

IMPOVERISHMENT RISKS ANALYSIS OF POPULATION DISPLACEMENT USING STRUCTURAL EQUATION MODELING :

A Case Study of Involuntary Resettlement Project in Phnom Penh *

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1. Introduction

Development projects ultimately aim to improve people's well-being. Yet, such projects frequently result in direct negative impacts on some portions of the population. Frequently, such people become involuntarily displaced and have to resettle elsewhere. Experts¹⁾ estimated that roughly 14 million people around the globe are displaced each year due to dam construction, urban development, transportation, and infrastructure programs. For those affected people, involuntary resettlement means a drastic disruption fraught with risks of impoverishment.

The terminology "impoverishment risks" used in this study is defined as a state that the affected people of post-displacement who are difficult to restore their socioeconomic patterns become poor due to gradual dismantling in community aspects.

The theoretical framework of *Impoverishment Risks* (IR) model was proposed by Cernea²⁾, a counteraction of the anticipated and predictable risk factors to work towards double sustainable development (for both the development projects and the socio-economic aspects of the affected people); but effective assessments of the model require individual observations of risk factors and construction of them into a comprehensive model. By using Structural Equation Modeling (SEM), researchers are possible to evaluate causal relationships in this theoretical model with complex variables structure. Use of this model will provide insight into the effect of changing living environmental factors when assessing risks. To improve the realm of impact evaluation of population displacement and to evaluate causal relationships of complex instruments, SEM and Geographic Information System (GIS) are used in a case study in Phnom Penh.

The three objectives of the impoverishment risks analysis in this study are: (1) to ascertain the scales and causations effect of population displacement by zone, (2) to analyze risks relationship by using SEM, and (3) to identify recurrent problems affecting performance, initiate midstream remedial actions, and propose reconstruction strategy for addressing resettlement more effective. This paper outlines an impact assessment model to improve theory-led fieldwork on the socio-economic and environmental impacts of involuntary resettlement.

2. Review on Related Papers

During the last several years, the IR model has been increasingly discussed by researchers and practitioners and is currently "at work" in numerous development and research projects. A large study carried out by the Institute for Socioeconomic Development (ISED) in Orissa, India, took the IR model as its conceptual and methodological basis in exploring resettlement processes caused by seven major projects (in dam construction, thermal plants, mining, and industry). The sample included 31 villages and 441 households with 2,274 people, selected from among 95 affected villages with 1,977 households. That study³⁾ produced one of the most comprehensive and integrated surveys of displacement impacts published to date in India, practically confirming the framework under the demands of a large-scale field investigation. Its key findings are structured along the model's impoverishment risks.

Another study^{4),5)} focused on "countering the impoverishment risks," reported from India's Rengali dam; the study measured actual impacts of each risk variable, analyzing counter-risk measures and formulating recommendations about what needs to be done on the ground. Research⁶⁾ on impoverishment risk and impacts was started in Lesotho at the request of the international panel monitoring the Water Engineering Project. In Nepal (Kali Gandaki Project) the application of the model in several ongoing impact evaluation resettlement studies⁷⁾ has revealed positive experiences and produced operational recommendations.

* Keywords: impoverishment risks, structural equation modeling, population displacement, resettlement

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The theoretical implications and potential of the IR have also been discussed during the last four to five years in several international scientific conferences that took place in Colombia, South Africa, India, the United States, and elsewhere. Several books and numerous articles have been devoted to discussion of the validity of the model, testing its applicability, or proposing various developments of its elements. A book published in 1999 by Indian resettlement scholar L. K. Mahapatra⁸⁾ reports on an original test to which the author submitted the model: The author undertook a vast secondary analysis of virtually the entire empirical research literature on resettlement published in India during the last 20 to 30 years, to explore whether or not the IR model is validated by the findings reported in the research literature. His analysis confirmed the model. Parasuraman⁹⁾ discussed the impoverishment risks identified by the IR model in his book on displacements in India and concluded that “loss of land is the single most important cause of post-displacement impoverishment in India”. Basu¹⁰⁾ explored the linkages between the IR model and the “basic needs” framework, emphasizing that people’s basic needs are retrieved and addressed in the IR model.

Several scholars proposed expanding the IR by including other risks and losses, such as the loss of access to public services¹¹⁾, loss of civil rights¹²⁾, or temporary loss of access to schooling for school-age children caught in the throes of displacement¹³⁾. Whether or not these or other risks should be added to the general risk model is a question deserving reflection, but the very proposals exploit the flexibility and adaptability of the model itself, which is prone to refinements.

In short, the IR is being increasingly used operationally in project preparation, appraisals, monitoring and evaluation work, in designing indicators or formulating recommendations, as well as in theory-led basic research. Further use of the risks and reconstruction model will certainly test its potential in more ways and will explore its relevance for various types of displacements and reconstruction approaches.

Having these review done, researchers do not emphasize enough the comprehensive model involved in actually preventing and mitigating its impoverishment risks and moral hazards. This is why forecasting impoverishment trends or main risk factors in this study are crucial for adopting and implementing policies that avoid displacement and counteract undesirable outcomes when resettlement is unavoidable.

Based on the review of previous studies, the types of loss usually include (i) loss of productive assets, including land, income, and livelihood; (ii) loss of housing, possibly entire community structures, systems, and services; (iii) loss of other civic amenities and community assets; and (iv) loss of community resources, habitat, and cultural sites. To construct the theoretical framework previously conducted by Cernea and other research works to a comprehensive model, the main eight types of risks are built and defined as follows:

- a) *Landlessness*: the land is lost in term of landholding size decrease, quality changes to worse, livestock holding decrease, and land improvement are lost (e.g. well, canals, nurseries, etc.).
- b) *Joblessness*: the affected people may become unemployed or underemployed last long after physical relocation.
- c) *Homelessness*: loss of house may be temporary for many people, but in some situations, it remains a long-term condition. This loss tends to have negative consequences on family cohesion and on mutual help networks, when neighboring household become scattered.
- d) *Marginalization*: it occurs when relocated family loses economic power and slide down toward lesser socioeconomic positions: middle-income farm household become small landholders; small shopkeepers and artisans lose business and fall below poverty thresholds. Economic marginalization is often accompanied by social and psychological marginalization: a drop in social status, in directly affected households’ loss of confidence in society and in felt injustice and vulnerability.
- e) *Morbidity*: the exposure of the poorest people to illness is increased by forced relocation because it causes increased stress, psychological traumas, and often the outbreak of parasitic or vector-borne diseases from poor environment. Food insecurity and under-nutrition tends to affect health, primarily among children.
- f) *Food insecurity*: it is defined as levels of calories and protein intake that are below the minimum necessary for normal healthy growth and work that because of displacement disrupts employment and agriculture production cycles.
- g) *Loss of access to common property natural resources*: poor farmers suffer a loss to the common property goods belonging to communities that are displaced; for instance, loss of access to forests and forest products, to water bodies, and to grazing lands. This loss is a form of income loss and livelihood down spiral, which remains uncompensated, typically overlooked by planners; as a results, incomes, and available food decline.
- h) *Social disarticulation*: the dismantling of community social structures, the dispersion of informal and formal networks, local associations, and etc. This is a massive loss of social capital, which is usually

not recognized and not measured by planners, and is a major cause of disempowerment and impoverishment.

3. Materials and Methods

(1) Study area

Cambodia is situated in Southeast Asia (Figure 1) and shares borders with Thailand in the northwest, Laos in the northeast and Vietnam in the southwest (Figure 2). The country occupies a total land area of 181,000 km² and has a total population of 14 million people. Cambodia's climate is tropical with two distinct seasons – the dry season from November through May and the wet season from June through October. Intensive rains fall during September and October leaving large areas of the country flooded.

Phnom Penh is the capital city of Cambodia, situated in the central part of the country along the Mekong River (Figure 2-3). Phnom Penh has a population of around one million and is organized in seven main administrative districts comprising of 76 communes or 637 villages. Four of the main districts are located in the centre of the city where there has been a progressive development, which has formed a diversified, rich, and bustling urban area. The other three districts are in the peripheral fringe of the city where less development has taken place and large areas are used for agriculture and mass industries.

A research was conducted in the relocation sites and indirectly affected villages under Emergency Flood Protection Project, Kob Srov Dike Rehabilitation subproject in 2001 supported by Asian Development Bank (ADB), loan CAM-1824¹⁴, implemented by Ministry of Water Resources and Meteorology. That project, dike rehabilitation, was carried out immediately after the floods in 2000, which had raised up to 0.6m above emergency levels from the greatest Mekong river and hit over 50% of both rural and urban infrastructure of Cambodia and caused 186 people deaths due to lack of food, economic instabilities, and infectious diseases.

The dike initially built in 1972–1973 for two functions, flood protection and as a road for heavy traffic to bypass the city, was at high risk of failure for one month. During the flood, MOWRAM undertook force account to prevent failure. The work directly affected 499 households (2,898 persons), and 390 of them were relocated to two identified resettlement sites covered 76,380.29 m² prior to civil construction works. The site located in a 63.46 km², its geographical coordinates are 11° 37' 0" North, 104° 49' 0", located in Dangkor (urban) and Ruessei Kaev (rural) district consisted of 3 communes (1-Kork Roka, 2-Khmouch, and 3-Svay Pak) (see Figure 3); 26 villages, total population of 8,434 households (41,569 people) as in 2005.



Figure 1: Southeast Asia and Cambodia



Figure 2: Map of Cambodia

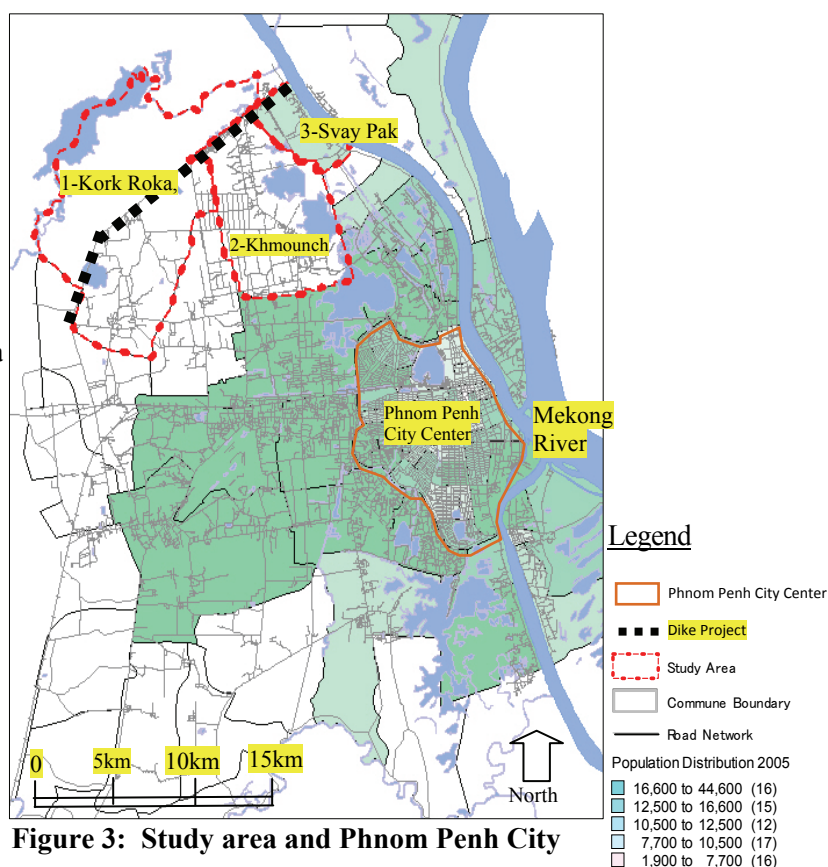


Figure 3: Study area and Phnom Penh City

(2) Indicator measurement

The measurement in the questionnaire was derived from quality of life¹⁵⁾ and impoverishment risks indicators¹⁶⁾. The former included 8 sustainability topics – socio-economic information, waste management, environmental sanitation, housing, opportunities and risks, health and well being, community safety, and community infrastructure; where the latter is a conceptual framework used in population displacement to indicate the predictable injurious affect-losses and destruction, and counter-concept to security: the higher the risks, the lower the security of displaced populations.

(3) Sampling design and data collection

This study compares people living in directly and indirectly affected areas. Sample 30% of “*directly affected households*” (people who are involuntary displaced) and 5% of “*indirectly affected households*” (*neighboring residents*) was randomly selected from detailed measurement survey databases conducted by MOWRAM in 2001, and from commune databases in 2006 respectively; as the result, 85% of response rate was received, 489 respondents. The field observations and interviews using face-to-face interview of post-displacement situation at the physical sites including structure and unstructured forms consisted of 32 questions measured by 76 main indicators were conducted from July-August 2007.

(4) Procedure

Missing values were removed from 489 samples, remaining a valid 439 of two affected and 24 neighboring villages/zone; 128 and 311 samples respectively. Moreover, due to limitation of samples sizes, databases were combined from 26 to 14 zones at minimum 10 and maximum 93 valid responses per zone; and then were computed in SPSS 16.0, MapInfo 8.5, and Amos 16.0 application. The zones were divided into two groups: “*directly affected group*” as shown in zone 1 and 8, and “*indirectly affected group*” indicated in the remaining zones for comparisons of changes and casual relationships of resettlement on impacted living environment (see Figure. 4).

(5) Conceptual framework of IR model

The analytical framework used in the concept of “de-capitalization” (i.e., affected persons who lose their previous productive basis and income sources) was explained by the model. As this study focused on factors affecting post-displacement; the main variables of reconstruction strategies extracted from Cernea²⁾ were applied in this research. The variables include: (1) *landlessness*, (2) *joblessness*, (3) *marginalization*, (4) *food insecurity*, (5) *morbidity*, (6) *loss access to common properties*, and (7) *social disarticulation*; which are highly contribute to *community living satisfaction*. The risks in this analysis are to be conceptualized indicators ($X_1, X_2, \dots, X_i$). However, variables such as education, homelessness, and threats to host population which were unable to obtain data are not included in this research. The anticipated relationships and paths of the model were constructed as shown in Figure 5.

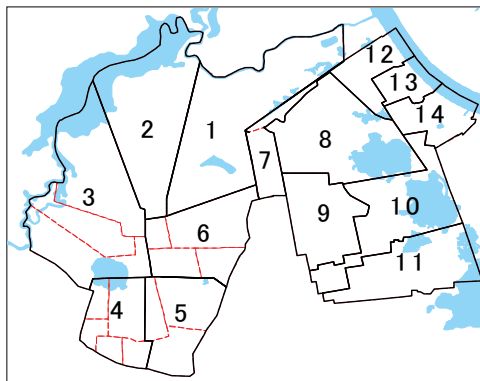


Figure 4: Zones of study area after recoding

Dashed line is boundary of zones before combining. Affected areas are zone 1 and zone 8.

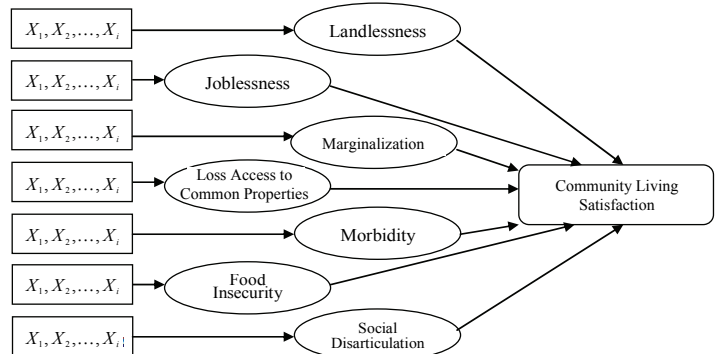


Figure 5: Path diagram of the IR model

(6) Model Specification

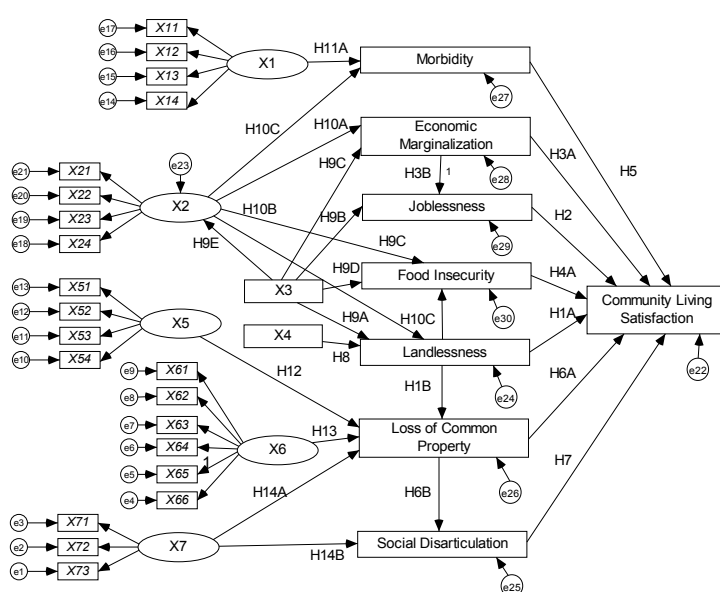
The specification of the model which consisted of the translation of verbal hypotheses into a series of equations was presented in the form of a path diagram as shown in the causal relationships among all variables in the system (Figure 6). To formulate the model; in the path diagram of structural equation modeling, *community satisfaction* was hypothetically contributed by the risk factors: “*landlessness, joblessness, marginalization, food security, morbidity, common property, and social disarticulation*”. These factors were defined by respective indicators as shown in Figure 6.

a) Hypotheses

In addition, the IRR literature utilizing the proposed constructs was used to provide an empirical framework with which such a system using structural equation modeling was assessed. Based on the literature, the following hypotheses were proposed.

The factors which affect risk factors will be estimated by 14 hypotheses, and parameters are to be estimated by the maximum likelihood method. As such, the following SEM sub-hypotheses will be tested.

- **H1.** As the extent of “*Landlessness*” increases, the “*Community living satisfaction, loss of common property, and food insecurity*” increases;
- **H2.** As the extent of “*Joblessness*” increases, the “*Community living satisfaction*” increases
- **H3.** As the extent of “*Marginalization*” increases, the “*Community living satisfaction and joblessness*” increases
- **H4.** As the extent of “*Food Insecurity*” increases, the “*Community living satisfaction*” increases
- **H5.** As the extent of “*Morbidity*” increases, the “*Community living satisfaction*” increases
- **H6.** As the extent of “*Loss of Common property*” increases, the “*Community living satisfaction and Social disarticulation*” increases
- **H7.** As the extent of “*Social disarticulation*” increases, the “*Community living satisfaction*” increases
- **H8.** As the extent of “*Easiness to facility locations*”, the “*landlessness*” increases
- **H9.** As the extent of “*Employment rate*” increases, the “*Socio economic aspects, marginalization, joblessness, food insecurity, and landlessness*” increases
- **H10.** As the extent of “*Socio economic aspects*” increases, the “*morbidity, marginalization, food insecurity, and landlessness*” increases
- **H11.** As the extent of “*Environmental aspects*” increases, the “*morbidity*” increases
- **H12.** As the extent of “*Easiness to facility location*” increases, the “*loss of common property*” increases
- **H13.** As the extent of “*Infrastructure score*” increases, the “*loss of common property*” increases
- **H14.** As the extent of “*Community safety*” increases, the “*loss of common property and social disarticulation*” increases



[X1=environmental aspects (X11=community solid waste management, X12=Air pollution, X13=Noise Pollution, X14= Water Pollution),

X2=socio economic aspects (X21= income, X22= expenditure, X23= family member, X24=vehicle),

X3=employment rate,

X4=house size,

X5=easiness to facility locations (X5= to local shop, X52=to local hospital, X53= to cultural/recreational area, and X54= to council/ neighborhood office),

X6=infrastructure score (X61=Connection to Water Supply, X62=Access to private electricity, X63=Connection to main drainage system, X64=Flood in the community, X65=Access to main road from community, X66=Community's road),

X7=community Safety (X71=Safety inside community, X72= Safety outside community, X73=Crime and safety within 1 year)]

Figure 6: Proposed hypotheses testing for IR model

b) Confirmatory Factor Analysis

The tests of goodness-of-fit were asymptotically distributed as a chi-squared under the assumption of multivariate normality in Confirmatory Factor Analysis (CFA)¹⁷. Because a chi-squared test to evaluate the goodness-of-fit of a SEM was required a multi-normal distribution which produced error failures, 30 errors were constructed in the model. In this test, the Norm Fit Index (NFI) and the Goodness-of-Fit Index (GFI)¹⁸ were inspected at range between 0 and 1, at recommended values >0.90; and Tucker Lewis Index (TLI): >0.90 =acceptable, >0.95 =excellent; Comparative Fit Index (CFI) >0.90; Root Mean Square error of approximation (RMSEA) <0.08 =acceptable, <0.05 =excellent; for indicating a good fit¹⁹.

c) Modification Fit Indices

The model may revalidate to improve the fit by using Modification Fit Indices (MFI) at threshold 40. MFI demonstrated fits that then flagged as potential changes to the model if it made theoretical senses.

d) Latent Variables

Five latent variables were constructed in the path diagram and tested in Confirmatory Factor Analysis (CFA). The latent variables include: (1) environmental aspects; (2) socio-economic aspects; (3) easiness to facility locations; (4) infrastructure score, and (5) community safety. The variables are estimated by their explanatory items ($X_1, X_2, \dots, X_i$) in the Confirmatory Factor Analysis (see Figure 6).

e) Multiple-Group Comparison

A multiple-group analysis was then conducted to identify potential developmental differences in factor structure. The pattern of factor loadings for the model structures consisting of constrained and unconstrained model were tested across the two groups (*directly affected households* and *indirectly affected households*).

4. Results

(1) Descriptive statistic analysis

Statistics of 439 samples for survey items were estimated and computed in GIS as shown in Table 1. The *directly affected group* can be found in zone 1 and 8, while the remaining are *indirectly affected group*. Figures 7-14 show the mean size of survey items per zone. In these figures, the higher the mean score, the darker the color and the more sustainable community perceived. The results indicated that the directly affected group (zone 1 and 8) was extremely impacted and lost of basic services.

Table 1: Summary discriptive statistic analysis

Indicators	Unit	Directly Affected Group		Indirectly Affected Group	
		Mean	Std.	Mean	Std.
Family member	<i>N</i>	5.89	0.07	5.61	0.84
Monthly income	<i>US\$</i>	109.97	5.59	127.81	35.16
Monthly expenditure	<i>US\$</i>	71.03	9.41	91.40	19.26
House size	<i>m²</i>	35.63	0.11	38.62	6.51
Infrastructure score	<i>1-3</i>	1.66	0.13	1.68	0.16
Easiness to facilities	<i>1-5</i>	2.60	0.06	2.72	0.25
Waste management	<i>1-5</i>	2.46	0.04	1.79	0.53
Air quality	<i>1-5</i>	2.83	0.07	3.06	0.50
Noise quality	<i>1-5</i>	3.70	0.08	3.55	0.31
Water quality	<i>1-5</i>	4.22	1.02	3.63	0.61
Health and welfare	<i>1-3</i>	1.75	0.07	1.88	0.37
Community safety	<i>1-5</i>	2.85	0.42	3.47	0.53
Risks and opportunities	<i>1-5</i>	3.15	0.11	3.45	0.26
Community satisfaction	<i>1-5</i>	2.56	2.64	2.72	0.25

[(Score 1-3): 1= getting worse/ staying poor/ less sustainable; 2= standing still/ no significant change; 3= getting better/ staying good/ more sustainable.

(Score 1-5): 1= highly dissatisfied/ moving away from sustainability, 2= fairly dissatisfied/ less moving away from sustainability, 3= standing still/ no significant change, 4= fairly satisfied/ less moving towards sustainability, 5= highly satisfied/ moving towards sustainability.]

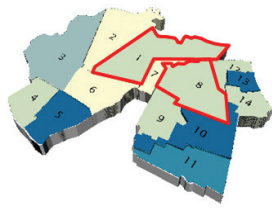


Figure 7: Income

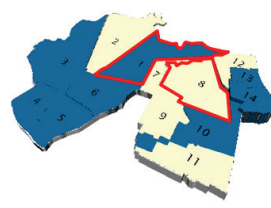


Figure 8: Infrastructure

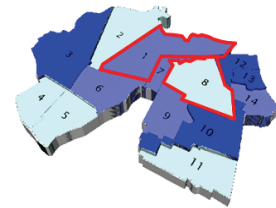


Figure 9: Easiness to facilities

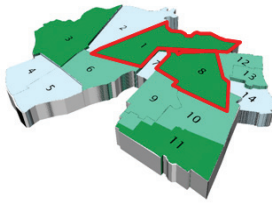


Figure 10: Environment score

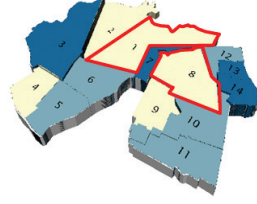


Figure 11: Health and welfare

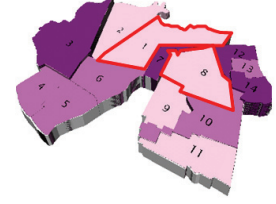


Figure 12: Community safety

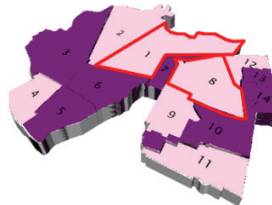


Figure 13: Job opportunity

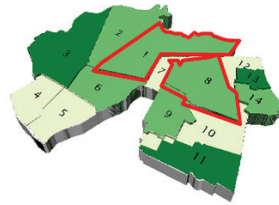


Figure 14: Food security

Legend

Directly affected zone
(zone 1 and 8)

(2) Structural equation modeling analysis

a) Confirmatory Factor Analysis

The model including five latent variables which were explained by items as indicated in Table 2 was tested in CFA. The results show that some factor loadings did not perform well with other items; and it then dropped from the constructs (as shown in bold in Table 2). Table 3 illustrates model fit summary of the full construct; the bolds are factors that did not load according to the standard fit level.

Table 2: Latent variables and its explanatory items

Latent Variables	Explanatory Items
Community Safety	(1) Safety inside community, (2) Safety outside community, (3) Crime and safety within 1 year
Infrastructure Score	(1) Connection to Water Supply, (2) Access to public electricity, (3) Access to private electricity, (4) Connection to main drainage system, (5) Flood in the community, (6) Access to main road from community, (7) Community's road, and (8) Public road lighting.
Easiness to Facility Location	(1) to local shop, (2) to shopping center/market, (3) to local clinic, (4) to local hospital, (5) to public park/green space, (6) to cultural/recreational area, and (7) to council/ neighborhood office.
Environmental Aspects	(1) Community solid waste management, (2) Air pollution, (3) Noise Pollution, (4) Water Pollution
Socio-Economic Aspects	(1) Income, (2) Expenditure, (3) Family member, and (4) Vehicle

Table 3: Model fit summary of latent variables

Latent Variables	NPAR	CMIN	DF	P	CMIN/DF	CFI	TLI	RMSEA	NFI	GFI
Community Safety	8	12.00	4	0.00	3.00	1.00	1.00	0.04	1.00	1.00
Infrastructure Score	8	32.52	2	.000	16.26	0.88	0.66	0.18	0.88	0.96
Easiness to Facility Location	14	255.44	14	.000	18.24	0.92	0.84	0.11	0.91	0.96
Environmental Aspects	8	41.86	6	0.00	6.97	0.91	0.96	0.08	0.91	0.95
Socio-Economic Aspects	8	3.62	2	0.00	1.81	0.99	0.98	0.04	0.99	0.99

[NPAR: Number of Parameters; CMIN: Chi-Square; DF: Degree of Freedom; P: Significant Level; CMIN/DF: Chi-square/DF; CFI: Comparative Fit Index; TLI: Tucker Lewis Index; RMSEA: Root Mean Square error of approximation; NFI: Norm Fit Index; GFI: Goodness-of-Fit Index]

b) Maximum Likelihood Estimation

After improving the latent variables, the model shows a reasonable fit. Table 4 indicates a summary of model fit indices comparing between initial model or theoretical concept model and competing model or final model with respective recommended fits. The results show promise, particularly considering the nature of this work as an extension of ethical theory into a larger domain. The statistic analysis of *Initial Model* indicates a reasonable fit at chi-square (χ^2) values 3340.33 (191df, $p < 0.001$, $\chi^2/df = 17.49$); TLI=0.92; RMSEA=0.75; and GFI>0.90; except the Norm Fit Index (NFI=0.88) in this *initial model* that does not reach to the recommended fit.

Table 4: Fit indices for the structural model

Criteria	Initial Model	Competing Model	Recommended
Number of Parameters	61	96	
Chi-Square (χ^2)	3340.33	3273.70	
Degree of freedom (DF)	191	282	
P	.00	.00	
χ^2/DF	17.49	11.61	
Comparative Fit Index (CFI)	.91	.93	<0.90
Tucker Lewis Index (TLI)	.92	.93	<0.90
Root Mean Square error of approximation (RMSEA)	.075	.072	<0.08
Norm Fit Index (NFI)	.88	.92	<0.90
Goodness-of-Fit Index (GFI)	.91	.91	<0.90

(3) Final Model Estimation

In addition to the model's overall fit statistics, AMOS 16.0 gives estimates of regression weights between parameters in the SEM, their associated standard error, critical ratios and significant level. Therefore, to improve Initial Model, some paths (H6a-b, H9c-d, H10a, H11a, and H14a) were dropped from analysis by using Confirmatory Factor Analysis (See Table 5). The Final Model was then estimated based on the improvement of the Initial Model. The results of path analysis of the Final Model reveal a chi-square for model fit, χ^2 3273.70 (282df, $p < 0.0001$, $\chi^2/df = 11.61$); and promising fit indices (CFI=0.93; TLI=0.93; RMSEA=0.072; NFI & GFI>0.90). The standardized regression weights are highlighted in the model illustrated in Figure 15-16; the bigger the path is, the higher the impact of one variable over another is.

In addition, the model was validated, and some of error terms of income and expenditure were found to be correlated for both comparing groups. Therefore, the model was reconstructed by considering correlation between these two error terms, and the *final model* was specified.

Furthermore, the multiple group analysis shows no significant differences between the unconstrained and constrained model (*measurement weights, measurement intercepts, structural weights, structural intercepts, and structural residuals*). It indicated that the model was valid for both groups as indicating in *unconstrained model*, which gave a chi-square value 3273.70 (282df, $p < 0.001$, $\chi^2/df = 11.61$); where the *constrained model* had similar results with a range chi-square between 3206.33 to 3280.96 (283-289df, $p < 0.0001$, χ^2/df (11.05-11.33)). Finally, the standardized regression analysis among two groups was compared; the results were shown in the path diagrams in Figure 15-16.

Table 5: Construct relationships with test statistics of causal model

Hypo.	Constructs relationship			SRW	RW	S.E.	C.R.	P
H1a	Community Satisfaction	←	Landlessness	0.02	0.05	0.07	0.71	0.48
H1b	Common Properties	←	Landlessness	0.19	0.17	0.04	4.27	***
H1c	Food Insecurity	←	Landlessness	0.01	0.15	0.04	3.55	***
H2	Community Satisfaction	←	Joblessness	0.05	0.18	0.05	3.37	***
H3a	Community Satisfaction	←	Marginalization	0.17	-0.04	0.01	-6.10	***
H3b	Joblessness	←	Marginalization	-0.11	-0.12	0.05	-2.43	***
H4a	Community Satisfaction	←	Food Insecurity	0.07	0.10	0.05	1.85	***
H5	Community Satisfaction	←	Morbidity	0.22	0.25	0.07	3.41	***
H6a	Community Satisfaction	←	Common Properties	0.08	0.07	0.08	0.91	0.36
H6b	Socio-Economic	←	Common Properties	0.30	3.37	2.78	1.21	0.23
H6c	Social Disarticulation	←	Common Properties	0.26	0.30	0.04	7.57	***
H7	Community Satisfaction	←	Social Disarticulation	0.61	0.17	0.07	2.56	***
H8	Landlessness	←	House Size	0.03	0.00	0.00	0.66	***
H9a	Landlessness	←	Employment	-0.18	-0.55	0.14	-3.86	***
H9b	Joblessness	←	Employment	0.11	0.39	0.17	2.27	***
H9c	Marginalization	←	Employment	-0.07	-0.24	0.19	-1.22	0.22
H9d	Socio-Economic	←	Employment	0.08	2.59	3.19	1.85	0.06
H10a	Marginalization	←	Socio-Economic	0.57	0.00	0.00	0.64	0.52
H10b	Food Insecurity	←	Socio-Economic	0.59	0.00	0.00	3.19	***
H10c	Morbidity	←	Socio-Economic	0.11	0.00	0.00	2.15	***
H11a	Morbidity	←	Environment	0.12	0.34	0.11	3.18	***
H11b	Common Properties	←	Environment	0.00	0.01	0.10	0.06	0.95
H12	Common Properties	←	Easiness to Facility	0.11	0.20	0.09	2.37	***
H13	Common Properties	←	Infrastructure	0.20	0.60	0.13	4.59	***
H14a	Common Properties	←	Community Safety	0.07	0.06	0.04	1.65	0.10
H14b	Social Disarticulation	←	Community Safety	0.25	0.26	0.03	7.79	***

[SRW= Standardized Regression Weights, RW=Regression Weights, S.E. =Standard error, P=Significant Level at $p<0.05$; C.R.: Critical ratio. The critical ratio is the parameter estimate divided by an estimate of its standard error. If the appropriate distributional assumptions are met, this statistic has a standard normal distribution under the null hypothesis that the parameter has a population value of zero. For example, if an estimate has a critical ratio greater than two (in absolute value), the estimate is significantly different from zero at the .05 level. Even without distributional assumptions, the critical ratios have the following interpretation: For any unconstrained parameter, the *square* of its critical ratio is, approximately, the amount by which the chi-square statistic would *increase* if the analysis were repeated with that parameter fixed at zero.]

5. Discussion

This study focuses on the impoverishment risks of the directly affected group and indirectly affected group by firstly examining the scales and causations effect of population displacement by zone, by secondly analyzing risks relationship by using SEM, and by thirdly identifying recurrent problems affecting performance, initiating midstream remedial actions, and proposing reconstruction strategy for addressing resettlement more effective.

By zone comparison of the two groups (directly affected group and indirectly affected group), the result show the resettlement areas (zone 1 and 8) are venerable to threats and to socio-economic downturn. The major threats were found in crime, job opportunity, food insecurity, health and welfare, and socio-economic. One of the most considered threats is crimes which has increased dramatically in recent years and makes the people living in the resettlement area fear and experience their day to day life. This threats have seriously affected to other factors under this study; especially the economics of the affected people at the new area.

In SEM analysis, the results indicate that the data have reasonable fit in the model well. The model does provide insight to the role that the variables – *food insecurity* and *joblessness* – had in strongly contributing to *community satisfaction* (Figure 15-16). Also, *economic marginalization* and *landlessness* impacts to *joblessness* and *food insecurity* respectively. Therefore, this study initially constructs the conceptual framework of the impoverishment risks into a meaningful IR model by building relationship of each variable of the existing risk factors.

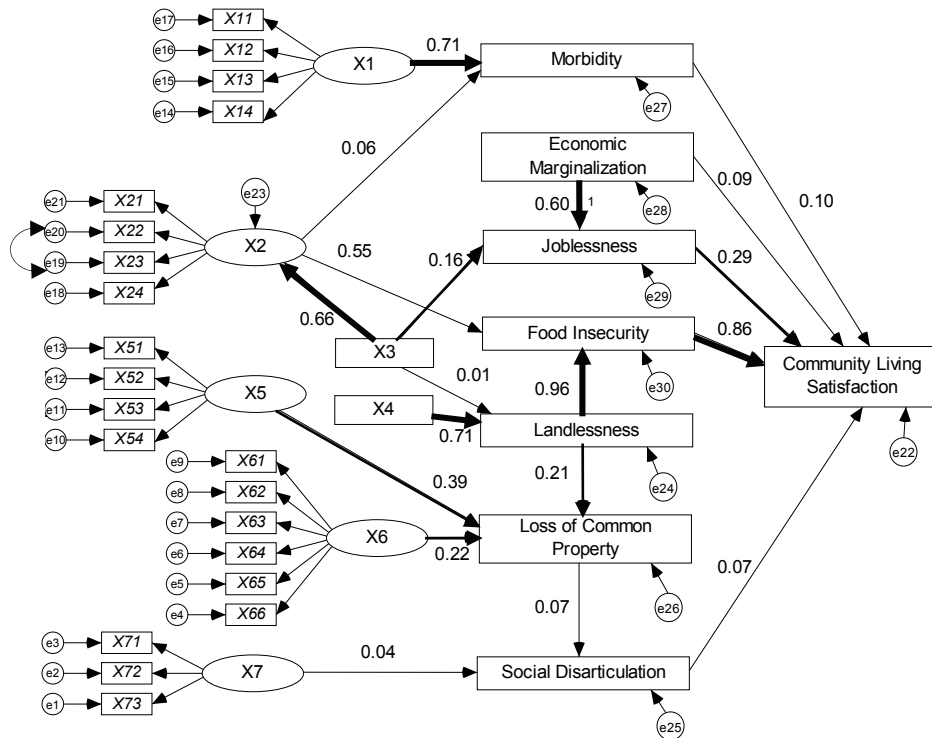


Figure 15: Final path analysis of IR model Standardized Regression Analysis “directly affected group”

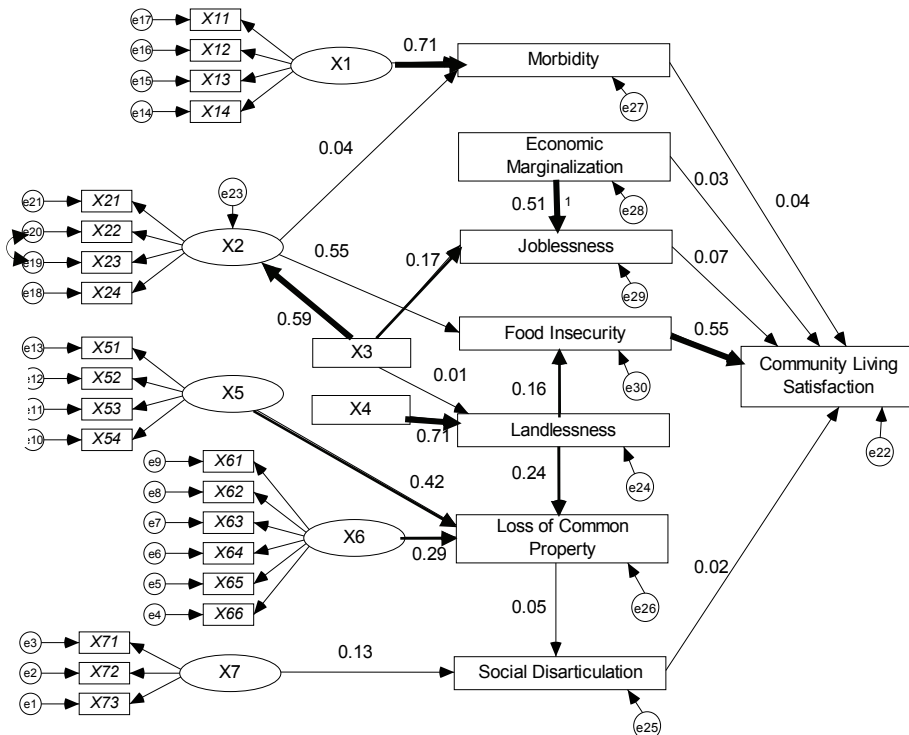


Figure 16: Final path analysis of IR model Standardized Regression Analysis “indirectly affected group”

In this context, considering that the model was built on theory well in the literature of numerous parallel fields, it is expected that the generalization of this model is possible without major discrepancy. Research involving the application of this model to other communities would be beneficial to rigorously test the model’s generalization, and for project implication, resettlement action plan shall highly focus on these aspects as of post-resettlement.

In addition, to address causation and to improve policy on resettlement and to response to the above critical risk factors more effectively, the reconstruction strategy shall be proposed by using reconstruction strategies. This can be done by giving a reverse risks factors into action plan; for instance, provision of (1) land-based reestablishment and reemployment, (2) provision of adequate nutrition and better health care. Sustainable reconstruction, however, requires long-term planning as well, beyond immediate relief measures, together with information and education, to foster needed changes in affected persons' behavior and their ability to cope with the circumstances of the new habitat.

The fundamental question to answer now is if the IR model can help predict and diagnose the risks of displacement, can it also guide problem resolution for addressing resettlement policy more effectively? The answer is affirmative. The risks and reconstruction model complements its risk diagnosis with an explicit framework for the socioeconomic reestablishment of those displaced. The model is not just a predictor of inescapable pauperization; it is a guide toward counteracting the risks and resolving the problems that displacement creates.

Moreover, the current findings should be also considered in light of several limitations. Firstly, the limitation of SEM is that it is only a statistical technique for testing and estimating the causal relationship using combination of statistical data and qualitative causal assumption. In this context, SEM encourages Confirmatory Factor Analysis (CFA) to test the theory rather than theory development. The causal assumptions embedded in the model often have falsifiable implications which can be tested against the data. With an accepted theory or otherwise confirmed model, SEM can also be used inductively by specifying the model and using data to estimate the values of free parameters. Often the initial hypothesis requires adjustment in light of model evidence, but SEM is rarely used purely for exploration. Secondly, extraneous factors shall be included to improve the fit and to examine the core problem impacting resettlement. Other affects such as access to education and threats to host population shall be included in future research.

6. Conclusion

In conclusion, this study examined the applicability of the theory of impoverishment risks by ascertaining the scales and causations of conceptual framework of involuntary resettlement. The results of the study provide insight into what factors lead to satisfaction with involuntary resettlement. Thus, these factors may also be important to satisfaction with relocation projects in other both urban and rural districts in Cambodia.

It is also noted that the IR model captures a broad range of hazards not only the economic risks, but also the social and cultural ones. It introduces a view on resettlement that reveals the causal mechanisms of impoverishment, its main processes, and dimensions. These include income and non-income dimensions of impoverishment, such as assets impoverishment, housing impoverishment, health, nutrition and educational impoverishment, loss of organization, and powerlessness. During displacement, people lose capital in all its forms-natural capital, man-made capital, human and social capital. Actions to safeguard against such capital losses are indispensable, but more than only safeguarding is required. We conclude therefore that reconstructive strategies must be multidimensional, taking the form of a comprehensive and systematic resettlement program.

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**Impoverishment Risks Analysis of Population Displacement Using Structural Equation Modeling:
A Case Study of Involuntary Resettlement Project in Phnom Penh ***

by Rinbo ENG** and Yasuhiro HIROBATA***

Development induced-displacement has been increased rapidly around the world. It is estimated that new displaced people increase to 15 million each year comparing to some 10 million each year in 1991-2000. To minimize risks, the conceptual framework of impoverishment risks and reconstruction (IRR) model was constructed by Cernea; however the model was only "probe in the dark" and need to be validated when assessing risks. This paper outlines an impacts assessment model to improve theory-lead field work on the impacts of involuntary resettlement by using Structural Equation Modeling (SEM) to predict the factors affecting to post-displacement from involuntary resettlement project in Phnom Penh.
