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Abstract: This paper demonstrates how the of Analytic Hierarchy Process (AHP) was useful in rationally measuring the intangible and complex impacts of the Trans-Sumatra Highway (TSH) built in the late 1970's. Specifically, the task, using the AHP, was to analyze the overall impact of the highway according to the perception of local people, not that of the researchers or some other party. Many cost–benefit studies tend to underestimate the importance of the local society where the impact of the project is felt most strongly. Yet, when one speaks about the costs and benefits of a local project, ideally, it should be referring to those benefits and costs that affect the local people, directly or indirectly.

Keywords: Trans-Sumatra Highway, Analytic Hierarchy Process, positive and negative impacts, supply and demand analysis of regional development, benefit–cost hierarchy, local people's perception versus secondary data, interregional trade, impact region, development scenario, Gross Regional Domestic Product (GRDP)

1. Introduction

The market potentiality of Sumatra and the need to spread regional development activities were the basis on which the government of Indonesia decided to construct a highway in the late 1970's, later known as the Trans-Sumatra Highway (TSH). It was originally planned that the highway would stretch from the extreme southern part to the northern tip of Sumatra Island to ease the flow of goods and passengers both to and from areas within the island and between Sumatra and the already developed island of Jawa. The post-evaluation study, upon which this paper is based, covers four provinces in the southern part of Sumatra island through which the TSH passes: Lampung, Bengkulu, South Sumatra and Jambi. The following is a glimpse of these regions.

In 1985 the population size of the area was 14.06 million with Lampung being the most

densely populated (180 people per square km). The role of Lampung in this region is unique for two reasons. First is its geographic proximity to Java, Indonesia's main island where 70% of the nation's population resides, and second is the fact that historically from the Dutch colonial period until the late 1970's it had been the major transmigration receiving area. With the exception of the South Sumatra province, the economy of the observed regions is predominantly agricultural. The value-added share of the agricultural sector, including forestry, ranges from 44.4% in Lampung to 49.9% in Bengkulu. The size of this region is about 10% of the total land area of Indonesia and its contribution to the nation's agricultural production is also about 10%. Although manufacturing is dominant in South Sumatra, the agricultural products of the province have always been very important to the area. All four provinces are important producers of rubber, coconut and coffee. The soil condition, largely being yellow podzolic, is indeed suitable for such products. All provinces

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produce wood products (either one or two of the following: plywood, sawn timber and semi-processed rattan).

South Sumatra, the exception to the agricultural norm, has a manufacturing sector that provides the largest value added among all 27 provinces of Indonesia. Large, medium and small industries coexist in this province. It is also the home of one of the major petrochemical industries in Indonesia primarily due to the richness of the region in mining products, in particular oil and gas.

There has been a shift in the manufacturing orientation of most provinces. During the period 1975–1980, the sector was characterized as being either low value-added or having a strong labor and raw-material orientation (the only exception was Jambi). In the early 1980's (1980–1981) the manufacturing orientation in Lampung and Bengkulu shifted from low value-added to labor and raw material intensive. Meanwhile, South Sumatra began to enter the capital-intensive industries. The shift apparently occurred during the period when some parts of the TSH had been completed. It is, however, still speculative to assert that the shift was primarily due to the presence of the highway. In Jambi, there was no clear systematic feature which could be observed during the 1980's.

The province of South Sumatra experienced the greatest increase in development among the four provinces. The per-capita GRDP (gross regional domestic product) of this province in 1984, measured in 1975 prices, reached more than Rp210 000 as compared to Rp77 500 thousand in Lampung, which had the lowest figure among the four provinces. The rate of growth of per-capita GRDP in South Sumatra, together with Bengkulu, has been also high, more than 7% annually during 1971–1984.

Perhaps a more representative proxy indicator of the per-capita income than the per-capita GRDP is the level of household consumption based on a series of economic and social surveys. Judging from the relatively high share of food consumption in the total expenditures, the level of per-capita income must have been relatively low in all four provinces. This is true for both urban and rural areas in comparison to the same areas in the rest of the nation. Jambi has the lowest income followed by Bengkulu, Lampung and South Sumatra. In terms of the level of per-capita con-

sumption, all four have lower figures than some of the other provinces in Sumatra, e.g., Aceh and West Sumatra.

During the period 1978–1981, the average annual growth rate of per-capita consumption was also relatively low. From 1978 to 1980, for example, none of the provinces experienced a rate of growth higher than the rate enjoyed by West Jawa, the province in Jawa that is closest to Sumatra. The differential rate is even more pronounced during the period 1980–1981. However, the gap began to be reduced after 1981, mainly because the growth rate in West Jawa began to slow down.

Another significant factor determining the demand side is the population size. Because of the large population, the observed region's low-effective demand probably cannot be altered. In the future, the population factor will contribute even less to strengthening local demand because the destination of the transmigration program will no longer be concentrated in this region (with perhaps the exception of Bengkulu).

The development in Lampung, measured by fairly standard socio-economic development indicators (e.g., poverty share and income disparity index) is ranked the worst. This seems to be due to an adverse impact of TSH there. This will be the subject of discussion in a later section. In general, though the income distribution is not even and the poverty level is still high, some improvements in poverty eradication have been taking place. Still, the characteristic of low purchasing power or small local demand remains.

Yet a look at the supply side gives a different picture. Judging from natural conditions (e.g., soils, rainfall, etc.) as well as the existing level of production and capacity, the southern part of Sumatra definitely has huge potential. More specifically, because of Indonesia's recent effort to boost exports of non-oil and gas, the region's plantation products, be they processed or unprocessed, appear to be the *prima donna* among Indonesia's exports, now and in the future. To realize the potential, however, the transportation network must be solid. Thus, the construction of a relatively good highway connecting the provinces which are major producers of commodities became inevitable.

The interrelation between overall supply and demand may be summarized by comparing two proxy variables, each representing supply and de-

mand in the region: the regional income elasticity, a proxy for potential demand, and the standard location quotient (LQ), an index for potential supply. From this information, one can conclude that the agricultural sector is always a surplus in the observed region, but at the same time is characterized by a low income elasticity (less than unity). The same conclusion is derived from the 1979 and the 1984 information. A large portion of the agricultural products (mostly plantation) must therefore be transported to other regions. This is a strong justification for constructing the highway. In addition, surplus products in the northern part of Sumatra may also benefit from the TSH, as

they do not have sufficient facilities and ocean ports of their own from which to export.

2. Objectives and rationale of using AHP

After the completion of the TSH project, some agencies were interested in examining the overall impact, particularly that felt by people living in the areas through which some component of the TSH actually passes. The Overseas Economic Cooperation Fund (OECF), a Japanese government agency that provided major financial support for TSH construction in the southern part of Sumatra,

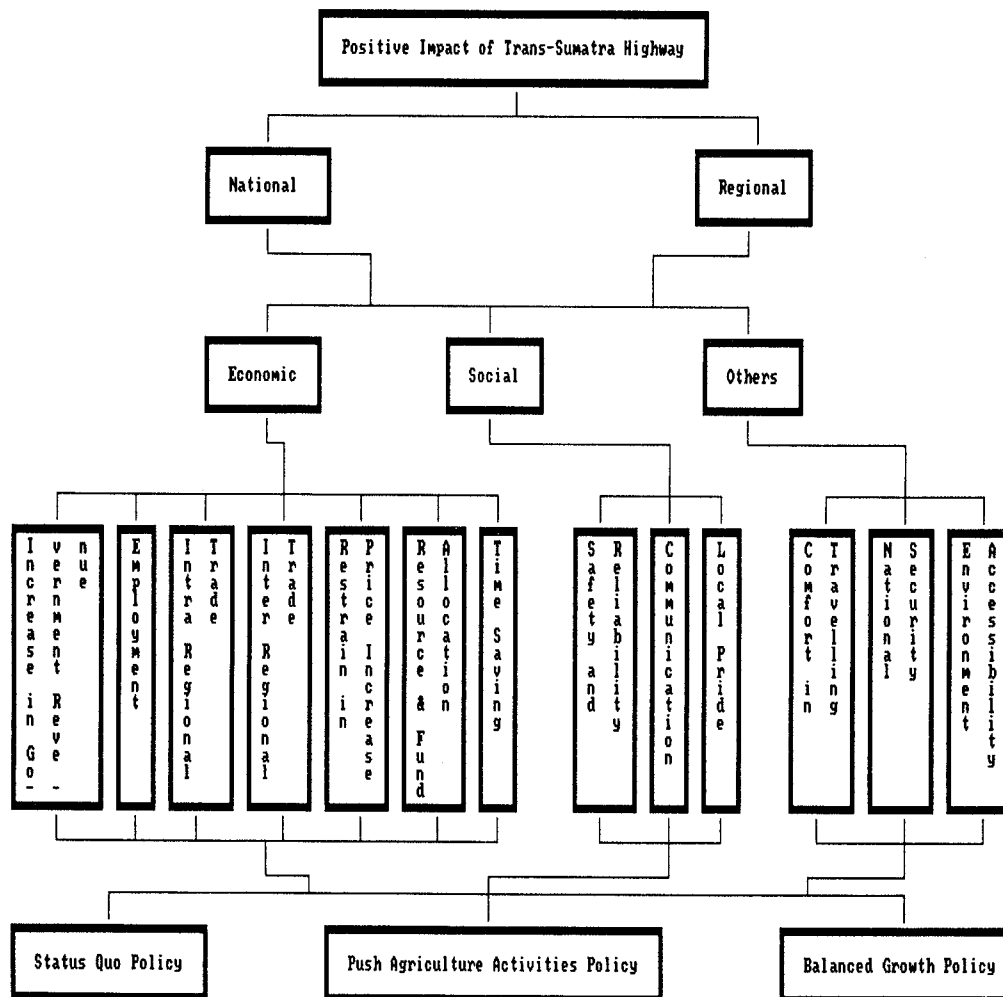


Figure 1. The hierarchy for the positive impacts of the Trans-Sumatra Highway

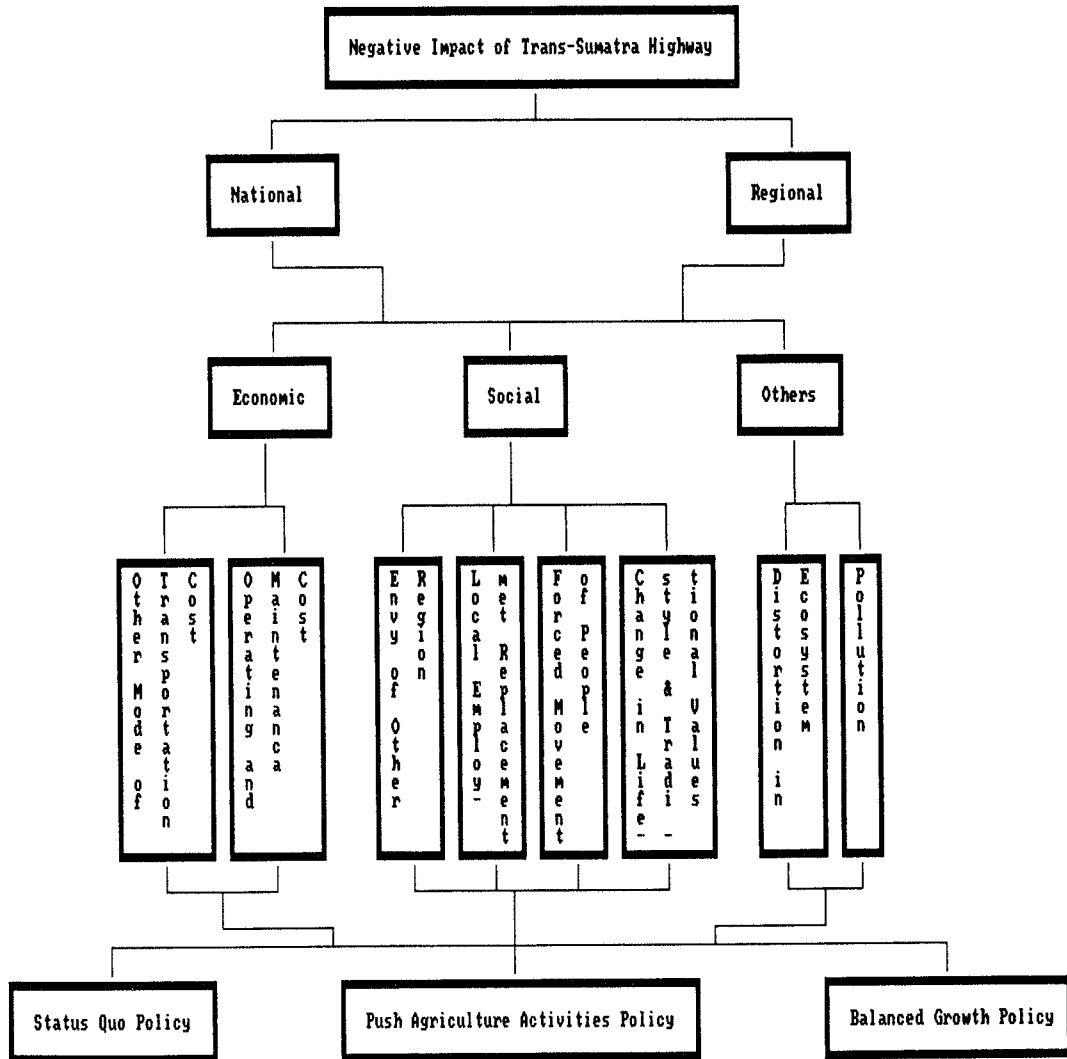


Figure 2. The hierarchy for the negative impacts of the Trans-Sumatra Highway

was one such agency. It was through their financial support that the survey was made possible. The research, however, could not have been done without also having broad manpower support from both the Institute for Economic and Social Research at the University of Indonesia and the regional government offices.

The main purpose of this paper is to demonstrate how the application of Analytic Hierarchy Process (AHP) was useful in rationally measuring the intangible and complex impacts of TSH. Specifically, the task, using the AHP, was to analyze the overall impact of the highway according to the perception of local people, not that of the researchers or some other party.

Many cost-benefit studies tend to underestimate the importance of the local society where the impact of the project is felt most strongly. Yet, when one speaks about the costs and benefits of a local project, ideally, it should be referring to those benefits and costs that affect the local people, directly or indirectly. This, of course, does not necessarily mean that we ought to confine our definition of impact region only to the spatial subset (region) where the project is located. A project built in a certain locality, a highway for example, very probably will generate benefits (and costs as well) for the neighboring area, and for the rest of the nation, and vice versa. Therefore, a 'national' component ought to be included in the

impact analysis along with the 'regional' component (see Figures 1 and 2).

It is important to note that neither the completion of TSH nor its impacts are uniform in time. In Lampung and Jambi, for example, the impact of the highway has been felt for quite some time although some of the components, i.e., the one connecting Muarabungo–Muaraupit and the one passing through Tebing Tinggi were actually completed only in early 1985. It is also necessary to remark that some of the roads connecting Kotabumi–Tanjung Karang and Muaraenim–Palembang are not newly built. Here the project took the form of road betterment.

Another note concerns the province of Bengkulu where there is no TSH component built. Bengkulu is a typical example of an impacted region that lies outside the area where the project is actually located. Therefore, the type and size of the highway's impact upon this province is somewhat unusual.

Highway impact studies more often than not tend to use information or data of a secondary type such as the amount and frequency of traffic, tonnage of goods being loaded and unloaded, traveling time, and so on. Despite the usefulness of this kind of data, particularly for describing the tangible repercussions of the highway, analysis using such data often do not appropriately reflect the economic, social and environmental impacts felt by the local people.

In addition to learning the perceptions of local people concerning the impacts of the TSH, we thought it would also be necessary to get their perceptions regarding future development. We certainly could not attain this objective with a standard benefit–cost approach. It was clear then that the perception of local people, its nature, direction and intensity, would have to be the inputs of our impact study.

We performed a comprehensive survey employing the Analytic Hierarchy Process (AHP). The AHP is a method used to capture, in a rational way, people's perceptions even when there is some degree of inconsistency in their inputs. All the aforementioned points, though far from being easy to pin down because of the complex nature of the impact hierarchy we were using to assess them, would be of prime importance in our study. A strong basis for taking the approach of measuring local people's perception, rather than relying upon

secondary data and then using them with our own perceptions regarding that data, is the premise that the opinions of members of the society itself are far more representative than those of researchers or policy makers who are not involved in the day-to-day local environment and who are isolated from any form of dynamics taking place in the region where the actual project is located.

3. The benefit–cost hierarchies

Figures 1 and 2 show the positive and negative hierarchies for the analysis. Notice that in both the positive and negative hierarchies, the bottom level consists of the future development scenarios desired in each region. The 'Status Quo' scenario means no change in the course of policy (and hence development) direction. The 'Agriculture Push' scenario means even more agricultural emphasis in the already plantation-based economy. The 'Balanced Growth' scenario means more variety of sectoral activities including manufacturing industries, mining, trade and other services sectors. These scenarios, when put in the questionnaires we used to conduct our survey, are associated with the time frame of 1985–2000. Notice that the same elements occur in level 2 in both hierarchies, and that all the elements of level 2 have descendents in both hierarchies.

Because TSH was a relatively big project and had the potential to generate benefits for other regions as well, we separated the impacts into 'regional' and 'national' at the outset (level 1). Each of these had three categories of impacts: 'economic', 'social', and 'others'. In the latter category, we consider factors proposed by local people that do not fit into the first two categories. For instance, national security, comfort in travelling and access to some environmentally preserved areas are its subfactors in the positive impacts hierarchy. In the negative impacts hierarchy, the distortion of the ecosystem and pollution are the subfactors. Subfactors in the economic and social categories are self-explanatory.

Notice that the three scenarios in the lowest level of hierarchy are evaluated for the factors in level 3. Therefore, the pairwise comparison questions will ultimately lead to the ranking the scenarios under economic, social and environmental categories. As these in turn are ranked under

national and regional, and national and regional are compared for importance with respect to priority ranking for level 1, level 2 and their interconnection, the goal, at the end, a priority ranking of those three scenarios is generated. The same procedure is carried out for the negative impacts hierarchy to obtain a ranking of the scenarios. The advantage of using the AHP is that the scores of the scenarios under positive and negative impacts hierarchies are now commensurate and can be compared. Taking the benefit–cost ratio under each scenario can therefore legitimate. The impact analysis may accordingly be based on these three ratios.

The survey was conducted at the regional planning office (Bappeda) of each observed region from April 14 to April 20, 1986. However, another meeting was conducted prior to the survey (approximately a month before) to discuss the framework and substance of the questionnaire. This step is essential to make sure of the relevance and completeness of the questions to be asked in the survey.

The respondents were categorized into six groups. Group 1 consisted of Bappeda and provincial office (Pemda) representatives, while Groups 2 to 6 represent the sectoral-regional offices (Kanwil) of the following sectors: agriculture, industry, transportation, public works and the department of trade. In some cases, the head of Kanwil attended the session.

4. Results of the survey

4.1. Positive impacts

With the exception of individuals from Jambi, the local people felt that the positive impact of TSH was more at the national rather than regional level. In most cases, they believed that the highway would ease the transportation of plantation products, because a large portion of them, directly or indirectly, are bound for international markets (export). This, in turn, they felt, was mainly to get more of the foreign exchange revenues needed to promote Indonesia's effort to rely less on oil and gas exports. Hence, they believed that the priority of TSH was high because of national interests rather than because of regional ones.

We expected that economic impacts would overwhelm the social and environmental impacts,

and also within the category of economic that the presence of the highway would generate more interregional benefits than intraregional one in the form of trade. This proved to be the case with the exception of South Sumatra. All three provinces ranked interregional trade benefits at the very top of the positive economic impacts. In fact, even in South Sumatra this factor received the second highest priority (out of seven factors).

In all the regions the local people regarded the increase in communication to be the most important social benefit of TSH, followed by increase in safety and reliability. The increase in communication was thought to account for a wide range of benefits. For instance, improvements in education and health were felt as people in the remote areas had greater accessibility to schools and peoples' health centers (puskesmas). Knowledge about farming, planting, and family planning increased as the officials in charge made more frequent trips. Another type of social improvement due to better communication was the possibility of more frequent visits by friends and relatives. This was also perceived to a significant degree by the respondents.

In the 'others' category strengthening national security was considered to be an important aspect of TSH, although not all provinces ranked it first. South Sumatra and Bengkulu have relatively good ocean ports. This may be why they ranked the national security benefit of TSH second.

4.2. Negative impacts

In the negative impacts hierarchy, the social and environmental disbenefits of the highway are considered to be stronger at the regional level. Indeed, a higher priority is given to the regional, rather than the national, negative impacts of TSH. Unlike in the positive case, the most important impact here has to do with a social 'costs' or disbenefits. Changes in life-style and the breakdown of traditional values, often referred to as 'cost of modernization', are considered the highest probable negative impacts. Some examples are worthy of note. In several areas of Lampung, people were accustomed to sitting and chatting during the mid-day. An exchange of news and other information took place along the roadside. Food vendors also benefited from the occasion. With the betterment of the roads and the subse-

Table 1

Results of the hierarchies in Figures 1 and 2: The perception of local officials on the positive and negative impacts of Trans-Sumatra Highway: The case of Lampung, South Sumatra, Jambi and Bengkulu ^a

Impacts	Lampung	South Sumatra	Jambi	Bengkulu
<i>Positive impacts</i>				
I 1. National	0.750 (1)	0.830 (1)	0.123 (2)	0.830 (1)
2. Regional	0.250 (2)	0.170 (2)	0.877 (1)	0.170 (2)
II 1. Economic	0.760 (1)	0.730 (1)	0.732 (1)	0.610 (1)
2. Social	0.170 (2)	0.190 (2)	0.187 (2)	0.200 (2)
3. Others	0.070 (3)	0.080 (3)	0.081 (3)	0.190 (3)
III 1. Time saving	0.180 (2/3)	0.127 (3)	0.249 (2)	0.153 (4)
2. Resource and fund allocation	0.060 (7)	0.360 (1)	0.075 (4)	0.098 (6)
3. Increase in government revenues	0.180 (2/3)	0.042 (7)	0.053 (6)	0.156 (3)
4. Restrain in price increase	0.070 (6)	0.120 (4)	0.053 (7)	0.112 (5)
5. Interregional trade	0.220 (1)	0.251 (2)	0.406 (1)	0.239 (1)
6. Intra-regional trade	0.120 (5)	0.052 (5)	0.096 (3)	0.073 (7)
7. Create employment	0.170 (4)	0.045 (6)	0.068 (5)	0.169 (2)
IV 1. Local pride	0.080 (3)	0.071 (3)	0.062 (3)	0.156 (3)
2. Increase in communication	0.490 (1)	0.651 (1)	0.710 (1)	0.595 (1)
3. Increase in safety and reliability	0.430 (2)	0.278 (2)	0.228 (2)	0.249 (2)
V 1. Environmental accessibility	0.260 (2)	0.156 (3)	0.163 (3)	0.594 (1)
2. National security	0.640 (1)	0.184 (2)	0.541 (1)	0.249 (2)
3. Comfort in travelling	0.100 (3)	0.660 (1)	0.296 (2)	0.157 (3)
<i>Negative impacts</i>				
I 1. National	0.170 (2)	0.170 (2)	0.330 (2)	0.248 (2)
2. Regional	0.830 (1)	0.830 (1)	0.670 (1)	0.752 (1)
II 1. Economic	0.110 (3)	0.273 (3)	0.130 (3)	0.170 (3)
2. Social	0.410 (2)	0.445 (1)	0.510 (1)	0.440 (1)
3. Others	0.480 (1)	0.282 (2)	0.360 (2)	0.390 (2)
III 1. Operation and maintenance cost	0.500 (1/2)	0.830 (1)	0.167 (2)	0.500 (1/2)
2. Other mode of transportation cost	0.500 (1/2)	0.170 (2)	0.833 (1)	0.500 (1/2)
IV 1. Changes in lifestyle and traditional values	0.450 (1)	0.544 (1)	0.320 (1)	0.207 (3/4)
2. Forced movement of people	0.160 (3)	0.122 (3)	0.235 (3)	0.293 (1/2)
3. Local employment replacement	0.150 (4)	0.271 (2)	0.294 (2)	0.293 (1/2)
4. Envy of other regions	0.240 (2)	0.063 (4)	0.151 (4)	0.207 (3/4)
V 1. Pollution	0.170 (2)	0.830 (1)	0.330 (2)	0.330 (2)
2. Distortion in eco-systems	0.830 (1)	0.170 (2)	0.670 (1)	0.670 (1)
<i>Benefit</i>				
1. Status quo policy	0.234 (3)	0.131 (3)	0.159 (3)	0.278 (3)
2. Push agricultural activities policy	0.402 (1)	0.604 (1)	0.571 (1)	0.393 (1)
3. Balanced growth policy	0.364 (2)	0.265 (2)	0.270 (2)	0.329 (2)
<i>Cost</i>				
1. Status quo policy	0.157 (3)	0.179 (3)	0.231 (3)	0.194 (3)
2. Push agricultural activities policy	0.374 (2)	0.521 (1)	0.369 (2)	0.575 (1)
3. Balanced growth policy	0.469 (1)	0.300 (2)	0.400 (1)	0.231 (2)
<i>Benefit – cost ratio</i>				
1. Status quo policy	1.490 (1)	0.732 (3)	0.688 (2)	1.433 (1)
2. Push agricultural activities policy	1.075 (2)	1.159 (1)	1.547 (1)	0.683 (3)
3. Balanced growth policy	0.776 (3)	0.883 (2)	0.675 (3)	1.424 (2)

^a Source: Calculated from the field survey in Lampung, South Sumatra, Jambi and Bengkulu, April 14–20, 1986.

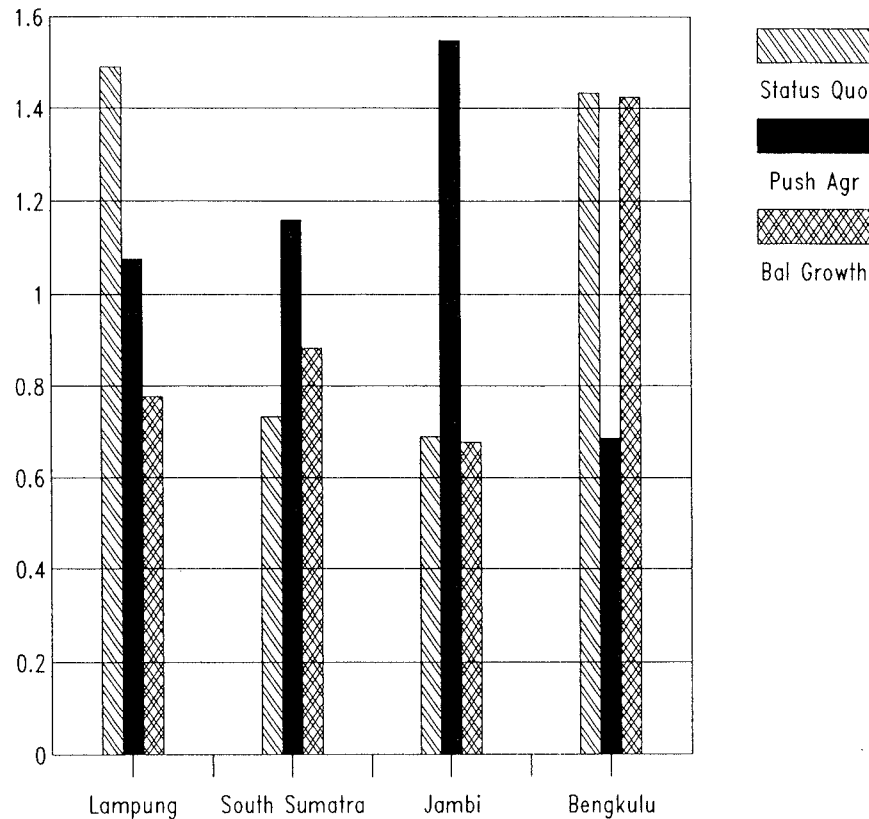


Figure 3. Chart of benefit-cost ratios for the four provinces

quent improvement of their quality more traffic moving at a higher speed began to change the picture. Social meetings and the accompanying exchange of information consequently are now rarely found. Thus, the life-style of the local people has been somewhat disrupted. However insignificant this phenomenon may appear, a complete impact study ought to include it in an explicit manner.

Another social disbenefit is the replacement of local employees. The local rattan workers in South Sumatra were replaced by workers coming from other regions—a noted example. As the ease of traveling by road increases, the mobility of the people increases. More workers move to and from Sumatra. Some of the rattan makers from West Jawa province, particularly Cirebon, got the opportunity to start new businesses in South Sumatra where raw materials are abundant. The new migrants, equipped with better skills and experience, in many cases, are forcing local rattan makers out of business. There was a close resemblance to

the well known side effect of the government-sponsored transmigration programs in some other regions in Indonesia (e.g., Kalimantan and Irian Jaya), although at a much smaller scale.

Pollution does not seem to be the most serious environmental problem generated by the presence of the highway. On the other hand, the distortion of the eco-system does. The presence of TSH somehow creates fragmentation of land, narrowing the food areas for some animals. *Ceteris-paribus*, the process of extinction, is made more likely. Many studies of this kind indicate that such undesirable impacts on the eco-system are less in the case of railroads. The primary reason for it seems to be that animals are less willing to cross a highway than a railroad track, probably due to the more predictable railway traffic.

Next the analysis turns to the most desirable future development scenario given the importance of the economic, social and other factors. The results are given in Table 1. It turns out that the preferred future scenario varies from one province

to another. The scenario of pushing further agricultural activities seems to have highest priority in the positive hierarchy. Simultaneously, however, South Sumatra and Bengkulu also think such a scenario ranks first in creating negative impacts (see Table 1). In other words, selecting this scenario would mean generating positive impacts as well as some disbenefits. This seemingly confusing picture is precisely the kind the AHP with its benefit-cost framework would expect. It is by taking the ratio of these comparable scores that the method provides a quantitative means to analyze the overall impacts of the highway.

Figure 3 is a chart of the benefit-cost ratios of the three possible scenarios for each of the four provinces. Clearly, in two provinces the perceptions are in favor of the status quo scenario, that is, maintaining the current plantation or agricul-

turally based strategy. In Jambi and South Sumatra, however, the current investment in the agricultural sector is considered insufficient, therefore they prefer further reinforcement on the agricultural based economy. The distinction between the two scenarios is indeed not unambiguous. This was evidenced from the discussion which took place during the survey. Despite the tremendous amounts of investment made in petrochemical-related industries, particularly in South Sumatra, the existing development emphasis in the observed region has always been heavy in the agricultural sector, particularly in food, forestry and plantation products. Therefore, when these provinces show a preference for the status quo scenario, what they have in mind is nothing else but more of the existing agricultural development strategy. Nonetheless, one thing is clear: even

Table 2
Results of the hierarchies in Figure 4^a

Impacts	Lampung	South Sumatra	Jambi	Bengkulu
<i>I. First phase impacts</i>				
1. Accessibility	0.480 (1)	0.428 (2)	0.594 (1)	0.715 (1)
2. Land value	0.113 (3)	0.142 (3)	0.249 (2)	0.067 (3)
3. Price level	0.407 (2)	0.430 (1)	0.157 (3)	0.218 (2)
<i>II. Second phase impacts</i>				
1. Commodity flows	0.584 (1)	0.298 (2)	0.472 (1)	0.393 (2)
2. Passenger flows	0.163 (3)	0.182 (3)	0.292 (2)	0.504 (1)
3. Industrial relocation	0.253 (2)	0.520 (1)	0.236 (3)	0.103 (3)
<i>III. Impacts on economic indicators</i>				
1. Investments	0.165 (3)	0.147 (4)	0.176 (3)	0.330 (1)
2. Employment	0.137 (1)	0.116 (6)	0.160 (4)	0.248 (2)
3. Production	0.202 (2)	0.178 (2)	0.180 (2)	0.116 (5)
4. Income	0.352 (1)	0.158 (3)	0.130 (5)	0.143 (3)
5. Government revenue	0.073 (5)	0.120 (5)	0.071 (6)	0.121 (1)
6. Regional development	0.071 (6)	0.281 (1)	0.283 (1)	0.042 (6)
<i>IV. Sectoral impacts</i>				
1. Agriculture	0.289 (1)	0.198 (2)	0.402 (1)	0.185 (2)
2. Mining and quarrying	0.069 (7)	0.043 (7)	0.031 (6)	0.076 (5)
3. Large and medium scale industry	0.156 (3)	0.091 (6)	0.145 (3)	0.070 (6)
4. Small scale industry	0.148 (4)	0.111 (5)	0.118 (4)	0.055 (7)
5. Construction	0.074 (5)	0.183 (3)	0.115 (5)	0.108 (4)
6. Trade and commerce	0.190 (2)	0.236 (1)	0.172 (2)	0.389 (1)
7. Hotel and restaurant	0.074 (6)	0.138 (4)	0.017 (71)	0.117 (3)
<i>V. Social impacts</i>				
1. Migration	0.192 (2)	0.125 (6)	0.217 (1)	0.256 (1)
2. Natural population growth	0.094 (5)	0.023 (7)	0.057 (7)	0.100 (6)
3. Education	0.150 (4)	0.169 (3)	0.197 (2)	0.096 (7)
4. Income distribution	0.247 (1)	0.131 (4)	0.116 (5)	0.106 (5)
5. Poverty line	0.070 (7)	0.128 (5)	0.066 (6)	0.110 (4)
6. Health	0.154 (3)	0.212 (1/2)	0.160 (4)	0.161 (3)
7. Crime rate	0.093 (6)	0.212 (1/2)	0.187 (3)	0.171 (2)

^a Source: Calculated from the field survey in Lampung, South Sumatra, Jambi and Bengkulu, April 14-20, 1986.

when viewed from many other angles, agricultural based activity is most desirable. Employment and earnings for the local people seem to dominate the considerations in arriving at such a preference. Even manufacturing activities are somehow agricultural related, e.g., industries to process agricultural products.

The current emphasis on an agricultural based economy and the clear-cut dominance of the two scenarios (which turn out to be similar) over the balanced-growth strategy suggest that overall and in net the TSH has produced benefits to the regional and national economy. But as the above discussion has brought into focus, the assertion that these *are* benefits should not at all give an impression of no adverse impacts, in various forms, from the highway project. It is clear from the discussion that AHP proved capable of providing

quantitative (ratio) scale priorities for every single factor and category under the negative impacts hierarchy just as it did for factors under the positive impacts hierarchy.

5. Cross-checking and comparison of results with secondary data

A third impact hierarchy was used to cross-check the results and at the same time to improve even more our post-impact analysis (see Figure 4). Notice in this figure that the scores ranking specific economic as well as specific non-economic sectors are the desired results from the bottom level of the AHP. The results for this hierarchy, affirmed the previous analysis.

The most immediate impact of the highway is

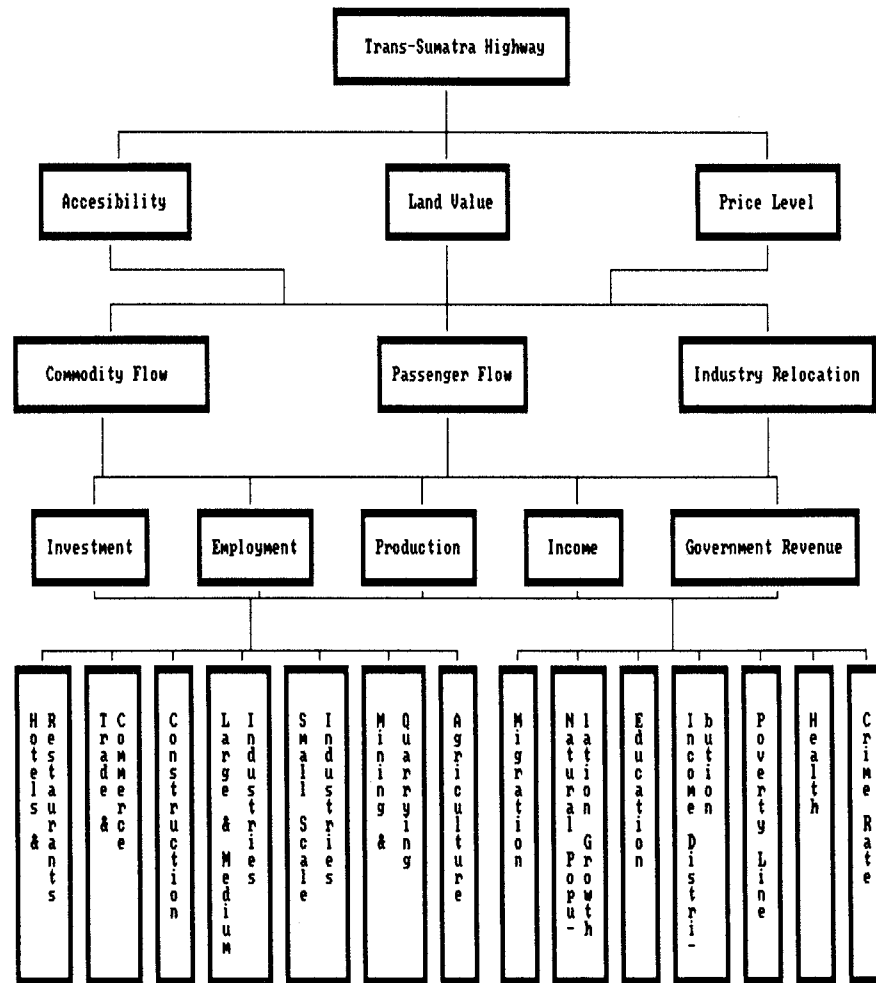


Figure 4. A third impact hierarchy constructed to check the results from the other hierarchies

uniformly agreed to be the increase in accessibility. This is consistent with the ranking of benefits in terms of increase in interregional trade and communication discussed earlier. Since the economic benefit is considered more significant than the social benefit, it is expected that in this new hierarchy commodity flows are ranked higher than passenger flows. The results from this hierarchy are given in Table 2, where one sees that this is indeed the case.

6. Final notes

According to the respondents, the two sectors receiving the largest impact are agriculture and trade and commerce. Consistently, the status of these two as the largest beneficiaries of TSH was also predicted earlier. Still, other examples that demonstrate the consistency of the ranking, and hence the validity of inputs provided by the respondents, may be found and discussed further in great detail. But because of space limitations, the full-blown comparative analysis had to be condensed. Instead, let us now move to the analysis of interregional commodity movement based on secondary data and see to what extent the results from AHP are consistent with the traditional analysis.

The direct and indirect impacts of TSH can be identified through the unloading figures for the ports. Because of close proximity to Jawa, many commodities from Sumatra bound for Jawa come from the southern part of Sumatra, through either the Bakauheni or the Panjang port. After the completion of the TSH, the tonnage of commodities loaded in Bakauheni jumped by 71% while the increase in unloaded goods was 61%. As a result, for the first time ever there were more tons of goods loaded in Bakauheni bound for Jawa, than there were unloaded goods that originated in Jawa (748 000 compared to 722 000 tons). Thus, clearly more goods were exported not only from the Lampung area, but also from the other provinces in Sumatra. A large part (72%) of the goods transported to and from Bakauheni is in the category of estate/plantation products and fruit produce. Geographically a kind of triangle is formed with Muaraenim and Baturaja located in the center. As expected, the lower part of the triangle (Lampung) attracts more traffic.

By consulting production tables one learns that rubber is dominant in South Sumatra with average annual growth rate of 2.98% during 1981–1983, and that for regions other than Lampung the production tends to exceed exports while the opposite trend occurs in Lampung. These export numbers were taken from the CBS 'Indonesia Export' where flows of goods are recorded mainly from the seaport-based traffic. Therefore, given the fact that products being transported are not in the category of basic necessities, at least certainly not for the local people who, as we said earlier in general possess low effective demand, the indicated trend demonstrates the presence of heavy flows of goods from three of the provinces to the Lampung area. This information indicates in particular a gap between production and exports of coffee. In 1980 the gap was practically non-existent, but immediately after the opening of Bakauheni ferry port and the completion of TSH the gap started to explode. Therefore, what was shown in the perception survey using AHP, interregional trade, is confirmed by the data. Furthermore, the largest beneficiaries of TSH being agriculture (plantation) and trade and commerce sectors, the conclusion gathered from the latter hierarchy (see Figure 4), is also in accord with what secondary data have shown.

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