao Praya River and Suphanburi River, effectively expanding the usable area from east of the Suphanburi River to the Chao Praya River. Furthermore, the crossing between the Praya Bun Lue and the Thawi Watthana canal helped turn these areas into a very densely populated one as they could be accessed from different directions.

Next, the perpendicular track area of the Tha Chin River basin around Nakhonpathom province is displayed in black. White appears on the upper basin around the boundary area of Suphanburi province and Chainat province indicating a minimum global integrator value or an accessibility of spatial centrality of 0.0521 (Table1). The obtained spatial centrality on the water-base around the middle part of the Tha Chin River basin like canals mostly displays fish-bone-type characteristics. There were many waterfront community markets in the Tha Chin River basin. The first part of the Tha

Chin River (Chainat province path) had low natural movement, a low integration value and low area usage level because of less connection with other areas. Only the Han Kha waterfront community market existed. For the second part of the Tha Chin River (the Suphanburi province path), a high integrated value, high area usage level and spatial centrality were found due to its connection with others area.

From the existent networks of good connections to other areas, a crowded formation of waterfront community markets was found. These were the Tha Chang, Sam Chuk, Pho Phra Ya, Sri Pra Chan, Kao Hong, Ban Sud, Bang Lee and Bang Sor waterfront community markets. In the third part of the Tha Chin River (Nakhonpathom province path), the second highest natural movement was shown. Again good connections among the areas produced seven waterfront community markets which were Bang Luang, Rang Kra Thum, Huay Plu, Tha Na, Mai, Sam Phran and Ngew Rai waterfront community markets. The last part (the Samutsakhon province path), before the Tha Chin River flows into the gulf of Thailand, had the third highest natural movement with only one waterfront community being found. This was the Kra Thum Ban waterfront community market. (Figure 5)

According to the result of this study, the emergence of waterfront community markets in the first period was most likely increased around the Tha Chin River basin in the second part as the central axis of the basin. In this area, there was a high level of natural movement as the result of good network connections and the spatial centrality of the Tha Chin River basin that featured in this period.



Figure 5: An axial map and the location of waterfront community markets in the first period (devised by the author)

The second period, the expansion era of water transportation (2485 BE – 2505 BE)

In this period, people still settled along the water routes as they had become increasingly more important. The people's livelihoods, due to the greater utility of agricultural lands and areas could be turned into useful commercial plots. From the results of the Tha Chin River basin in the first period, it is indicated that the waterfront community markets related directly to the spatial centrality because of the occurrence of the network connection. The results of the study in the second period indicate that the expansion era of water transportation had an assumption linked to the first period as the result of the increase of network connections and waterfront community markets in the first period which attracted to a cluster of waterfront community markets.

The study of the Tha Chin River basin during 2485 BE - 2505 BE involved studying transportation networks and the spatial centrality of water transportation networks. It was found that most areas started to become developed. Physical changes were noted as a direct reflection of the evolution of the water transportation network, because of the digging of canals in the prior period. In addition, the small canals crossing the Praya Bun Lue canal and the Thawi Watthana canal and the Jeg canal had produced the maximum global integrator value of 0.1948 (Table 1). The area in Ayutthaya province shows deep black around the center of Tha Chin River basin, whereas the boundary areas of Suphanburi province and Nakhonpathom province show in black. White appears in the upper basin around the boundary area of Suphanburi province and Chainat province with a minimum global integrator value of 0.0574 (Table 1). The spatial centrality appears on water-based; canals have fish-bone-type characteristics and more grid intensification.

In this period there were continuous formations of waterfront community markets. The first part of the Tha Chin River (the Chainat province path) had low natural movement, a low integration value and low area usage level because it was less connected with other areas as in the first period. It was not found to have any new formation of waterfront community markets. For the second part of the Tha Chin River (the Suphanburi province path), high integrated value, a high area usage level and spatial centrality were found. This was due to the connection with others area. From the presence of good network connections, it was found that there was a crowded formation of waterfront community markets; which were the Bang Khwak, Ban Grang, Wang Wa, Bang Pla Ma, Khor Wang, Bang Mae Mai and Bang Sam waterfront community markets. In the third part of the Tha Chin River (the Nakhonpathom province path), the second with the highest natural movement was shown. From the good connection system, one waterfront community market was found; the Bang Len waterfront community market. The last part (the Samutsakhon province path), this was found to be the third highest natural movement with no formation of new waterfront community markets (Figure 6). In addition, there was more crucial evidence making clear that the new waterfront community market in this period mostly emerged around the Tha Chin River basin at the second part and had a high network connection due to the increasing levels of the water transportation network as compared to the first period. Thus, the second part of the Tha Chin River basin was a spatial centrality of the Tha Chin River basin.



Figure 6: An axial map and the location of waterfront community markets in the second period (devised by the author)

The third period, the era of land transportation (2506 BE–2554 BE)

Based on the results of the study around the Tha Chin River basin in the first and second periods, it was seen that the emergence of waterfront community markets relate directly with the spatial centrality as considered from the network connections. Furthermore, the result of the study in the second period of the expansion of water transportation indicate that the area around the central axis of the Tha Chin River basin had special characteristics that influenced people to do commercial business and become the spatial centrality at the same time.

This third period completely changed the transportation network from a water-based to a land-based system. This was due to the development of the land transportation network initiated by the government which had been stipulated in the National Economic and Social Development Plans. An evolution of route ways around the Tha Chin River basin had existed as a direct consequence of the Plans. Human settlement took a drastic change of direction, from areas dependent on water transportation to land transportation areas. Obviously, people appreciated popularity the of land transportation over water transport since road transport was faster and more convenient. In this period, the study focused on the transportation network and spatial centrality of the road transportation network, of the third part of the Tha Chin River basin showing that the Asian Highway 32 was the main road for land transport. This route encompassed the locations of several residential and some projects major industries. The road also effectively connected Bangkok to its perimeter and had the maximum global integrator value of 0.3877 (Table 1).

The area in Ayutthaya province showing in deep black (high global integrator value) is the National Highway 9 (Kanchanapisek Road) which is the boundary between Pathumthani province and Ayutthaya province. The National Highway 347 and The Asian Highway 32 show in black respectively. White appears on the upstream of the Mae Klong River in Kanchanaburi province, with a minimum global integrator value of 0.1519 (Table 1). The spatial centrality had completely changed from a water to land-based means. Even though the central area of the Tha Chin River basin's integration values had decreased, the road grid had become tightly firmed.

This was a period of decline for waterfront community markets and many went out of business. In the first part of the Tha Chin River (the Chainat province path), the activities of the Han Kha waterfront community market had noticeably decreased from the former period. Although the second part of the Tha Chin River (the Suphanburi province path) used to be the area that had the greatest level of natural movement around Tha Chin River basin, seven waterfront community markets were found to be disused. They were the Wang Wa, Ban Grang, Pho Phra Ya, Bang Pla Ma, Bang Mae Mai, Bang Sam and Bang Sor waterfront community markets. Another six waterfront community markets that had reduced activity compared to former periods were the Tha Chang, Bang Khwak, Kao Hong, Ban Sud, Kor Wang and Bang Lee waterfront community markets. In the third part of the Tha Chin River (the Nakhonpathom province path), two waterfront community markets were disused. They were the Huay Plu and Mai waterfront community markets. Another four waterfront community markets that had died down from the former periods were the Bang Len, Rang Kra Thum, Ngew Rai and

Sam Phran waterfront community markets. The last part (the Samutsakhon province path), before the Tha Chin River flowed into the gulf of Thailand, the Kra Thum Ban waterfront community market had reduced activity in line with the changed natural movement level. In addition there was another group of waterfront community markets that once had not been as active as before turning out to be livelier in their trading. There were four of them as follows: the Sam Chuk, Sri Pra Chan, Bang Luang and Tha Na, and all were regenerated by the locals (Figure 7). Therefore, it can be summed up that the waterfront community markets forming themselves in the first and second periods that have survived the test of time till today are sixteen known markets namely, the Han Kha, Tha Chang, Sam Chuk, Bang Khwak, Sri Pra Chan, Kao Hong, Ban Sud, Khor Wang, Bang Lee, Bang Luang, Bang Len, Rang Kra Thum, Ngew Rai, Tha Na, Sam Phran and Kra Thum Ban (Figure 8).

The research study found that it was the spatial centrality of this period that started the change of network connections in a positive way. This was due to the fact that the route could be linked endlessly around a land transportation network especially with the apparently higher hierarchy of road transportation. Moreover, the change of spatial centrality affected the status of waterfront community markets in different ways.

To sum up, high integration value areas attracted high trading activities. Areas that faced a reduction of integration values would have their commercial activities unavoidably affected. In some cases, waterfront community markets that had high natural movement could not attract the same amount of commercial activity. Some areas had high integration value but their waterfront community markets were turned down, and in some cases the integration value was reduced but the waterfront community markets could be regenerated. It was indicated that not only the transportation network and the spatial centrality affected the emergence and transformation of the waterfront community market around the Tha Chin River basin, but also there were some related variables outside the scope of this research that will be recommended for study in the future.

Conclusion and Discussion

Results from the study of the emergence and transformation processes of the Tha Chin River's waterfront community markets can be explained as follows: the central area of the city did not move from the center area of the Tha Chin River basin especially the conjunction area of Suphanburi province and Nakhonpathom province in the first and second period. This might be because the center area was in a centre of geometric form. In the past, people transportation was mainly made via waterways; it was the natural original network with a low frequency of change. This changed in the third period; the central city area was in the east of the study area, due to the lesser importance of waterway traffic and the increase occurrence of travel by roads. Both study results are consistent with the fact that the spatial centrality had high integration value and attracted trading activities. The study result of the third period can confirm the theory of the spatial centrality process of a reduction of the integration value affecting trading activities; this is highlighted by the Tha Chin River basin having had a reduction in its integration value that affected the transformation of waterfront community markets.



Figure 7: An axial map and the location of waterfront community markets in the third period (devised by the author)



Figure 8: The existing waterfront community markets (devised by the author)

In short, the global integrator values of land and water transport vary according to the number of available transportation networks. Conversely, an increase in transportation networks result in the increase integrator in an value. Furthermore, transportation networks and spatial centrality are important spatial factors influencing the emergence and transformation process of waterfront community markets. High integration value areas have spatial centrality and crowded waterfront usually have community market locations because of the convenience of travel to places. Transportation networks and spatial centrality also confirm that the changed activities of the waterfront community markets, such as inactive markets, are a result of the development of faster land routes. Additionally, the transportation network that had maximum global integrator value or good network connection was the main transportation means in each period of time, e.g. the Praya Bun Lue canal, the Thawi Watthana canal, the Jeg Canal, and the Asian national highway. The results have confirmed the facts that took place in each period of study.

If the results of this study are to be explained by the aforementioned three theories that were used as the bases of this study, it could be concluded that the area that had spatial centrality had a good network connection. In addition, it was appropriate for establishment as a location of a waterfront community market. Furthermore, the waterfront community market with a high level of natural movement would attract people and businesses to increasingly join in this area along with the movement economy theory. For these reasons, it can be proved that the mentioned area was the spatial centrality of the studied location. However, as time passed, the transportation network changed its characteristics because of changing travel behavior. Thus, the spatial centrality changed from water based to land based, thereby unavoidably affecting the condition of waterfront community markets. Moreover, the effect from this change led to many waterfront community markets being inactive and some ceasing to exist. Thus, it is conclusive that the transportation network and the spatial affected the centrality process of emergence and the transformation of waterfront community markets around the Tha Chin River basin. This is, in fact, in accordance with the assumption set out from the beginning of this study.

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