

## **CHAPTER 5: RESEARCH STRATEGY & METHODS**

### **5.1 INTRODUCTION**

The purpose of this chapter is to present the design and different research methods involved in the author's research relating to the selection of freight modal choice and the modelling of multimodal transport corridors in South East Asia. First, a framework for research methodology for transport and logistics studies is presented, with a particular emphasis on case study research strategy. "Triangulation" is then proposed and utilised as a research technique. The chapter concludes with the different research methods used in this case study.

### **5.2 TRANSPORT & LOGISTICS RESEARCH**

Several academics and researchers (e.g. Mentzer & Khan, 1995; Mentzer & Flint, 1997) have stressed the need for improvement and increased rigour in the research process of the transport and logistics discipline. Research is an intricate and rigorous process that should not be taken lightly nor pursued in an unstructured manner. According to Mentzer and Khan (1995), the research process is:

*"A series of logically ordered...choices. Those choices run from formulation of the problem, through design and execution of a study, through analysis of results and their interpretation. The series of choices is locally directional: Plan must come before execution; data collection must come before data analysis. But the set of choices is systematically circular: It starts with a problem, and gets back to the problem. The end result of the process, however, never arrives back at the exact starting point, even if all goes well."*

They also stated that transport and logistics research has been influenced by the economic discipline and, to a lesser degree, the behavioural approaches to scientific

study. The economic approach focuses attention mostly on cost minimisation and profit maximisation through cost analysis, mathematical modelling, simulation, etc. The behavioural approach focuses on the psychological and sociological aspects of situations and is primarily obtained via questionnaires, interviews, and case studies.

The author's research is centred on a case study that involves both the economic (i.e. transport modelling) and behavioural aspects (i.e. perception and usage of transport modes). The case study is a research strategy, which focuses on understanding the dynamics present within single settings (Eisenhart, 1989). Yin (1994), proposed a technical definition as follows:

*A case study is an empirical enquiry that:*

- investigates a contemporary phenomenon within a real-life context;
- when the boundaries between phenomenon and context are not clearly evident;
- and, in which multiple sources of evidence are used.

The case study typically uses a combination of specific methods: interview, observation, questionnaires, and documentary sources, etc. Ellram (1996) explained that the case study method is one of the least understood and often most criticised research method today. Table 5.1 summarises some of the common misconceptions related to case study research.

***Table 5.1: Misconceptions related to the use of the case study method of research***

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1. Case study research and teaching are closely related.
  2. The case study method is only a qualitative research tool.
  3. The case study method is an exploratory tool that is appropriate only for the exploratory phase of investigation
  4. Each case study represents the equivalent of one research observation. Thus, extremely large numbers of case studies are required to produce any meaningful results.
  5. Case studies do not use a rigorous design methodology.
  6. Anyone can do a case study; it's just an ad-hoc method.
  7. Results based on the case study methodology are not generalisable.
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*Source: Ellram (1996)*

The first misconception is because of the confusion between case studies for teaching which give students the opportunity to make decisions or solve problems and case studies with a research objective that explain, explore, or describe a phenomenon of interest.

Misconceptions two and three can be overcome by the use of quantitative research methods in the case study such as simulation, modelling and statistical testing of survey data. Quantitative case study design usually focuses on a small number of cases due to the depth of research required.

Misconception four is dealt with by the fact that a single case study should be considered as a single experiment and not a single observation of the phenomenon. Misconception five and six are addressed by developing a research protocol for the case study based on previous research and review of the relevant literature.

Lastly, misconception seven that research results are not generalisable can be overcome by an understanding of the research methodology used in the case study. The more sound the research methodology appears, the greater the validity and generalisability of results (Yin, 1994).

According to Hakim (1989), case studies tend to demand a wider range of skills: interviewing, the analysis and interpretation of information held in documents and records, the design and analysis of structured surveys, extended periods of observation as well as the usual literature search and drafting skills for research reports.

The framework developed by Mentzer and Khan (1995) in Figure 5.1 offers a comprehensive perspective on the transport and logistics research process. The research process begins with idea generation, which may occur via a literature review, observation or both. The literature review and observation are two forms of logical induction that promotes substantive justification. Substantive justification should be able to justify the value of the research within its substantive area. After establishing substantive justification, the researcher must derive theories about the current phenomenon to be studied (Eisenhart, 1989).

From the theory base emerge the hypotheses that are conceptually linked to the theory through the process of logical deduction. Theory is also directly linked to constructs<sup>1</sup> that are abstract, non-observable concepts that represent different components of a theory (Peter, 1981). Measures are then defined to operationalised the constructs. Methodology is an extension of the research design. Choices of research design process involve the outlining of strategies for performing the research. Prior to undertaking the research, measures must therefore be established in order to properly reflect the constructs to be studied. After the research design and methodology stage, data will then be collected. The data will need to be valid, reliable and precise in order for the data analysis to be meaningful. Data management will need to be systematic with the process of data collection coherent. An efficient storage and retrieval system are a prerequisite. According to Huberman and Miles (1994) data analysis contains three linked sub-processes: data reduction, data display, and researcher's interpretation<sup>2</sup>. After data analysis, conclusions will then be formulated.

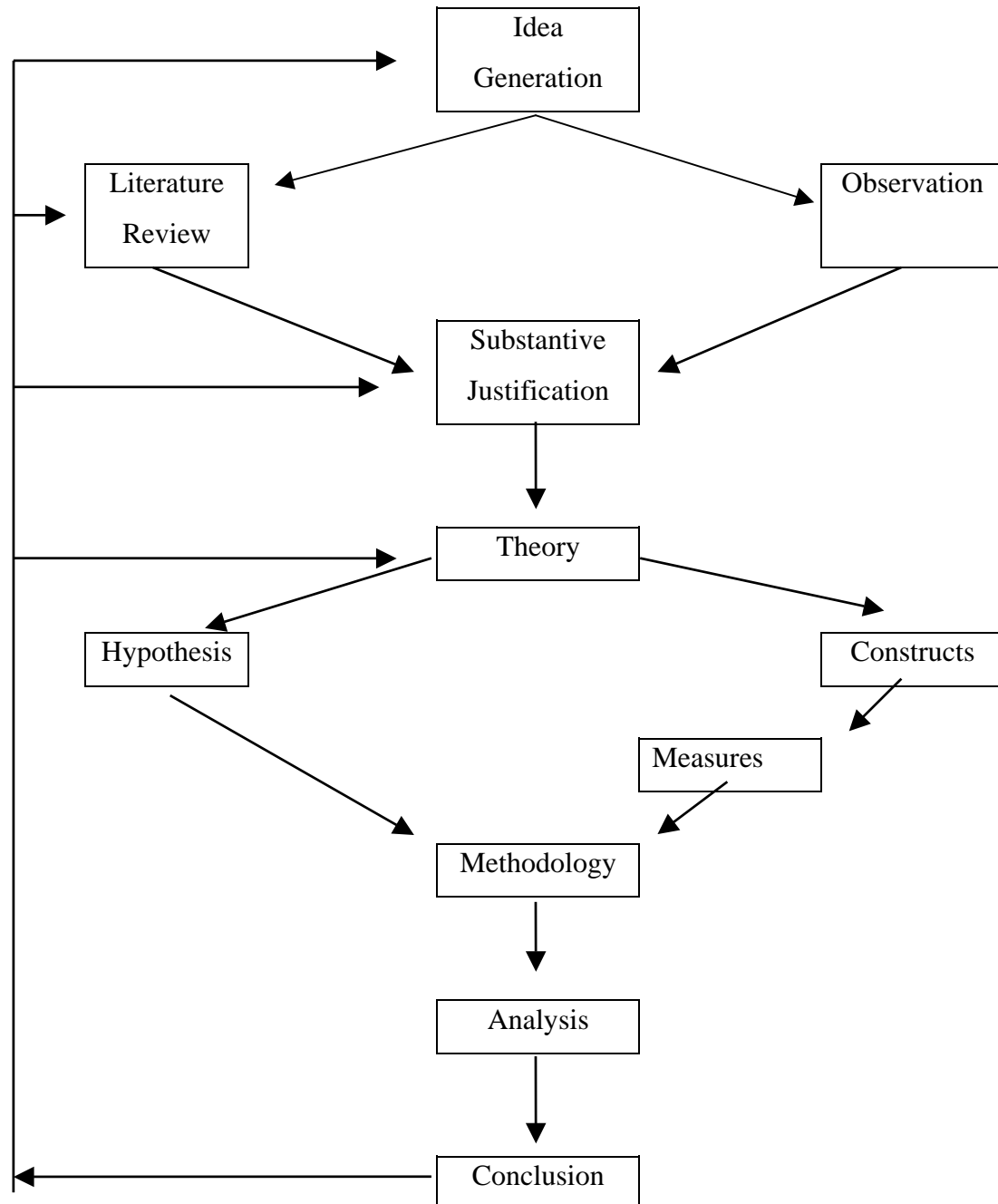
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<sup>1</sup> A construct is a term specifically designed for a special specific purpose, generally to organise knowledge and direct research in an attempt to describe or explain some aspect of nature.

<sup>2</sup> The researcher is drawing meaning from the displayed data.

This framework of transportation and logistics research is dynamic in its nature, as conclusions will become the starting point for the generation of new ideas.

*Figure 5.1: A framework of transportation and logistics research*



*Source: Adapted from Mentzer & Kahn (1995)*

This framework can be used as a template for transport and logistics research as well as for research in any other discipline. The author's research process is based on this framework. Idea generation was developed from the author's previous work

experience relating to multimodal transport issues in South East Asia and how it is believed that multimodal transport could increase trade competitiveness and sustains economic development. The literature review, demonstrated that multimodal transport could be considered as a mean of gaining competitive advantage as well as increasing trading opportunities while the author observed that there were no truly holistic multimodal transport corridors in the region. The movement of goods in the region is done with a combination of modes of transport but without the integrated management approach that is characteristic of an efficient multimodal transport service. Barriers that are both physical and institutional have also hindered the implementation and development of multimodal transport.

This is the primary motivation for this research to be undertaken. There is a need to examine the effect of integrated multimodal transport corridors operating in the region, and their impact on regional trade competitiveness. The main theory behind the research is that of “multimodal transport”. One of the main hypotheses that are derived from the theory is that multimodal transport effectiveness and competitiveness is dependent on the selection of optimal modes of transport for the movement of goods from door-to-door as well as from the quality of the infrastructure in place. Multimodal transport is also recognised as a broad construct that contains many logistics dimensions such as JIT<sup>3</sup>, TQM<sup>4</sup>, customer service, reliability, etc. Measures are then implemented to develop questions that need to be answered relating to the selection of modes of transport and multimodal transport corridors. Lao PDR as a less developed land-locked country is subject to infrastructure constraints that may exist in transit countries for sea access.

Choice of research design and methodology are closely linked. The research design process will involve the outlining of strategies for performing the research and the use of the most appropriate types of research methods. Analysis and conclusions will be dealt with in the following chapters. In this research, the author’s main research strategy is to use the “triangulation” technique with his case study.

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<sup>3</sup> Just-in-Time

## 5.3 TRIANGULATION

### 5.3.1 Definition

Denzin and Lincoln (1998) defined “Triangulation” as the use of multiple methods in the study of the same object. The main objective of using triangulation or the use of multiple research methods is described by Aastrup *et al.* (2000), as a plan of action that will raise researchers above personal biases that stems from single methodology. The use of triangulation as a technique may involve a variety of data, investigation techniques, theories or methods when conducting research. It is believed that triangulation will increase the research scientific rigour.

### 5.3.2 Types of triangulation

According to Denzin (1989), there are basically four types of triangulation:

- **Data triangulation**, by using different data sources (not methods of generating data).
- **Investigator triangulation**, by employing multiple observers for the same phenomenon.
- **Theory triangulation**, by approaching empirical materials from various perspectives, theoretical framework and interpretations.
- **Methodological triangulation**. There exists two forms of method triangulation:
  1. “**Within**” method triangulation is employed by choosing one method and employing different strategies to examine data.
  2. “**Between**” method triangulation is on the other hand used when combining dissimilar methods to investigate a set of data.

### 5.3.3 Relevance and justification of triangulation

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<sup>4</sup> Total Quality Management

The rationale for using “triangulation” for this research is closely related to the issue of validity (Altheide & Johnson, 1994; Yin, 1994; Ellram 1996). In the natural sciences, findings are usually regarded as validated when they are replicated by a second investigator who repeats the initial investigator’s experiment. In the social science, such as transport and logistics research, validation is conventionally equated with a different sort of replication that is called triangulation: the use by the investigator of different methods to produce the same findings (Bloor, 1983).

Mentzer and Flint (1997) have argued for multiple studies of a logistics or transport phenomenon using different methods (i.e., surveys, interviews, case studies, simulation and modelling) to triangulate on the “true nature” of the phenomenon. They described that through this technique; logistics and transportation research can achieve the level of rigour sought in other areas of research, especially scientific research.

Triangulation of research methods lends greater empirical support to the theory in question where both qualitative and quantitative methods may be used appropriately (Guba & Lincoln, 1994). According to Whipp (1997) the emphasis of quantitative research is on statistical relationships which allows generalisations or point to specific linkages between elements of a problem while qualitative research is, by contrast, is more prone to acknowledge multiple interpretations. It is feasible and encouraged to link qualitative and quantitative approaches within the same study or at different stages of a research programme (Jick, 1989). Bringing the results together is often instructive as new questions are often generated.

Flint *et al.* (1998) indicated that a variety of non-positivistic<sup>5</sup> approaches (i.e., phenomenology<sup>6</sup>) should have an increase role in logistics and transportation research. The argument for a more interpretative approach is that theoretical

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<sup>5</sup> Positivism is characterised by the idea of the unity of scientific research method amidst the diversity of subject matter. Natural sciences, in particular mathematics and physics represent a methodological ideal.

<sup>6</sup> Phenomenology is usually portrayed as the opposite of positivism.



triangulation does not necessarily reduce bias, nor does methodological triangulation increase validity. Theories are generally the product of quite different paradigms and traditions, so when they are combined, the picture might be “fuller” but not more objective. Similarly, different methods have emerged as products of different theoretical traditions. The combination of various methods may add range and depth to the research but maybe not in accuracy. Jick (1989) is considered to represent a more pragmatic approach to the rationale of triangulation. He recognises the positivist-based argument of improved validity but for him triangulation can be something more than scaling, reliability, and convergent validation. For him, triangulation will help capture a more complete, holistic, and contextual portrayal of the unit(s) under study.

New and Payne (1995) used a two method approach in their research relating to partnerships in the supply chain. They combined a scientific approach (i.e. questionnaires) with seven “expert” panel meetings (i.e. qualitative and interpretative). The interplay of the questionnaires and panels meetings allowed both sources of data to be used more effectively. The study did not follow the traditional model oriented research paradigm of logistics, nor a strict hypothesis-testing approach but it was able to understand (up to a certain extent) the mechanisms and perceptions of partnerships in the supply chain. The combination of survey and panel methodologies is a valuable way of extending the explanatory power of the case study approach to a wider range of organisations.

The use of multi-method research such as triangulation is a useful technique when used carefully and purposely in order to add breadth and depth to the research, but not for the purpose of pursuing the “objective” truth (Fielding & Fielding, 1986).

### 5.3.4 Types of triangulation used in the research

In this study, the author uses two types of triangulation techniques:

1) The first one is “data” triangulation as he collects data from users of the transport network; transport and logistics service providers, and policy makers. This data triangulation has been done in Cambodia, Lao PDR, Malaysia, Myanmar, Thailand and Vietnam<sup>7</sup> (see Table 5.2).

*Table 5.2: Data sources utilised for the research*

Country	No. of policy makers	No. of transport & logistics providers	No. of shippers & consignees	Others
<b>Cambodia</b>	27	21	0	4(a)
<b>Lao PDR</b>	14	12	21	7(a)
<b>Malaysia</b>	17	16	1	14(b)
<b>Myanmar</b>	5	29	0	6(b)
<b>Thailand</b>	23	15	0	17(b)
<b>Singapore</b>	0	1	0	1(c)
<b>Vietnam</b>	7	34	0	3(d)

*Source: The Author*

(a) Include Customs Officers & Insurance companies.

(b) Include professional organisations, customs, banks and university staff.

(c) Singapore Logistics Association.

(d) Include journalist, Ministry of Security and university staff.

Since Lao PDR is the main focus of the research, the emphasis on Lao shippers and consignees is a prerequisite for the successful completion of the study. Shippers and consignees in the neighbouring countries are not considered part of this research. Nevertheless, the role of policies makers and transport/logistics providers in neighbouring countries are of critical importance for the transit of goods to and from Lao PDR.

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<sup>7</sup> Singapore is also studied as it is the main transshipment hub, articulation point, and the biggest port in the region, but only logistics service providers have been contacted directly.

Access to data in the region is quite difficult. Myanmar remains South East Asia's most closed society, where access to information is generally denied. To get information from the government in Malaysia is not easy. It depends on who you are and whom you know. Thailand is considered the freest country in the region for access to information but authorities frequently twist economic reality to fit public expectations. Singapore may be the most "wired" country in the region but access to information is less than satisfactory. While Cambodia does not have an information law, its existing information infrastructure allows easier access to information held by government agencies. This is probably due to the fact that Cambodia's laws and regulations are still emerging after decades of civil war and there is leeway to obtain information if one knows the right persons or channels<sup>8</sup>. Lao PDR and Vietnam also limit access to information. The author was fortunate enough to know most of the respondents on a personal basis before the start of the research. These personal connections greatly facilitated access to data that is not usually made publicly available.

2). The second triangulation technique that has been used in this study is "between" method triangulation. The author uses and combines different research methods in order to try to obtain a "fuller" picture of the study.

The research will therefore focus on the determinants of modal choice in freight transport in Lao PDR through a questionnaire-based survey as well as the modelling of the various multimodal transport corridors in the region. The methods of data collection and interpretation used in this study are:

1. Surveys (structured interviews);
2. Unstructured interviews;
3. Transport modelling.

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<sup>8</sup> "Southeast Asia loosens access to information", in: *The Nation*, 30 October 2000, Internet Edition.

## 5.4. METHODS OF DATA COLLECTION

### 5.4.1 Interviews

The interview is the primary means of accessing the experience and subjective views of actors (Whipp, 1997). The purpose of the interview is to elicit answers pertinent to the research hypotheses. In this case the hypothesis relates to the choice of transport modes, multimodal transport corridors in South East Asia as well as the management of these corridors.

Interview formats vary. At one extreme is the highly structured type where questions are asked in a fixed form and sequence. The aim here is to produce quantifiable results from set sample, which may provide generalisable findings. The systematic collection of interviews with a number of respondents is the basis of a survey. At the other end of the scale is the open or unstructured interview; it is particularly useful where subject matter is sensitive and especially during “elite<sup>9</sup>” interviewing. Many problems arose with the “elite” respondents during the research as access had to be negotiated and schedule submitted before the interviews. Certain issues were also too volatile to be discussed<sup>10</sup> due to the different political systems in place in the region. The objective here is to try to give the fullest opportunity for view and values of the respondents to become known. Interviews of this kind are based on lists of themes or key issues rather than set questions.

There are real advantages and clear limitations to interviews. The greatest value lies in the depth and detail of information that can be secured. The interview also provides maximum interviewer flexibility for meeting unique situations. According to Cooper & Emory (1995), the interviewer can also do more things to improve the quality of the information than with other research methods. Interviewers can note conditions of the interview, probe with additional questions and gather supplemental

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<sup>9</sup> People that are in positions of power sometimes do not want their identities to be revealed.

<sup>10</sup> “Laos, the comrade in need, keeps Thailand at arm’s length”, in: *The Nation Multimedia*, Internet Edition, 11 May 2000.

information through observation. The interviewers also have a better control over the process.

Limitation of the interview method comes from the cost of conducting large scale interviews and also the change in the social climate that have made interviewing more difficult as people are more wary of strangers. Interviewer bias cannot be totally controlled even with standardised questionnaire interview. All interviewers are instructed to remain objective but the flexibility of this data collection method makes interviewer bias possible.

Last but not the least, is the lack of anonymity, as the interviewer will collect respondents' personal details as well as disclosing themselves. Certain sensitive issues will surely have a probable negative impact on respondents, especially when a rapport has not yet been established.

#### **5.4.2 Surveys: Interviews using questionnaires**

To *survey* is to question people and record their response for analysis. The type of surveys used in this research is: structured interviews by using questionnaires to elicit the data required. Questionnaires have been used frequently in logistics and transportation research<sup>11</sup> (Mentzer & Kahn, 1995). For this study, a pilot of the questionnaire was not conducted due to financial constraints. Nonetheless, the questionnaire format and structure was discussed with staff members of the logistics and operations management section of Cardiff Business School. The author acknowledges that the quality of the questionnaire would surely have been enhanced from pertinent feedback that could have been delivered by selected test-respondents. Stated Preference technique is discussed and discounted as a possible questionnaire method.

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<sup>11</sup> Mostly postal questionnaires.

- *Questionnaire and sample design*

The questionnaire-based survey is a classic approach to acquiring information (Read & Holbrook, 1998) but its design is a difficult task and full of complexity (Oppenheim, 1992). In this study a questionnaire has been developed with reference to the three main hypotheses. The questionnaire that was developed was based on previously published research on similar subjects and the literature review.

Sampling design is another very important issue as the result of the research is only as good as the data collected (Gorard, 1997). In order to be valid, the sample selected must be able to reflect the whole population. This validity is based upon the accuracy and the precision of the sample (Cooper & Emory, 1995). According to Churchill (1991) sampling procedures can be classified into two main types: *probability* sampling, which is based on the concept of random selection, and, *non-probability* sampling, which is non-random and subjective.

In this study, the questionnaire ( see Appendix C) focused on users of the transport networks in Lao PDR. These users are the exporters, the importers, and the logistics and transport service providers operating in Lao PDR. The sample for the questionnaire was chosen from the Lao National Chamber of Commerce and Industry Membership Directory<sup>12</sup>. The selected respondents were identified through their involvement in international trade (either export and/or import, or the international transport of goods). The sample for exporters is representative of the main foreign income earners of the country (i.e., wood and garments); the foodstuff importers were selected randomly from the Directory within Vientiane municipality, and the logistics service providers were chosen on the basis of their market shares. The delivery of the questionnaire was quite difficult as not all respondents were fluent in English. Depending on the respondents, the questionnaire had to be orally translated by the author in French, Thai or Lao.

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<sup>12</sup> It is the only trade and industry association that is recognised by the Lao government.

The questionnaire for this research is separated into seven parts:

- Part 1: relates to general information relating to the respondents, such as name of the establishment, position held, etc., and also when the interview took place.
- Part 2: concerns the current status of the firm and its main business(es). This part is intended to obtain information on the respondents' firm structures, type of business, overall turnover, and transport cost ratio, and import and/or export activities.
- Part 3: deals with the respondent's firm size, employment and organisation. The importance of the transport function within the firm is assessed in relation to the firm's size.
- Part 4: analyses transport usage according to the modes of transport available in Lao PDR. Shortcomings of the transport systems are also discussed with open ended questions
- Part 5: looks into the linkages' patterns and product characteristics of the transported goods.
- Part 6: investigates the attitudes towards factors that affect freight modal choice in Lao PDR. A Likert-type scale has been introduced in this part in order to measure respondents' perception towards the various factors relating to product, decision-makers, and transport services.
- Part 7: addresses the person responsible for transport decisions and operations within the firm. The respondent's educational background is examined and a discussion on the transport system that is available then follows.

- *Questionnaire strengths and limitations*

It must be noted that the questions, their wording, and their sequence should be fixed and identical for every respondent (Nachmias, 1992) but researchers must be careful as respondents are not standard and their understanding may differ. There is a need to support respondent in making responses without feeding answers and must be correct methodologically.

The strength of using questionnaire-based interview is that interviewers can provide a guard against confusing questionnaire items. The interviewer can pick up on ambiguities and clarify matters, therefore obtaining relevant responses (Babbie, 1992). Standardised questionnaires also have an important strength with regard to measurement as well as control of the interview situation. An interviewer can ensure that the respondent answers the questions in the appropriate sequence or that they answer certain questions before they are asked subsequent questions (Nachmias, 1992)

But the requirement of standardisation often represents the least common denominator in assessing peoples' attitudes, orientation, circumstances, and experiences. Similarly, structured interviews can seldom deal with the context of social life. The initial study design cannot be changed throughout, as its reliability and validity will depend on its standardised format. The type of data collected will be very precise and quantifiable. Nonetheless, open-ended questions are possible when the researcher is seeking respondents' perception or evaluation of a particular situation. Some critical issues may not always be explored with closed questions. In this study, the author tried to balance open-ended and closed questions in order to obtain a more 'complete' picture of the situation.



- ***Stated Preference technique***

Stated Preference (SP) techniques could have been used to forecast modal choice for international freight transport to and from Lao PDR but calibration of the models would have been complicated. The essence of SP is that respondents are asked to state their preference among a number of hypothetical options. Forecasting mode choice for freight transport by using SP requires the researcher to consider the effects of price, quality of service, consignments characteristics, consignor characteristics, consignee characteristics, infrastructure and equipment characteristics and characteristics of any feasible mode (Fowkes *et al*, 1993). The relative weight attached to these characteristics can be expected to vary according to the nature of the product. SP provides respondents with alternative hypotheses that include trade-offs between the numerous determinants of modal choice and routeing selection. Respondents then rank these alternative hypotheses. According to Fowkes (1998), if every respondent is in such a position that his preferred option is overwhelmingly superior to all other options, it will be very difficult to make an accurate estimation of the trade-off which is believed to be taking place. Reluctance to trade between alternatives offered is also a problem (Fowkes *et al.*, 1989a). In this study, discussion with respondents showed that many of the routeing alternatives available in the region are unknown. Routeing alternatives will have to be described, which will reflect in a large number of standard errors if SP was used, while the ability to rate various alternatives at one iteration may also have some limitations (Fowkes *et al.*, 1989c). SP techniques present a challenge to Lao respondents as they do not have the “full” picture and may not be able to provide a valid way of obtaining data on trade-offs. The use of SP techniques in this context would have been too complicated for the respondents and were considered inappropriate especially since the unstructured interviews tended to provide strong exploratory power.

### **5.4.3 The unstructured interview**

The result of the author's questionnaire survey showed that there were many areas where national and regional rules, regulations, and policies' makers had a great influence. In order to obtain a 'clearer' picture of the situation and the various constraints existing for the transit of Laotian goods, it was necessary to interview policies' makers. These policies' makers were located not only in Lao PDR but also in neighbouring countries. Many of these policy-makers were high-ranking government officials in their respective countries, and access had to be negotiated constantly. The respondents were selected based on their involvement with transport infrastructure, transport policies, trade facilitation and international commerce. The sampling method was non-probabilistic because of limited access, time, and available resources. According to Rees (1998), the most efficient way to collect data from high-ranking officials or 'elite' is through the use of unstructured interviews. This is a very important method as 'elite' respondents do not like to feel guided or pressured during interviews. In this study, it was noticed that the less formal the interview, the more 'open' was the elite respondent.

According to Nachmias (1992), this type of interview has four characteristics:

- It takes place with respondent known to have been involved in a particular experience.
- It refers to situations that have been analysed prior to the interview.
- It proceeds on the basis of a loose interview guide related to research hypotheses.
- It is focused on the subjects' experiences regarding the situation under study.

There are no pre-specified sets of questions, nor are questions asked in a specified order. Furthermore, no schedules are used. With little or no direction from the interviewer, respondents are encouraged to relate their experiences to describe whatever seems significant to them, to provide their own definition of situations, and to reveal their opinion and attitudes as they see fit. The interviewer has a great deal of freedom to probe various areas and to raise specific queries during the course of the

interview. This means that the same broad topics will be introduced during each interview but the questions may change over time. Although the encounter between the interviewer and respondent is structured and the major aspects of the study are explained, respondents are given considerable liberty in expressing their definition of a situation that is presented to them.

The advantage of using this technique is that the interviewer may be able to establish better rapport with the respondent as he has more flexibility. The interviewer can answer questions concerning the research area, probe for answers, use follow up questions, and also gather information by observation. This will lead to less formal interaction between the interviewer and the respondent, thus making the respondent more comfortable and informative.

In contrast there are disadvantages. High implementation cost seems to be a common denominator but for unstructured interview, there is also a need for trained interviewers, especially if the researcher himself is unable to conduct the interviews. This will most probably increase the final research cost. Another sensitive area is that questions may be altered or respondent coached by interviewers. This may be due to the nature of the questions as they are open ended. This is because an unstructured interview allows the testing of hypothesis, to follow up on unexpected results and to discover the deeper motivation of respondents. A questionnaire-based interview is unable to provide this sort of flexibility and data depth even when certain questions are open ended. The type of data collected from this technique will be more exploratory, explanatory and confirmatory of certain situation or hypotheses on transport infrastructure, transport policy, freight modal choice, multimodal transport corridors, trade facilitation, etc.

In an unstructured interview, the interviewer seeks to explore and understand a particular theme through casual, unstructured conversation. There is a need for specialised and highly trained interviewers for this interview technique. If the interview is mishandled, the respondent may feel interrogated. The balance between casual conversation and unstructured data collection is very hard to maintain.

Nevertheless, this technique provides a very good understanding of the social context where trust is an important issue as the respondent will provide 'secrets'. It is also more costly than any other type of interview technique as it is rarely a one-off affair. This technique requires an ongoing process.

In this research, more than 200 respondents were interviewed between 1998 to early 2000. Some respondents were interviewed individually and some were interviewed in small groups of 4 or 5 persons depending of their availability. The author explained the purpose of the study at the start of the interviews. When consent was given, the interviews started with the author asking questions relating to respondents' areas of expertise. Notes were taken during the discussions. Policy-makers were interviewed individually and were asked about rules and regulations relating to transit issues. Transport and logistics service providers were usually interviewed in small groups and discussion was centred on routeing alternatives, transport modes or combination of modes and operational problems. Pricing issues were discussed on an individual basis as they are commercially sensitive. The Internet was also used for follow-up questions or clarifications. Data collected from policy-makers explained the legal environment affecting regional and national transit rules while data collected from transport and logistics service providers was used in the modelling of multimodal transport corridors.

The key for success is to find the right respondent, someone who knows the environment well and who is currently involved. The interviewer must never pick an analytical respondent, as the respondent will try to analyse the situation for the interviewer. The data acquired with this type of technique will be mostly exploratory and explanatory as no preconceptions are being made on freight modal choice rationale or the selection of multimodal transport corridors for Lao PDR. This particular technique will provide a useful understanding of the transport decision maker, how he makes his transport choices, and how he assesses the reliability of the regional transport network. There may also be other parameters that have not been taken into account by the interviewer that may appear.

#### **5.4.4 Summary**

Interviewing allows great flexibility in the questioning process. The greater the flexibility, the less structured the interview will be. The choice of a technique is not as complicated as it might appear. By comparing research objectives with the strength and weaknesses of each technique, it is possible to choose one that is optimally suited to the research.

If none of the choices turns out to be a particularly good fit, it is possible to combine the best characteristics of two or more alternatives onto a “mixture of techniques”. In this research a “mixture of techniques” has been used as there are various levels to the research process. Many respondents did not feel comfortable with the interview questionnaire and asked for a less formal method of interviews. This was mostly requested by high-level policy makers.

One must also bear in mind that for these techniques to be successful in the data collection process other factors must be taken into account (i.e. personal identity of interviewer, gender, ethnic group, age and dress codes). These factors relate to the interviewer’s impact on the respondent and will be reflected in the data collected. As long as the interviewer is aware of his impact on the respondent, an objective interview is assumed.

## 5.5 LOGISTICS & TRANSPORT MODELLING

Transportation is a very particular human activity. There is infrastructure and vehicles, which are the mean people and freight is moved from place to place and there is the management of these activities. Since all human activities cannot be done at one location they are, in fact, distributed over space and occupying different sites. It is the spatial distribution of human activities and the differentiation of land uses that guarantees the need for transport. This is why transport modelling is important for the analysis of the behaviour and forecasting of transport operations. One of the main purposes of transport modelling is to determine the attributes of locations that promote flows of people, goods or idea between them. Transport modelling will be used mainly to address the second hypothesis.

The development of spatial interaction models has been done through analogy with other academic subjects. Inspiration has come from scientific subjects such as mathematics and physics to social sciences subjects such as economy and geography. A vast majority of spatial interaction models <sup>13</sup>used in transport modelling draw on physical analogies, in particular Sir Isaac Newton's Law of Universal Gravitation propounded in 1687. This law state that the gravitational attraction between two bodies is proportional to their respective masses and inversely proportional to the square of the distance between them.

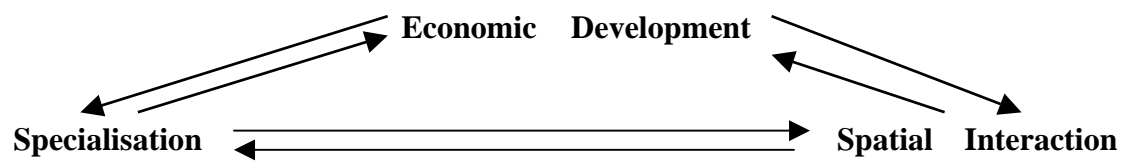
### 5.5.1 Spatial interactions models

Spatial interaction has been defined, in Fotheringham & O'Kelly (1989) as: "...movement or communication over space that result from a decision process." Spatial interaction is linked with economic development through the process of specialisation, as shown in figure 5.2, which allows increased efficiency and production.

#### ***Figure 5.2: Economic development linkages***

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<sup>13</sup> Linear programming models represent the other main type of spatial interaction models, which assumes that decision made are based on deterministic utilities of alternative relations.



Source: Fotheringham & O'Kelly (1989)

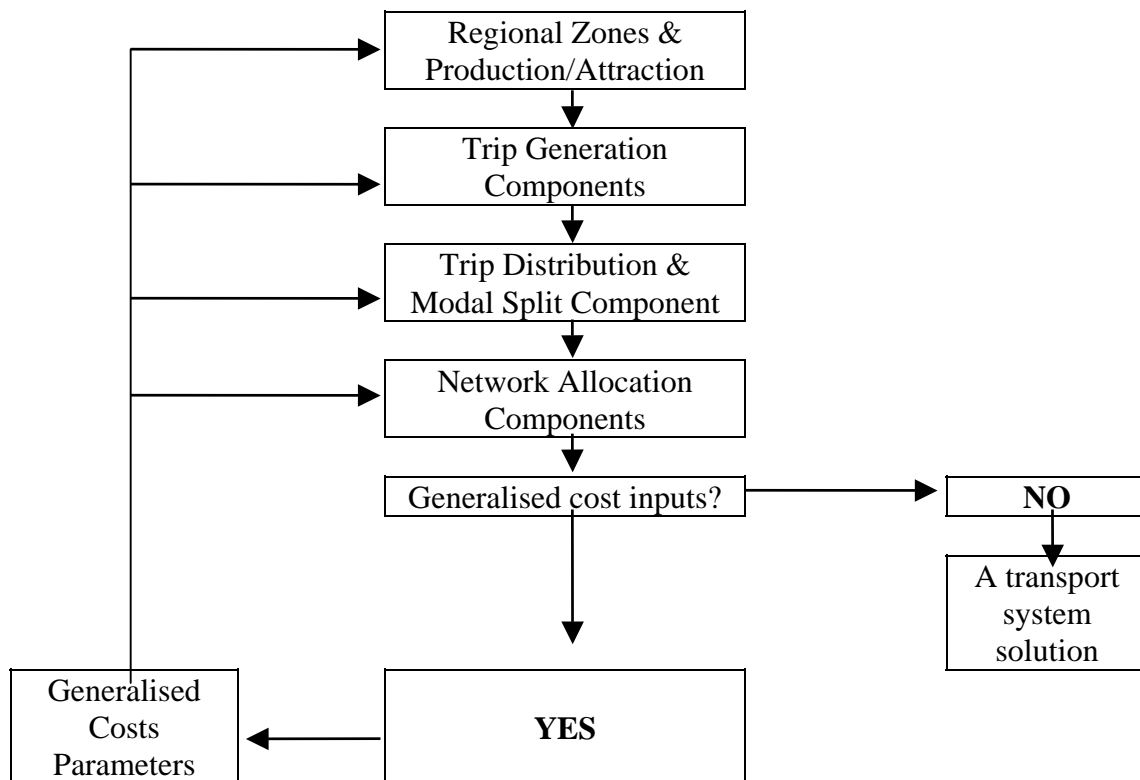
A prerequisite of specialisation is trade and transport, both at the national and international level. Therefore, even though economic development is determined by specialisation, specialisation can only be achieved through spatial interaction. The relationship among these three factors is derived from neo-classical economic theories (Krugman, 1995). Depending on the level of economic development, countries spatial interactions will be different. That is why there is a need to model not only spatial interaction within the countries studied but also spatial interactions within regions. The purpose of spatial interaction models is to explain and predict certain patterns of flows.

There are four major types of spatial interaction models:

- *Unconstrained/ total flow constrained*  
Those that yield insight into interaction patterns by providing information on the attributed of both origins and the destinations of the interaction.
- *Production constrained*  
Those that provide information only on destination characteristics
- *Attraction constrained*  
Those that provide information only on origin characteristics
- *Doubly constrained or production-attraction constrained model*

A multimodal transport corridor is a subset of a general transport system. A general transport system is usually made up of origins, destinations, links, nodes, and modes of transport. The spatial interaction methods that may be used in the modelling process of a general transport system are indicated in figure 5.3.

**Figure 5.3: Structure of a general transport model**



Source: Adapted from Lalwani et al. (1991)

- **Regional zones and trip generation component**

The pattern of regionalisation of world trade indicates that world economic activity is not uniform in its spatial distribution but gravitates around epicentres. Therefore, the trip generation component of the model will consider the levels of production and consumption (attraction) within a regional zone. A gravity model may be used as a spatial interaction instrument. As summarised by Poon (1997):

*“...the gravity model relates the interaction of trade between countries by reference to some measure of trade potential to various factors analysed in the theory of international trade, namely the size of economies and barriers to trade”.*



Singapore is seen by Poon (1997) as the gravity centre of South East Asia, where regional trade flow patterns converge to Singapore due to the country's natural strategic location and 'attraction' power.

- **Trip Distribution and Modal Split Component**

Probably the most recognised model on spatial interaction is Wilson's (1970) trip distribution and modal split model. The model simulates using the number of trips between zone  $i$  and  $j$  using transport mode  $k$  by commodity of type  $n$ . Other modal split models have been developed. A large number is available in the literature such as Bayliss (1988), where he viewed that in the demand for a mode of freight transport, there should be four main variables:

1. Shipping cost per unit
2. Mean transit time
3. Variance in transit time
4. Carrying cost per unit time while in transit

Other types of aggregate models tried to look into the importance of commodity, region, distance, and consignment size in modal split (Tavasszy *et al.*, 2000).

- **Network Allocation Component**

Singapore is considered the main transport hub in South East Asia. Hubs and articulation points are a type of facility located in a network in such a manner, so as to provide a switching point for flows between interacting nodes and modes. Hubs pose problem for spatial interaction since indirect routeing of flows through central facilities implies a distortion of conventional transport costs. This may require a re-evaluation of the demand for interaction between any two nodes. Even if the demand for interaction is inelastic, it is important to know which freight flows are influential in the network's design. Al Kazily (1982) argued that a hub system in a developing region seems to be the most efficient and rational choice, cost wise for ports in developing countries, as it is not feasible for all ports in the region to service

efficiently mainline ship operators. The most suitable model for network allocation is probably a discrete multi-hub model as depending on the mode of transport, there will be multiple hubs and articulation points within a region (Werner, 1985).

The main problem in using spatial interaction models for this research was the availability of reliable data and statistics needed for aggregate transport modelling. Countries in South East Asia are not renowned for keeping accurate data or statistics. There is also no uniformity in trade statistics as well as discrepancies in the methods involved for data collection among the various agencies involved with international trade and transport, even within the same country. These discrepancies can be explained by the fact that two of the countries involved in this study have a centrally-planned economy (i.e. Lao PDR & Vietnam) and two are slowly opening up their economies to the outside world (i.e. Cambodia & Myanmar) with a varying degree of success.

### ***5.5.2 Multimodal transport modelling***

Other types of transport modelling techniques had to be used in this research in order to illustrate the various multimodal transport corridors in operation in South East Asia. Models of the disaggregated type are closer to the actual decision making unit and, therefore may be more realistic in their description of logistics activities (Tavasszy *et al.*, 2000). This disaggregated modelling approach is also consistent with the questionnaire-based survey and the unstructured interview research methods used for this research, as the primary unit of research in this study is the Lao transport user and decision makers.

The choice of transport mode has a direct impact on the efficiency of a multimodal transport system. Depending on the mode chosen (Liberatore & Miller, 1995), the overall performance of the multimodal transport system will be affected. Simple cost-distance models of road versus rail are commonly found (Fowkes *et al.*, 1989; Hayuth, 1992; Marlow & Boerne, 1992) for national movements or sea versus air (Hayuth, 1986; Jung, 1994) over longer, intercontinental routes. As an efficient

multimodal transport choice is of vital importance to the success of international trade, various models have also been created (Beresford & Dubey, 1990; Beresford, 1999; Minh, 1991; Barnhart & Ratliff, 1993; Yan, Bernstein & Sheffi, 1995) to aid transport decision makers in choosing the most effective transport mode or combination of transport modes that not only minimises cost and risk, but also satisfies various on-time service requirements.

The cost model, which is presented below and utilised in this study, includes both transport (road, rail, inland waterway, sea) and intermodal transfer (ports, rail freight terminals, inland clearance depots) as cost components<sup>14</sup>. This model has been adapted from Beresford & Dubey (1990) and improved by Beresford in 1999.

The model may be considered in four developmental stages from its basic form (Figure 5.4a) through 2 intermediate stages (Figure 5.4b and 5.4c) to its final mature form (Figure 5.4d). It is based on the premise that unit costs of transport vary between modes, with the steepness of the cost curves reflecting the fact that, for volume movements, sea transport should be the cheapest per tonne-km, road transport should normally be the most expensive (at least over a certain distance), and waterway and rail costs should be intermediate. At ports and inland terminals, a freight handling charge is levied without any material progress being made along the supply chain; a vertical “step” in the cost curve therefore represents the costs incurred here. The height of the step is proportionate to the level of the charge. Depending on the route chosen, the combination of modes and cost will be different. The purpose is to find the most competitive route cost-wise or time-wise<sup>15</sup>.

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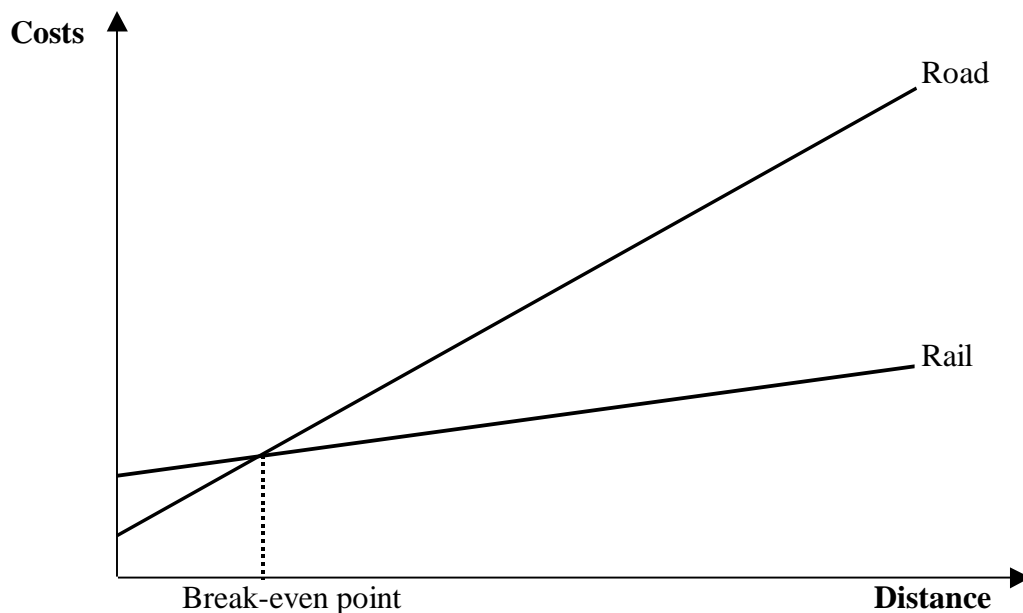
<sup>14</sup> a time component can replace the cost component on the y-axis to also illustrate the effect of intermodal transfers on the total transit time.

<sup>15</sup> if the time component is represented in the y-axis

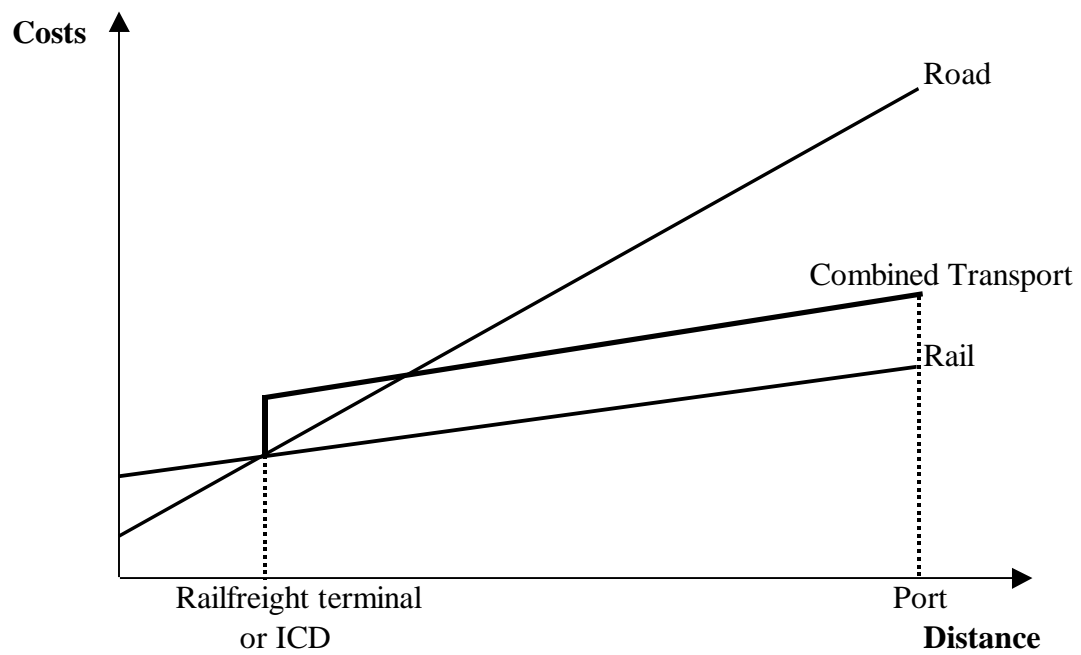
This model may also be used as a contributory tool in the debate over the value of time in freight transport operations when the time component replaces the cost component. According to Lalwani *et al.* (1991), the longer freight transport takes (including dwell times at terminals), the greater will be the costs of working capital (e.g. rate of interest). The aggregate time costs may, however, be a good deal more since some goods may be needed urgently and markets may be lost for goods that arrive too late. This time costs will ultimately depend on the nature of commodities transported. The costs of delay must also be taken into account when appraising risks of specific routes and transport modes. As part of the analysis of routeing decision, it is important to examine the trade-off between money costs of transport and the costs of time (Fowkes *et al.*, 1989a, Fowkes, 1998). This model is able to illustrate the main bottlenecks and the variations in transit time that may occur depending on the routeing option.

**Figure 5.4: Cost Model for Multimodal Transport**

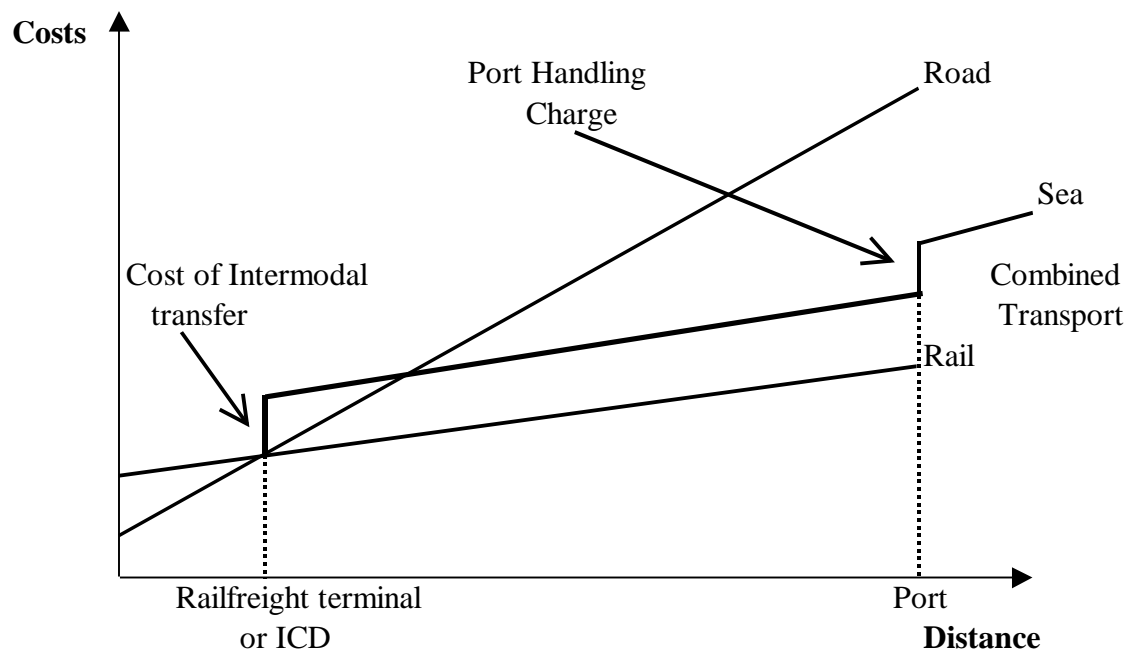
**(a) Unimodal Alternative, Road vs. Rail**



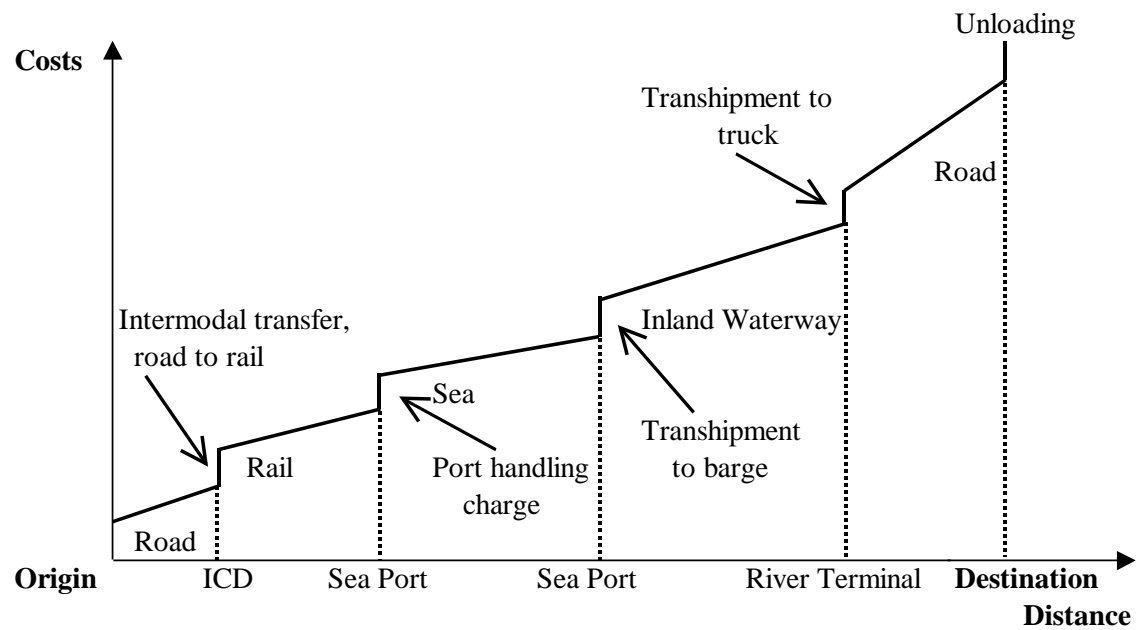
*(b) Combined Transport, Road-Rail*



*(c) Combined Transport, Road-Rail-Sea*



*(d) Multimodal Transport, from Origin to Destination*



*Source: Adapted from Beresford (1999)*

Beresford & Savides (1997) and Beresford (1999a) tested this model on the UK-Greece transport corridor. The model highlighted the factors, which affected the choice of transport modes or combination of modes for given movements. The model could also assist in the logistics trade-offs, such as those between speed and costs, to be thoroughly examined in a range of circumstances. Similar types of models were also proposed by Levander (1992) and Christopher (1998).

- *Limitations of the multimodal transport model*

The choices of multimodal transport combinations differ on factors other than transportation cost, time, distance, and intermodal transfer costs. Other issues such as the nature of freight, value, marketing strategy, stockholding policy, damage, packing requirement, pilferage, security, etc., also need to be assessed in order to find the most appropriate multimodal transport corridor for traders in Lao PDR. It is normal for analytical models, such as this multimodal transport cost-model, to be based on some simplifying assumptions. To minimise the limitations of the multimodal transport cost-model, the author also examined the various factors affecting freight modal

choice in Lao PDR. Part 6 of the questionnaire survey investigate the attitudes of Lao traders and transport/logistics providers towards freight modal choice.

In this study, the model is tested using real data over a series of alternative routes for export and import between Lao PDR and the European Union. Data was obtained either directly or through secondary data sources: from Lao exporters, importers, logistics service providers, Customs; Vietnamese transport service providers, port authorities, Customs; Thai transport operators, freight forwarders, ports and ICD operators, Customs, Malaysian logistics service providers, railway, port, and Customs; Singapore logistics service providers, port authority, Customs; regional and international shipping lines.

### **5.5.3 Risk analysis: the confidence index**

The multimodal transport model that is used in this study is subject to limitations. While part 6 of the questionnaire survey deals with factors affecting freight modal choices in Lao PDR, the issue of uncertainty needs to be explored. The significance of uncertainty for a decision situation depends on the cost of reversing a commitment once made. It is when high uncertainty is coupled with high cost that uncertainty needs to be acknowledged and allowed for in any analysis (Rosenhead, 1989).

According to Hertz and Thomas (1984) risk means both uncertainty and the results of uncertainty. That is, risk refers to a lack of predictability about structure, outcomes or consequences in a decision or planning situation. In this case, how certain can the decision-maker be that the goods will arrive safely at destination after the selection of a particular multimodal transport corridor. The term 'risk analysis' is used here to denote methods, which aim to develop a comprehensive understanding, and awareness of the risk associated from the decision involved in the selection of multimodal transport corridors.

A number of methods can be used for the ‘risk analysis’ of multimodal transport corridors in South East Asian. Many of the more frequently used methods seen in the literature are taken from the field of operation management (Littlechild & Shutler, 1991). As an example, Analysis of Interconnected Decision Areas (AIDA) was used for the formulation of a national policy on the storage, handling, transport mode selection, routeing and the use of Liquefied Petroleum Gas (LPG) in the Netherlands (Hickling, 1989).

Moskowitz (1987) stated that all decision problems have certain general characteristics. These characteristics constitute the formal description of the problem and provide structure for solutions. The decision problem of modal or combinations of transport mode selection for traders in Lao PDR may be represented in terms of the following elements:

- 1). *The Decision Maker*: The decision maker is responsible for making the decision.
  - Lao shippers, consignees and logistics providers are the decision makers.
- 2). *Alternative Courses of Action*: An important part of the decision maker’s task, over which he has control, is the specification and description of the alternatives that are specified.
  - The research proposes five multimodal transport corridors to choose from for both export and import to and from Europe.
- 3). *Events*: Events are the scenarios or states of the environment not under the control of the decision maker that may occur. Uncertainty is measured in terms of probabilities assigned to the events.
  - Measurement of uncertainty for each mode of transport, intermodal transfer and other nodal activities is done via a confidence index. This confidence index is based on a five point type scale: (1) = Almost no confidence; (2) = Not very confident; (3) = Fairly Confident; (4) = Confident, and (5) = Very confident.



4). *Consequences*: The consequences that result from a decision depend not only on the decision maker but also on the event that occurs.

- The confidence index tries to capture some of the uncertainties involved in the selection of each multimodal transport corridors. These ratings reflect the subjective values of the decision makers. The consequence will depend on the multimodal transport corridor chosen and the assigned confidence index. In theory, it will be the most competitive multimodal transport corridor.

The confidence index that is used for ‘risk analysis’ in this study is derived from the field of political science, especially political instability methodology. Qualitative predictive research in political instability focuses upon intuition, judgement and Delphi forecasting (Andriole & Hopple, 1983). Intuitive qualitative forecasting is central to a systematic analysis. All the persons interviewed for this study are knowledgeable about international trade transactions, transport operations, documentary procedures, and rules and regulations in their respective countries or region. The respondents ‘intuitively’ assign a rating for each transport mode, intermodal transfer charge and other nodal activities. This intuition is based on the respondents immersion in the history, culture, politics, experience in trading practices, transport operations, administrative procedures of their own country and up to a certain extent of their own region (Bruce, 1983).

The confidence indices for each routeing alternatives were derived from the unstructured interviews held with transport and logistics providers. During the interviews, the author would ask the groups to assign a rating for each mode of transport and nodal links along a particular route by consensus. This is why only integer numbers appear for each mode of transport or nodal link while fractions appear for the total confidence index. A route’s total confidence index is calculated from the average of all the confidence indices on that particular route. But, there might be a problem when consensus ratings are assigned as it becomes more difficult for respondents with divergent views to express them openly (New & Payne, 1995).

This confidence index or rating is accurate as long as the national and regional environment has not changed. It is very important to continually assess and monitor the situation in South East Asia. Turmoil in a country, changes in national or regional policies can have a significant impact on the selection of a particular multimodal transport corridor (Simon, 1983). If changes occur, then there will be a need to re-evaluate which multimodal transport corridor is the most appropriate under the new circumstances. This re-evaluation can be done by following the same methodology.

## **5.6 CONCLUSIONS**

This chapter has described in detail the research strategy, techniques and methodologies proposed for this study and the rationale behind them. First, the case study research strategy is developed. Secondly, “triangulation” as a research technique is justified. Thirdly, the reasoning behind the sample selection has been described, as well as the different methods of data collection.

The use of transport modelling methods is discussed with the justification for a desegregate multimodal transport model to be utilised for this research. Limitations of the model are presented as well as a number of solutions used, in this study, to counter the proposed multimodal transport model deficiencies.