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Comparing the Viability of Commercial Areas in Relation to the Existing and Proposed Spatial Configuration of Rajshahi City.

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ABSTRACT
Rajshahi, a city despite of having more than two hundred years of history, has developed a few commercial centers like Shaheb Bazaar and New Market. The overall city pattern and road network contribute in the growth of these commercial areas. But at a same time this spatial organization didn't support the commerce to spread much beyond these two areas. Rajshahi development authority (RDA) is planning to expand the urban area by creating some new commercial centers. This paper aims to study the integration and accessibility of the selected commercial centers of Rajshahi City Corporation with "Space syntax" methodology. Through comparison and analysis, this paper thrives to find out the viability of the existing and proposed commercial zones in relation to the existing spatial configuration and the proposed Master plan of Rajshahi City Corporation. Outcome of this research indicates that the proposed road layout has a positive result in the integration and connectivity of the commercial areas.
Keywords - Commercial area, Rajshahi city, Spatial Configuration, Space Syntax, Integration

I. INTRODUCTION

The network of street is considered as effective device to organize movements, which influentially affect the pattern of urban functions like commerce. The spatial configuration of urban grid creates topological inequalities as particular location attracts more movements than other. The pattern of natural movement –ultimately the urban pattern itself– is then impacted on land-use patterns by attracting movement-seeking uses (e.g. retail) to location with high natural movement and sending non-movement seeking uses (e.g. residence) to low natural movement locations [1]. According to Hillier, the urban grid is the means by which the city or town become a mechanism for generating contract. In space syntax, the structure of the urban grid considered purely as a spatial configuration which is the most powerful single factor determining movement, both pedestrian and vehicular [2].

The pedestrian accessibility to public spaces is usually analyzed in terms of time or distance of trips along the pedestrian network. This network and its configuration is a key factor to collect the pedestrian flows at different scales in the city; neighborhood, quarter, district or city. Therefore, a planning process that analyzes these structural implications on the city could plan public spaces with better criteria [3].

The walking route of the shopping customers is one of the most major factors to contribute to the shopping motivations. It can be easily thought that the consumers' shopping mind and the physical mapping of the roads and shops are strongly related [4]. As regards to research on physical "space", the Space Syntax Theory, which developed in London, introduced the concept of "depth" and has left several research results in the architectural area of study. Using this theory, it may be possible to characterize and compare the spatial construction of different commercial centers, and analyze them as relatives to predict the viability of the future commercial centers.

1.1 Existing Commercial Activity of Rajshahi City

Rajshahi, the fourth largest city of Bangladesh, lays between $24^o\ 21^\prime$ and $24^o\ 25^\prime$ North latitudes and between $88^o\ 32^\prime$ and $88^o\ 40^\prime$ East longitudes, with an area of about 96.68 sq. km. According to the census of 2001 the population was 388020. Considering an average projected growth rate of 2.3% the population will be about 0.6 million in 2020.

Daily shopping facilities in urban Rajshahi is provided mainly by the municipal authority. To serve its over 3 lakh 83 thousand population (2001) Rajshahi city has 8 daily bazaars, with each bazaar serving approximately 47,875 population. However, the bazaars are not evenly distributed over the city to serve its entire inhabitant efficiently. In future new bazaars will have to be extended to serve the future city population more efficiently. Besides daily markets, the city has a few shopping centers like, New Market and Shaheb Bazaar [shown in figure 1]. New Market is an important posh retail shopping center where all sort of household goods and necessities are available. Shaheb Bazaar is both, retail and wholesale shopping mall. This is also a

place of afternoon gathering place, remains lively all the time.

Rural markets are mostly hats that sat once or twice a week, there are, however a few permanent shops in these hats. Sites of existing hats are to be maintained and preserved with necessary extensions facilities. Because when these areas will be developed as urban areas, these hats will turn into daily bazaars. Therefore, they must be taken proper care of during detailed area planning.
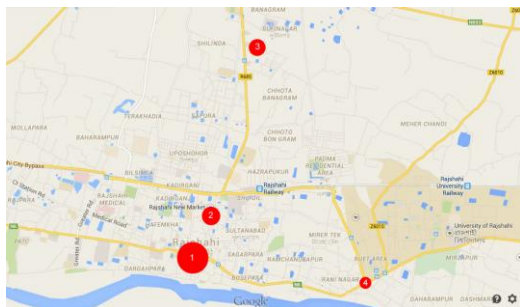

Figure 1: Commercial areas of Rajshahi City 1) Shaheb bazaar area 2) new market area 3) Banalata commercial area 4) Talaimari area

Rajshahi development authority for the first time in 1984 prepared a master plan for its area jointly with Urban Development Directorate (UDD) and UNDP-UNCHS. In town Center Proposal the plan recommended to locate a new town center on the north of the railway line by the Naohata Road where new commercial and administrative establishments can be set up and linked with main city by access roads. In this new center at Purba Natunpara area it was proposed to create new activities towards north by developing a commercial center and other CBD functions. RDA took some initiatives to develop a commercial center beyond the railway line. One such project is "Banalata Commercial Area" [shown in figure 1] developed in an area of about 18.80 acres. But commercial activities did not flourish in the area till now. There was another proposal for development of a shopping area near Talaimari Junction [shown in figure 1]. RDA took up a project in this respect but could not proceed far.

1.2 Existing Road Network and Movement Pattern of Rajshahi City

Rajshahi Development Authority (RDA) area is served by 618 km of road network managed by 5 different agencies namely, Rajshahi city corporation (RCC), Rajshahi Development Authority (RDA), Roads and Highway Department (RHD), local Government Engineering Department (LGED) and Barind Multipurpose Development Authority (BMDA).

About 78% of the road network has bitumen surface. Non-motorized transport (rickshaw, van, bicycle, etc.) dominates the traffic scene in the metropolitan area of Rajshahi where percentage of rickshaws and bicycles varies between 70 to 91% of the traffic and where 90% of all retail and wholesale food stuff are moved by rickshaws and vans. A comprehensive socio economic household survey revealed that 55% of dally trips in Rajshahi are made by rickshaws/van, while another 29% are made on foot. Average journey time within RDA area is around 22 minutes and 69% of all trips are related to either home or work, leaving another 15% which are made to school/college and universities. No major traffic congestion is observed anywhere in city except in front of Rajshahi Rail Station and Rail Bhaban on the airport road.

Household survey by the consultants (2001-2002) reveals the household travel pattern of the study area people. It has been found that, within the urban perimeter take place between certain selected destinations. These are Shaheb bazaar, Harogram, Kazihata, Laxmipur, Chhoto Bonogram, Paba, Rajshahi University, Seroil, Binodpur, Budhpara, Upashahar, Hatem kha, Rajshahi court. (Shown in figure 2)
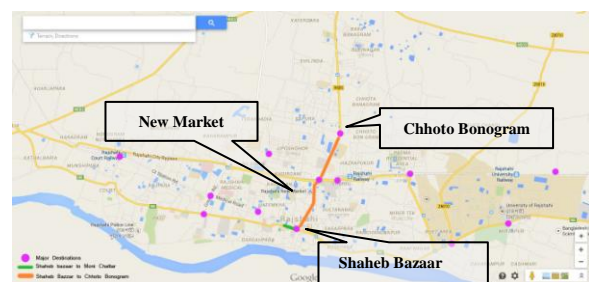

Figure 2: Major destination points of travel in Rajshahi city

The highest number of trips per day (both directions) was found around 6890 over a period of 14 hours between Shaheb Bazaar and Chhoto Bonogram [figure 2]. Pedestrian survey at important locations reveals that out of 32 road links surveyed, the highest peak hour movement of 1312 pedestrian was observed along Shaheb Bazaar to Moni Chattar [figure 2], where footpath of 1.83m (6 feet) width is availed. The area is commercially dominated and is a place of evening attraction for the young people. The average movement at pedestrian points was found 700-800.

1.3 Proposal on Road Network

After invalidation of the first Master Plan of 1984, RDA has prepared a new Master Plan named Rajshahi Metropolitan Development Plan (RMDP), 2004-2024. Under this RDA has planned

for the construction of some new roads and widening some existing busy roads. (Shown in figure 3)

a. Construction of Road from Shaheb Bazar to Gourhanga Mour
b. Widening of Road from Court to Bypass Road
c. Widening of Road from Natore Road (RUET) to Bypass Road
d. Construction of Road from Airport Road (Shalbagan Morh) to By-pass Connecting Road
e. Construction of Road from Bhodra Morh to Kazipara Rajshahi Bypass Morh
f. Construction of Road from TTC to Silinda Rajshahi By-pass Connecting Road
g. Construction of Road from Meherchandi Morh to Harian Rajshahi City By-pass Road
h. Construction of Road from Ramchandrapur Khorbona (Nator - Nawabgonj Road) via Mirere Chalk to Seroil Shatibagh Morh

Figure 3: proposed roads

The total spatial configuration of the city will have a new organization after the construction of these new roads.

II.   OBJECTIVE

This paper deals with the potential commercial centers of Rajshahi City the analysis of physical location and accessibility of these centers will be carried out by using 'Space Syntax'. With the aim of analyzing the viability of the existing and future commercial areas; integration of access roads and location of the study area in respect to the integration core of the city are going to be assessed. This paper intends to indentify the reason of the commercial viability of existing centers and the reason of failure of the new commercial centers in relation to the spatial configuration of the city road network and to predict the viability of these commercial centers in relation to the proposed future spatial organization. In order to study how these areas are associated with the city, this paper will consider the followings:

– To indentify the existing Integration Core of Rajshahi City.
– To identify the access roads of the existing commercial centers.
– To analyze the integration of selected commercial centers and to assess the accessibility of these areas using space syntax.

– To analyze newly proposed the Rajshahi Metropolitan Development Plan (2004-2024) to access the potentiality of these commercial centers.

III.   SPACE SYNTAX METHODOLOGY

When historic cities are observed in the development process of cities, it is known that the old city center is now off center and the city center has changed its place. The understanding of the complex process of city development can be explained with the development of the sub centers simultaneous local development processes. The specialization process of sub centers in historic cities is very important in the definition of the transformation of the centers in the urban network development. The understanding of the relation between the reflection of urban systems of different scales and different integration values is a key in understanding the relation between parts and the whole [5]. Space syntax approach with its analytical structure is an important tool in understanding the parts-whole structure of urban areas, and the development of city centers in connection. This model supports decision for planning by understanding the central areas as part of the urban area and their relations with other parts of the city [6]. This paper is developed on two key ideas: accessibility and spatial configuration. In application of these ideas or its measures it is going to link other concept, integration. Accessibility refers to the ease to arrive to facilities, activities or goals, which could be appointed in general as opportunities. In addition accessibility could be defined as "the intensity of the possibility of interaction" [7] and interchange [8]. The spatial configuration plays a primitive or principal role for the pedestrian mobility [9].

As cities grow with respect to their population and area, the centers with a high level of use also grow towards their surroundings. The integration of each piece with the whole area during this growth in the urban correlations in the center can be revealed with the comprehension of the relation of the center both with the whole city and with its own sub districts. The level and type of integration of the center with other parts of the urban area can be observed with a network formation of the space. The integration of the center that is in the process of urban growth, with other urban areas and the revelation of the correlation of commercial centers like shaheb bazaar area, will help the right decisions for the future in these areas. Space Syntax analysis model has been utilized for understanding the spatial configuration of the work area. Axial maps that are used for the calculation of Space Syntax analysis model configuration parameters and core maps related to (R-n) integration values of

urban network configuration characteristics have been utilized for the analysis of morphological structuring.

These measures of spatial configuration in the axial map are put in together with the diversity of commercial space and their capacity to offer accessibility. Then analysis with Space Syntax has been done on two phases.

Phase: 01

The configurational properties of the Rajshahi City have been analyzed by "Space Syntax". Then five existing shopping centers along with three under construction shopping centers and one proposed shopping center from two existing major commercial areas and two proposed commercial areas have been selected based on Field Survey. The location and accessibility of these commercial centers have been analyzed.

Phase: 02

The configurational properties of the Rajshahi Metropolitan Development Plan (2004-2024) have been analyzed. Then the findings of the syntactic analysis are triangulated with some observations which offer some predictions on viability of the selected commercial centers with the comparison of the existing commercial circumstances.

IV. SPATIAL ANALYSIS OF RAJSHAHI CITY
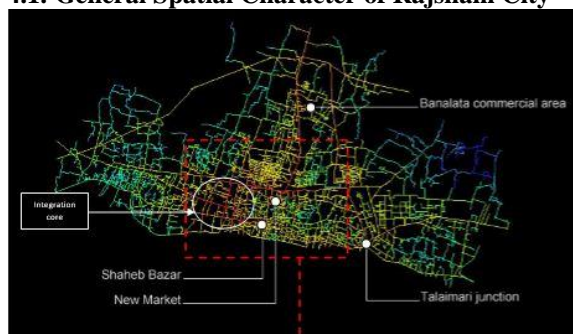
4.1. General Spatial Character of Rajshahi City

1,2,3,4,5,6,7,8,9,10,11,12,13,14, 15	Most Integrated Road, R=n

Figure 4: Analysis of Global integration [r=n]

A,B,C,D,E	Most Integrated Road, R=3
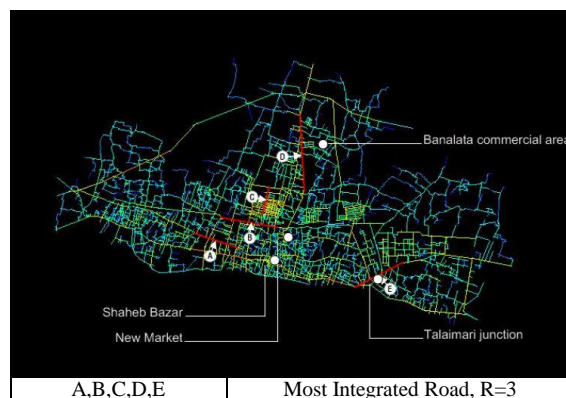
Figure 5: Analysis of Local Integration [r=3]

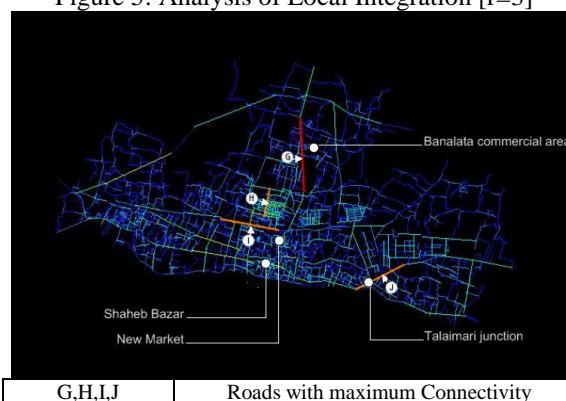| G,H,I,J	Roads with maximum Connectivity

Figure 6: analysis of connectivity

The axial map of Rajshahi City has been analyzed by Depthmap and Global Integration (R=n), Local Integration (R=3) and connectivity measures are considered.

The high value lines (marked as red by Space syntax) of Global integration, Local integration and Connectivity are indentified and compared with corresponding 10% Core. It is found that all the red marked lines in Global context (Road 1-15), in Local context (Road no: A, B, C, D, E) along with red and orange marked lines for connectivity (Road No: G, H, I, J) are within the 10% core of corresponding measure of Rajshahi City.

Table 1: Global Integration values, Local integration values and Connectivity

Road No Ref: figure: 5,6,7	Global Integration Value, HH	Local Integration Values [HH]	Connectivity
1	0.665909		
2	0.674979		
3	0.660408		
4	0.686101		
5	0.687404		
6	0.699036		
7	0.702734		
8	0.711912		
9	0.688848		
10	0.670836		
11	0.668646		

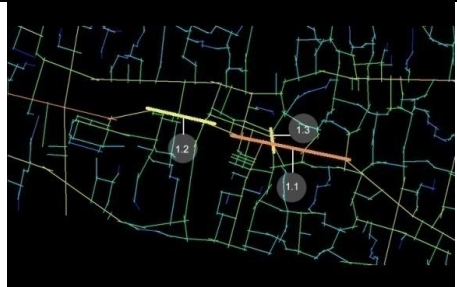| 12	0.665001				E		3.17885	
13	0.676578				G			21
14	0.691698				H			19
15	0.674025				I			17
A		3.13760			J			17
B		3.18821			Maximum	0.711912	3.44099	21
C		3.44099			Minimum	0.190054	0.333333	1
D		3.24024			Mean	0.46578	1.24565	2.52677

4.2. Identifying Access Road To Sample Area

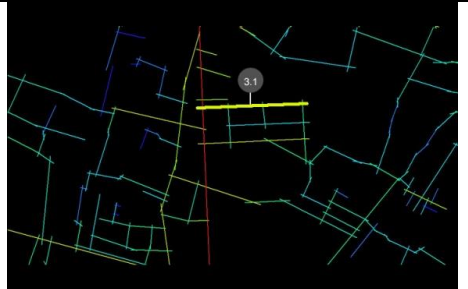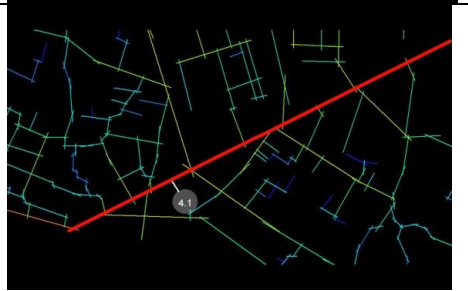Table 2: Commercial areas with their Connectivity and Integration Values

Area no.	Area Name	major shopping centers	Access Road	Integration HH, R=n	Integration HH, R=3	Connectivity
1	Shaheb bazar area	RDA market	1.1	0.630128	2.90639	12
		Haque Super market				
		Jamal super market				
		Rajshahi city center (under construction)	1.2	0.644279	2.34302	8
		SS Tower (under construction)	1.3	0.591825	2.27285	6
2	New market area	Rajshahi New market	2.1	0.635288	2.69245	11
		Aftab Plaza				
		RDA rehabilitation market (proposed)				
		Daruchini complex (under construction)	2.2	0.602383	2.13553	5
3	Banalata Commercial area	Proposed by RDA	3.1	0.614869	2.30361	4
4	Talaimari Junction	Proposed by RDA	4.1	0.62135	3.17885	17
Maximum				0.644279	3.17885	17
Minimum				0.591825	2.13553	4
Mean				0.620017	2.54753	9

The integration of the access roads of the selected shopping centers are analyzed to understand how the sample areas are integrated with the whole city at present (Table 3)

Table 3: Access Road Identification

Area no.	Area Name	Global Integration	Local Integration
1	Shaheb Bazar area		
2	New market area		

3	Banalata Commercial area		
4	Talaimari Junction		

4.3. Analysis Of Access Road To Sample Area

The Global and Local Integration and Connectivity of these access roads are analyzed to evaluate the existing condition of intelligibility of the commercial areas. (Table: 2)

4.3.1. Global Integration Of Access Roads

The mean global integration of the city is 0.46578. Now the global integrations of the access roads to the commercial areas are compared below.

Shaheb Bazaar Area: (Area no. 1; Road no. 1.1, 1.2, 1.3): The average integration value of this area (0.6221) is higher than the mean global integration value of the city (0.46578). This space is strongly connected with the city. The report of household survey also supports this analysis as the highest numbers of pedestrian and vehicular movement are observed along Shaheb bazaar. As a result major commercial activities are found in this area. Being nearer to the integration core of the City this area became commercially dominant. And lots of new shopping centers are being built here. Shaheb bazaar is also a place of afternoon gathering place, remains lively all the time.

New Market Area: (Area no. 2; Road no. 2.1, 2.2): New Market area also has a high global integration value (0.6188) and also acts as important posh retail shopping center where all sort of household goods and necessities are available. New multistoried commercial centers are under construction at this area. Rajshahi Development Authority has also proposed a new Rehabilitation market here.

Banalata Commercial Area: (Area no. 3; Road no. 3.1): Though the global integration value of the access road of the area (0.6149) suggests that Banalata Commercial Area is well connected with the city, the commercial activities didn't flourish in this area as it is too far from the integration core. As one of the key proposals of master plan of 1984 was to locate a new town center at the northern part of the city, there is a good chance to convert this area as a successful commercial center of Rajshahi City.

Talaimari Junction Area: (Area no. 4; Road no 4.1): This area is situated at the eastern part of the city and has a high global integration value (0.6214). RDA took up a project for developing a commercial center in this area but was not succeeded. The reasons are the long distance from the integration core and the trend of growth of the city that headed towards north.

So it is found that not only the high global integration value but also distance from the integration core is a major indicator of a successful commercial area.

4.3.2. Local Integration Of Access Roads

The mean local integration of the city is 1.24565. Now the global integrations of the access roads to the commercial areas are compared below.

Shaheb Bazaar Area (Area no. 1; Road no. 1.1, 1.2, 1.3) has a good local integration value (2.50742) which is higher than mean local integration value (1.24565). New Market Area (Area no. 2; Road no. 2.1, 2.2) also has a higher local integration value (2.41399).

The most interesting observation from the analysis is, the access road of Talaimari Junction Area (Area no. 4; Road no 4.1) has the fifth highest local integration value (3.17885) but it is not functioning as a successful commercial area. So only the high local integration value cannot be the indicator of a successful commercial area. In Rajshahi the average journey time within RDA area is around 22 minutes. So people can easily reach the

core commercial zone and local commercial areas remain under developed. So to create a successful commercial center the global integration values of the areas need to be increased, instead of local integration.

4.3.3. Connectivity Of Access Roads

The mean connectivity of roads of Rajshahi city is 2.52677. The selected access roads of successful commercial areas (Area no, 1 & 2) have dissimilar connectivity measures vary from 12 to 4. Besides, the access road of Banalta Commercial Area (Road no. 3.1) has a low connectivity (4) and the access road of Talaimari Junction Area (Road no. 4.1) has very high connectivity (17). But both remain unsuccessful as a commercial center though they were proposed 20 years ago. Therefore, here connectivity cannot be considered as an indicator of a good commercial center.

V. SPATIAL ANALYSIS OF PROPOSED ROAD NETWORK AND THEIR EFFECTS

According to the new Master Plan named Rajshahi Metropolitan Development Plan (RMDP), 2004-2024, RDA is executing the construction of some new roads and widening of some existing busy roads (figure 3). Now there is a possibility for Rajshahi to be a well-integrated city which can provide more facility to its commercial centers through spatial organization.

Now by observing the impact of these new road connections, this paper is assessing the potentiality of the existing commercial centers along with the proposed but not successful commercial centers like Banalata Commercial Area and Talaimari Junction Area to review the viability of these areas.
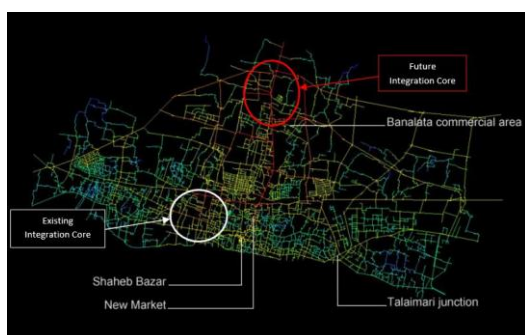

Figure 7: spatial impact of the proposed road network

The analysis of axial map of the proposed road network shows that the current integration core will move to the northern part of the city corporation area. This will definitely support the growth direction proposed by the previous Master Plan of

1984. The Master Plan anticipated a growth direction towards north-east. But in reality the growth took a three way direction- north, east and west. The new spatial configuration of Rajshahi City will accentuate the possibility of northward development trend of the city.

Table 4: Existing and Proposed Access Roads to the selected commercial Areas

Area	Road	Existing		Proposed	
		HH	Connectivity	HH	Connectivity
Shaheb Bazaar Area	1.1	0.630128	12	0.747419	12
	1.2	0.644279	8	0.703375	8
	1.3	0.591825	6	0.745957	5
New Market Area	2.1	0.635288	11	0.782705	12
	2.2	0.602383	5	0.72543	5
Banalata commercial	3.1	0.614869	4	0.845392	7
Talaimari Junction Area	4.1	0.62135	17	0.697072	17

Figure 8 shows that the proposed spatial configuration has significantly improved the Global Integration values (marked as red) of the selected commercial areas. So it can be said, the Rajshahi Metropolitan Development Plan (RMDP), 2004-2024 can adopt the policy to integrate the commercial areas within the whole city.
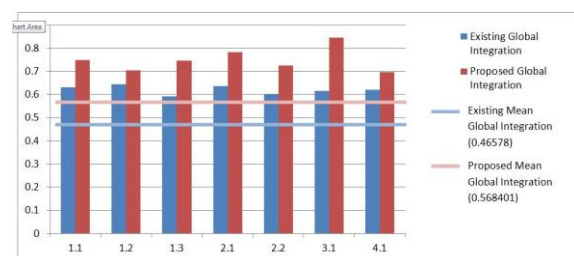

Figure 8: Comparative Analysis of Global Integration of Access Roads

Through this analysis we can predict the future viability of the proposed but not yet successful commercial areas anticipated by RDA.

Banalata Commercial Area: In the new spatial configuration, the higher Global Integration value of this area (0.845392) suggests that with the new road network this area will be more integrated with the whole city. Furthermore the distance of Banalata Commercial Area from the existing integration core, which appeared as one of the main reasons of the failure of this proposal, will be reduced as the integration core will be shifted

towards north in the new spatial organization. Therefore it can be said Banalata Commercial Area has high potentiality as a successful commercial center in the newly proposed road network.

Talaimari Junction Area: Though the Global Integration value of Talaimari Junction Area (0.697072) increases in respect to its previous value (0.621350), still it is the lowest among all the selected commercial areas. Besides, the distance of Talaimari Junction Area from the new integration core refers its less possibility as a successful commercial center in the new spatial configuration of Rajshahi City.

VI. CONCLUSION

The master plan of Rajshahi city has full potentiality to develop as a balance area in future in respect of the distribution of commercial centers. This paper provides a base of an intervention strategy for the upcoming spatial configuration of Rajshahi City Corporation. If the commercial centers locate at highly integrated area and near to the integration core, these will be within people's daily movement network and used frequently. So the construction of newly proposed roads and widening of some busy roads (Figure 3) will improve the viability of the proposed but yet unsuccessful commercial areas like Banalata Commercial area. Space syntax helps us to analyze the associability of these commercial areas which in turn helps in such prediction. This paper thus supports the new proposals of Rajshahi Metropolitan Development Plan (RMDP), 2004-2024 based on Space Syntax to integrate the new commercial centers with the city. Further studies and analysis have to done to have a comprehensive planning proposal of Rajshahi City.

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