Original Article

Internationally Validating a Conceptual Framework for Health Impact Assessment

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Abstract

Aims: This study has internationally tested and refined a framework for institutionalizing and practicing health impact assessment (HIA). HIA is conducted differently in different contexts and recently HIA experts suggest that broader context, in which HIAs are carried out is linked to technical aspects of the HIA. **Materials and Methods:** A survey internationally attained viewpoints of academics and practitioners (n = 38) on the identified parameters of the framework including factors influencing HIA. Structural equation modeling (SEM) through SmartPLS was used to test for relations between the factors. Finally, the model was modified to reach an appropriate fit. **Results:** The framework emphasizes HIA Context, HIA Capacities including Institutional, Technical and Participation capacities, HIA Content, and HIA Outcomes as key factors in implementation and practice of HIA. This framework reflects the broad range of factors that influence HIA. All broad factors were perceived as significant influences on the practice of HIAs. Some fit measures, i.e., the standardized root mean square residual appear to be in the acceptable range. **Conclusion:** We have demonstrated the utility of SEM for developing and testing a framework to do HIA in different country contexts.

Keywords: Health impact assessment, SmartPLS, structural equation modelling

Introduction

Health impact assessment (HIA) is a tool to consider the community health impacts of projects and policies. HIA is carried out in many countries that have own policy framework and specific procedures to practice HIA that must be adapted to their structures, laws, and environments.[1] For example, some countries undertake a stand–alone HIA, while others undertake it integrated into environmental impact assessment (EIA).[1,2] HIAs are not uniform in practice, for instance there have been noted differences with assessing health inequalities, quantifying the results, and community participation.[3]

However, just as a complex set of factors that influences decision-making, similar complexities affect HIA practice and therefore need to be identified.[4] There are some studies to proceed to these factors,[5-7] but there is no comprehensive framework including all parameters surrounding HIA practice beyond the technical HIA process steps.[3,8] Harris-Roxas *et al*. proposed a framework for evaluating HIA to reflect the wider factors that influence HIA effectiveness,[9] but there is not a conceptual framework that considers these factors in managing HIA from establishing to evaluating. Better understanding of these conditions will help institutionalize HIA practice.[4,6,10,11]

There has been no quantitative research however which has suggested internationally accepted framework for the conditions surrounding HIAs practice. A quantitative approach to doing this will provide statistical robustness concerning what the perceived variables surrounding HIA practice are according to international experts.

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Materials and Methods

Our study was designed in a cross-sectional format to assess international HIA experts' views about factors surrounding HIA in 2019. 91 variables related to HIA categorized in 20 categories were extracted from Iranian studies.[7] Then an electronic questionnaire was designed to elicit three international experts' agreement or disagreement on those categories and to attain their comments to modify categorization to achieve appropriate content validity. Two rounds inquiry resulted finally to 22 categories. Aimed to use structural equation modeling (SEM) for developing the model, we developed another questionnaire by converting categories to questionnaire's items for attaining HIA experts' viewpoints.

To validate this tool, we presented a draft to seven HIA experts from Universities of Southern Denmark, Japan Occupational and Environmental Health, Manitoba, Brighton, Copenhagen, West London and Khon Kaen to take their suggestions to confirm its face and content validity using Polit method.[12] We also attained, in this stage, experts' views about constructs suggested in Iranian study that theoretically could reflect the questionnaire items. This stage reduced the number of items in the final questionnaire to 21 [Table 1].

Initially, the questionnaire was sent to 60 HIA experts individually through their emails. Publishing peer review papers in the HIA field or conducting HIA projects were our inclusion criteria. Due to the low response rate (35%), we sent messages to IAIA and also Asia and pacific HIA Networks to get the point of view of their members. This increased the completed questionnaires to 41 (8 from IAIA and 11 from Asia and pacific HIA Network, and 22 through individual emails). Three participants were omitted because of few years of experience.

Considering our small sample size, partial least square-SEM (PLS-SEM) was used in this study for modeling variables that influence comprehensiveness of HIA based on international experts' perspective. 38 responses are sufficient for analysis by PLS-SEM[13] which is able to analyzed data regardless of small sample and normality of the data distribution.[14] We took five steps of a PLS-SEM analysis, i.e., determining the conceptual model, the algorithm method analysis, the re-sampling method, verified the path coefficient diagram and the model evolution.[15] SmartPLS software 3.2.8 was used to analyze the model. Latan's and Ramli's suggestions were our guideline to report our results.[14]

Different theoretical models can be tested by SEM that to imagine relations between measurable variables and latent constructs.[16] Measurable variables are questionnaire items. This means that participants' views have been assumed as proxies for what really exists. This allowed us to refine the conceptual framework to be responsive to participants' views about HIA characteristics while focusing on the independent and dependent variables. Questionnaire items are independent variables in this case and model's constructs are dependents and mediator variables that could be varied in theoretical and modified models.

We considered all constructs in the model as reflective

Table 1: Health impact assessment characteristics and proposed constructs

HIA characteristics' categories	Proposed questionnaire items	Related construct in Iranian model
The effect of economic growth in the HIA	Economic context	HIA context
The effect of participatory and transparent policy making process in the HIA	Political context	
The effect of social development in acceptance of the HIA recommendations	Social context	
The role of policy and decision makers in the HIA	Decision makers	HIA actors
The role of key informants in the HIA	Key informants	
The role of community in the HIA	Community	
The role of proposal proponents in the HIA	Proposal proponents	
The role of supportive regulation to conduct comprehensive HIA	Formal legal requirements	HIA capacities
The role of formal organizational structure to conduct comprehensive HIA	Formal organizational structure	
The role of assessors' knowledge and skills to conduct comprehensive HIA	Knowledge and skills	
The role of methods and tools to conduct comprehensive HIA	Appropriate methods and tools	
The role of appropriate data and evidence to conduct comprehensive HIA	Data and evidence	
Accepting international HIA principles for example HIA process and HIA values	HIA principles and features	HIA principles and policies
Conducting the HIA for policies	HIA level	
Integrating the HIA in other IAs	Integration to other IAs	
Situations in which rapid assessment should be conducted	HIA type	HIA content
Health impacts and health determinants that should be assessed	Health impacts	
health inequalities that should be assessed	Health inequities	
The extent of quantification in the HIA	Quantitative or qualitative	
The extent of participation in the HIA	Participation	
Multi-disciplinary and intersectional cooperation	Multi-disciplinary and Intersectional engagement	

IA: Impact assessment, HIA: Health IA

constructs because they were extracted from a categorization and supposed homogenous data due to being attained from people who have experience in HIA. Considering the Iranian HIA framework as our theoretical model, the "HIA Context" was selected to refer to contextual conditions; "HIA Actors" was used to include principal stakeholders; "HIA Principles" covered the accepted core principles for doing HIA; "HIA Capacities" include any requirements to carry out HIA and lastly "HIA Content" used to consider HIA details to do a comprehensive HIA.[7]

Having maximum 300 iterations to weight paths and 10^{-7} as stop criterion, we focused on construct validity to test whether determined variables load on proposed constructs.[17] Then by resampling through bootstrapping to 500 subsamples, we tested the statistical significance for all path coefficients of the model. Considering analysis results, we modified the model to reach appropriate fitness.

The ethical committee of Kashan University of Medical Sciences (KAUMS) approved the present study (IR.KUMS.REC.1394.136).

Results

Analyzing the "outer model" consisting of the indicators and the paths connecting them to their respective factors shows that the outer loading of some variables is less than cut off of 0.7 that was generally suggested for acceptance. We dropped variables "Social context," "Proposal proponent," "Key informants," "HIA type," "Health determinants" and "Health inequities" with a measurement loading <0.4 and maintained "Data and evidence," "Formal legal requirement," "Formal organizational structure" and "Quantification" because as a rule of thumb by which in the condition of improving composite reliability, a measurement loading in the 0.4–0.7 range should be dropped.[17-19] This primary model modification is shown in Figure 1.

We examined the reliability and validity of the data that represent our constructs. Running the model in this stage showed accepted internal consistency that was assessed by composite reliability. Composite reliability is suggested instead of Cronbach alpha[14,20] considering cut-off point of 0.7 for satisfactory reliability and lack of reliability whereas a value is below 0.6.[21,22] Average variance extracted (AVE) to assess validity via software indicated an acceptance level too. Here, cut-off is 0.5 which shows that 50% or more of the variance from the indicators is explainable[20] [Table 2].

Bootstrapping the data illustrated that except from one path, i.e., Actors to HIA Principles, other three paths were significant (PV < 0.05). However, model fit indices were not in acceptable range [Supplementary File].

Considering theoretical support, we repeatedly tested modifications to reach the best fit, so the model was modified by segregating "HIA Outcome" from "HIA Content" as a new construct reflected by two variables of "Health determinants" and "Health inequities" and subdividing "HIA Capacities" into "Institutional Capacities," "Technical Capacities" and "Participation Capacities." We also understand from our participants' comments that they know "HIA Principles" as a contextual variable and "Integration to other IAs" and "HIA Level" as two reflections of "HIA Content" [Figure 2].

Table 3 shows the reliability and validity of the data through composite reliability and AVE. The hypothetical model tested using SEM by *t*-value through bootstrapping is also shown in Table 3 where five paths were significant. Based on these data, some hypothesized relations in the model were not significant (PV < 0.05) [Supplementary File].

Table 2: Construct reliability and validity

	Cronbach-alpha	Rho-A	Composite reliability	AVE
Context	0.717	0.816	0.871	0.772
Actors	0.799	0.807	0.908	0.832
HIA principles	0.672	0.675	0.842	0.521
HIA capacities	0.760	0.881	0.943	0.575
HIA content	0.646	0.763	0.791	0.771

IA: Impact assessment, HIA: Health IA, AVE: Average variance extracted

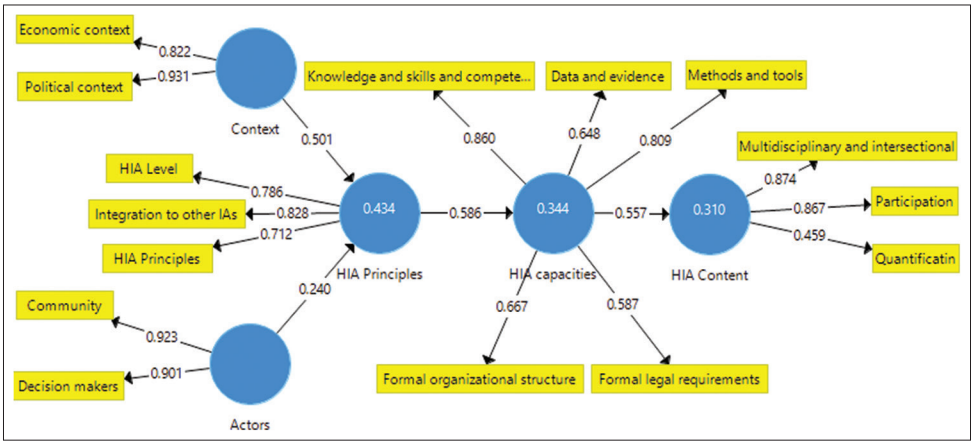

Figure 1: Primary model modification (outer loadings, path coefficients, and R-squares)

Table 3: Construct reliability and validity of modified model

	Cronbach-alpha	Rho-A	Composite reliability	AVE	Causal path	*T**
Context	0.799	0.862	0.906	0.764	→ Actors	6.757
					→ Institutional capacities	3.345
Actors	0.845	0.821	0.908	0.831	→ Participation capacities	4.517
Institutional capacities	0.777	0.811	0.898	0.816	→ Content	2.457
Technical capacities	0.879	0.892	0.943	0.891	→ Content	1.749
Participation capacities	0.803	0.705	0.871	0.771	→ Content	1.866
HIA content	0.800	0.799	0.909	0.833	→ Outcome	2.331
HIA outcome	0.876	0.805	0.903	0.823	-	-

*Based on α of 0.05, cut-off is±1/96. IA: Impact assessment, HIA: Health IA, AVE: Average variance extracted

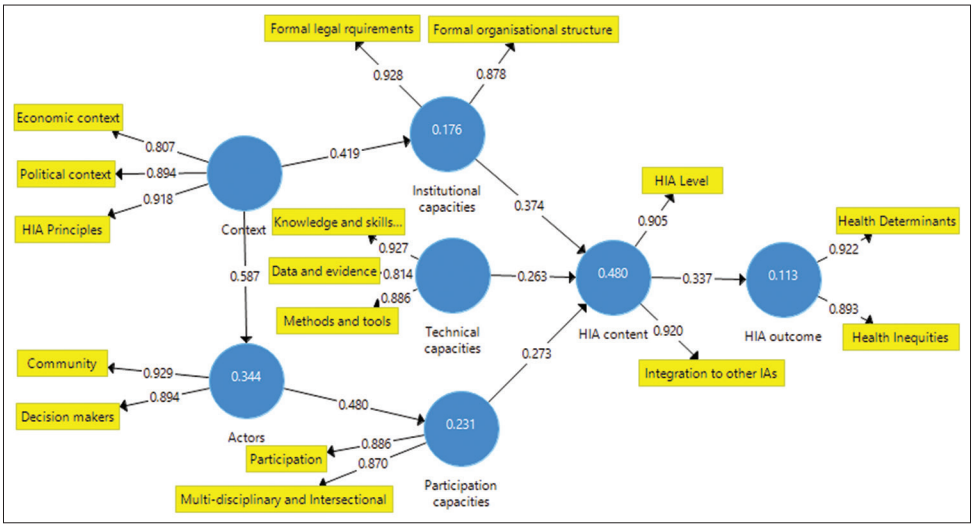

Figure 2: Modified model (outer loadings, path coefficients, and R-squares)

Because our recursive model has only one direction of causality without any direction of loop feedback, we reported the analysis using Adjusted R- square. Calculating Adjusted R- square showed that model prediction for "HIA Outcome" is weak and for other endogenous variables, i.e., "HIA Content," "Actors," "Institutional Capacities" and "Participation Capacities" are moderate considering cut-off of 0.25, 0.40 and 0.75 for weak, moderate and strong models, respectively. On the other hand, f- square shows how large the exogenous variable influences the endogenous variable as effect size [Table 3].[14]

However, fit measures, i.e., the standardized root mean square residual, Unweighted Least Squares discrepancy (d_ULS), Geodesic discrepancy (d_G) calculated by the software after bootstrapping appear to be in the acceptable range but Normed fit index seems to be in the un-acceptable range [Table 4].

Discussion

The present study has internationally tested a framework proposed to include HIA in decision-making at project or policy level. Given the substantial complexity of factors surrounding HIA practice, the proposed framework includes the broad range of factors influencing HIA. Considering broad contextual factors such as political context in this model can provide an opportunity to institutionalize and practice HIA as a tool to consider health in all policies.[23]

Results show that the variables surrounding HIA practice perceived by International experts are similar to those considered by Iranian studies.[7,24] In the present study, similar to Iranian viewpoints, "Proposal proponents" was loaded negatively on "HIA Actors" that means the experts believe this stakeholder could suppress the HIA progress.[25] Low factor loading of "HIA type" on the "HIA Content" could also support this view that HIA could be carried out in a continuum of a rapid HIA to a comprehensive HIA based on personal opinion of assessors not exclusively under the influence of existence of HIA capacities e.g., data and evidence. And finally, nonacceptable measurement loading of "quantification" on "HIA Content" could be judged as these experts' opinion that quantitatively reporting of HIA results is not significantly more valuable than qualitative reports to influence decision-making in project or policy level.

This model in comparison with Iranian model shows that international experts likely believe that deciding about if HIA can be used for policies, could be made individually in each proposal considering existing HIA capacities. Such a decision can also be made to integrate HIA into other IAs.

Table 4: The comparison of fit statistics of theoretical framework and modified model

Fit statistics	Theoretical framework	Modified model	Recommended value (smart PLS software)
SRMR	0.146	0.080	<95% bootstrap quantile
d_ULS	2.558	0.860	<95% bootstrap quantile
d_G	0.992	0.661	<95% bootstrap quantile
NFI	0.437	0.585	>0.9

PLS: Partial least square, SRMR: Standardized root mean square residual, d_ULS: Unweighted Least Squares discrepancy, d_G: Geodesic discrepancy, NFI: Normed Fit Index

This decision could be made in the early stages of HIA process, i.e., screening and scoping but Iranian experts think those decisions must be made by government once primarily in the start point of implementing HIA in the country. This could mean that modified model flexibly permits to carry out HIA in integration into EIA or no and in project or policy level considering existing capacities for example interdisciplinary and intersectional cooperation. Another message received from the model is that HIA implementation should be institutionalized and that could be done by, but not exclusively, the government.

Another important result is focusing on "health determinants" and "health inequities" as health outcomes in the internationally validated model. Separating this factor out from other HIA content could help to emphasis specific types of HIA such as Equity-focused HIA.[26,27]

Conclusion

While our aim was quantitative analysis, the small sample size of our study was a significant limitation to use an covariance based approach for SEM, e.g., LISREL. Nevertheless, we used PLS-SEM for analysis that introduced about three decades ago[28] and the use of it has surprisingly increased in its popularity from every different fields such as operational[29] and strategic management.[30] It is, however, a tool for modeling in health policy and planning[31-34] and a powerful statistical technique to combine measurement and structural model into a simultaneous statistical test.[35]

However, the analysis we have presented can be the basis for future research assessing our model's validity by employing a larger sample size and other SEM methods.

Our framework supports the institutionalization of HIA for health in all policies. Making decision about HIA level, i.e., projects or policies and integrating the HIA into other Impact Assessment specifically into Environmental Impact Assessment can be done during early stage of the assessment. We have shown that international HIA experts know that the most important factors related to HIA are HIA context, HIA actors and HIA capacities to conduct an HIA to improve health outcomes in the communities in level and distribution. Factors influencing function of HIA in decision-making are correlated and these complex relations are contextual in different setting but we have developed a conceptual framework for establishment and practicing HIA in differing countries.

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Conflicts of interest

There are no conflicts of interest.

References

1. Winkler MS, Krieger GR, Divall MJ, Cissé G, Wielga M, Singer BH, *et al*. Untapped potential of health impact assessment. Bull World Health Organ 2013;91:298-305.
2. Harris-Roxas B, Viliani F, Bond A, Cave B, Divall M, Furu P, *et al*. Health impact assessment: The state of the art. Impact Assessment Proj Appraisal 2012;30:43-52.
3. Mindell JS, Boltong A, Fordea I. A review of health impact assessment frameworks. Public Health 2008;122:1177-87.
4. Harris P, Sainsbury P, Kemp L. The fit between health impact assessment and public policy: Practice meets theory. Soc Sci Med 2014;108:46-53.
5. Wismar M, Blau J, Ernst K, Figueras J. The Effectiveness of Health Impact Assessment, Scope and Limitations of Supporting Decision-making in Europe. United Kingdom: Cromwell Press; 2009.
6. Harris PJ, Kemp LA, Sainsbury P. The essential elements of health impact assessment and healthy public policy: A qualitative study of practitioner perspectives. BMJ Open 2012;2:e001245.
7. Fakhri A, Harris P, Maleki M. Proposing a framework for health impact assessment in Iran. BMC Public Health 2015;15:355.
8. Hebert KA, Wendel AM, Kennedy SK, Dannenberg AL. Health impact assessment: A comparison of 45 local, national, and international guidelines. Environ Impact Assess Rev 2012;34:74-82.
9. Harris-Roxas B, Harris E. The impact and effectiveness of health impact assessment: A conceptual framework. Environ Impact Assess Rev 2013;42:51-9.
10. Bnken R. Health impact assessment: How to start the process and make it last. Bull World Health Organ 2003;81:389.
11. Wismar M, Blau J, Ernst K, Elliott E, Golby A, Van Herten LM, *et al*. Implementing and institutionalizing health impact assessment in Europe. In: Ståhl T, Wismar M, Ollila E, Lahtinen E, Leppo K, editors. Health in All Policies: Prospects and Potentials. Helsinki: Ministry of Social Affairs and Health; 2006.
12. Polit DF, Beck CT, Owen SV. Focus on Research methods; is the CVI an acceptable indivator of content validity? Apprisal and recommendation. Res Nurs Health 2007;30:459-67.
13. Barclay D, Higgins C, Thompson R. The partial least squares (PLS) approach to causal modelling: Personal computer adoption and use as an illustration. Technol Stud 1995;2:285-309.
14. Latan H, Ramli NA.The results of partial least squares-structural equation modelling analyses (PLS-SEM). SSRN Electron J 2013. Available at SSRN: https://ssrn.com/abstract=2364191.
15. Latan H, Ghozali I. Partial Least Squares: Concept, Method and Application WarpPLS for Empirical Research. Semarang: Badan Penerbit Universitas Diponegoro; 2012.
16. Schumacker RE, Lomax RG. A Beginner's Guide to Structural Equation Modeling. New Jersey: Lawrence Erlbaum Associates; 2004.
17. Garson GD. Partial Least Squares: Regression and Structural Equation Models. Asheboro: Statistical Associates Publishing; 2016.
18. Hair JF, Sarstedt M, Ringle CM, Mena JA. An assessment of the use of partial least squares structural equation modelling in marketing

research. J Acad Market Sci 2012;40:414-33.
19. Henseler J, Ringle C M, Sarstedt M. Using partial least squares path modelling in international advertising research: Basic concepts and recent issues. In: Okazaki S, editor. Handbook of Research in International Advertising. London: Edward Elgar; 2012.
20. Hair JF, Sarstedt M, Hopkins L, Kuppelwieser VG. Partial least squares structural equation modeling (PLS-SEM) An emerging tool in business research. Eur Bus Rev 2014;26:106-21.
21. Henseler J, Ringle CM, Sinkovics RR. The use of partial last squares path modelling in international marketing. Adv Int Market 2009;20:277-319.
22. Hair JF, Ringle CM, Sarstedt M. PLS-SEM: Indeed a silver bullet. J Merket Theory Pract 2011;19:139-50.
23. Collins J. Health impact assessment: A step toward health in all policies. 2009;302:315-7.
24. Fakhri A, Maleki, Gohari M, Harris P. Investigating underlying principles to guide health impact assessment in Iran. Int J Health Policy Manag 2014;3:17-22.
25. Fakhri A, Maleki M. A model for Health Impact Assessment of developmental plans in Iran. Hakim Health Sys Res 2015;18:83-9.
26. Mahoney M, Simpson S, Harris E, Aldrich R, Williams JS. Equity-Focused Health Impact Assessment Framework. Sydney; 2004.
27. Simpson S. An introduction to health impact assessment. N S W Public Health Bull 2005;16:106-7.
28. Wold H. Soft modelling: the basic design and some extensions. In: Jöreskog KG, Wold H, editors. Systems under indirect observation. In: Causality, Structure, Prediction. Vol. 2. Amsterdam: North Holland; 1982.
29. Peng DX, Lai F. Using partial least squares in operations management research: A practical guideline and summary of past research. J Oper Manag 2012;30:467-80.
30. Furrer O, Tjemkes B, Henseler J. A model of response strategies in strategic alliances: A PLS analysis of a circumplex structure. Long Range Plan 2012;45:424-50.
31. Kunkel S, Rosenqvist U, Westerling R. Implementation strategies influence the structure, process and outcome of quality systems: An empirical study of hospital departments in Sweden. Qual Saf Health Care 2009;18:49-54.
32. Batterham R, Southern D, Appleby N, Elsworth G, Fabris S, Dunt D, *et al*. Construction of a GP integration model. Soc Sci Med 2002;54:1225-41.
33. Konu A, Alanen E, Lintonen T, Rimpela M. Factor structure of the school well-being model. Health Educ Res 2002;17:732-42.
34. Della LJ, DeJoy DM, Goetzel RZ, Ozminkowsk JR, Wilson MG. Assessing management support for worksite health promotion: Psychometric analysis of the leading by example (LBE) instrument. Am J Health Promot 2008;22:359-67.
35. Hoe SL. Issues and procedures in adopting structural equation modeling technique. J Appl Quant Methods 2008;3:76-83.

Supplementary File

The *T*-value of hypotheses tests		
Causal path	***T***	***P***
Context→HIA principles	3.626	0.000
Actors→HIA principles	1,652	0.098
HIA principles→HIA capacities	4.721	0.000
HIA capacities→content	4.887	0.000
Based on α of 0.05, cut-off is±1/96		

IA: Impact assessment, HIA: Health IA

The *T*-value of structural model paths (modified model)	
Causal path	***T***
Context→actors	6.757
Context→institutional capacities	3.345
Actors→participation capacities	4.517
Institutional capacities→content	2.457
Technical capacities→content	1.749
Participation capacities→content	1.866
Content→outcome	2.331
Based on α of 0.05, cut-off is±1/96	

Adjusted *R*-Square and f-square of constructs (modified model)						
	F-square					Adjusted *R*-square
	Actors	**Institutional capacities**	**Participation capacities**	**HIA content**	**HIA outcome**	
Context	0.525	0.213				
Actors			0.300			0.326
Institutional capacities				0.209		0.153
Technical capacities				0.059		
Participation capacities				0.109		0.209
HIA content					0.128	0.417
HIA outcome						0.089

IA: Impact assessment, HIA: Health IA