Comparison of Rural Road Prioritisation between Structural Equation Modelling (SEM) process and Analytic Hierarchy Process (AHP) to approach the suitable and effective analysis.

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Content

- Background
- AHP
- SEM
- Comparison between AHP and SEM
- Conclusion

Thailand Road Network

396,903 km.

Department of Highway
51,537 km.

- Arterial Roads
  - Paved road 51,537 km.

Department of Rural Roads
47,649 km.

- Collector Roads
  - Paved road 41,270 km.
  - Laterite road 4,834 km.

Local Governments
297,450 km.

- Local Roads
  - Paved road 114,300 km.
  - Laterite road 183,150 km.

Background

- Logistic system of agricultural products in Thailand has low efficiency.
- Rural roads are a fundamental element in the provision of access in growing areas, distribution centers, and multimodal transportation.
- However, the infrastructure of rural roads does not suit for heavy trucks.The increasing of trucks ultimately increases road maintenance needs.
- Therefore, it is important to study about the multimodal transportation of rice in order to increase efficiency and maximize profit. This study aims to find the suitable method of prioritisation analysis for Department of Rural Roads to select the roads that have the economics worthiness for the road improvement plan.

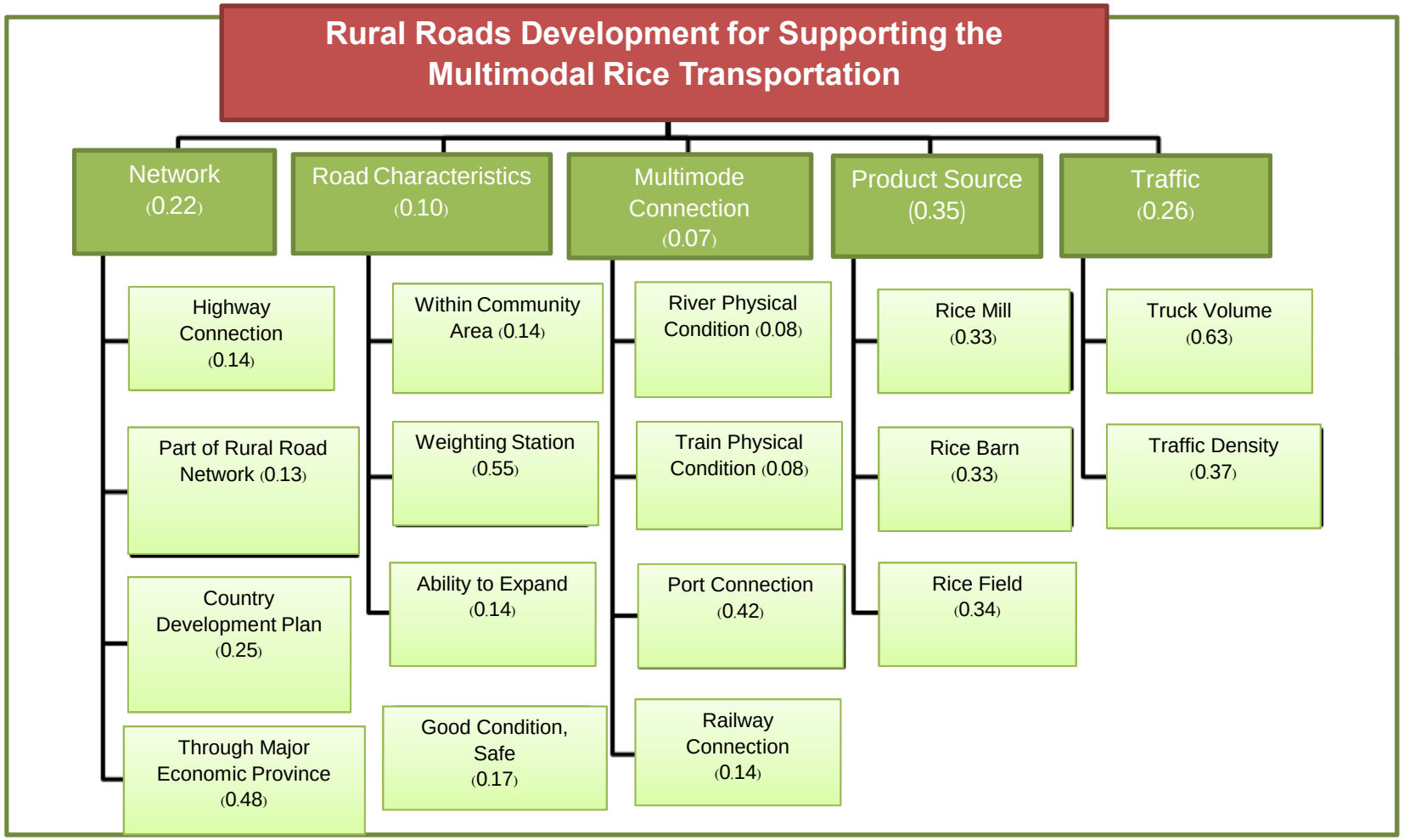
Analytic Hierarchy Process (AHP)

AHP is to prepare a questionnaire and collect all data

Evaluation of the information on the influent factors to the road selection.

Department of Rural Roads then develop a network to improve the transportation connectivity.

Analytic Hierarchy Process (AHP)



Analytic Hierarchy Process (AHP)

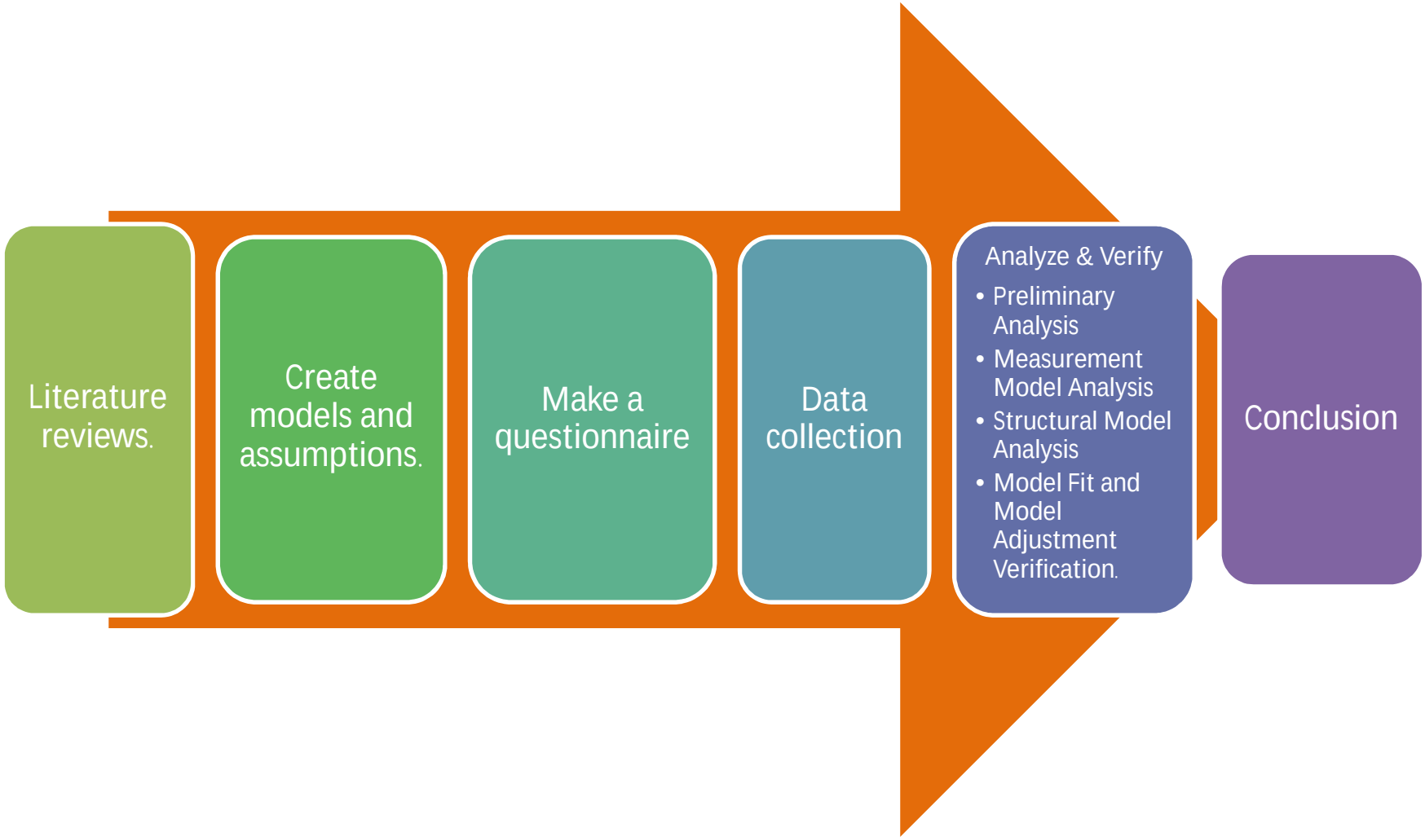
Summarise of the total net score of roads from the AHP

Rank	Route	Percentage (%)
1	Nakonsawan 3009	90.44
2	Ayuttaya 2008	75.02
3	Nakonsawan 3104	74.06
4	Ayuttaya 2022	65.18
5	Pathumthani 3009	60.70
6	Pathumthani 3015	60.70
7	Nakonsawan 3041	59.57
8	Ayuttaya 2005	59.29
9	Nakonsawan 3016	57.87
10	Ayuttaya 3032	57.59

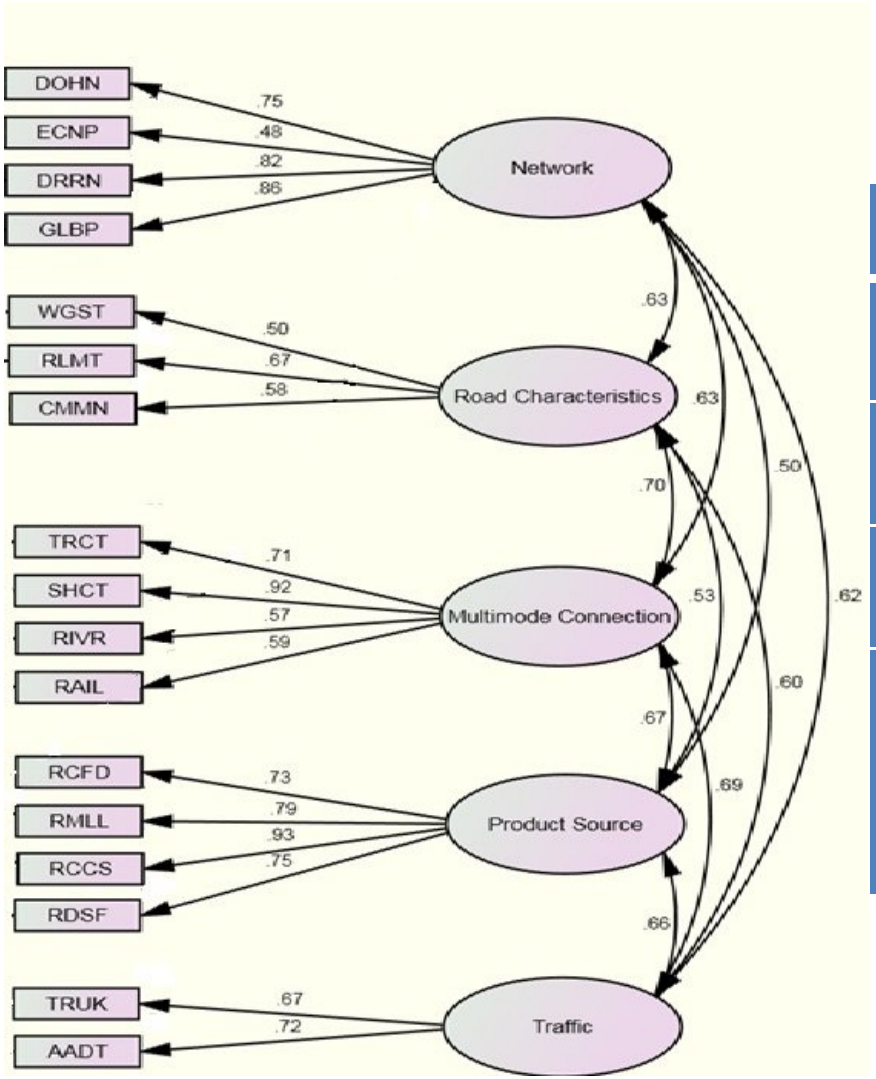
Structural Equation Modeling (SEM)

SEM is a multivariate data analysis technique that employs a variety of techniques to analyze common data. Therefore, it is possible to find the relationship and find the cause and it can also be used to analyze both observed variables and latent or unobserved variables.

Structural Equation Modeling (SEM)

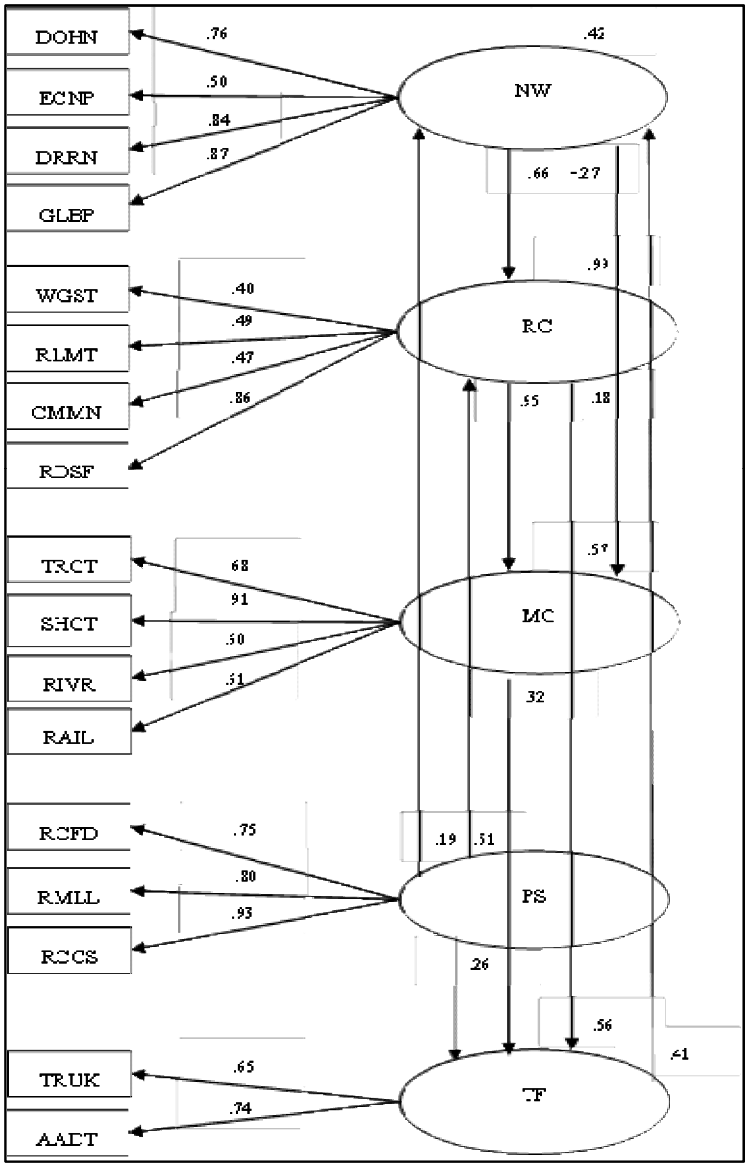


Structural Equation Modeling (SEM): Best Fit Measurement Model



Modification Indices	Acceptable Range	Value
Normal Chi-Square (CMIN/DF)	≤ 2.00	1.86
Comparative Fit Index (CFI)	≥ 0.90	0.91
Incremental Fit Index (IFI)	≥ 0.90	0.91
Root Mean Square Error of Estimation (RMSEA)	≤ 0.10	0.09

Structural Equation Modeling (SEM): Best Fit Structural Model



Modification Indices	Acceptable Range	Value
Normal Chi-Square (CMIN/DF)	≤ 2.00	1.79
Comparative Fit Index (CFI)	≥ 0.90	0.91
Incremental Fit Index (IFI)	≥ 0.90	0.92
Root Mean Square Error of Estimation (RMSEA)	≤ 0.10	0.08

Structural Equation Modeling (SEM): Best Fit Structural Model

	Path Coefficient										
To	Road Network		Road Characteristics		Multimodal Transportation		Product Source		Traffic Volume		Total
From	Direct	Indirect	Direct	Indirect	Direct	Indirect	Direct	Indirect	Direct	Indirect	
Road Network	-	-	0.66	-	0.27	0.63	-	-	-	0.32	**1.88**
Road Characteristics	-	0.12	-	-	0.95	-	-	-	0.18	0.30	**1.55**
Multimode Transportation	-	0.13	-	-	-	-	-	-	0.32	-	**0.45**
Product Source	0.19	0.11	0.51	0.13	-	0.61	-	-	0.26	0.16	**1.97**
Traffic Volume	0.41	-	-	0.27	-	0.37	-	-	-	-	**1.05**
Total	6.90										

COMPARISON RESULTS FROM SEM & AHP

Ranking	SEM Analysis	AHP Analysis
1	Nakhonsawan – 3009	Nakhonsawan – 3009
2	Nakhonsawan – 3104	Ayuttaya – 2008
3	Ayuttaya – 2008	Nakhonsawan – 3104
4	Ayuttaya – 2005	Ayuttaya – 2022
5	Nakhonsawan – 3041	Pathumthani – 3009
6	Nakhonsawan – 3102	Pathumthani – 3015
7	Ayuttaya – 2022	Nakhonsawan – 3041
8	Ayuttaya – 3032	Ayuttaya – 2005
9	Ayuttaya – 2039	Nakhonsawan – 3016
10	Nakhonsawan – 3016	Ayuttaya – 3032

COMPARISON RESULTS FROM SEM & AHP

AHP

- Process of dividing primary factors into several sub-factors and the main factors and the sub-factors have different and independent weight values which allowing for more detailed analysis.
- However, this analysis is based on the assumption that each factor and have no correlation and the used data in this analysis come from an expert interview. Therefore, it is necessary to select those who are knowledgeable in providing information. If the information is very complex, it may affect the understanding of the interviewer.

COMPARISON RESULTS FROM SEM & AHP

SEM

- Process of considering the relationship of each factor by making assumption of if there is a change of one factor, it will affect the change of other factors, both directly and indirectly.
- This can be reflected in actual performance, however, the analysis in this way is complex and need a lot of information to make the analysis as accurate as possible.

CONCLUSION

- Many factors are related to each other and affect to the analysis when one of the factor is changed.
- For rural roads, the preferred analysis method possibly is the SEM, as it can reflect actual performance and show the relationship between all the factors.
- AHP analysis is suitable for a multi-factorized study, which makes it possible to know the importance of each of the key factors and sub-factors and the expert in the study area is also important.

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