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SETTLEMENTS' HIERARCHY AND CENTRALITY IN BANTUL DISTRICT SPECIAL PROVINCE OF YOGYAKARTA, INDONESIA

by
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ABSTRACT

In this article, the assessment of centrality of settlements in a district in Central Java is discussed. This with a view to determine a system of service centres in the area which is functional for regional planning purposes. The study area, Bantul District, is a densely populated area which boasts a large variety of services. The assumption is tested that both the geographical location of the district, close to the city of Yogyakarta, and the high mobility of the population, due to a well-developed public transportation system, allow for a situation whereby the hierarchical position of a settlement, based on the combination of services provided, is not necessarily similar to the centrality of that very settlement, based on the number of incoming interactions. From an analysis of an intensive set of primary data, it shows that although the level in the hierarchy of a settlement largely coincides with its centrality level, the centrality level of some settlements considerably deviates from what might be expected on basis of these centres' service level.

INTRODUCTION

Since the early 1970s, rural centre planning has gained renewed attention from policy makers and regional planners. It became increasingly accepted that the location of new social services and of new production related services required appropriate attention. Also in Indonesia such renewed attention to

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rural service centres could be observed. Especially after the establishment of planning boards at the provincial level in 1974, it became an important issue. The number of publications on rural centres and their role in rural development has grown substantially since, both in Indonesia as well as in other countries. (cf. Johnson, 1970; Kuklinski, 1972; Rondinelli and Ruddle, 1976; Southall, 1979; ESCAP, 1979, Misra *et al.*, 1981; DHV, 1985).

ESCAP (1979), for instance, has advocated that rural development can only be furthered if facilities and services which stimulate production are concentrated in rural centres. These rural centres should be placed in a hierarchical order, which is closely related to the standards for the level of the services as indicated by the central place theory. The key concepts in this theory are the threshold value and the range of a good or service. The threshold value is determined as the minimum aggregate purchasing power required to create a sufficient demand for the supply of certain goods and services. The range of a good or service is defined as the distance people are prepared to travel to obtain that specific good or service. From these definitions, it follows that the level of centrality of a certain place is determined to a large extent by population density and its distribution and the general level of development.

Based on these two factors, a hierarchy of settlements can thus be determined. In this hierarchy some places will perform more central functions than others, depending on the size of the population served. This is not necessarily determined by the size of the centre itself. ESCAP (1979) points at a three tiered hierarchy of settlements, viz. regional cities, district towns and locality towns. The regional cities are considered to be urban rather than rural centres. Their population size is 50,000 on average. Between 200,000 and 800,000 people are using its services or are purchasing goods provided by those centres. The district towns are considered to be the largest type of rural centres. They include a number of services which are used rather frequently, not only daily, by the population living in their service area. The district towns are the locations of educational, medical, social, cultural and administrative amenities, which require a higher threshold population than is available in the lower order centres. Besides, they play an important role in linking the countryside with the regional centres, because they usually form a focus or node in communication and transformation networks. Finally, locality towns are distinguished. They aggregate inputs from larger centres, and distribute them to the smaller ones, while simultaneouslyy collecting inputs from the smaller centres and channeling them to central places of a higher order. They provide the farming villages with basic services, as well as with agricultural inputs and household goods for 'daily' use. Below the locality towns, one finds the rural villages, which usually do not provide services to a significant extent.

The central place theory implicity assumes that availability of services automatically implies the usage of those services. This may be true for sparsely populated areas without the presence of alternative destinations. For more densely populated parts, which have good connections with surrounding areas, this assumption may be questioned.

Bantul district is an example of such a densely populated area with a large variety of services provided. Due to a relatively well-developed public transport system, the majority of the population is very mobile. This means that people can choose between various alternatives for the provision of a certain service, and not necessarily opt for the nearest alternative. In addition, the district is located close to the city of Yogyakarta, which provides an ample range of alternatives. Through so- called "multiple-purpose (shopping) trips" people may combine visits to several (including lower level) services into one trip, which makes it worthwhile to travel to a big city rather than to visit some intermediate towns. In other words, the centrality of a settlement, based on the combination of services provided ("from above"), is not necessarily similar to the centrality of that very settlement based on the number of incoming interactions ("from below").

Against this background, a research has been carried out in 1990. The objective of this research is to assess the centrality of settlements in Bantul in order to arrive at a system of service centres in the area which is functional for regional planning purposes. Attention has been paid to the hierarchical system of service centres as present in the study area, as well as to the actual use of the various services. In this way, it is possible to establish to what extent the hierarchical level of a settlement corresponds to its centrality level as expressed through the number of incoming interactions. The following data have been collected within the framework of this research. Details pertaining to size and location of all administratively delimited village areas, i.e. 75 *desa*, have been gathered. An inventory per settlement has been made of the services as present and their respective characteristics. Information has taken place indirectly. In view of logistic and time constraints, we have opted for approaching key informants : Five key informants per village have been asked where, in their opinion, the majority of their fellow villagers, normally, go for specific services or certain shopping purposes. This study presents part of the research findings; four main questions be addressed here.

a. What are the main geographic characteristics of the study area?
b. Which hierarchy of settlements can be discerned?
c. Where do people go to to visit particular services?
d. What is the actual functionality of the present settlement pattern?

MAIN CHARACTERISTICS OF THE AREA

The district Bantul is situated in densely populated Central Java, Indonesia, just south of the City of Yogyakarta. It enjoys a good access to the islands' major transportation routes, i.e. railways and roads. It is one out of four districts in the Special Area of Yogyakarta and is administravely sub-divided in

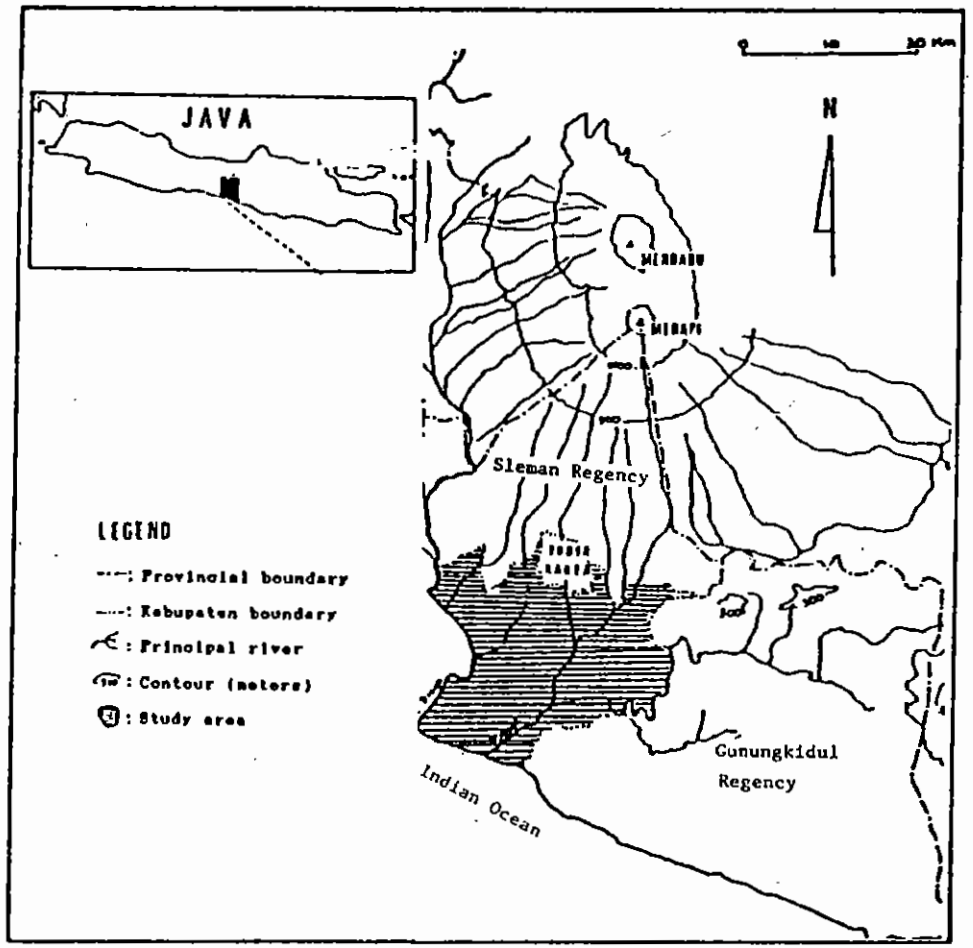

Figure 1. Location of the Study Area

17 sub-districts or *kecamatan*. The district can be subdivided in a number of distinct zones, viz. a rather flat lowland area in the central and southern part, a calciferous plateau in the western part, and a topographically rather rough upland area in the eastern part. The upland area in the eastern part is clearly demarcated from the lowlands by a steep escarpment with slopes of 40 percent and over, which rises to an altitude of some 500 meters above sea level. The characteristics make parts of the eastern area relatively inaccessible. The soils in this zone area largely lateric and have a low degree of fertility and a limited moisture retaining capacity. The western plateau, which rises to an elevation of some 150 meters above sea level, largely comprises of a limestone formation with both limestone and grumosoils (a mixed soil type, consisting of weathered limestone, marl and volcanic parent material). Although of a different composition compared to the predominant soils in the eastern part, also these soils have poor characteristics for agriculture as both fertility and moisture capacity are extremely limited. The central lowland zone, which comprises by far largest segment of the district, is offering a highly valuable agricultural production potential. The very thick soils are of a basic volcanic origin and have been deposited either in the form of ash or by the various rivers and streams which dissect the area. The soils are highly fertile and have favourable moisture retaining capacity levels. In the southernmost part of the central zone sand predominates. Consequently, this part of the district is far less fertile and the moisture capacity is rather problematic in comparison to the rest of the central zone (McDonald, M. and Binnie, 1983; Dept. of Public Works, 1975).

To do justice to this internal differentiation, a classification of the seventeen sub-districts has been made, based on two criteria (see figure 2).

First, the proportion of the working force active outside the agricultural sector is used to identify non-formal area: Sub- districts with more than 65 percent of the work force active outside agriculture have been earmarked as peri-urban areas. Second, the percentage of irrigated land per sub-district is taken. Three separate categories can be discerned, viz. the dry land category with less than 10 percent of irrigated land (rural zone 1), the *sawah* dominated category with 36 percent of irrigated land and more (rural zone 3), and the category which falls in between these values (rural zone 2).

In 1990, the population of Bantul district amounted to 688,195 persons. These inhabit an area of some 507 square km. This implies an average population density of 1357 persons per square km. Of the land area, almost half is used permanently as farmland. This figure points at a very high agricultural density of 2730 persons per square km. Although population density is very high in general, substantial differences in distribution of the population over the zones can be discerned (figure 3). Kecamatan Dlingo in the eastern part, for instance, has an overall population density of 583 per square km and a farmland

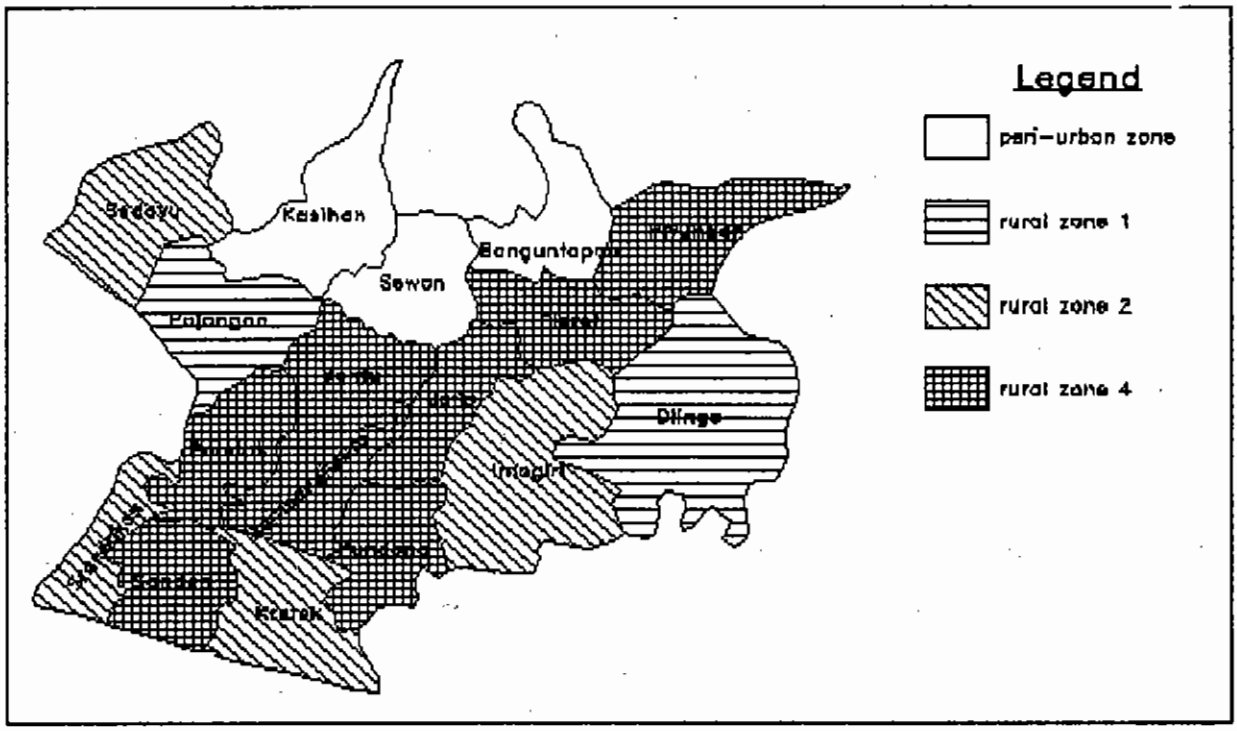

Figure 2. Typology of Sub-districts in Bantul District

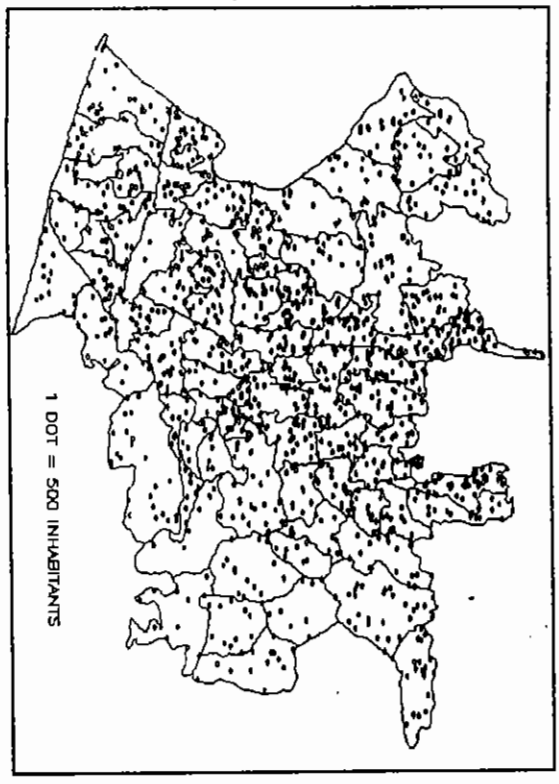

Figure 3. Population Distribution

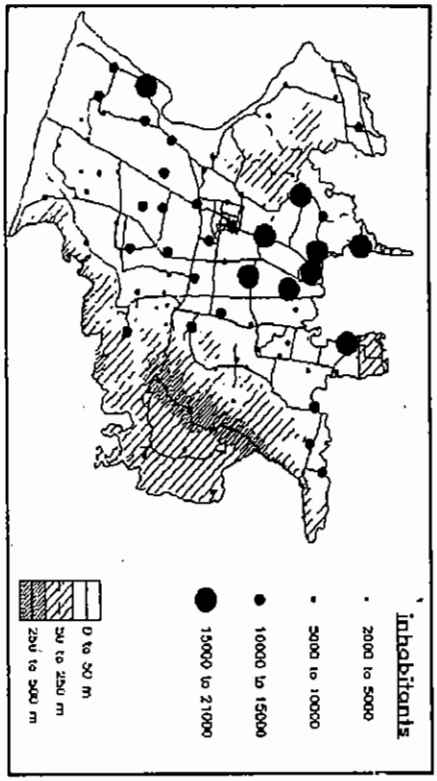

Figure 4. Settlements, Roads and Elevation

density of 1333 persons, while kecamatan Bambanglipuro in the central part is characteristics by figures of, respectively, 1679 and 3110 per square km.

The population growth is rather modest, i.e. 1.2 percent per annum. This is also related to the incidence of out migration (0.1 per cent). The overall mortality rate is 4.9, the natality rate amounts to 17.9. The life expectancy at birth in Bantul is relatively high in comparison to other areas. In 1985, it was over 60 years for the total population. The population dynamics vary over the zones as identified. It appears that the net out migration is much higher in the irrigated areas in comparison to the dry land zone.

The differences in population density are also reflected in the distribution of the settlements, according to size, over the area (figure 4). The larger settlements are concentrated in the northern part of the district. In fact they form the urban fringe of the City of Yogyakarta. Besides, the more densely populated central zone can clearly be distinguished from the less densely populated parts in the east and west. In the latter areas, the number of settlements, as well as their size, is far lower than in the first. In the administrative hierarchy, each subdistrict has one "capital", i.e. one settlement in which all government offices are located. The subdistrict capitals are not necessarily the largest settlements within the administrative unit.

The settlement pattern varies between the accidented and low lying parts. In the former zone, the build up area is more dispersed; in the latter area, the build up area is much more condensed. This is related to the agricultural resources base and the relative value of the types of land for production. In addition, the irrigation infrastructure greatly determines where new homesteads can be located. There are clear indications that settlements grow by spatial expansion, whereas the settlements in the *sawah* zone predominantly show growth by fission. Obviously, this does not apply to the settlements bordering Yogyakarta city. In these parts both types of settlement growth can be observed.

SERVICES AND SETTLEMENT HIERARCHY

A considerable variation exists in the spatial distribution of services over the area (Huisman and Stoffers, 1991). The spatial distribution of the community services over the area is rather equitable. The lower level or less specialized services are easlily accessible for most of the population. The higher level or more specialized services, commercial as well as non-commercial, tend to be concentrated in the lowland part of the subdistrict, especially in the northernmost part. The agro- support services and, albeit to a lesser extent, the other production related services, are underrepresented in the upland areas. This occurs despite the fact that agriculture is the main economic activity in that zone. Regarding the intermediate and higher level commercial services a major role is performed by Bantul town and Imogiri.

The number of units in a settlement which provide a certain service is often a function of the population size of that settlement, and does not offer a correct indications for its total service level for the surrounding area. The number of primary schools, for instance, is highly correlated to the number of children in primary school going age in a settlement. On the other hand, if a service has to be provided at only one location in each subdistrict, its location may be influenced by factors other than number of inhabitants of the settlement, or the presence of other services. Frequently the village cooperative (KUD), the branch of the People Bank of Indonesia (BRI), and the rural health clinic (PUSKESMAS) are not located in the same settlement, although they have to serve the same population. This may imply that for certain services political considerations may be important than accessibility or economic rationality.

As regards the weighing of the various services to obtain these scores, three problems present themselves.

First, how to allocate weights to the various within a category. For instance, regarding health care: should a hospital have a weight which is twice or ten times as high as a health care? What is the weight of a health centre as compared to an auxiliary establishment? Although various methods exist to overcome this problem, the final classification always remains based on arbritary decisions.

Second, if the various weights have been determined, the question remains wheter all units within a certain group deserve the same weight. Is the quality of the medically trained staff the same for all village health centres? Are the services equally accessible (opening hours)? To incorporate all these aspects in the assessment of the level of a service centre, a very detailed data based is needed. Even if all data required are available, biases may influence the decision making.

Third, there is the problem of weighing different kinds of services. Are a banking office and a village health centre equally important? Should a village cooperative receive the same weight as a shop selling electric household utensils; If not, should it be "lighter" or "heaver". It may be clear that the decisions taken to arrive at such a classification are even more arbitrary.

We have opted for a simple approach. In principle, each service obtains a score of "1" if present and a score "0" when absent. If various levels can be distinguished within a certain kind of service, a simple weighing system has been used, whereby for each subsequent service level one point is added to its score.

An analysis of the hierarchy of settlements based on all services has been made. To this end, the total scores of three groups of services, i.e. community services (0-13 points), production related services (0-12 points) and the

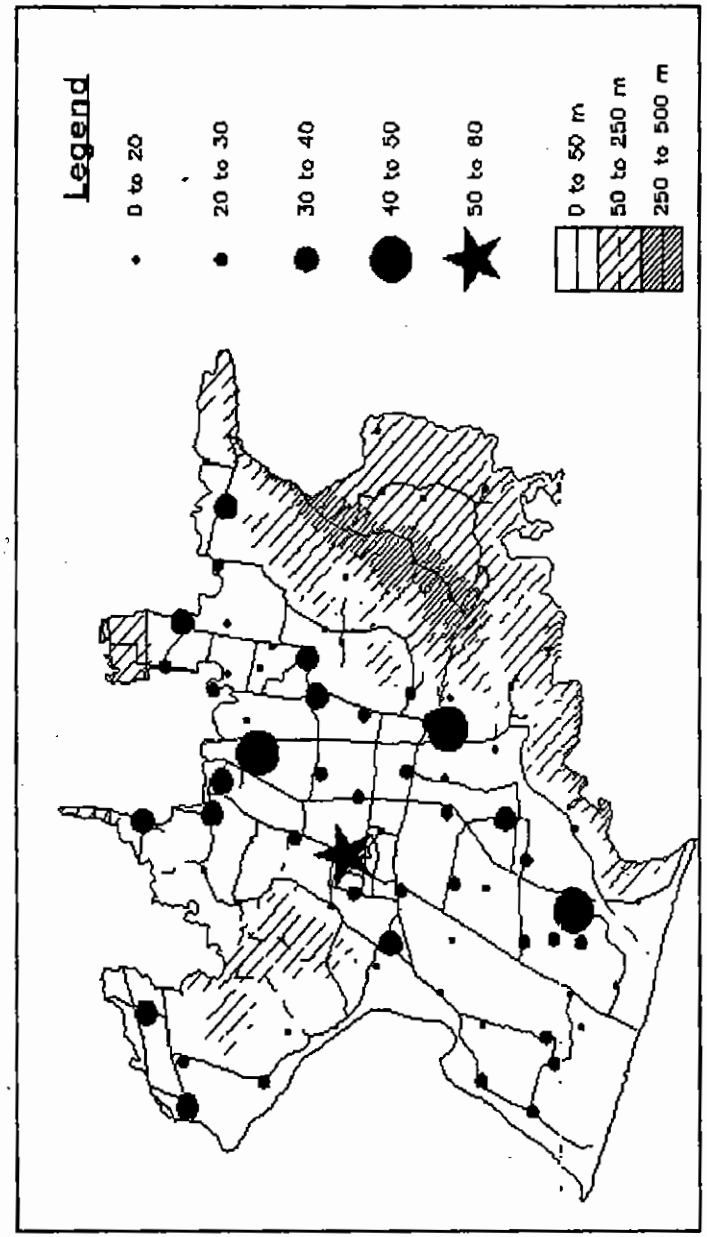

Figure 5. A Hierarchy of Settlements on Basis of All Services

commercial services (0-40 points), are added up (Appendix 1). The relative high number of commercial services influences the final score to a larger extent than the other two groups. However, since most commercial services are more frequently used than the other ones, this is not considered to be a distorting factor in this respect. The results are given in figure 5, displaying the score for each settlemnt and in table1, where the subdistricts are listed, according to the score of the most important settlement. The intra regional differences are clearly shown. It is evident that the service level in the settlements of Dlingo and Pajangan (the subdistricts with the most accidented topography) is the lowest by far. Although two of the four settlements with the highest total score (Donotirto and Karangtalun) are located in the southeastern part of the district, the general level of services is mostly higher in the settlements in the northern and central parts in comparison to the southern zone. From the nine lowest scoring settlements, six are located in the south.

On basis of the scores obtained, the 75 settlements in Bantul district have been grouped into five categories. Bantul is the settlement with the highest score by far and forms a "group" by itself. Following the ESCAP terminology one may refer to this settlement as 'regional city'. The second group with 5 settlements (scores between 45 and 39) may be labeled 'district towns'. The third group consists of 10 settlements (with scores between 30 and 35), which are categorized as 'locality towns'. The remaining sixty-odd settlements are ESCAP's 'rural villages'.

Two types can be discerned within this group, viz. the D-level rural villages which have a score in between 21 and 30, and the E-level rural villages which have a score of less than 20. A closer look at this classification now follows. The interaction flows to the settlements are presented with a view to establish the extent in which the interaction flow-pattern coincides with the hierarchy as constructed.

INTERACTION AND CENTRALITY

The position of settlements in the hierarchy in relation to centrality now comes into focus. The presence of a service, or a combination of services, obviously implies that those settlements are visited. However, whether settlements with a higher service level are more frequently visited than those with a lower service level, still remains an interesting question. To this end, data reflecting the interactions between settlements as perceived by a few key respondents per settlement are analyzed. These data present insight into the movement for the majority of the population from that settlement for obtaining a certain good or service. The number of interactions thus does not reflect the actual number of movements, but the number of times a settlement has been mentioned by key respondents as the most likely destination.

Table 1. Subdistricts, Settlements And Level Of Services

No	Settlement	Kecamatan	Score	Subdistric capital
1	Bantul	Bantul	58	*
2	Bangunharjo	Sewon	45	
3	Donotirto	Kretek	43	*
4	Karangtalun	Imogiri	41	*
5	Srimulyo	Piyungan	40	*
6	Ngestiharjo	Kasihan	39	
7	Srihardono	Pundong	35	*
8	Argosari	Sedayu	33	
9	Baturetno	Banguntapan	33	*
10	Wijirejo	Pandak	33	*
11	Pleret	Pleret	32	*
12	Trimurti	Srandakan	29	*
13	Sumbermulyo	Bambanglipuro	27	
14	Gadingsari	Sanden	26	
15	Patalan	Jetis	24	
16	Terong	Dlingo	18	
17	Sendangsari	Pajangan	17	*

Source : Field research data, 1990

During the investigation a total number of 17,232 interactions has been reported; the main destinations are listed in table 2.

Table 2. Interactions in Bantul District, According to Main Destination

Destination	Interactions ABS	%
Bantul		
District 1	14017	81.2
Yogyakarta	2974	17.3
Sleman	166	1.0
Kulon Progo	47	0.3
Gunung Kidul	28	0.2
Total	17232	100

Source : Field research data, 1990

From the data it shows that destinations inside Bantul district are the most important by far. More than four out of five interactions aim at a location inside Bantul disrict. Not surprisingly, the municipality of Yogyakarta is the second most important destination, since Yogyakarta is the only large urban settlement in the vicinity of the district. Part of the district actually constitutes the southern urban fringe of Yogyakarta.

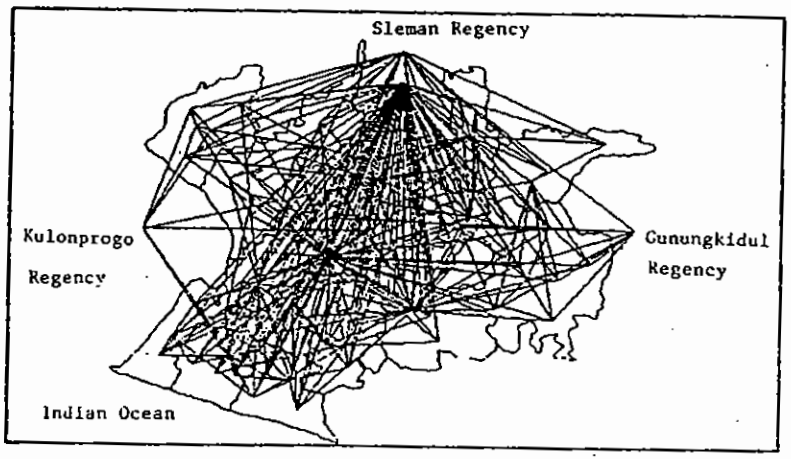

Figure 6. Interactions from Bantul District

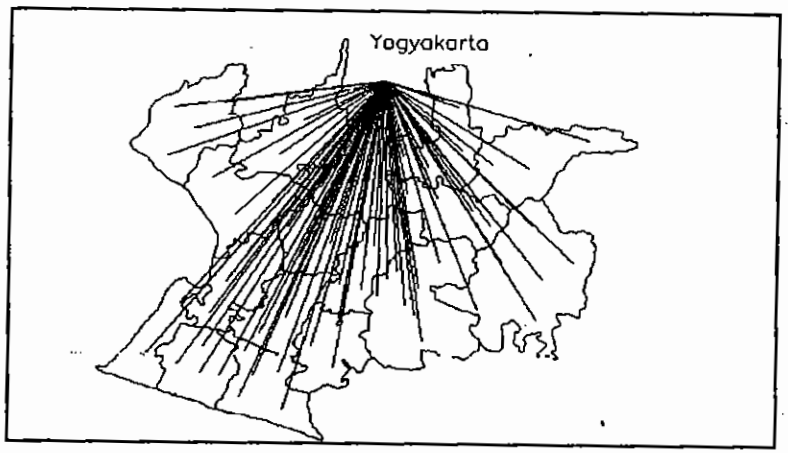

Figure 7. Interactions with Destination Yogyakarta

Neighbouring districts appear to play an unimportant role as regards the provision of services or goods. Some persons, living near the district boundaries, reportedly cross the border for certain services, however, their influence in the total pattern is negligible.

Figure 6 displays the spatial pattern of interactions in the district. To improve clarity, the possible destinations have been aggregated to subdistrict level. Although the pattern, in the first instance, may look like a very complicated cobweb, it indicates that some subdistrict are more frequently chosen as a destination than others. This implies that not all subdistricts are equally important from a services provision point of view, and that some perform a more important role in that respect and actually have a higher level of centrality.

The centrality of the various settlements within the district, should be assessed in conjunction to the role of the city of Yogyakarta as a provider of services and goods. As can be seen from figure 7, from each settlement in the district, people go to this city. Not shown in this figure is the frequently of interactions from various settlements to Yogyakarta.

Data indicate that, especially in the southern part of the district, people tend to visit Bantul town more frequently than Yogyakarta. However, Yogyakarta is mentioned at least a couple of times in each village.

For analysis of the centrality of settlements within Bantul district, the classification as made in the previous chapter is used. A start is made at the bottom of the structure with the settlements with the lowest level of services (Appendix 1).

E-Level Rural Villages

The bottom end of the hierarchy includes 36 settlements, two of which are subdistrict capitals. From the number of inhabitants, it appears that the level of services present is not related to the size of the settlement. Population sizes vary from a minimum of 2834 in Tirtoharjo (Kretek) to a maximum of 16116 in Bangunjiwo (Kasihan). The latter settlement is even one of the largest ones in the district. Due to its location in the urban fringe of Yogyakarta, this settlement most likely experiences a fierce competition from its surrounding units.

The spatial distribution of the lowest level settlements (figure 8), shows some interesting aspects.

First, all settlements in the upland areas of Dlingo in the east and Pajangan in the west, turn out to belong to this group. This is another indication that the level of services provided in those subdistricts is very low. In contrast, three subdistricts (Srandakan, Sewon and Sedayu) do not have any settlement which belongs to this group.

Note : For the names of the settlements as indicated in figure 8 - 12, see the annex which contains a complete list of settlements and a map showing their respective location.

Second, some settlements do not have any interaction line(s) attached. Although not all of them can clearly be seen due to the fact that no direction is indicated by the interaction lines 6 of the 36 settlements, do not have any incoming interactions.

Some expections present themselves here. Dlingo and Terong in subdistrict Dlingo and Gilangharjo in subdistrict Pandak, possess interaction characteristics which make them more comparable to 'locality towns'. Especially the number of incoming interactions is far higher than might be expected on basis of their service level. This is caused by the presence of specialized services, like, for instance, a village cooperative, an auxiliary post office, or an (auxiliary) village health centre.

D-Level Rural Villages

The D-level service centres are depicted in figure 9. Most of the 23 settlements concerned are located in the central plain. Both settlements in Srandakan belong to this category. The subdistricts Sanden, Bambanglipuro and Jetis, do not enjoy any service centres above this level. This makes the actual services situation in these subdidtricts only marginally better than the situation in the subdistricts Dlingo and Pajangan.

The interaction pattern for the present group of rural villages is more complicated than the previous one. Although a large number of interactions is within the subdistricts, there is also a fair amount of interactions to neighbouring, or even more distant, subdistricts. This implies that people are willing to travel longer distances to visit those service centres.

The average number of interactions to the D-level rural villages is much higher than to the lower level centres, 162 and 92 respectively (Appendix 3). This higher number of destinations is mainly caused by an increasing number of incoming interactions, and to a lesser extent by an increasing number of internal interactions. The services provided by this level of service centres, therefore, is additional to the services as provided by lower level centres. However, a considerable number of interactions is directed towards higher level centres still.

Also in this category, one finds some settlements which differ considerably from the average, both upward as well as downward deviations can be discerned. Some 6 settlements recorded only a very limited number of incoming interactions. This indicates that the services available in those centres perform a function for the local population, but that they do not serve any people from lower level centres. Most likely because there are still higher level alternatives in the vicinity. On the other hand, there is Palbapang (Bantul), which receives a far higher number of incoming interactions than might be expected from its service level. This can be explained by the location of the

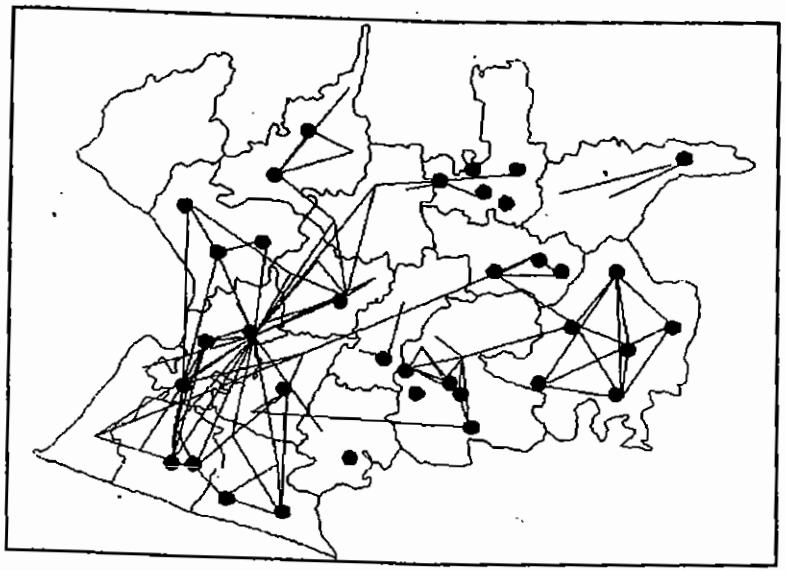

Figure 8. Interactions with E-level Rural Villages as Destination

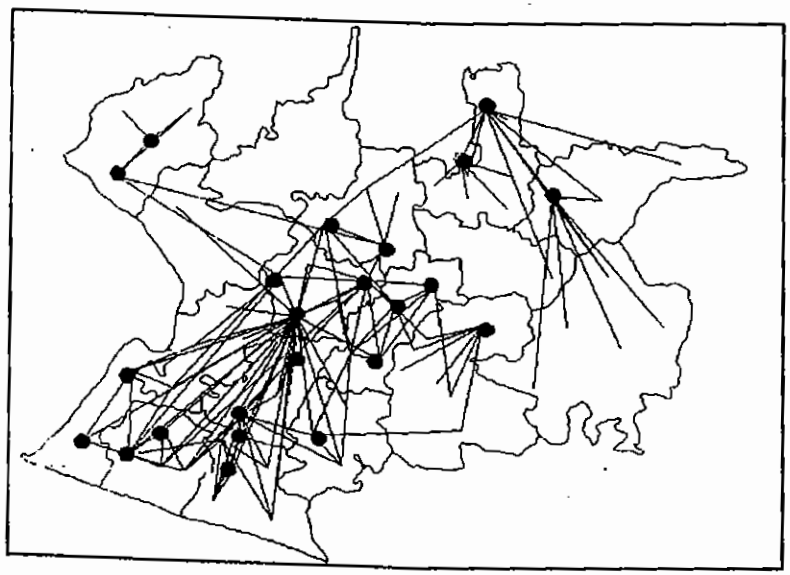

Figure 9. Interactions with D-level Rural Villages as Destination

district bus terminal in this settlement. Since this terminal is still fairly recent, it does already attract people to shop in its vicinity, but it has not (yet) resulted in an attraction of higher level services as well.

Locality Towns

This group consists of ten settlements, which are mainly located in the northern part of the district (figure 10). In the southern part of the district, the centres are relatively scarce. Especially Imogiri in the east and Wijirejo in the west seem to perform an important function as regional centres for the population in subdistricts which only possess lower level centres. Those settlements attract people from various neigbouring subdistricts. The centres in the northern part, on the other hand, seem to perform a more important role for people in their own subdistrict. The settlements included in this category can be clearly distinguished from the two groups described previously. The differences can be seen from the relative importance of incoming, internal and outgoing interactions. The difference with the lower level centres becomes especially clear when looking at the average interaction pattern. The number of destinations for the settlements within this category is almost twice as high as the number for D-level rural villages, and four times as high as for the E-level settlements. This increase is mainly caused by a higher number of incoming interactions and to a lesser extent by a lower importance of outgoing interactions.

On basis of the number of incoming interactions one can separate Imogiri and Pleret from the other settlements in this group. Their characteristics are more compatible to 'district towns' than to the settlements in their category.

District Towns

The group of district towns comprises five settlements only, as depicted in figure 11. The settlements are fairly well dispersed over the area, three in the northern and two in the southern part. Taking the centres belonging to this category as a group, one can hardly observe differences with the group of 'locality towns'. Differences in average number of destinations, and in the distribution between outgoing, incoming and internal interactions are largely absent. An analysis of all centres individually, however, indicates important differences. Two settlements, Bangunharjo (Sewon) and Ngestiharjo (Kasihan) receive far less incoming interactions than might be expected on basis of their service level. This limited number of incoming interactions seems anomalous if compared with the pattern as shown by figure 10.

The 'catchment area" for those two settlements appears to be much larger than is indicated by the number of incoming interactions. Apparently,

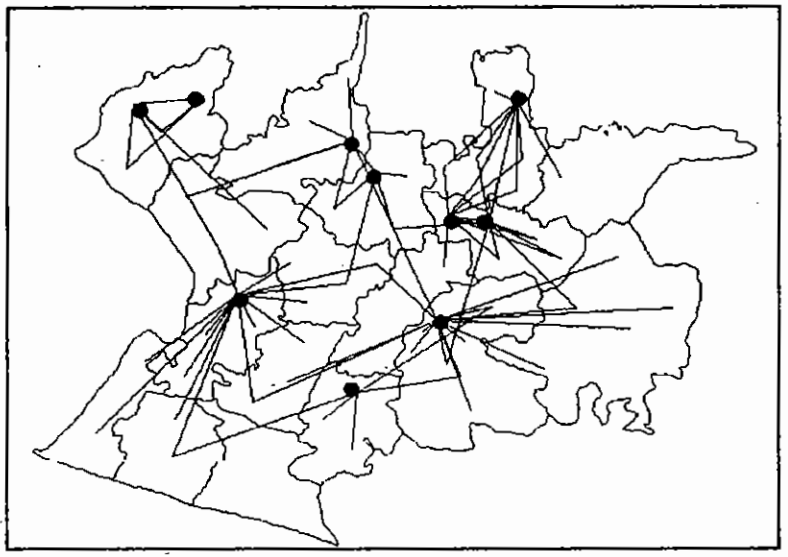

Figure 10. Interactions with Locality Towns as Destination

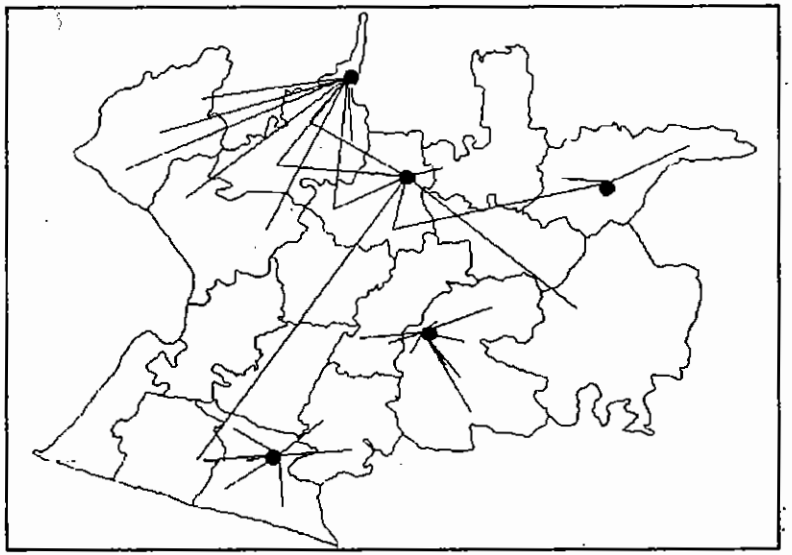

Figure 11. Interactions with District Towns as Destination

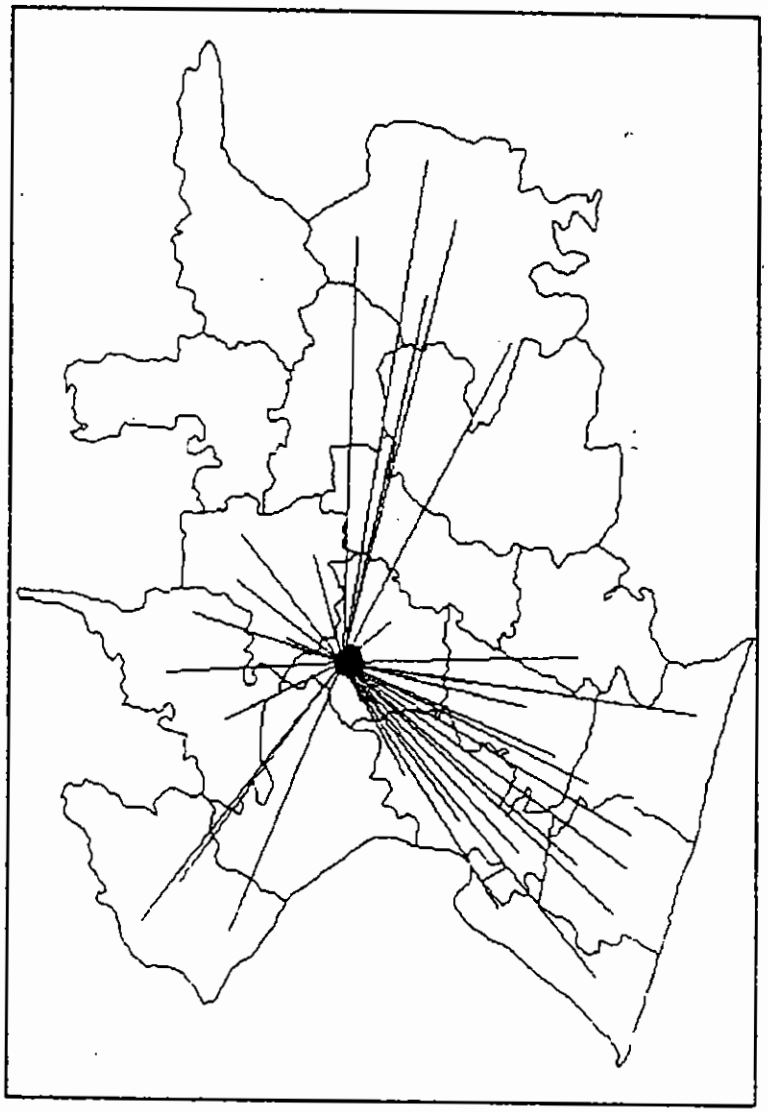

Figure 12. Interactions with Bantul as Destination

these settlements attract incidental visitors only. The three other settlements perform a much more important regional function. The number of interactions to these settlemnts is considerably higher than for the other two, although their catchment areas are far smaller.

Regional Town Bantul

The settlement, with the highest service level by far is Bantul town. This settlement is a category in itself. The service level is much higher than for the other settlements. The score is partly the result of the high level of services provided and is also caused by the large variety of services as supplied by this settlement. The important role of Bantul as a regional centre can be clearly distilled from the number of intections and the size of its catchment area. A large number of people is attracted from a large area, although not from the entire district; Bantul town seems to be an important destination for the areas without 'district towns'. In addition, it is an alternative for the district towns Bangunharjo and Ngestiharjo. This in turn may explain the limited number incoming interactions for those two settlements.

CONCLUSION : HIERARCHY AND CENTRALITY

From the previous analysis, it has become clear that the classification of settlements on basis of services largely coincides with the classification made on basis of centrality. A few aspects need to be noted here. For some settlements, the centrality level is higher than might be expected on basis of the service level, whereas other settlements appear to have a lower level of centrality.

In table 3, all settlements are listed according to rankorders. The first column displays the ranks obtained according to the level of services. The second column displays the ranks obtained according to the centrality level. In the final column, both rankorders are added up. The exclusivity of Bantul town remains evident. In both rankings, this settlement occupies the top position. Therefore, there is no doubt about the classification of Bantul as the only regional town in the study area.

In the category of district towns and locality towns, some changes in rank have occurred. First, the settlements Ngestiharjo and Bangunharjo have disappeared. This is mainly the result of the low incidence of incoming interactions for both settlements. On the other hand, Imogiri has climbed several positions to reach a position in the category of district towns. Actually, the settlements of Karangtalun and Imogiri should be taken together as one service center. This because both settlements are located very close to eachother and may be considered one functional entity. On basis of the two classifications, three district towns can be distinguished in the study area, viz. Srimulyo in Piyungan, Donotirto in Kretek and Imogiri/Karangtalun in Imogiri.

Table 3: Classification of Bantul District's Settlements on Basis of Hierarchy and Centrality

Settlement	Kecamatan	Rankorder on Basis of Hierarchy	Rankorder on Basis of Centrality	Rankorder on Basis of Hierarchy and Centrality
Bantul	Bantul	76	76	152
Karangtalun	Imogiri	73	74	147
Donotirto	Kretek	74	72	146
Imogiri	Imogiri	63	75	138
Srimulyo	Piyungan	72	66	138
Srihardono	Pundong	69.5	68	137.5
Baturetno	Banguntapan	66.5	70	136.5
Pleret	Pleret	63	73	136
Wijirejo	Pandak	66.5	69	135.5
Panggungharjo	Sewon	69.5	62	131.5
Tirtonirmolo	Kasihan	66.5	61	127.5
Palbapang	Bantul	56.5	71	127.5
Bangunharjo	Sewon	75	45.5	120.5
Argomulyo	Sedayu	63	56	119
Trimurti	Srandakan	59	57	116
Argorejo	Sedayu	48	67	115
Ngestiharjo	Kasihan	71	40.5	111.5
Gadingsari	Sanden	52	58.5	110.5
Murtigading	Sanden	52	58.5	110.5
Sidomulyo	Bambanglipuro	44.5	64	108.5
Wukirsari	Imogiri	59	49	108
Sumbermulyo	Bambanglipuro	54.5	50	104.5
Argosari	Sedayu	66.5	36	102.5
Patalan	Jetis	48	54	102
Wonokromo	Pleret	61	39	100
Sumberagung	Jetis	44.5	55	99.5
Gilangharjo	Pandak	34.5	60	94.5
Terong	Dlingo	31.5	63	94.5
Banguntapan	Banguntapan	59	35	94
Tirtomulyo	Kretek	40.5	51	91.5
Sitimulyo	Piyungan	38	53	91
Jagalan	Banguntapan	44.5	45.5	90
Pendowoharjo	Sewon	52	38	90
Trimulyo	Jetis	44.5	43	87.5
Dlingo	Dlingo	20.5	65	85.5
Trirenggo	Bantul	37	47	84

Settlement	Kecamatan	Rankorder on Basis of Hierarchy	Rankorder on Basis of Centrality	Rankorder on Basis of Hierarchy and Centrality
Timbulharjo	Sewon	56.5	27.5	84
Sendangsari	Pajangan	29	52	81
Sabdodadi	Bantul	40.5	37	77.5
Srigading	Sanden	29	48	77
Ringinharjo	Bantul	54.5	19	73.5
Argodadi	Sedayu	48	25.5	73.5
Sriharjo	Imogiri	26	43	69
Temuwuh	Dlingo	23.5	43	66.5
Panjangrejo	Pundong	50	15.5	65.5
Caturharjo	Pandak	23.5	40.5	64
Tamantirto	Kasihan	31.5	31.5	63
Tirtosari	Kretek	40.5	21	61.5
Mulyodadi	Bambanglipuro	26	31.5	57.5
Bangunjiwo	Kasihan	20.5	34	54.5
Canden	Jetis	26	25.5	51.5
Poncosari	Srandakan	40.5	10.5	51
Srimartani	Piyungan	34.5	15.5	50
Segoroyoso	Pleret	15	31.5	46.5
Tirtoharjo	Kretek	34.5	10.5	45
Kebonagung	Imogiri	17.5	24	41.5
Selopamioro	Imogiri	29	10.5	39.5
Gadingharjo	Sanden	15	22.5	37.5
Karangtengah	Imogiri	9.5	27.5	37
Girirejo	Imogiri	5	31.5	36.5
Tamanan	Banguntapan	3	29	32
Potorono	Banguntapan	20.5	10.5	31
Parangtritis	Kretek	7	22.5	29.5
Triharjo	Pandak	13	15.5	28.5
Wonolelo	Pleret	9.5	19	28.5
Triwidadi	Pajangan	17.5	10.5	28
Seloharjo	Pundong	20.5	3.5	24
Bawuran	Pleret	1	19	20
Wirokerten	Banguntapan	9.5	10.5	20
Mangunan	Dlingo	15	3.5	18.5
Guwosari	Pajangan	3	15.5	18.5
Jambidan	Banguntapan	9.5	3.5	13
Muntuk	Dlingo	7	3.5	10.5
Jatimulyo	Dlingo	7	3.5	10.5
Singosaren	Banguntapan	3	3.5	6.5

Source: Field research data, 1990

The distinction between the locality towns and the rural villages appears to be the most complicated. The first six settlements classified as locality towns are all sub-district capitals. Also due to their administrative functions, it makes

sense to classify those settlements as locality towns. This also applies to Trimurti and Argorejo, although the service level of Argorejo is considerably less if compared to the other settlements in this group. The objective does not comprise the mere labeling of a settlement. The main aim of this research has been to assess whether the settlement pattern, as reflected by hierarchy and centrality, is a functional one. The results of our analysis -based on information obtained from key informants- clearly indicate the functionality of the present settlement pattern in the study area. Most of the high level settlements are sub-district capitals and therefore are supposed to have a high level of centrality. The high incidence of 'capitals' in the first three types of settlements indicates that the distribution of services is fairly equitable. However, there are some subdistricts which have low level settlements only. These subdistricts are located in the upland areas and the southern part of the district which borders the Indian Ocean.

The distinction between D-level and E-level settlements appears to be an artificial one. Depending on the classification criteria applied, some differences occur in the relative position of settlements in these categories. Some settlements appear to have a higher number of incoming interactions than could be expected on basis of their service level. When both rankings are combined, however, most settlements still receive very modest scores.

The rural villages (both levels) can be distinguished from the other settlements on basis of two characteristics. First, the incoming interactions are far less important for these settlements than the outgoing interactions - the other three categories of settlements present the opposite picture -. Second, the total number of times those rural villages are mentioned as a destination is far smaller if compared to the other three categories of settlements. Therefore, it seems justified to drop the distinction between E-level and D-level rural villages.

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Appendix 1: Weighed Scores for the Various Groups of Services for All Settlements

Code	Settlement	1	2	3	4	5	6	7	8	9	10	11	12	13
21701	Argodadi	3	1	0	4	3	1	1	5	3	6	6	15	24
21704	Argomulyo	6	2	2	10	3	4	2	9	3	4	6	13	32
21702	Argorejo	1	1	3	5	2	2	1	5	3	8	3	14	24
21703	Argosari	6	1	2	9	3	3	1	7	3	8	6	17	33
21403	Bangunharjo	6	3	2	11	4	3	2	9	3	10	12	25	45
21501	Bangunjiwo	3	2	0	5	2	2	0	4	2	2	0	4	13
21308	Banguntapan	6	1	0	7	2	1	0	3	4	6	9	19	29
20703	Bantul	6	1	6	13	3	4	2	9	5	10	21	36	58
21307	Baturetno	6	2	3	11	4	3	2	9	3	4	6	13	33
21104	Bawuran	0	0	1	1	0	0	1	2	0	0	2	4	
20802	Canden	3	1	0	4	2	1	1	4	3	2	3	8	16
20601	Caturharjo	3	1	0	4	2	0	1	3	3	4	0	7	14
21002	Dlingo	3	2	2	7	0	1	0	1	3	2	0	5	13
20303	Donotirto	6	2	4	12	2	1	2	5	3	8	15	26	43
20202	Gadingharjo	1	1	0	2	2	0	0	2	2	2	3	7	11
20201	Gadingsari	6	1	0	7	3	1	6	10	2	4	3	9	26
20603	Gilangharjo	3	1	0	4	2	2	1	5	3	4	3	10	19
20905	Girirejo	1	0	0	1	1	0	0	1	2	2	0	4	6
21603	Guwosari	1	1	0	2	2	0	0	2	1	0	0	1	5
20907	Imogiri	3	0	1	4	1	3	0	4	4	8	12	24	32
21302	Jagalan	6	1	0	7	0	2	0	2	4	4	6	14	23
21305	Jambidan	3	1	0	4	1	0	0	1	1	0	3	4	9
21006	Jatimulyo	3	1	0	4	0	0	0	0	1	2	0	3	7
20906	Karangtalun	1	2	2	5	3	1	6	10	3	8	15	26	41
20904	Karangtengah	1	1	1	3	0	0	0	0	1	2	3	6	9
20903	Kebonagung	3	0	0	3	2	0	0	2	2	2	3	7	12
21001	Mangunan	6	1	0	7	1	0	1	2	2	0	0	2	11
20502	Mulyodadi	6	1	0	7	1	0	1	2	3	4	0	7	16
21004	Muntuk	3	1	1	5	1	0	0	1	1	0	0	1	7
20204	Murtigading	6	2	2	10	1	1	0	2	2	6	6	14	26
21504	Ngestiharjo	6	1	1	8	2	4	0	6	5	8	12	25	39
20701	Palbapang	6	2	1	9	2	3	0	5	4	4	6	14	28
21404	Panggungharj	6	3	3	12	1	3	0	4	4	6	9	19	35
20402	Panjangrejo	3	1	2	6	2	1	0	3	3	4	9	16	25
20302	Parangtritis	6	1	0	7	0	0	0	0	0	0	0	0	7
20801	Patalan	3	2	0	5	3	3	0	6	3	4	6	13	24
21401	Pendowoharj	3	1	2	6	2	3	0	5	3	6	6	15	26
21101	Pleret	6	1	4	11	3	3	4	10	4	4	3	11	32
20101	Poncosari	6	1	1	8	2	0	1	3	2	6	3	11	22
21306	Potorono	6	1	0	7	1	0	0	1	3	2	0	5	13

Appendix 1 Continued

Code	Village	1	2	3	4	5	6	7	8	9	10	11	12	13
20702	Ringinharjo	4	1	2	7	1	1	0	2	4	8	6	18	27
20705	Sabdodadi	6	1	1	8	2	1	0	3	3	2	6	11	22
21103	Segoroyoso	3	1	0	4	1	1	0	2	3	2	0	5	11
20401	Seloharjo	3	1	0	4	0	0	0	0	2	4	3	9	13
20901	Selopamioro	1	1	0	2	2	0	2	4	3	2	6	11	17
21602	Sendangsari	3	2	3	8	2	1	0	3	4	2	0	6	17
20501	Sidomulyo	6	2	2	10	2	0	1	3	3	4	3	10	23
21303	Singosaren	1	1	0	2	1	0	0	1	2	0	0	2	5
21201	Sitimulyo	3	1	1	5	1	0	2	3	3	4	6	13	21
20203	Srigading	3	1	1	5	1	2	2	5	3	4	0	7	17
20403	Srihardono	3	2	3	8	3	3	2	8	4	6	9	19	35
20902	Sriharjo	3	1	0	4	2	0	2	4	3	2	3	8	16
21203	Srimartani	6	1	1	8	2	0	2	4	2	2	3	7	19
21202	Srimulyo	3	2	3	8	3	2	6	11	4	8	9	21	40
20803	Sumberagung	6	0	0	6	3	1	2	6	3	2	6	11	23
20503	Sumbermulyo	6	1	0	7	3	3	2	8	2	4	6	12	27
21301	Tamanan	3	2	0	5	0	0	0	0	0	0	0	0	5
21503	Tamantirto	3	1	1	5	2	2	0	4	3	6	0	9	18
21003	Temuwuh	6	1	0	7	2	0	1	3	2	2	0	4	14
21005	Terong	6	2	1	9	2	1	1	4	3	2	0	5	18
21402	Timbulharjo	3	3	2	8	3	2	2	7	3	10	0	13	28
20301	Tirtoharjo	1	1	2	4	2	0	0	2	3	4	6	13	19
20305	Tirtomulyo	6	1	0	7	3	1	0	4	2	6	3	11	22
21502	Tirtonirmolo	6	1	2	9	3	3	2	8	3	4	9	16	33
20304	Tirtosari	3	1	2	6	2	0	0	2	4	4	6	14	22
20602	Triharjo	1	2	1	4	1	0	0	1	3	2	0	5	10
20804	Trimulyo	3	2	2	7	3	3	0	6	3	4	3	10	23
20102	Trimurti	6	2	2	10	2	3	1	6	3	4	6	13	29
20704	Trirengo	6	4	0	10	1	0	0	1	5	4	0	9	20
21601	Triwidadi	3	1	1	5	1	1	1	3	2	2	0	4	12
20604	Wijirejo	6	2	3	11	3	4	2	9	3	4	6	13	33
21302	Wirokerten	1	1	1	3	2	1	0	3	1	2	0	3	9
21101	Wonokromo	6	2	1	9	3	1	1	5	4	4	9	17	31
21105	Wonolelo	1	1	0	2	2	0	0	2	3	2	0	5	9
20908	Wukirsari	6	1	1	8	3	2	0	5	3	4	9	16	29

1 = education
2 = health
3 = other community services
4 = total community services
5 = agro-support
6 = markets
7 = other production related
8 = total production related services
9 = low level comm. services
10= intermediate level commercial services
11= high level comm. services
12= total commercial services
13= grand total = final score

Appendix 2: A Classification of Bantul District's Settlements

Score	Settlement	Kecamatan	Population	# of departures	# of internal trips	# of destinations	# of outgoing trips	# of incoming trips
58	**Bantul**	**Bantul**	**13289**	**246**	**203**	**935**	**43**	**732**
45	Bangunharjo	Sewon	15232	253	126	164	127	38
43	Donotirto	Kretek	8837	214	149	464	65	315
41	Karangtalun	Imogiri	2776	282	149	534	133	385
40	Srimulyo	Piyungan	13382	214	155	318	59	163
39	Ngestiharju	Kasihan	19073	235	143	169	92	26
35	Srihardono	Pundong	11426	225	151	329	74	178
35	Panggungharjo	Sewon	18640	234	113	236	121	123
33	Wijirejo	Pandak	9607	239	162	364	77	202
33	Tirtonirmolo	Kasihan	15438	235	140	257	95	117
33	Baturetno	Banguntapan	7873	131	72	286	59	214
33	Argosari	Sedayu	7802	235	86	102	149	16
32	Pleret	Pleret	9107	187	145	466	42	321
32	Imogiri	Imogiri	3432	232	93	622	139	529
32	Argomulyo	Sedayu	10879	229	158	248	71	90
31	Wonokromo	Pleret	8556	236	128	149	108	21
29	Wukirsari	Imogiri	13052	237	122	171	115	49
29	Trimurti	Srandakan	15820	234	164	272	70	108
29	Banguntapan	Banguntapan	20921	299	67	81	232	14
28	Timbulharjo	Sewon	15326	249	79	88	170	9
28	Palbapang	Bantul	11958	231	109	397	122	288
27	Sumbermulyo	Bambanglipuro	14834	244	141	204	103	63
27	Ringinharjo	Bantul	6337	236	66	69	70	3
26	Pendowoharjo	Sewon	15254	228	67	85	161	18
26	Murtigading	Sanden	8154	237	109	219	128	110
26	Gadingsari	Sanden	10657	241	128	238	113	110
25	Panjangrejo	Pundong	9217	231	62	64	169	2
24	Patalan	Jetis	11090	244	115	193	129	78
24	Argorejo	Sedayu	7987	244	140	304	104	164
24	Argodadi	Sedayu	9475	241	59	67	182	8
23	Trimulyo	Jetis	12058	234	102	138	132	36
23	Sumberagung	Jetis	10478	233	161	245	72	84
23	Sidomulyo	Bambanglipuro	2516	244	123	279	121	156
23	Jagalan	Banguntapan	3163	213	63	101	150	38
22	Tirtosari	Kretek	4127	284	87	91	197	4
22	Tirtomulyo	Kretek	6762	192	59	123	133	64
22	Sabdodadi	Bantul	5215	236	68	85	168	17
22	Poncosari	Srandakan	11923	229	75	76	154	1
21	Sitimulyo	Piyungan	10398	218	69	140	149	71
20	Trirengo	Bantul	14643	242	78	121	164	43
19	Tirtoharjo	Kretek	2834	237	48	49	189	1
19	Srimartani	Piyungan	10707	214	58	60	156	2

Appendix 2 Continued

Score	Settlement	Kecamatan	Population	# of departures	# of internal trips	# of destinations	# of outgoing trips	# of incoming trips
19	Gilangharjo	Pandak	13950	236	127	239	109	112
18	Terong	Dlingo	4625	217	97	224	120	127
18	Tamantirto	Kasihan	12188	229	81	92	148	11
17	Srigading	Sanden	9104	236	95	141	141	46
17	Sendangsari	Pajangan	9306	227	90	159	137	69
17	Selopamioro	Imogiri	11788	231	68	69	163	1
16	Sriharjo	Imogiri	8758	235	91	127	144	36
16	Mulyodadi	Bambanglipuro	11045	245	71	82	174	11
16	Canden	Jetis	9406	233	77	85	156	8
14	Temuwuh	Dlingo	5776	210	69	105	141	36
14	Caturharjo	Pandak	10465	236	85	111	151	26
13	Seloharjo	Pundong	9361	229	46	46	183	0
13	Potorono	Banguntapan	7287	216	46	47	170	1
13	Dlingo	Dlingo	5626	195	108	270	87	162
13	Bangunjiwo	Kasihan	16116	229	88	100	141	12
12	Triwidadi	Pajangan	9062	233	64	65	169	1
12	Kebonagung	Imogiri	3204	217	40	47	177	7
11	Segoroyoso	Pleret	5262	287	95	106	192	11
11	Mangunan	Dlingo	4012	207	71	71	136	0
11	Gadingharjo	Sanden	3392	242	28	33	214	5
10	Triharjo	Pandak	10486	232	76	78	156	2
9	Wonolelo	Pleret	3674	224	68	71	156	3
9	Wirokerten	Banguntapan	7627	222	65	66	157	1
9	Karangtengah	Imogiri	4228	186	41	50	145	9
9	Jambidan	Banguntapan	6926	218	66	66	152	0
7	Parangtritis	Kretek	6333	238	107	112	131	5
7	Muntuk	Dlingo	6741	206	46	46	160	0
7	Jatimulyo	Dlingo	6459	199	38	38	161	0
6	Girirejo	Imogiri	4058	235	46	57	189	11
5	Tamanan	Banguntapan	6609	210	101	111	109	10
5	Singosaren	Banguntapan	2209	218	53	53	165	0
5	Guwosari	Pajangan	8020	231	57	59	174	2
4	Bawuran	Pleret	4837	224	82	85	142	3

Appendix 3: Average Number of Interactions for the Various Types of Settlements

Type of Settlement	Total # of Destinations	Incoming Interactions	Internal Interactions	Outgoing Interactions
Bantul Regional City	935	732	203	43
District Towns	330	185	145	95
Locality Towns	305	181	124	94
Level D Villages	162	65	97	141
Level E Villages	93	22	71	154
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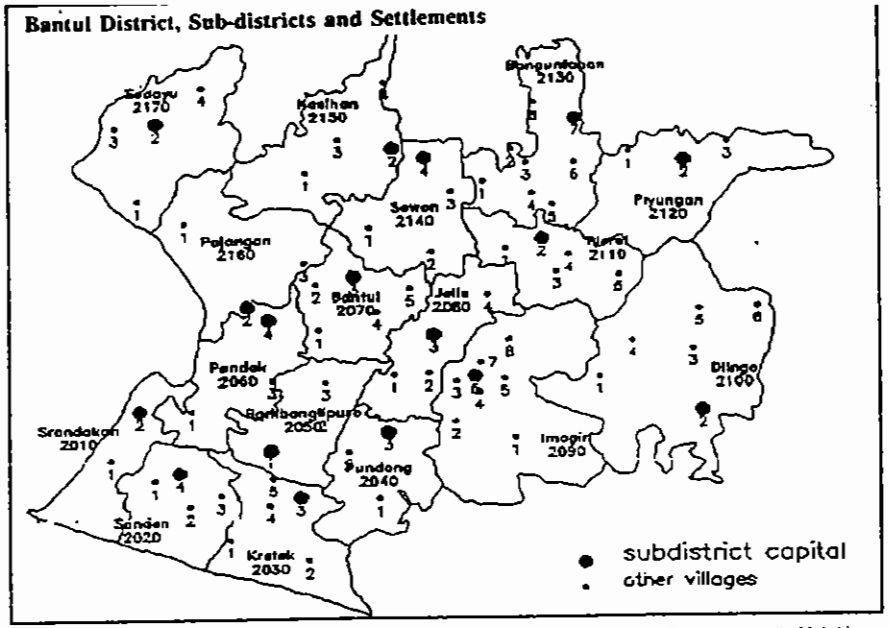
All settlements	170	77	93	137



Code	Settlement	Kecamatan	# of Inhabitants
20101	Poncosari	Srandakan	11923
20102	Trimurti	Srandakan	15820
20201	Gadingsari	Sanden	10657
20202	Gadingharjo	Sanden	3392
20203	Srigading	Sanden	9104
20204	Murtigading	Sanden	8154
20301	Tirtosrgo	Kretek	2834
20302	Parangtritis	Kretek	6333
20303	Donotirto	Kretek	8837
20304	Tirtosari	Kretek	4127
20305	Tirtomulyo	Kretek	6762
20401	Seloharjo	Pundong	9361
20402	Panjangrejo	Pundong	9217
20403	Srihardono	Pundong	11426
20501	Sidomulyo	Bambanglipuro	2516
20502	Mulyodadi	Bambanglipuro	11045
20503	Sumbermulyo	Bambanglipuro	14834
20601	Caturharjo	Pandak	10465
20602	Triharjo	Pandak	10486
20603	Gilangharjo	Pandak	13950
20604	Wijirejo	Pandak	9607
20701	Palbapang	Bantul	11958
20702	Ringinharjo	Bantul	6337
20703	Bantul	Bantul	13289
20704	Trirenggo	Bantul	14643
20705	Sabdodadi	Bantul	5215
20801	Patalan	Jetis	11090
20802	Canden	Jetis	9406
20803	Sumberagung	Jetis	10478
20804	Trimulyo	Jetis	12058
20901	Selopamioro	Imogiri	11788
20902	Sriharjo	Imogiri	8758
20903	Kebonagung	Imogiri	3204
20904	Karangtengah	Imogiri	4228
20905	Girirejo	Imogiri	4058
20906	Karangtalun	Imogiri	2776
20907	Imogiri	Imogiri	3432
20908	Wukirsari	Imogiri	13052

Code	Desa	Kecamatan	# of Inhabitants
21001	Mangunan	Dlingo	4012
21002	Dlingo	Dlingo	5626
21003	Temuwuh	Dlingo	5776
21004	Muntuk	Dlingo	6741
21005	Terong	Dlingo	4625
21006	Jatimulyo	Dlingo	6459
21101	Wonokromo	Pleret	8556
21102	Pleret	Pleret	9107
21103	Segoroyoso	Pleret	5262
21104	Bawuran	Pleret	4837
21105	Wonolelo	Pleret	3674
21201	Sitimulyo	Piyungan	10398
21202	Srimulyo	Piyungan	13382
21203	Srimartani	Piyungan	10707
21301	Tamanan	Banguntapan	6609
21302	Jagalan	Banguntapan	3163
21303	Singosaren	Banguntapan	2209
21304	Wirokerten	Banguntapan	7627
21305	Jambidan	Banguntapan	6926
21306	Potorono	Banguntapan	7287
21307	Baturetno	Banguntapan	7873
21308	Banguntapan	Banguntapan	20921
21401	Pendowoharjo	Sewon	15254
21402	Timbulharjo	Sewon	15326
21403	Bangunharjo	Sewon	15232
21404	Panggungharj	Sewon	18640
21501	Bangunjiwo	Kasihan	16116
21502	Tirtonirmolo	Kasihan	15438
21503	Tamantirto	Kasihan	12188
21504	Ngestiharjo	Kasihan	19073
21601	Triwidadi	Pajangan	9062
21602	Sendangsari	Pajangan	9306
21603	Guwosari	Pajangan	8020
21701	Argodadi	Sedayu	9475
21702	Argoreje	Sedayu	7987
21703	Argosari	Sedayu	7802
21704	Argomulyo	Sedayu	10879

The first four digits form the sub-district number, the last digit is the village number

Bold printed settlements are sub-district capitals