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LOCAL LEVEL PLANNING AND INVESTMENT PRIORITISATION: APPLICABILITY STUDY (Project – DCP/015)

FINAL REPORT

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I.T. Transport Ltd.

Consultants in Transport for Rural Development

The Old Power Station, Ardington,
Nr. Wantage, Oxon,OX12 8QJ, UK
Telephone: 01235 833753/821366
Int. + 44 - 1235 - 833753/821366
Facsimile: 01235 832186
E-mail: itt@ittransport.co.uk

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EXECUTIVE SUMMARY

This report details the process and results of a study carried out in Vietnam and Malawi over the period 2000 to 2002 to investigate the feasibility of utilising the field accessibility assessment method described in the report "Local Level Planning and Investment Prioritisation" of 1999.

Investigating the applicability of the method involves answering two basic questions.

a) Is the method effective in providing useful, objective, consistent, robust figures for use in local level planning?
b) Is the method efficient in terms of effort put in to extract the figures against usefulness of the figures achieved? This includes an assessment of whether the resources required to complete the method are available at the local level in the countries studied.

In the report these two basic questions have been expanded to the investigation of 10 detailed points of reference (10 questions). Answering these ten details allows us to reach a conclusion about the two basic factors of applicability.

In both Malawi and Vietnam the method was applied in two areas. One area where IRAP (Integrated Rural Accessibility Planning) had been in use previously and one new area where neither IRAP nor other method of accessibility planning had been applied. The study was conceived and resourced on the basis that the majority of data required would be readily available in the IRAP areas but would have to be collected fresh in the non-IRAP areas. This proved to be correct in Vietnam but in Malawi the data was not available as expected in the IRAP area. This caused resource and timing problems which led to extended contractual difficulties. This problem was not fully resolved and results in some data gaps for this particular area. Despite this problem full data is available for all other areas covering some 76 villages and 6 terrain types.

The method under investigation hinges on the assessment of two factors.

i. SWUE- Standard Walking Unit Equivalent. The ratio of actual time to access any service or facility against time taken to walk to the same service or facility at standard speed on level ground.
ii. CAI – Cross-sectoral Accessibility Index. The sum of the products of household numbers, distance and SWUEs for the various facilities and services and geographical areas or villages.

The analysis shows that the method proposed gives consistent statistically robust figures for the socio-economic comparison of proposed interventions and investments affecting access to services and facilities for rural areas. The method is robust in picking out the actual modes used by the people and is not based on assumptions of use from the availability of modes. The fact that a bus passes nearby does not mean that people actually use it. The report goes further to show that the technical resources required to carry out the process can be expected to be available at the local level in most areas. The amount of technical ability on behalf of planning officers required is not onerous, and the people usually available are up to the task. The formulae look daunting but in fact require no more than simple arithmetic to manipulate them. The only question would be on the mobility of the planners themselves and their ability and motivation to go out to the field to collect the large amount of data required and carry out the field verification of secondary data collected.

In essence the method is applicable and useful for local level planning decisions that need to take access and accessibility into account.

Chapter 1

BACKGROUND AND INTRODUCTION

1.1 Definition and importance of access

"Accessibility" and "mobility" are two terms that are often used in transport planning processes, but sometimes confusion is created by the way these terms are used. Mobility refers to the ease with which a person can move about. It relates to the person's physical fitness, availability of different modes of transport, and the resources available to the person concerned (Jones, 1975). Mobility is also dependent on the individual's other personal attributes (e.g. a mother with young children would be considered less mobile than a woman without small children).

On the other hand accessibility is defined as the opportunity that an individual or type of person at any given location possesses to take part in a particular activity or a set of activities (Jones, 1981). The concept of access has been applied to regional and rural planning for some years now and a considerable body of literature exists on this subject. It is widely accepted that accessibility has three elements:

- the location of the individual
- the location of the supply, service or facility to which the individual needs access
- the link to bring the two together

The objective of bringing the individual to the location of the supply, service or facility to which the individual needs access can be achieved by: (i) moving the individual physically to the facility (mobility of the individual); (ii) taking the facility closer to the individual (relocation of the facility); and (iii) a combination of (i) and (ii) which reduces physical movement of the individual and the use of the transport system. Therefore, any interventions to improve access involve one or more of the above.

1.2 Accessibility and poverty

It is generally accepted that isolation is one of the key causes of poverty. However, a reduction of isolation (i.e. improvement of access) will not necessarily contribute directly to poverty reduction as poverty has many dimensions and lack of access is just one of them. Making a provision to improve access to basic facilities and services (e.g. health, water, sanitation etc.) in subsistence economies will only provide a foundation for development. Improvements of access to the wider economic and socio-economic facilities (e.g. markets) will play a catalytic role in the poverty reduction process.

Table 1 identifies the key items to which rural people require access including the factors that are directly and indirectly related to the access (I. T. Transport, 1999). Edmonds (1998) discusses this issue more elaborately.

Table 1: Access and poverty

	Factors Related to Access	Other Factors
Employment	Physical Access to Job Locations Lack of Transport Services	Lack of Job Opportunities
Land	Distance/Time to Fields	Size of Holdings Cultivable Land Population Density
Technology		Not Known Not Understood Expensive Not Available
Information	No Radio No Telephone Poor Postal Services	Lack of Extension Workers
Credit	Location of Credit Facility	Poor Banking Services Strict Credit Regulations
Health Services	Lack of Health Centres Poor Access Lack of Transport Services	Limited Personnel Lack of Medicines
Water	Lack of Irrigation	Distance to Supply Lack of Wells
Energy	Limited Electricity Decreasing Supply of Wood	Distance to Source
Markets	Poor Transport Facilities Poor Location	Poor Marketing System Lack of Fertiliser, Seeds
Transport	Poor Tracks Poor Transport Services Lack of Roads Limited Number of Vehicles	
Education	Poor tracks Lack of Transport Facilities	Lack of Teachers Limited Educational Materials

1.3 Accessibility Planning (AP) and development approach

Though the use of accessibility in transport planning is not new in developed countries, its application in developing countries does not have a long history. There are three stages in the evolution of the accessibility planning process in rural transport planning in developing countries (Barwell and Ahmed (1992): (i) the classical model; (ii) rural transport planning; and (iii) accessibility planning. The classical model stage is a supply driven model. The public sector was considered as a provider of infrastructure and the formulator of policy and regulatory framework. The private sector role was to respond to the improvements of infrastructure and to operate the transport services. Such joint efforts would improve access to facilities and services that the rural people need access to.

The rural transport planning phase was a demand driven one. It considered the demands for travel and transport of rural people as the entry point in planning. However, one of the limitations of the approach was that it did not consider that bringing facilities and services closer to the people could also improve accessibility. The accessibility planning stage is an improvement on the rural transport planning stage. It recognises the fact that bringing the facilities and services closer to the people can also improve access. Accessibility Planning (AP) process has been applied in many countries. Prominent among them are Tanzania, the Philippines, Zambia, Malawi and the Lao PDR.

1.4 Background of the study

In 1999 the Department for International Development (DFID), UK and International Labour Organisation (ILO) commissioned a study to develop a simple methodology to prioritise alternative intervention options to solve identified access problems. One of the key requirements of the study was how to assess the costs and benefits of the alternative interventions. The target audience of the methodology was local level planners who are involved in the rural accessibility planning process. The final report of the study was published in late 1999 (I. T. Transport, 1999). Before the submission of the final report a workshop attended by rural transport practitioners from around the world was held. The workshop discussed the draft methodology and the methodology was fine tuned in light of the discussions held. One of the recommendations of the workshop was to field test the methodology. In view of this recommendation this present study was conceived. However, the study suffered considerably due to contractual problems. There was also postponement of data collection efforts.

1.5 Objectives of the Study

The objective of this study was to assess the utility and efficiency of the methodology developed for the selection of rural accessibility interventions. The basis for this work is the report entitled “Local Level Planning and Investment Prioritisation” (I. T. Transport, 1999).

1.6 Structure of the Report

Apart from this chapter, there are two other chapters in this report. Chapter 2 presents the summary of the methodology proposed in 1999 for the prioritisation of access related interventions and describes the work carried out in this study. Chapter 3 presents the results of the analysis carried out and concludes on the utility and efficiency of the proposed methodology on the basis of the analysis of results.

Chapter 2

DESCRIPTION OF THE METHODOLOGY PROPOSED AND DESCRIPTION OF THE WORK CARRIED OUT

2.1 Introduction

The previous chapter highlighted different aspects of accessibility, including its relationships with poverty, and the background of the study. This chapter briefly describes the methodology proposed for prioritisation of the investments to improve access to rural facilities and services in the accessibility planning process. The chapter also describes the work carried out to assess the utility and efficiency of the developed methodology.

2.2 Brief description of the methodology proposed in the first phase

2.2.1 Towards the development of the methodology: requirements and assumptions

The detailed methodology is described in a report entitled “Local Level Planning and Investment Prioritisation” (I. T. Transport, 1999).

The main requirements while developing the investment prioritisation methodology in an accessibility planning process were that it:

(i) would provide a cross sectoral framework whereby alternative solutions in improving the access problem could be consistently appraised;
(ii) would be understood easily by the transport and rural development practitioner;
(iii) would be simple and transparent in its assumptions;
(iv) would be consistent in application in all countries where access related interventions are necessary;
(v) would develop upon the existing AP procedure which has been successfully applied at least in three countries;
(vi) could be applied at the local level with varying level of planning capacity;
(vii) would be consistent with the appraisal requirements of the central government and donors;
(viii) would reflect the actual situation in the rural areas and would be easy to calibrate.

Another prime requirement was its ability to deal with different types of interventions that increase access. They include: increase in mobility with the provision of transport infrastructure or services; relocation of facilities closer to the settlements; and those that include elements of both measures.

Other major requirements in order to develop the methodology were:

(i) avoidance of any arbitrary values given its potential universal application;
(ii) a consideration of community participation as the mainstay of the methodology, particularly in the identification of the interventions and in the identification of non-quantifiable benefits.
(iii) a theoretically robust but simple in application methodology;
(iv) a procedure for ranking different intervention options in an accessibility process in a most cost effective way – not a fully fledged appraisal procedure;
(v) suitable for application at different local government levels with varying technical capacity - with the minimum being the level of technical expertise of the local governments where the Integrated Rural Accessibility Planning (IRAP) procedures were being applied.
(vi) Ability to handle quantitative as well as qualitative benefits;
(vii) Ability to encompass the effects of population density of the area concerned.

The Methodology

The main premise of the methodology is based on two terms: The Standard Walking Unit Equivalent (SWUE) and the Cross-Sectoral Accessibility Indicator (CAI).

2.2.2 The SWUE

The SWUE is the ratio of the time taken to access a facility or a service to the time to walk to the same facility or a service on a flat surface. Therefore, the concept of SWUE is centred around the normal time taken to walk[1] a certain distance on a flat surface. For example, if the time taken to reach a destination 10 km away using a single mode or a combination of modes is 60 minutes and the time taken to reach the same destination by walking is 150 minutes (i.e. at a normal walking speed of 4km/hr), then the SWUE will be 0.4 (i.e. 60/150). The SWUE is a function of the following: modes used; terrain and the transport infrastructure conditions. Thus in an area that has a well developed transport system that is used extensively by the community the SWUE will be less than in an area with a less well developed transport system. But also the people's choice to use the system matters and an area with a well developed transport system but less extensively used by the community will have a higher SWUE. Also the SWUE of an area with difficult terrain and/or with poor infrastructure will be higher than an area with flat terrain and/or with good infrastructure.

[1] The choice of relating SWUE to the time for walk relates to the fact that walking still remains the predominant mode in rural areas in a majority of the developing countries.

The SWUE is dependent on three factors:

- the terrain type
- the mode of transport
- the condition of the track, path or road which is being traversed

The anticipated advantages of using this indicator are:

(i) Its formulation is simple;
(ii) It can capture the effects of the terrain on the transport effort required in accessing the facilities;
(iii) It takes into consideration the level of development of transport infrastructure and services;
(iv) It captures the effect of use of existing improved transport by the villagers without assuming that the transport infrastructure and services will be used by all the rural population irrespective of their ability to use them; and
(v) It can be used for assessing comprehensive accessibility improvements which cut across all sectors.

2.2.3 The Cross-Sectoral Accessibility Indicator (CAI)

The CAI is defined as:

$$CAI = \sum_j \sum_i N_{hh} * d_i * SWUE_i \text{ .... } (i)$$

Where, N_{hh} is the number of households in a unit geographical area, d_I and $SWUE_i$ are the distance and SWUE for an i type of facility respectively.

As can be seen from the above formula the CAI is a function of number of households in a unit geographical area (e.g. village), the distance to the facilities the villagers need to access, and the SWUE. Therefore, the CAI captures the effects of: the state of development of the transport infrastructure and services of the area and their use by the communities; the terrain of the area concerned; the population density of the area; and the distance to the facilities the communities need to access. The CAI is called the Cross-sectoral Accessibility Index as the CAI needs summing up for all facilities (i in the formula) and for all areas/villages (j) depending on the aggregation needed (for example, if someone is interested for the district level CAI for secondary schools then it is necessary to sum up CAI for all villages within the district concerned with the secondary schools).

2.2.4 The CAI in the overall AP process

The developers of the methodology have anticipated the following use of the CAI in the accessibility planning process:

(i) to cross check the access problem at a specific local government level;
(ii) to be used to prioritise villages that need interventions to improve access;
(iii) Once the villages are prioritised, the communities may then be involved to identify different types of interventions needed to improve access. The interventions may include one or a combination of the following: (i) an improvement of transport infrastructure; (ii) an improvement of transport services; (iii) an improvement of siting of facilities. Communities may also specify different options in terms of interventions;
(iv) When the different options have been specified by the communities then different options can be appraised for best value for money.

The developers of the methodology argued that the CAI can be used at any local government level.

2.2.5 Community participation

The methodology also suggested the potential use of community participation in the identification of the access problems in a particular local government area. It suggested the use of community preference ranking to weight the CAIs for each sector. For example, if the communities rank access to health facilities as the most important one then the access weight in a scale of 1 to 5 will be 5. On the other hand if access to post harvesting facilities is the least important one then the access weight will be 1. The methodology suggested that the CAI for health facilities should be multiplied by 5 to provide a measure of community preference.

2.2.6 The assessment of costs and benefits and investment prioritisation

The assessments of costs and benefits will be similar to the assessment of costs and benefits in a standard appraisal process with the following exceptions:

(i) Unlike other appraisal methods the methodology suggested the concept of total costs approach (Table 2 explains the approach). This means that instead of presentation of costs and benefits separately, the methodology suggested a single parameter – total costs where benefits are treated as negative costs;
(ii) The methodology suggested that the definition of costs should not be restricted to the infrastructure improvement and maintenance costs only. To encompass the concept of accessibility it suggested that

management costs of facilities should also be included (for example, if a school is established near a village then the costs should include the construction and maintenance costs of the school plus the salary and other costs for running the school);

(iii) The methodology suggested a matrix for presentation of non-quantifiable benefits/costs qualitatively to facilitate the decision making process (Table 3).

Table 2: Summary table of total costs

Item	Option 1	Option 2	Option 3
Transport Infrastructure Roads/Footpaths Improvement Maintenance **Water Supply** Construction Maintenance Management (salaries and other)			
Health Infrastructure Construction Maintenance Management (Salaries and other)			
Educational Infrastructure Construction Maintenance Management (salaries and other)			
Benefit or Negative Costs (monetary) Vehicle Operating Cost Savings Car Bus IMTs			
Total Costs			
Change in CAI			
Cost/Change in CAI			

Note:

(i) Costs are the discounted financial costs over the life of the project or services.

(ii) A standard vehicle operating cost saving may be applied for a particular vehicle and particular improvement type.

Table 3: Significance of non-quantifiable benefits

Item	Very Significant	Moderately Significant	Insignificant
Benefits			
Direct Employment Generation			
Indirect Employment generation			
Business Opportunities generated			
Improved use of marketing facilities			
Improved use of educational facilities			
Improved use of health facilities			
Facilitate use of water source			
Improved use of Transport Aid/Non-motorised Transport			
Encourage production of cash crop			
Community Participation			
Dis-benefits			
Environmental degradation (felling of trees, top soil loss, damage to historical sites etc.)			
Land-Use			
Migration			

2.3 Description of the work carried out in the applicability phase

The objective of the study was to assess the utility and efficiency of the methodology (described above) developed for the selection of rural accessibility interventions. Previous sections elaborated the salient features of the methodology. The main premise of the methodology is based on application of two terms SWUE and CAI. Therefore, the applicability study is mainly concerned with different aspects of practical application of these two terms. The study is mainly designed to answers the following questions:

I. Is the formulation of SWUE and CAI simple enough to be understood easily by transport and rural development practitioners?
II. Does their formulation depend on simple and transparent assumptions?
III. Can they capture the effects of the terrain on the transport effort required accessing the facilities?
IV. Can they capture the effects of the level of development of transport infrastructure and services in the area concerned?
V. Can they capture the effect of use of existing improved transport by the villagers without assuming that the transport infrastructure and services will be used by all the rural population irrespective of their ability to use them?

VI. Can they be used for assessing comprehensive accessibility improvements which cut across all sectors?
VII. Does the overall methodology provide a cross sectoral framework whereby alternative solutions in improving the access problem can be consistently appraised?
VIII. Would it be consistent in application in all countries where access related interventions are necessary?
IX. Can the methodology be applied at the local level with varying level of planning capacity?
X. Is it possible to calibrate the SWUE in an area for different modes of transport and different types of terrain?

Study areas and data collection procedures

The study uses the data collected in two countries: Vietnam and Malawi. The reasons for selection of these two countries were: (i) Malawi and Vietnam have experienced the application of AP process (Malawi under the International Labour Office (ILO) executed Pilot Rural Transport Project and Vietnam under the DFID assisted Rural Access Programme. Therefore, the data collection would take less effort due to the availability of secondary data; (ii) with the selection of AP and non-AP districts, the viability of the methodology can be tested for AP as well as non-AP districts.

Initially two districts (one within an IRAP area and one outside IRAP area) in each country were selected for data collection for this study (Table 4). For IRAP districts the assumption was that the data collection efforts would be minimal due to the existence of substantial data. However, the assumption was proved wrong when the collection of data started in late 2000. Initially the data collected under the ILO project in Dedza, Malawi, could not be located. There was a break in data collection due to contractual problems after the collection of non-IRAP Dowa district data. When finally the data of Dedza districts were made available they were found to be incomplete and not suitable for application in the study. Therefore, the Malawi data only contain data of the non-IRAP district. With this experience it was possible to avoid this situation in Vietnam. Vietnam provided data from both IRAP (Ky Anh) and non-IRAP (Dien Ban) districts. The Dowa district data of Malawi represent data from two traditional authorities[2] (TA) - Chakaza TA and Chiwere TA.

[2] Traditional Authority is also known as the Area Development Committee (ADC); A typical district in Malawi is divided into 5 to 15 ADCs, which in turn consist of 5 to 10 Village Development committees (VDCs). A VDC is the administrative grouping of a small number of villages (5-10).

Table 4: Study areas selected initially

Country	"IRAP" area	Non-IRAP area
Malawi	Kasumbu TA (Dedza district in the Central Region)	Chakaza TA and Chiwere TA (both in Dowa district in the Central Region)
Vietnam	Ky Anh district (Ha Tinh province in the north central coast)	Dien Ban district (Quang Nam province in the south central coast)

Note: The study did not eventually use Dedza district data

The study data consist of data from a total of 76 villages – 31 villages from Vietnam representing five terrain types and 45 villages from Malawi representing four terrain types (Table 5).

Table 5: Selected villages and terrain

Terrain	Village
Mountainous	4
Hilly	3
Irrigated Lowland	16
Delta	2
Sandy Coastal Area	6
Total Vietnam	**31**
Flat	24
Hilly	8
Mountainous	3
Rolling	10
Total Malawi	**45**
Overall Total	**76**

The data collection procedure and types of data collected

The data collection procedures for the two countries are summarised below:

Vietnam

(i) At the beginning of the data collection process the maps of the study areas were collected. The maps contained information on: administrative boundaries and location of population (Towns, Communes, Villages); road network and condition classification; water/river network, ports, railway, etc. terrain type/land use and natural features (e.g. mountain, river, swamp, etc.); location of different facilities (e.g. markets, schools, health centres, agriculture processing facilities, services, places of employment etc.);

(ii) The key-informants meetings were conducted in a total of 13 communes (6 in Dien Ban and 7 in Ha Tinh). The meeting produced completed commune questionnaires and detailed sketch maps with the location of villages, different facilities, transport infrastructure, boundaries and land use etc. The meeting also established different aspects of the physical access to facilities and services from different villages within the commune in two seasons – dry and wet. They include the identification of routes, physical condition of the routes, use of modes, terrain types etc. This information was then added to the commune sketch maps and the district maps. The district maps are mainly used for cross-checking of the information;

(iii) Further interviews were held in the proximity of different facilities (for example, health facilities, schools, markets etc.) to establish their area of influence and to cross-check the information generated from the commune level interviews.

(iv) The study collected access related information on 8 types of facilities:

- Clinics
- District Health Centres
- District Centres
- Primary Schools
- High Primary Schools
- Secondary Schools
- Markets
- Processing Facilities

Malawi

(v) Like Vietnam before the start of the actual data collection hard copies of the maps of the two traditional authorities (Chakaza and Chiwere) were collected. At the beginning of the data collection process the maps of the study areas were collected. The maps contained information on: administrative boundaries and settlements; road network and condition of the roads; terrain type & natural features (e.g. mountains/hills, rivers, swamps etc.), location of different facilities (markets, schools, health centres, agriculture processing facilities etc.);

(vi) The key-informants meetings were held in the villages. The meeting assisted in the collection of village access information (e.g. distance to the facilities, time to reach these facilities using the available modes in two seasons (dry and wet), approximate modal shares, infrastructure condition etc.). The maps collected earlier were used in cross-checking the information provided by the villages;

(vii) Information collected at the village level was cross-checked with information collected through interviews at different facilities (e.g.

health centres, schools, grinding mills) identified by the key informant interviews;

(viii) The study collected information on the following facilities:

- Administrative centres
- Area markets
- Local markets
- Hospitals
- Health Centres
- Clinics
- Dispensaries
- Full primary schools
- Junior primary schools
- Secondary schools
- Grinding mills

The study also collected relevant secondary information on: topography, population, number of households, land use, employment, transport Infrastructure, vehicle ownership etc. Appendix I presents the different detailed information on the villages.

The study did not collect any data on the potential improvements of infrastructure to improve access as that could raise the expectation of the local people.

Data processing

The processing of data involved the following steps:

(i) the collected data were first entered into the computer and then processed with the help of a standard database software. Use of a database helped in the linking of different information;

(ii) Before the main analysis the input records were checked for any inconsistencies. In the case of an inconsistency, the particular record was checked using the survey outputs and corrected accordingly;

(iii) The main analysis was designed to answer the questions posed at the beginning of this chapter and involved the following:

a. First the average speeds of different modes of transport on a good flat surface were calculated to check whether there existed substantial country differences. This was necessary as the average walking speed on a flat surface was used in the calculation of the SWUE. Figure 1 shows the calculated average speeds for different modes. It can be seen that the average speed figures are very close for the two countries. The original assumption of walking speed of 4.0 km per hour while formulation of the methodology for the calculation SWUE seems valid when compared to the average walking speed figures from both the countries. The average speeds of other motorized and non-motorised modes are not substantially different in the case of the two countries.

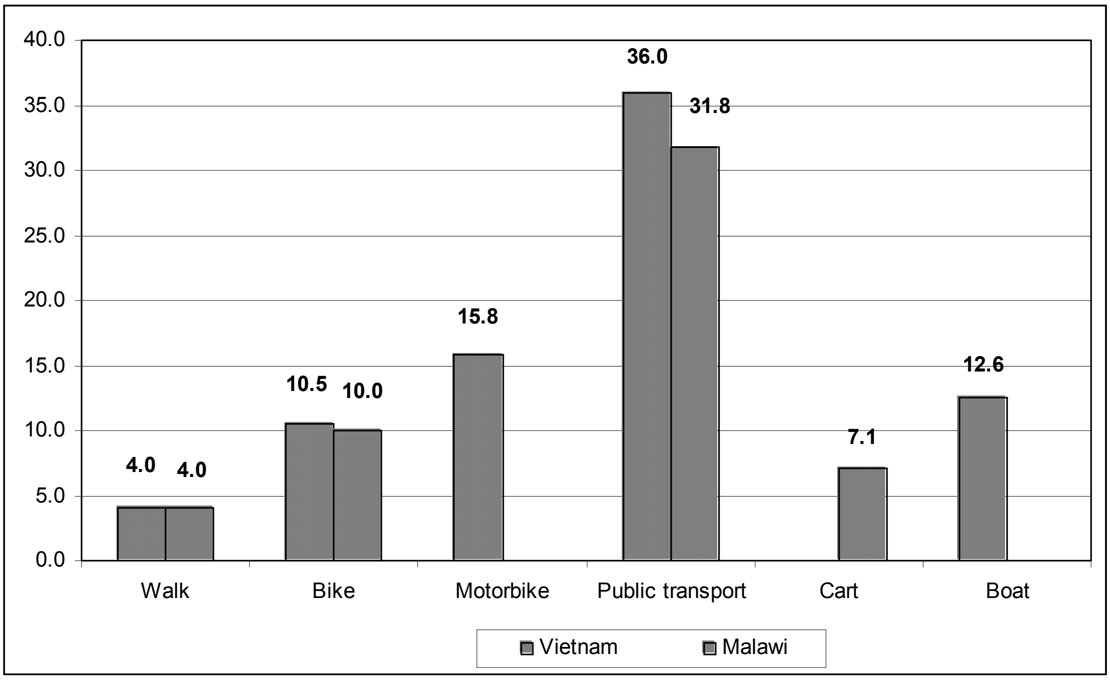


Figure 1: Standard speed of different modes on a good flat surface in the dry season

b. The average walking speed figure of 4.0 km per hour was then used in the calculation of SWUEs for different facilities in two seasons. The other inputs were the distances to facilities, time to reach the facilities using different modes, the average proportions of different modes used to reach the facilities.

c. The SWUEs were then used to calculate the CAIs for all villages and for different facilities. The other inputs in the calculation of the CAIs were the no. of households in the villages, distance to facilities (Eq. 1). The CAIs were also calculated for both dry and wet seasons.

Chapter 3 presents the results of such an analysis.

2.4 Summary of the chapter

The chapter first presented the summary of the methodology developed in 1999 to prioritise investments to improve access to rural facilities and services in the accessibility planning process. The main premise of the methodology is based on application of two terms: The Standard Walking Unit Equivalent (SWUE) and the Cross-Sectoral Accessibility Indicator (CAI). Then the chapter described the study areas along with the data collection procedures. It also elaborated the steps in the processing of the data. The applicability of the proposed methodology was tested in two areas of Malawi and Vietnam. The study collected access related data for eight facilities in Vietnam and eleven facilities in Malawi. Data were collected from a total of 76 villages – 31 in Vietnam and 45 in Malawi.

Chapter 3

RESULTS AND CONCLUSIONS

3.1 Introduction

Chapter 2 summarised the proposed methodology for the investment prioritisation for accessibility improvement related interventions. The chapter also described the work carried out in the applicability phase and the how the data were processed. This chapter presents the results and the conclusions.

3.2 Analysis of results

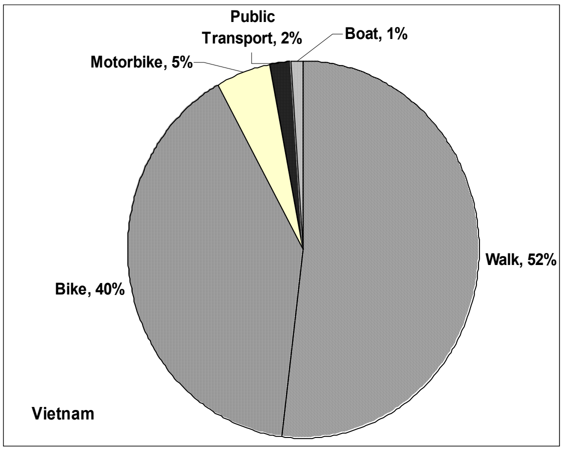
3.2.1 The SWUE

SWUE and Use of modes

Table 6 presents the SWUE values for different terrains. The average Vietnam SWUE (0.87) is lower than the average Malawi SWUE (1.02). This means that the average efforts to access facilities in Malawi is higher than in Vietnam. Such a difference can be explained if one looks at the average shares of different modes used in order to access the facilities (Figure 2). In the case of Malawi the villagers walk to the facility in an overwhelming majority of the cases (91%). However, although in Vietnam walking is the main mode to access different facilities, the average figure is not as high as for Malawi (52% against a figure of 91% in the case of Malawi).

Table 6: Average SWUE values for different terrains

	Average SWUE
Vietnam	
Mountainous	0.73
Hilly	0.70
Irrigated Lowland	0.94
Delta	1.02
Sandy Coastal Area	0.80
Average Vietnam	**0.87**
Malawi	
Flat	0.95
Hilly	1.20
Mountainous	1.43
Rolling	0.89
Average Malawi	**1.02**



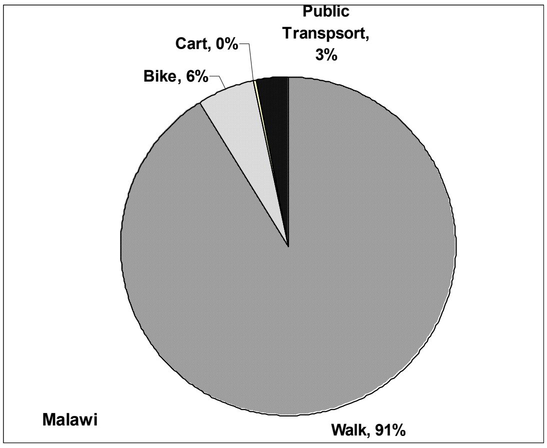


Figure 2: Overall modal share

The SWUE values in the case of Malawi are consistent with the natural features – i.e. the SWUEs are higher for difficult terrain (e.g. average SWUE value for mountainous terrain is higher than the flat or rolling terrain). However, the SWUE values do not look consistent with the physical features in the case of Vietnam. For example, the average SWUE of mountainous terrain is less than irrigated lowland or delta areas. A close examination of the modal shares of different modes of transport to access facilities in different terrains explains the counterintuitive results in the case of Vietnam. It can be seen that the villagers living in the mountainous areas make more use of the motorbike than the villagers living in other villages. In the hilly areas, the villagers use bicycles more extensively than villagers in other areas. The average SWUE figure is highest in the case of villages in delta areas. In the case of these villages walking is the most extensively used mode of transport to access the facilities.

Table 7: Modal share by terrain type (Vietnam)

Terrain	Walk	Bicycle	Motorbike	Public Transport	Boat
Mountainous	53%	35%	12%	0%	0%
Hilly	50%	47%	3%	0%	0%
Irrigated Lowland	54%	37%	5%	3%	1%
Delta	57%	36%	3%	1%	3%
Sandy Coastal Area	46%	49%	4%	1%	0%

Table 8: Modal share by terrain type (Malawi)

Terrain	Walk	Bicycle	Cart	Public Transport
Flat	88%	7%	<1%	5%
Hilly	94%	4%	0%	2%
Mountainous	100%	0%	0%	0%
Rolling	93%	5%	<1%	1%

The conclusion from the above is that the SWUE captures the effects of the terrains and the use of modes by the villagers to access the facilities.

SWUE and Season

Table 9 presents the summary overall, wet and dry season values of SWUE and CAIs from the two countries. It can be seen that the average SWUE (0.66) in the dry season is substantially lower than the average SWUE in wet season (0.98). This means that the efforts to reach the facilities in the dry season are considerably lower than in the wet season. However, in the case of Malawi the difference is marginal. Results of t-tests for equality of means show that in the case of Vietnam they are, indeed, significantly different (2-tail significance of 0.000[3]). However, in the case of Malawi they are not found significantly different (2-tail significance of 0.196). The reason for such a significant difference in the case of Vietnam but not in the case of Malawi can be the following:

(i) Seasonal effects are more prominent in Vietnam than Malawi due to the topographical features - crisscrossed with numerous rivers and streams. The effects of these rivers and streams on access are more prominent in the rainy season than in the dry season. This has become apparent when the calculated speeds of different modes of transport are considered (Table 10). Table 10 shows that the speeds of different modes (including walking) in the rainy season are considerably lower than the comparable speeds in the dry season. In the case of Malawi the seasonal effects on the speeds of different transport modes are marginal.

(ii) Also the seasonal effects on the use of modes by the villagers are high in the case of Vietnam (Table 11). For example, more villagers walk to access different facilities in the rainy season (58%) than in dry season (48%). Also the use of bicycle reduces in the rainy season (33%) compared to the dry season (47%). The differences of the use of modes in dry and wet seasons in the case of Malawi are not significant.

[3] A value of less than 0.05 means that the hypothesis of equality of means can be rejected at 95% confidence level.

Table 9: Average SWUE and CAI (overall, dry and wet season)

	SWUE			CAI per 1,000 HH		
Vietnam	Overall	Dry	Wet	Overall	Dry	Wet
Dist.: Dien Ban	0.85	0.66	1.05	9.1	7.4	10.8
Dist.: Ky Anh	0.72	0.69	0.76	7.6	7.3	7.9
Overall Vietnam	**0.82**	**0.66**	**0.98**	**8.8**	**7.4**	**10.2**
Malawi						
TA: Chiwere	1.09	1.06	1.11	N/A	N/A	N/A
TA: Chakaza	0.95	0.94	0.96	N/A	N/A	N/A
Overall Malawi	**1.02**	**1.00**	**1.03**	**N/A**	**N/A**	**N/A**

Table 10: Average speed (km/hr)

	Walk	Bicycle	Motorbike	Public Transport	Animal Cart	Boat
Vietnam						
Dry	4.2	10.2	10.71	23.8	N/A	12.6
Wet	3.3	8.18	9.83	18.1	N/A	12.6
Malawi						
Dry	4.0	8.9	N/A	28.45	4.25	N/A
Wet	3.9	7.9	N/A	28.45	4.64	N/A

Note: N/A = Not applicable

Table 11: Average model share in different seasons

	Walk	Bicycle	Motorbike	Public Transport	Animal Cart	Boat
Vietnam						
Dry	46%	47%	5%	1%	N/A	0%
Wet	58%	33%	5%	2%	N/A	1%
Malawi						
Dry	92%	5%	N/A	3%	<1%	N/A
Wet	91%	6%	N/A	4%	<1%	N/A

The conclusion from the above discussion is that the SWUEs have been able to capture the seasonal effects to access facilities by the villagers.

SWUE Values and facilities to access

Table 12 and Table 13 present the average SWUE values to access different facilities for Vietnam and Malawi respectively. Appendix II and Appendix III provide SUWE values for different villages to access different facilities in Vietnam and Malawi respectively. It can be seen that in the case of Vietnam the overall SWUE values vary from 1.38 (for primary schools) to 0.28 (for district centres). In the case of Malawi such values vary from 1.2 (junior primary schools) to 0.74 (administrative centres). Such variations can easily be explained if one looks at the use of different modes to access the facilities (Table 14 and Table 15). For example, in Vietnam the SWUE values to access district centres are considerably lower than other SWUE values as the villagers use more efficient modes of transport (57%, 13%, 13% of the trips are made with bicycles, motor cycles and public transport respectively; villagers walk to the district centres only in 9% of the cases). Similarly, the SWUE values to access primary schools are higher than other values as in 98% of the cases primary school children walk to the schools. The SWUE values to access different facilities are considerably closer in Malawi except for access to administrative centres. This is as the overwhelming majority of the trips are walking trips. Appendix II and Appendix III show that the SWUE values differ within a village depending on the type of the facilities. Therefore, the conclusion is that SWUE is sensitive to the actual use of modes to access the facilities rather than the availability of modes in the area.

Table 12: SWUE for accessing different facilities (Vietnam)

Clinic	District Health Centre	District Centre	Market	Crop Proce-ssing Facility	Primary School	High Primary School	Secon-dary School	Overall
Province: Quang Nam; District: Dien Ban								
0.96	0.41	0.26	0.91	1.31	1.46	0.92	0.60	0.85
Province: Ha Tinh; District: Ky Anh								
0.87	0.57	0.32	0.85	0.90	1.10	0.72	0.46	0.72
Overall								
0.94	0.45	0.28	0.89	1.22	1.38	0.87	0.57	0.82

Table 13: SWUE for accessing different facilities (Malawi)

	TA: Chakaza	**TA: Chiwere**	**Overall**
Administrative Centres	0.58	0.88	0.74
Area markets	0.97	1.08	1.02
Clinics	N/A	1.08	1.08
Dispensaries	0.86	1.05	0.95
Full primary schools	1.04	1.09	1.06
Grinding mills	1.04	1.11	1.07
Health Centres	0.93	1.09	1.03
Hospitals	0.99	1.12	1.05
Junior Primary School	0.99	1.39	1.2
Local markets	0.96	1.10	1.03
Secondary schools	0.99	1.12	1.04

Table 14: Average modal share to access different facilities (Vietnam)

	Walk	Bicycle	Motorbike	Public Transport	Boat
Clinics	65%	35%	0%	0%	0%
District Health Centres	9%	57%	13%	13%	8%
District Centres	13%	46%	37%	3%	0%
High Primary Schools	61%	39%	0%	0%	0%
Markets	62%	37%	0%	0%	1%
Primary Schools	98%	2%	0%	0%	0%
Processing Facilities	71%	29%	<1%	0%	0%
Secondary Schools	18%	80%	1%	1%	0%

Table 15: Average modal share to access different facilities (Malawi)

	Walk	Bicycle	Cart	Public Transport
Facility				
Administrative Centres	67%	3%	0%	30%
Area markets	91%	9%	0%	0%
Clinics	95%	5%	0%	0%
Dispensaries	86%	14%	0%	0%
Full primary schools	100%	0%	0%	0%
Grinding mills	96%	4%	0%	0%
Health Centres	92%	8%	0%	0%
Hospitals	91%	9%	0%	0%
Junior Primary School	100%	0%	0%	0%
Local markets	91%	9%	0%	0%
Secondary schools	96%	4%	0%	0%

Standardisation of the SWUE

The methodology proposed the standardisation of the SWUE for different transport modes and terrain types. The idea is that such standardisation will reduce the data collection efforts and thereby will make the application of the methodology easier. In order to test such proposition the coefficients of variation[4] of the SWUE values for different transport modes and terrain types are calculated (Table 16 and Table 17). It can be seen from the tables that the coefficients of variation range from 0.00 to 0.50 for Malawi and from 0.0 to 0.98 for Vietnam. This means that the standard deviation can be as high as 98% of the average SWUE. This high difference of the SWUE values among the villages with similar type of terrain can be attributed to the condition of roads over which the journeys take place (for example, SWUE to access a facility with a bicycle in a dry season with good infrastructure condition will be considerably lower than the SWUE to access the same facility with a bicycle in wet season with poor

[4] Coefficient of Variation (CV) is the ratio of the standard deviation to the average.

infrastructure condition. This is confirmed by the coefficient of variation of SWUE for walking being considerably higher in Vietnam in areas where the infrastructure conditions vary considerably due to seasonal influences (e.g. in Vietnam, the road conditions in the irrigated lowland, delta areas are more susceptible to seasonal variations due to the severance of access links at water crossing during the monsoon).

Table 16: SWUE and Co-efficient of Variation (Vietnam)

Terrain		Walk	Bicycle	Motorbike	Public Transport	Boat
Mountain	Average	1.02	0.50	0.23	N/A	N/A
	CV	0.24	0.28	0.16	N/A	N/A
Upland hilly Agricultural Area	Average	1.04	0.41	0.20	N/A	N/A
	CV	0.15	0.24	0.00	N/A	N/A
Irrigated Lowland	Average	1.34	0.53	0.18	0.35	0.37
	CV	0.54	0.98	0.34	0.59	0.33
Delta Area	Average	1.57	0.54	0.23	0.13	0.42
	CV	0.43	0.61	0.31	0.22	0.00
Sandy Coastal Area	Average	1.17	0.50	0.17	0.14	N/A
	CV	0.43	0.49	0.26	0.23	N/A

Note: CV=Co-efficient of Variation; N/A = Not Applicable

Table 17: SWUE and Co-efficient of Variation (Malawi)

		Walk	Bicycle	Public Transport	Cart
Flat	Average	1.03	0.53	0.12	0.57
	CV	0.14	0.50	0.23	0.18
Hilly	Average	1.24	0.66	0.43	N/A
	CV	0.21	0.42	0.00	N/A
Mountainous	Average	1.43	N/A	N/A	N/A
	CV	0.15	N/A	N/A	N/A
Rolling	Average	0.91	0.55	0.50	1.33
	CV	0.24	0.48	0.00	0.00

Note: CV=Co-efficient of Variation; N/A = Not Applicable

The conclusion from the above is that calibration of SWUE values for different terrains and for different modes is not practical due to the variability of infrastructure conditions. The major part of the variability can be attributed to the seasonal variations.

3.2.2 The CAI

Suitability of aggregation, investigations to access problems

Table 18 presents the calculated Vietnam CAI values along with the average SWUE values, average distance to facilities villagers needs access to, number of households and ranking of the villages on the basis of these variables. The CAI values for different villages disaggregated by facilities are presented in Appendix II. Table 19 presents the aggregated overall and district-wise CAI values. As mentioned earlier the CAI values for Malawi could not be calculated due to the incomplete collection of data that are required for the calculation of the CAI. However, with such shortcomings it is still possible to make conclusion on different aspects of CAI using the results from Vietnam.

As can be seen from Table 18, Table 19 and Appendix II, CAI values can be aggregated at any levels to investigate the access problems. Having looked at the CAI values at a more aggregate level, one can investigate the problems associated with access by examining different aspects of access at lower levels. For example, the CAI per 1,000 households of village no. 3 under Dien Ban district is the highest (CAI per 1,000 household value of 16.12) among the 31 villages of the two districts. Table 18 shows that village no. 3 ranks 26 and 22 respectively when ranked on the basis of number of households and distance to facilities respectively. However, it only ranks 4th when ranked on the basis of SWUE values. This means that the village is better off than most of the other villages in terms of condition of transport infrastructure and/or the use of more efficient transport services. However, the village ranks 25th when ranked on the basis of CAI without taking into account the effects of number of households. Therefore, the conclusion is that the intervention to improve accessibility of village no. 3 will certainly be the re-location of facilities along with or without improvement of transport infrastructure or services. Appendix II confirms this findings as the SWUE values for different facilities in almost all the cases are below the average values for the whole study area and the CAI values in all the cases are higher than the average CAI values due to longer distances to facilities.

Table 18: No of households, average SWUE, average distance to facilities, CAI and rankings (Vietnam)

					Ranking			
	Household	Distance (km.)	SWUE	CAI per 1,000 HH	No of HH	Av. distance to facilities (km.)	SWUE	CAI (CAI without HH[5])
Province: Quang Nam; District: Dien Ban								
10	203	7.51	0.70	4.43	7	26	7	6 (14)
5	160	7.31	0.58	3.40	4	24	1	3 (12)
7	143	6.13	0.68	2.83	3	18	6	1 (11)
Th Quyt	521	2.48	0.99	5.83	25	2	26	11 (1)
Vi Tay	548	3.66	1.00	9.06	27	4	28	19 (6)
Ph Ngu	456	2.81	0.84	6.51	18	3	19	12 (4)
Benden	305	6.06	0.77	5.42	13	17	12	9 (8)
Bao An	506	7.42	0.95	14.10	23	25	25	27 (22)
Ph Tay	466	7.19	0.92	14.65	19	23	24	28 (26)
4	270	6.41	0.85	8.57	11	20	20	18 (27)
7	272	4.31	1.06	5.29	12	9	29	8 (10)
11	198	5.43	0.80	4.78	6	14	13	7 (17)
H Nong1	516	4.48	1.20	12.20	24	10	31	22 (16)
H Nong2	479	5.36	0.87	13.66	20	13	23	26 (23)
La Hoa	362	5.06	0.74	7.76	16	11	9	15 (13)
2	402	6.25	0.75	10.12	17	19	10	20 (18)
5	337	3.89	0.86	4.32	15	6	22	5 (3)
6	675	3.72	0.74	12.48	31	5	8	24 (9)
1	583	5.71	0.85	15.46	29	15	21	30 (20)
3	521	7.06	0.64	16.12	26	22	4	31 (25)
4	493	5.94	0.82	8.55	21	16	16	17 (7)
Tr Dong	581	4.13	1.00	14.84	28	7	27	29 (19)
Tr Nam	499	5.30	1.06	11.42	22	12	30	21 (15)
D Khuong	624	2.14	0.81	7.44	30	1	15	14 (2)
Overall	**421**	**5.24**	**0.85**	**9.14**				
Province: Ha Tinh; District: Ky Anh								
6	100	9.25	0.83	5.59	1	28	18	10 (30)
Tr Lai	205	4.13	0.59	3.18	8	8	3	2 (5)
4	263	7.75	0.59	7.14	10	27	2	13 (21)
7	133	11.50	0.67	4.00	2	30	5	4 (24)
My Thuan	178	11.67	0.76	7.96	5	31	11	16 (29)
Tr Xuan	238	10.25	0.80	13.30	9	29	14	25 (31)
Tam Hai	324	6.81	0.83	12.21	14	21	17	23 (28)
Average	**206**	**8.76**	**0.72**	**7.63**				

[5] CAI calculated without taking the number of households into consideration (i.e. N_{hh} value of Eq. i is taken as 1)

Table 19: CAI per 1,000 households (Vietnam)

	Province: Quang Nam; District: Dien Ban	Province: Ha Tinh; District: Ky Anh	Overall
Clinics	0.92	0.66	0.86
Dist. Health Centres	1.82	1.93	1.84
Dist. Centres	1.20	1.14	1.19
Markets	1.33	1.04	1.26
Crop Processing Facilities	0.44	0.21	0.38
Primary Schools	0.84	0.68	0.80
High Primary Schools	1.04	0.55	0.93
Secondary Schools	1.56	1.42	1.53
Overall	9.14	7.63	8.80

CAI and Seasons

Table 20 presents the summary of the seasonal influence on the CAI values in Vietnam. Details of the seasonal influences on the CAI values of different villages are presented in Appendix IV. It can be seen from Table 20 that the CAI values vary considerably between dry and wet seasons. Results of the t-test for equality of means show that the CAI values in the dry season are significantly different from CAI values in the wet season (2-tail significance of 0.013). The conclusion is that the CAI can capture the seasonal effects.

Table 20: CAI and seasonal influence (Vietnam)

	SWUE			CAI per 1,000 HH		
	Overall	**Dry**	**Wet**	**Overall**	**Dry**	**Wet**
Province: Quang Nam; District: Dien Ban						
Average	0.85	0.66	1.05	9.14	7.43	10.84
Province: Ha Tinh; District: Ky Anh						
Average	0.72	0.69	0.76	7.63	7.33	7.92
Overall	0.82	0.66	0.98	8.80	7.41	10.18

Sensitivity of CAI values

Figure 3 plots the village rankings for CAI without taking the no. of households into consideration, average distance to facilities, average SWUE and the CAI. The correlation between the calculated CAI values and the parameters (no. of households, average distance to facilities, SWUE) that can influence the CAI values are presented in Table 21. It can be seen from Figure 3 that apart from the number of households the other two parameters (SWUE and distance to facilities) do not have strong association with the overall CAI values. Table 21 also confirms the close association between the CAI values and the number of households (correlation coefficient of .0.67 with significance of 0.000). Although the association between the CAI and the SWUE values have significant association, the association is not very strong. The conclusion is that the CAI values are most sensitive to the number of households among the three parameters they are dependent on.

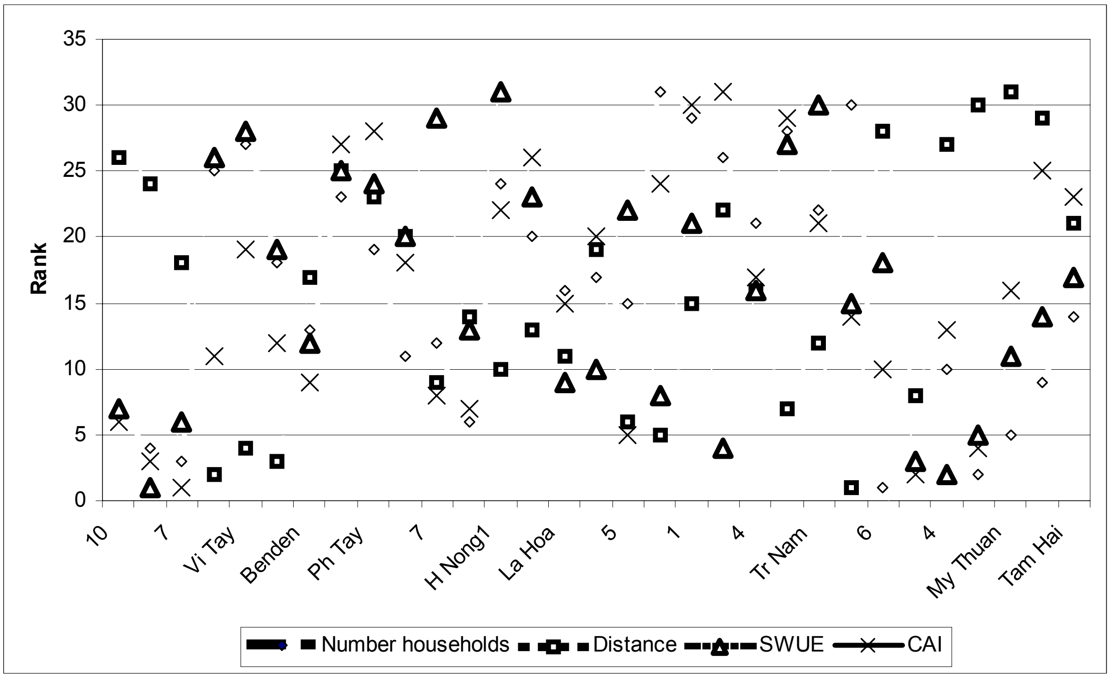


Figure 3: Plot of village rankings on the basis of CAI, CAI calculated without number of households, SWUE and average distance to facilities.

Table 21: Correlation between CAI and other parameters

	Distance	No of Households	SWUE
Correlation coefficients	0.0171	0.6685	0.3704
Significance	0.927	0.000	0.040

3.3 Conclusions

The objective of the study was to assess the utility and efficiency of the methodology developed for the prioritisation of the rural accessibility interventions. As mentioned in Section 2.3 the study is centred on answering ten questions. The conclusions are therefore be drawn on these ten questions.

Q.1 Is the formulation of SWUE and CAI simple enough to be understood easily by transport and rural development practitioners?

The answer to the question is yes. The calculations of the SWUE and the CAI require data on few items: standard walking speed, speed of the mode used, number of households, and the distance to the facility. The assumption of average walking speed of 4.0 km/hour on a good flat road surface seems appropriate as shown in Section 2.3. The local consultants in Vietnam calculated the SWUEs and CAIs and the local consultants in Malawi also calculated the SWUEs.

Q.2 Does their formulation depend on simple and transparent assumptions?

Again the answer is yes. The assumptions seem to be simple and transparent except one. The assumption concerning the share of different modes is not as straightforward as thought by the developers of the methodology. This is especially crucial in areas where the transport system is well developed and there exist different modes of transport. Again the different modal shares of passenger and freight transport will complicate the situation further. However, in areas with an underdeveloped transport system (a majority of the travel and transport is on foot) this problem is not a critical one. Therefore, it requires some extra calculations to determine the modal shares of different modes of transport to access different facilities.

Q.3 Can they capture the effects of the terrain on the transport effort required to access the facilities?

The methodology managed to capture the effects of terrain on the transport efforts required to access the facilities. Section 3.2.1 shows that the methodology effectively captures the effects of different terrain.

Q.4 Can they capture the effects of the level of development of transport infrastructure and services in the area concerned?

The SWUEs (and therefore the CAIs) can, indeed, capture the effects of the level of development of transport infrastructure and services. Section 3.2.1 shows how the SWUE values vary with the level of development of infrastructure and services in an area.

Q.5 Can they capture the effect of use of existing improved transport by the villagers without assuming that the transport infrastructure and services will be used by all the rural population irrespective of their ability to use them?

Discussions in section 3.2.1 show that the SWUE values successfully capture the use of transport modes without assuming that the transport infrastructure and services will be used by the rural population irrespective of their ability to use them. The different SWUE values within a village to access different facilities and different SWUE values for different villages with similar levels of development of transport infrastructure and services to access the same facility confirm this notion.

Q.6 Can they be used for assessing comprehensive accessibility improvements which cut across all sectors?

Section 3.2.2 shows from the study results how the CAI values can be used to assess the access situation for a particular type of facility or to assess the access situations that cut across all sectors. However, the study has not managed to assess the situation due to potential access improvements arising out of access improvement related interventions. Such an exercise would have raised the expectations of the local people where the study was conducted. Apart from calculation of potential SWUEs and CAIs due to access related interventions such an exercise would involve calculations of costs and benefits arising out of the interventions. The calculations of costs and benefits are like any other appraisal procedures. Barring one problem of prediction of modal shift due to interventions, the calculations of SWUEs and CAIs involve similar procedure as done in the pre-intervention situation. Therefore, the conclusion is that the SWUEs and CAIs can be used in assessing comprehensive accessibility improvements that cut across all sectors except that the prediction of the modal shift due to improvement of transport infrastructure and services could be tricky.

Q.7 Does the overall methodology provide a cross sectoral framework where alternative solutions to improving the access problem could be consistently appraised?

Discussions of section 3.2.2 confirms that the methodology can provide a cross sectoral framework whereby the alternative solutions in improving the access problem could be consistently appraised.

Q.8 Would the methodology be consistent in application in all countries where access related interventions are necessary?

The methodology is tested in two countries that are geographically different and have different transport attributes. It never appeared that any of the features of the methodology are country specific. Therefore, the conclusion is that the methodology is suitable for all countries where access related interventions are necessary.

Q.9 Can the methodology be applied at the local level with varying levels of planning capacity?

The study can not answer the question directly as the methodology was not tested at local level with varying levels of planning capacity. However, the application of the methodology seems to be straightforward and can be applied at any level of the local government. The application does not require a high level of technical expertise. However, like any other methodology a short training for local level planners on different aspects of the methodology will be required to make it operational.

Q.10 Is it possible to calibrate the SWUE in an area for different modes of transport and different types of terrain?

Discussion in Section 3.2.2 showed that it was not possible to calibrate the SWUE values in an area for different modes of transport and different terrain types. The SWUE values showed a very high level of variability for the same transport mode and the same type of terrain. The reason for the high variability is that apart from terrain type and mode of transport the SWUE value also depends on the infrastructure condition.

Other conclusions

Sensitivity tests show that the CAI values are more sensitive to the number of households within the unit area concerned than the distances to the facilities and the SUWE values;

The methodology is capable of capturing the changes in access arising out of season effects.

3.4 Summary of the chapter

The chapter presented the results of the analysis and the conclusions that can be drawn from the results. The chapter highlighted different aspects of the SWUE and CAI – their suitability, their variability etc. Sensitivity test results for the CAI were also presented in this chapter. The overall conclusion is that the methodology is suitable for the prioritisation of investments to improve access to rural facilities and services in the accessibility planning process. The methodology is based on simple and transparent assumptions that can easily be understood by transport and rural development practitioners. The methodology is capable of capturing the effects of terrain, level of development of infrastructure and services of an area, level of use of different transport modes by the rural people and the transport efforts needed to reach a facility. The methodology is also capable of assessing the comprehensive accessibility improvements that cut across all sectors. One of the main advantages of the methodology is that it is capable of providing a cross-sectional framework to consistently appraise alternative solutions to access problems. The methodology does not seem to be biased towards any country where it was tested. The main problem in the application of the methodology seems to stem from the fact that the estimates of the modal shares of means of transport to access facilities and services are not as straightforward as assumed by the developers of the methodology.

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Appendix-I

Description of villages (Vietnam)

Commune	Village	terrain	area	population	Nos. HH	HH Size	Ownership of transport modes (Number)						Per 100 HH		
							Cong Nong	MT	Pushbike	Motorbike	Cart	Boat	NMT	MT	Overall
Province: Quang Nam, District; Dien Ban															
D Tien	10	IL	91	773	203	3.8	0	0	0	25	0	2	1.0	12.3	13.3
D Tien	5	IL	60.7	615	160	3.8	1	0	15	10	0	4	11.9	6.9	18.8
D Tien	7	UHAA	1071	576	143	4.0	0	0	2	33	0	0	1.4	23.1	24.5
D Thang	Th Quyt	IL	105.26	2517	521	4.8	3	2	72	120	0	3	14.4	24.0	38.4
D Thang	Vi Tay	DA	159.71	2571	548	4.7	4	4	200	112	0	20	40.1	21.9	62.0
D Thang	Ph Ngu	IL	137.88	2019	456	4.4	5	0	0	60	0	0	0.0	14.3	14.3
D Quang	Benden	IL	152	1355	305	4.4	0	0	0	15	3	0	1.0	4.9	5.9
D Quang	Bao An	IL	179.84	2220	506	4.4	7	0	0	50	1	0	0.2	11.3	11.5
D Quang	Ph Tay	DA	307.2	2056	466	4.4	2	0	0	18	0	0	0.0	4.3	4.3
D Hong	4	IL	146	1201	270	4.4	4	0	20	20	0	200	81.5	8.9	90.4
D Hong	7	IL	135.5	1116	272	4.1	3	0	10	8	0	0	3.7	4.0	7.7
D Hong	11	IL	81.49	887	198	4.5	2	0	0	15	23	0	11.6	8.6	20.2
D Phuoc	H Nong1	IL	149	2116	516	4.1	4	1	30	20	8	0	7.4	4.8	12.2
D Phuoc	H Nong2	IL	166.38	1877	479	3.9	3	0	10	21	0	0	2.1	5.0	7.1
D Phuoc	La Hoa	IL	109.9	1568	362	4.3	6	0	29	15	0	0	8.0	5.8	13.8
D Nam	2	SCA	121	1689	402	4.2	5	0	0	20	0	95	23.6	6.2	29.9
D Nam	5	SCA	82	1460	337	4.3	6	0	0	43	30	0	8.9	14.5	23.4
D Nam	6	SCA	380	2856	675	4.2	7	0	50	137	0	0	7.4	21.3	28.7
D Duong	1	IL	450	2728	583	4.7	5	1	0	10	0	34	5.8	2.7	8.6
D Duong	3	SCA	510	2229	521	4.3	4	3	0	30	0	0	0.0	7.1	7.1
D Duong	4	SCA	270	2417	493	4.9	2	1	0	50	7	15	4.5	10.8	15.2
D Phuong	Tr Dong	IL	88	2703	581	4.7	4	0	110	68	0	0	18.9	12.4	31.3

D Phuong	Tr Nam	IL	227	3225	499	6.5	5	0	50	100	25	0	15.0	21.0	36.1
D Phuong	D Khuong	IL	60.95	2877	624	4.6	4	14	124	243	0	42	26.6	41.8	68.4
Province: Ha Tinh, District; Ky Anh															
Ky Hoa	6	M	69.09	433	100	4.3	1	0	0	6	30	4	34.0	7.0	41.0
Ky Thinh	Tr Lai	UHAA	81.3	1170	205	5.7	1	0	0	10	205	0	100.0	5.4	105.4
Ky Tay	4	M	239	1117	263	4.2	7	0	0	15	0	0	0.0	8.4	8.4
Ky Thuong	7	M	48.03	598	133	4.5	2	0	0	22	0	0	0.0	18.0	18.0
Ky Son	My Thuan	M	1470	1000	178	5.6	0	0	0	12	178	0	100.0	6.7	106.7
Ky Hop	Tr Xuan	UHAA	808.34	694	238	2.9	2	0	0	20	0	0	0.0	9.2	9.2
Ky Ninh	Tam Hai	SCA	172.85	1283	324	4.0	3	0	0	25	0	56	17.3	8.6	25.9
Average						4.4	3.3	0.8	23.3	43.6	16.5	15.3	17.6	11.7	29.3

Note: D=Delta Area; IR=Irrigated Lowland; M=Mountainous; SCA=Sandy Coastal Area; UHAA=Upland Hilly Agricultural Area; NMT=Non-motorised transport; MT=Motorised transport; HH=Household

Description of villages (Malawi)

Village	Terrain	Area in Ha.	No of HH	Population	HH size	Ownership of transport modes (Number)			
						No of bicycle	No of cart	No of pack animal	Overall per 100 HH
District: Dowa, TA; Chiwere									
Chikuni	Hilly	152.4	130	780	6.00	8	0	0	6.2
Kalinda	Hilly	483	333	2383	7.16	3	2	0	1.5
Mashana	Hilly	180.6	119	589	4.95	11	0	0	9.2
Maliseni	Mountainous	3	16	81	5.06	0	0	0	0.0
Chamvu	Hilly	228.9	121	699	5.78	3	2	0	4.1
Bimphi	Hilly	514.6	177	1355	7.66	26	1	0	15.3
Kantayeni	Rolling	204.2	130	653	5.02	7	1	3	8.5
Kankosi	Hilly	230	96	404	4.21	5	2	0	7.3
Mpanje	Rolling	283	118	334	2.83	13	0	0	11.0
Chidothi Makanda	Hilly	626.4	261	1258	4.82	15	2	7	9.2
Lavu	Rolling	751	313	1084	3.46	7	4	0	3.5
Magodi	Hilly	172	72	370	5.14	10	0	0	13.9
Chikuse	Rolling	328.8	137	555	4.05	3	0	0	2.2
Chiwala	Rolling	129.6	54	348	6.44	7	1	0	14.8
Mtungwi	Rolling	245	102	385	3.77	9	2	0	10.8
Chilima	Rolling	156	65	322	4.95	1	0	0	1.5
Chilombo	Mountainous	459	191	848	4.44	2	0	0	1.0
Mkoche I	Rolling	326	136	667	4.90	20	2	0	16.2
Zalakoma	Flat	118	49	242	4.94	6	0	0	12.2
Doko	Mountainous	261	114	540	4.74	4	0	0	3.5
Mchakulu	Rolling	110	46	221	4.80	3	1	0	8.7
District: Dowa, TA; Chakaza									
Mulangeni	Flat	75	52	242	4.65	9	1	0	19.2
Magatha	Flat	610	418	1717	4.11	30	6	10	11.0
Mazinga	Flat	61	37	134	3.62	13	0	0	35.1
Kachiza	Flat	184	104	501	4.82	35	10	2	45.2

Mzira	Flat	217.7	167	960	5.75	28	3	0	18.6
Chilawo	Flat	129.4	72	292	4.06	25	3	0	38.9
Chigoma	Flat	208	137	613	4.47	5	4	0	6.6
Chizolowonda	Rolling	289	159	449	2.82	100	5	2	67.3
Mlembo	Flat	155.3	172	860	5.00	12	1	2	8.7
Chapuwala	Flat	179.5	199	739	3.71	10	6	4	10.1
Kamungwe	Flat	63.5	70	410	5.86	6	0	0	8.6
Mbuluma	Flat	138.1	153	955	6.24	65	5	1	46.4
Chakaza	Flat	254.1	282	1692	6.00	9	2	5	5.7
Mkwichi	Flat	81.6	92	552	6.00	34	3	0	40.2
Mwangala	Flat	74.7	78	576	7.38	9	1	0	12.8
Chidekwende	Flat	65.9	67	341	5.09	39	10	0	73.1
Chatewa	Flat	226.5	250	1616	6.46	25	3	0	11.2
Madziada	Flat	191.4	210	1260	6.00	80	8	1	42.4
Cheyo	Flat	77.7	86	516	6.00	27	2	0	33.7
Mtakuza	Flat	127.9	139	840	6.04	13	6	0	13.7
Chilora	Flat	403.8	447	1968	4.40	94	14	0	24.2
Chinkhwiri	Flat	52.6	58	288	4.97	9	0	0	15.5
Chimamba	Flat	66.1	73	438	6.00	14	0	2	21.9
Makombwa	Flat	259.6	287	1435	5.00	102	8	7	40.8
Average		225.66			5.10	21.24	2.69	1.02	18.03

Note: HH= Household

Appendix II

SWUE (Vietnam)

Village	Clinic	District Health Centre	District Centre	High Primary School	Market	Primary School	Processing Facility	Secondary School	Overall
Province: Quang Nam; District: Dien Ban									
10	0.76	0.17	0.16	1.33	0.85	1.08	0.88	0.35	0.70
5	0.67	0.23	0.18	0.63	0.57	0.93	0.97	0.50	0.58
7	0.68	0.44	0.18	0.73	0.85	1.17	1.02	0.38	0.68
Th Quyt	1.05	0.49	0.58	1.19	0.71	2.50	0.97	0.41	0.99
Vi Tay	1.17	0.37	0.28	0.89	1.15	1.81	1.93	0.41	1.00
Ph Ngu	1.10	0.57	0.25	0.83	0.82	1.67	1.07	0.40	0.84
Benden	0.83	0.21	0.17	0.77	0.77	1.67	1.12	0.67	0.77
Bao An	1.18	0.43	0.33	1.28	1.03	1.11	1.49	0.74	0.95
Ph Tay	1.13	0.47	0.14	0.83	1.08	1.22	1.67	0.81	0.92
4	0.92	0.42	0.24	1.26	0.83	1.30	1.07	0.76	0.85
7	1.60	0.41	0.32	1.33	0.60	1.56	2.02	0.61	1.06
11	0.92	0.21	0.26	0.90	0.95	1.06	1.17	0.95	0.80
H Nong1	1.04	0.50	0.29	1.05	1.20	1.67	3.06	0.77	1.20
H Nong2	0.73	0.65	0.32	0.83	0.83	1.56	1.41	0.65	0.87
La Hoa	0.73	0.38	0.26	0.69	1.16	1.08	1.13	0.52	0.74
2	1.93	0.36	0.23	0.67	0.61	0.83	0.52	0.82	0.75
5	0.61	0.31	0.26	0.57	0.43	2.78	1.22	0.73	0.86
6	0.83	0.43	0.30	0.77	1.04	1.11	1.01	0.43	0.74
1	0.92	0.46	0.39	0.99	0.88	1.44	1.29	0.43	0.85
3	0.74	0.44	0.33	0.71	0.82	0.82	0.70	0.52	0.64
4	0.89	0.17	0.24	0.83	1.07	1.67	1.20	0.47	0.82
Tr Dong	1.40	0.62	0.30	1.10	1.06	1.91	0.92	0.67	1.00
Tr Nam	0.38	0.38	0.26	0.84	1.45	1.85	2.70	0.61	1.06
D Khuong	0.86	0.76	0.10	1.00	1.02	1.17	0.86	0.70	0.81
Average	**0.96**	**0.41**	**0.26**	**0.92**	**0.91**	**1.46**	**1.31**	**0.60**	**0.85**

Province: Ha Tinh; District: Ky Anh									
6	0.98	0.77	0.32	0.62	0.89	1.21	1.25	0.60	0.83
Tr Lai	0.46	0.46	0.33	0.40	0.53	1.44	0.67	0.47	0.59
4	0.77	0.45	0.31	0.52	0.77	0.73	0.67	0.49	0.59
7	0.76	0.40	0.05	0.48	1.11	1.17	1.07	0.33	0.67
My Thuan	1.08	0.30	0.27	1.08	1.15	1.08	0.67	0.43	0.76
Tr Xuan	0.97	1.00	0.22	0.93	0.83	1.03	1.00	0.42	0.80
Tam Hai	1.07	0.58	0.75	1.00	0.64	1.06	1.01	0.50	0.83
Average	**0.87**	**0.57**	**0.32**	**0.72**	**0.85**	**1.10**	**0.90**	**0.46**	**0.72**
Overall Average	0.94	0.45	0.28	0.87	0.89	1.38	1.22	0.57	0.82

CAI per 1000 HH (Vietnam)

Village	Clinic	District Health Centre	District Centre	High Primary School	Market	Primary School	Processing Facility	Secondary School	Overall
Province: Quang Nam; District: Dien Ban									
10	0.46	0.70	0.58	0.95	0.49	0.44	0.10	0.71	4.43
5	0.32	0.67	0.51	0.20	0.69	0.37	0.15	0.48	3.40
7	0.15	1.05	0.42	0.16	0.32	0.17	0.15	0.43	2.83
Th Quyt	0.38	1.02	1.22	0.43	0.56	0.26	0.25	1.69	5.83
Vi Tay	0.64	1.21	1.24	0.73	1.59	1.23	1.06	1.36	9.06
Ph Ngu	1.00	1.04	0.46	1.14	0.56	0.76	0.49	1.06	6.51
Benden	0.50	1.07	0.86	0.59	1.09	0.25	0.24	0.81	5.42
Bao An	0.72	3.92	3.64	0.81	2.46	0.84	0.36	1.35	14.10
Ph Tay	1.06	4.19	1.24	0.78	3.11	0.85	0.78	2.64	14.65
4	0.99	1.89	0.79	0.95	1.00	1.22	0.29	1.44	8.57
7	0.44	1.23	0.94	0.36	0.59	0.63	0.27	0.82	5.29
11	0.55	0.50	0.61	0.53	0.94	0.63	0.09	0.94	4.78
H Nong1	1.44	2.24	1.31	1.46	2.02	0.43	0.46	2.84	12.20
H Nong2	1.08	3.11	1.53	1.23	2.51	1.12	0.59	2.49	13.66
La Hoa	1.19	1.57	1.06	1.13	1.05	0.78	0.41	0.57	7.76
2	1.55	2.01	1.29	1.07	1.23	0.67	0.42	1.88	10.12
5	0.41	1.16	0.61	0.38	0.29	0.28	0.12	1.07	4.32
6	1.40	2.03	1.22	1.29	3.22	1.13	0.68	1.52	12.48
1	1.61	3.21	2.62	1.16	2.06	1.65	0.52	2.62	15.46
3	1.16	2.74	2.61	2.61	1.70	2.30	1.10	1.91	16.12
4	1.10	1.38	1.40	1.03	0.72	0.41	0.30	2.22	8.55
Tr Dong	1.63	2.54	1.24	2.56	1.51	1.67	0.80	2.91	14.84
Tr Nam	0.75	1.70	1.16	2.10	1.46	1.22	0.27	2.74	11.42
D Khuong	1.61	1.41	0.19	1.25	0.70	0.73	0.54	1.02	7.44
Average	**0.92**	**1.82**	**1.20**	**1.04**	**1.33**	**0.84**	**0.44**	**1.56**	**9.14**

Province: Ha Tinh; District: Ky Anh									
6	0.78	0.93	0.38	0.50	1.07	0.97	0.25	0.72	5.59
Tr Lai	0.28	0.14	0.68	0.08	0.46	0.44	0.14	0.96	3.18
4	0.20	2.24	1.54	0.14	0.20	0.19	0.18	2.45	7.14
7	0.40	1.80	0.21	0.26	0.59	0.16	0.14	0.44	4.00
My Thuan	0.77	1.35	1.21	0.77	1.01	0.77	0.18	1.90	7.96
Tr Xuan	1.15	4.76	1.05	1.11	2.26	1.23	0.24	1.51	13.30
Tam Hai	1.04	2.27	2.92	0.97	1.69	1.03	0.36	1.94	12.21
Average	**0.66**	**1.93**	**1.14**	**0.55**	**1.04**	**0.68**	**0.21**	**1.42**	**7.63**
Overall Average	**0.86**	**1.84**	**1.19**	**0.93**	**1.26**	**0.80**	**0.38**	**1.53**	**8.80**

Appendix III

SWUE (Malawi)

VillageName	Administrative	Area market	Clinic	Dispensary	Full primary school	Grinding mill	Health Centre	Hospital	Junior Primary schools	Local market	Secondary
District: Dowa; TA: Chiwere											
Chikuni	1.18	1.17	N/A	1.17	1.26	0.69	N/A	0.78	1.19	1.17	1.26
Kalinda	0.73	1.41	N/A	N/A	0.93	1.22	1.22	1.14	1.50	1.41	N/A
Mashwana	1.25	1.20	0.91	N/A	0.96	1.21	N/A	1.29	N/A	1.20	N/A
Maliseni	1.33	1.39	N/A	N/A	1.46	1.46	N/A	1.35	N/A	1.39	1.15
Chamvu	1.60	1.16	N/A	N/A	1.33	1.00	N/A	1.16	N/A	1.16	N/A
Bimphi	1.45	1.14	N/A	N/A	1.41	1.50	N/A	1.47	N/A	1.19	1.34
Kantayeni	0.71	0.68	N/A	N/A	0.67	0.83	N/A	0.66	0.80	0.68	1.12
Kankosi	0.43		N/A	N/A	1.00	1.33	1.29	1.29	1.33	1.50	N/A
Mpanje	0.67	1.16	N/A	N/A	0.95	1.10	0.93	N/A	N/A	1.16	1.16
Chidonthi Makanda	0.40	1.08	1.52	N/A	0.89	1.60	1.51	1.51	1.60	1.08	1.51
Lavu	0.67	0.67	0.80	N/A	0.83	0.67	N/A	0.80	N/A	0.67	0.80
Magodi	0.85	1.05	N/A	N/A	0.90	1.18	N/A	1.44	N/A	1.05	1.26
Chikuse	0.80	1.00	N/A	N/A	1.00	1.00	N/A	0.67	N/A	1.00	0.71
Chiwala	0.50	1.16	N/A	N/A	0.83	0.97	0.94	N/A	N/A	1.13	1.00
Mtugwi	0.89	1.15	N/A	1.04	1.16	1.02	N/A	N/A	1.13	1.15	1.33
Chilima		0.93	N/A	0.80	1.16	1.00	N/A	0.93	N/A	0.94	N/A
Chilomo	1.25	1.50	N/A	N/A	1.50	1.50	1.45	1.50	N/A	1.50	1.33
Mkoche	0.96	0.67	N/A	N/A	0.73	0.67	0.71	N/A	N/A	0.67	0.67
Zalakoma	0.13	1.06	N/A	N/A	1.16	1.20	1.06	N/A	N/A	1.03	N/A
Doko	N/A	1.33	N/A	1.26	1.41	1.48	N/A	1.33	2.22	1.33	1.36
Mchakulu	N/A	0.75	N/A	1.00	0.94	0.67	0.67	0.75	N/A	0.75	0.75
Average	0.88	1.08	1.08	1.05	1.09	1.11	1.09	1.12	1.39	1.10	1.12
District: Dowa; TA: Chakaza											
Mulangali		1.05				0.99		0.96		1.05	1.02

Magatha	N/A	0.70	N/A	N/A	1.00	0.78	0.88	1.02	0.90	0.70	0.90
Mazinga	N/A	0.90	N/A	N/A	0.94	0.93	N/A	1.11	1.00	0.86	N/A
Kachiza	N/A	0.90	N/A	N/A	1.14	1.11	1.09	1.00	0.94	0.90	1.06
Mzira	N/A	1.00	N/A	N/A	N/A	1.03	0.98	0.96	N/A	1.00	1.15
Chilawo	0.17	1.06	N/A	N/A	1.03	0.70	N/A	1.00	N/A	1.06	1.10
Chigona	N/A	1.08	N/A	N/A	1.00	1.00	N/A	1.20	1.00	1.08	1.00
Chizoloondo	N/A	0.94	N/A	N/A	1.20	0.86	N/A	0.94	N/A	0.94	1.03
Mlembo	1.05	1.11	N/A	N/A	1.04	1.23	0.71	N/A	N/A	0.99	0.80
Chapuwala	N/A	0.94	N/A	N/A	0.80	0.90	N/A	1.10	0.93	0.94	0.80
Kamungwe	0.13	0.94	N/A	N/A	1.00	1.00	N/A	1.00	N/A	0.94	1.02
Mbuluma	1.00	1.00	N/A	N/A	1.05	1.13	N/A	1.00	N/A	1.00	N/A
Chakaza	0.10	0.97	N/A	N/A	1.33	1.06	1.00	N/A	N/A	0.97	0.90
Mkwichi	1.00	0.90	N/A	0.86	0.90	0.90	N/A	N/A	N/A	0.85	1.07
Mwangala	1.00	0.86	N/A	N/A	N/A	1.33	N/A	0.91	N/A	0.86	1.00
Chidekwende	0.13	0.86	N/A	0.55	1.16	0.96	N/A	N/A	N/A	0.86	1.00
Chatewa	1.03	0.68	N/A	0.74	0.95	1.33	N/A	N/A	N/A	0.79	N/A
Madziada	0.11	1.00	N/A	N/A	1.00	1.16	N/A	0.80	N/A	1.00	1.06
Cheyo	N/A	0.87	N/A	0.73	0.86	0.76	N/A	N/A	N/A	0.92	N/A
Mtakuzi	0.08	1.33	N/A	1.05	0.93	1.33	N/A	N/A	1.16	1.33	0.80
Chilora	0.50	1.05	N/A	N/A	1.11	0.84	N/A	1.00	N/A	1.05	0.98
Chinkhuni	1.01	1.33	N/A	1.22	1.33	1.33	N/A	N/A	N/A	1.33	1.06
Chimamba	0.57	1.03	N/A	N/A	1.00	1.16	N/A	1.03	N/A	0.84	0.96
Makombwa	0.83	0.86	N/A	N/A	1.05	1.11	N/A	0.80	N/A	0.86	1.06
Average	0.58	0.97	N/A	0.86	1.04	1.04	0.93	0.99	0.99	0.96	0.99
Overall av.	**0.74**	**1.02**	**1.08**	**0.95**	**1.06**	**1.07**	**1.03**	**1.05**	**1.21**	**1.03**	**1.04**

Appendix IV

Vietnam: SWUE and CAI per 1000 HH

	SWUE			CAI		
Village	Overall	Dry	Wet	Overall	Dry	Wet
Province: Quang Nam; District: Dien Ban						
10	0.70	0.59	0.81	4.43	3.95	4.91
5	0.58	0.46	0.71	3.40	2.77	4.03
7	0.68	0.58	0.78	2.83	2.52	3.14
Th Quyt	0.99	0.72	1.26	5.83	4.88	6.77
Vi Tay	1.00	0.77	1.23	9.06	7.22	10.91
Ph Ngu	0.84	0.67	1.00	6.51	5.27	7.75
Benden	0.77	0.53	1.02	5.42	3.78	7.07
Bao An	0.95	0.66	1.23	14.10	12.32	15.89
Ph Tay	0.92	0.70	1.14	14.65	12.36	16.93
4	0.85	0.66	1.04	8.57	6.23	10.90
7	1.06	0.78	1.33	5.29	4.29	6.29
11	0.80	0.51	1.09	4.78	3.23	6.34
H Nong1	1.20	0.78	1.62	12.20	7.92	16.48
H Nong2	0.87	0.69	1.05	13.66	11.88	15.43
La Hoa	0.74	0.60	0.89	7.76	6.34	9.19
2	0.75	0.59	0.90	10.12	8.68	11.55
5	0.86	0.74	0.99	4.32	3.24	5.41
6	0.74	0.62	0.86	12.48	10.85	14.11
1	0.85	0.74	0.96	15.46	13.66	17.26
3	0.64	0.54	0.73	16.12	13.96	18.29
4	0.82	0.68	0.95	8.55	7.13	9.98
Tr Dong	1.00	0.73	1.27	14.84	11.40	18.28
Tr Nam	1.06	0.84	1.27	11.42	8.93	13.91
D Khuong	0.81	0.62	0.99	7.44	5.55	9.33
Average	**0.85**	**0.66**	**1.05**	**9.14**	**7.43**	**10.84**
Province: Ha Tinh; District: Ky Anh						
6	0.83	0.76	0.90	5.59	5.01	6.17
Tr Lai	0.59	0.60	0.58	3.18	3.13	3.23
4	0.59	0.51	0.66	7.14	6.66	7.62
7	0.67	0.66	0.68	4.00	4.21	3.80
My Thuan	0.76	0.71	0.81	7.96	7.22	8.71
Tr Xuan	0.80	0.79	0.81	13.30	13.30	13.30
Tam Hai	0.83	0.80	0.85	12.21	11.79	12.64
Average	**0.72**	**0.69**	**0.76**	**7.63**	**7.33**	**7.92**
Overall	**0.82**	**0.66**	**0.98**	**8.80**	**7.41**	**10.18**

Appendix V

Malawi: SWUE

Village	Overall	Dry	Wet
District: Dowa; TA: Chiwere			
Chikuni	1.11	1.10	1.11
Kalinda	1.21	1.14	1.29
Mashwana	1.14	1.09	1.20
Maliseni	1.36	1.33	1.40
Chamvu	1.23	1.17	1.30
Bimphi	1.36	1.27	1.45
Kantayeni	0.78	0.75	0.81
Kankosi	1.18	1.21	1.14
Mpanje	1.02	0.99	1.04
Chidonthi Makanda	1.24	1.24	1.24
Lavu	0.74	0.72	0.76
Magodi	1.11	1.01	1.20
Chikuse	0.88	0.92	0.84
Chiwala	0.93	0.98	0.89
Mtugwi	1.11	1.14	1.08
Chilima	0.96	0.92	1.00
Chilomo	1.44	1.39	1.49
Mkoche	0.72	0.74	0.70
Zalakoma	0.94	0.99	0.90
Doko	1.47	1.43	1.50
Mchakulu	0.79	0.76	0.82
Average	**1.09**	**1.06**	**1.11**
District: Dowa; TA: Chakaza			
Mulangali	1.01	1.00	1.03
Magatha	0.86	0.89	0.83
Mazinga	0.96	0.98	0.93
Kachiza	1.02	0.97	1.06
Mzira	1.02	1.02	1.02
Chilawo	0.87	0.85	0.90
Chigona	1.05	1.05	1.05
Chizoloondo	0.98	0.95	1.02
Mlembo	0.99	0.97	1.01
Chapuwala	0.92	0.85	1.02
Kamungwe	0.86	0.85	0.87
Mbuluma	1.03	1.03	1.03
Chakaza	0.90	0.87	0.94
Mkwichi	0.93	0.93	0.92
Mwangala	0.99	1.00	0.99
Chidekwende	0.79	0.77	0.82
Chatewa	0.92	0.88	0.96
Madziada	0.88	0.88	0.88
Cheyo	0.83	0.82	0.84
Mtakuzi	1.00	0.99	1.01

Chilora	0.93	1.04	0.82
Chinkhuni	1.22	1.21	1.23
Chimamba	0.94	1.01	0.87
Makombwa	0.94	0.92	0.96
Average	**0.95**	**0.94**	**0.96**
Overall Average	**1.02**	**1.00**	**1.03**

Appendix VI

Modal Split (Vietnam)

	Walk	Bicycle	Motorbike	Public Transport	Boat
Facility					
Clinics	65%	35%	0%	0%	0%
District Health Centres	9%	57%	13%	13%	8%
District Centres	13%	46%	37%	3%	0%
High Primary Schools	61%	39%	0%	0%	0%
Markets	62%	37%	0%	0%	1%
Primary Schools	98%	2%	0%	0%	0%
Processing Facilities	71%	29%	0%	0%	0%
Secondary Schools	18%	80%	1%	1%	0%
Season					
Dry	46%	47%	5%	1%	0%
Wet	58%	33%	5%	2%	1%
Overall	52%	40%	5%	2%	1%

Modal Split (Malawi)

	Walk	Bicycle	Cart	Public Transport
Facility				
Administrative Centres	67%	3%	0%	30%
Area markets	91%	9%	0%	0%
Clinics	95%	5%	0%	0%
Dispensaries	86%	14%	0%	0%
Full primary schools	100%	0%	0%	0%
Grinding mills	96%	4%	0%	0%
Health Centres	92%	8%	0%	0%
Hospitals	91%	9%	0%	0%
Junior Primary School	100%	0%	0%	0%
Local markets	91%	9%	0%	0%
Secondary schools	96%	4%	0%	0%
Season				
Dry	92%	5%	0%	3%
Wet	91%	6%	0%	4%
Overall	91%	6%	0%	3%

Appendix VII

Average SWUE, St Dev. & Error Coefficient for different types of terrains (Vietnam)

Average

Facilities	Mountainous	Hilly	Irrigated Lowland	Delta	Sandy Coastal area
Clinic	0.90	0.70	0.94	1.15	1.01
District Health Centre	0.48	0.63	0.43	0.42	0.38
District Centre	0.24	0.24	0.27	0.21	0.35
High Primary School	0.68	0.69	1.00	0.86	0.76
Market	0.98	0.74	0.92	1.12	0.77
Primary School	1.05	1.21	1.47	1.51	1.38
Processing Facility	0.91	0.89	1.38	1.80	0.94
Secondary School	0.46	0.42	0.61	0.61	0.58
Overall	0.71	0.69	0.88	0.96	0.77

Standard Deviation

Facilities	Mountainous	Hilly	Irrigated Lowland	Delta	Sandy Coastal area
Clinic	0.23	0.24	0.44	0.25	0.59
District Health Centre	0.20	0.29	0.19	0.11	0.14
District Centre	0.12	0.07	0.11	0.08	0.19
High Primary School	0.32	0.34	0.37	0.45	0.19
Market	0.25	0.23	0.32	0.24	0.26
Primary School	0.23	0.23	0.52	0.52	0.78
Processing Facility	0.30	0.19	0.85	0.49	0.29
Secondary School	0.15	0.05	0.29	0.43	0.17
Average	0.35	0.34	0.59	0.60	0.50

Co-efficient of variation

	Mountainous	Hilly	Irrigated Lowland	Delta	Sandy Coastal area
Clinic	0.26	0.34	0.47	0.22	0.58
District Health Centre	0.42	0.45	0.43	0.27	0.38
District Centre	0.50	0.30	0.40	0.39	0.54
High Primary School	0.47	0.49	0.37	0.52	0.26
Market	0.26	0.31	0.35	0.22	0.34
Primary School	0.22	0.19	0.35	0.34	0.57
Processing Facility	0.33	0.21	0.61	0.27	0.31
Secondary School	0.33	0.12	0.48	0.70	0.30

Average SWUE, St Dev. & Error Coefficient for different types of terrains (Malawi)

Average

Facilities	Flat	Hilly	Mountainous	Rolling
Administrative Centre	0.55	0.99	1.29	0.74
Area market	0.98	1.17	1.41	0.91
Clinic		1.21		0.80
Dispensary	0.86	1.17	1.26	0.95
Full primary School	1.03	1.11	1.46	0.96
Grinding mill	1.06	1.22	1.48	0.88
Health Centre	0.95	1.30	1.45	0.83
Hospital	0.99	1.24	1.39	0.79
Junior Primary School	0.99	1.40	2.22	0.96
Local market	0.97	1.22	1.41	0.91
Secondary School	0.99	1.34	1.28	0.95

Standard Deviation

Facilities	Flat	Hilly	Mountainous	Rolling
Administrative Centre	0.46	0.44	0.08	0.15
Area market	0.16	0.13	0.13	0.22
Clinic		0.39		0.00
Dispensary	0.23	0.01	0.09	0.17
Full primary School	0.15	0.31	0.15	0.25
Grinding mill	0.20	0.36	0.09	0.18
Health Centre	0.14	0.12	0.00	0.14
Hospital	0.12	0.23	0.12	0.13
Junior Primary School	0.17	0.25	0.00	0.21
Local market	0.15	0.16	0.08	0.22
Secondary School	0.11	0.16	0.22	0.24

Coefficient of Variation

Facilities	Flat	Hilly	Mountainous	Rolling
Administrative Centre	0.83	0.45	0.06	0.21
Area market	0.16	0.11	0.10	0.24
Clinic	N/A	0.32	N/A	0.00
Dispensary	0.27	0.01	0.07	0.18
Full primary School	0.15	0.28	0.10	0.26
Grinding mill	0.19	0.30	0.06	0.21
Health Centre	0.15	0.09	0.00	0.17
Hospital	0.12	0.19	0.09	0.17
Junior Primary School	0.17	0.18	0.00	0.21
Local market	0.16	0.13	0.06	0.25
Secondary School	0.11	0.12	0.17	0.25