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Focusing on the Quality of EIS to Solve the Constraints on EIA Systems in Developing Countries: A Literature Review

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Abstract

The purpose of this study was to clarify the trends in the constraints on environmental impact assessment (EIA) systems and their recommendations in developing countries through a review of the past 30 years of relevant literature, and to propose solutions to improve these systems. EIA was introduced in many developing countries from the early 1980s. They have implemented EIA over the past 30 years and donors played a catalytic role in the application of EIA systems in developing countries. But weak enforcement has been a major problem. After compiling the brief history of EIA system in developing countries, the study built a sample of 82 documents produced between 1985 and 2016 on the EIA systems in developing countries, and examined the revealed constraints on the EIA system and its recommendations using quantitative text analysis. The constraints and recommendations changed before and after 2000 and, in particular, the ratio of constraints from report quality nearly doubled. The study focused on improving the quality of the environmental impact statement (EIS) in order to solve the constraints on EIA systems, because the EIS is a product of the EIA process, and its quality is the fundamental indicator of an effective EIA system. At the same time, the study proposed to analyze the quality of EIS using statistical methods, and identify the determination factors influencing its quality. These factors could be concrete recommendations with evidence. Further research is needed to review the quality of EIS in developing countries, and analyze the quality of the data to propose concrete recommendations.

Keywords: environmental impact assessment, developing countries, constraints, quantitative text analysis, environmental impact statement

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1. Introduction

Environmental impact assessment (EIA) was introduced in developing countries from the early 1980s, and many studies have evaluated its use in these countries over the past 30 years. Kennedy (1985) identified six constraints to its effective implementation: low public awareness; lack of a framework of EIA law; lack of strong and well-organized institutions; lack of EIA-trained personnel; poor availability of data; and lack of finance. In Southeast Asia for example, despite the early introduction of mandatory EIA systems, after the first 10 years the practice was still limited (Briffett 1999). The World Bank revealed that project design did not yet sufficiently reflect EIA (Scholten & Post 1999). Even after the passage of another 10 years, weak enforcement was a still major problem in many developing countries in East and Southeast Asia. This was reflected through late implementation, insufficient consideration of alternatives, weak consultation, and a lack of information disclosure (World Bank 2006, 15). Thus, previous studies evaluating EIA in developing countries have pointed out the constraints on the use of EIA systems and the recommendations flowing from its use.

However, little is known about possible solutions for these constraints over the past 30 years. It is possible that a more comprehensive literature review would assist in finding a way to address the constraints. Quantitative text analysis (QTA), which allows the quantitative organization and analysis of textual information in documents, is applied to environmental studies, such as characterizing project design of clean development mechanism projects (Olsen & Fenhann 2008); and analysis of newspaper about radiation pollution (Fukuda and Noda 2016). Thus, by taking advantage of QTA's ability to analyze a sample of many documents this study aims to obtain new and valid knowledge to improve EIA systems in developing countries, and to propose possible solution for the constraints. The study discusses the status of EIA systems in developing countries before undertaking a literature review, in order to promote understanding

of the brief history of EIA, the role of donors, and the impact of the efforts of the Japan International Cooperation Agency (JICA) in this field.

2. The Status of the EIA system in developing countries

2.1 A brief history of EIA in the world and developing countries

The National Environmental Policy Act of 1969 (NEPA) was signed by the U.S. President Richard Nixon on January 1, 1970. Under that law, project proponents were required to file an environmental impact statement (EIS) detailing the impacts of the proposed project, project alternatives, mitigation measures for each impact and a monitoring program to ensure that mitigation measures were actually working. The major benefit was that many environmentally bad projects were never proposed or at least were stalled. The process changed policy makers' thinking about the benefits of pre-planning. This change was particularly true for engineers and others from technical backgrounds (Burdge 1991). Subsequently, many countries have incorporated some form of impact assessment process into formal procedures of environmental decision-making. After 40 years, it seems reasonable to say that EIA is now universally recognized as a key instrument for environmental management (Morgan 2012).

In the developing countries, Colombia introduced EIA procedures in 1974 (Toro et al. 2010), the Philippines established EIA by presidential decree in 1978 (Smith and Wansem 1995), Thailand in 1978 (Suwanteep et al. 2016), and Brazil in 1981 (Glasson and Salvador 2000). However, progress in adopting EIA was extremely slow in developing countries. Although many of these countries had general environment-related laws and regulation, as of 1990, only 19 out of the 121 developing countries (12 in Asia and Pacific, and 7 in Latin America) had put in place the necessary administrative, institutional and procedural frameworks for EIA implementation (Ebisemiju 1993). Principle 17 of the Rio Declaration on Environment and Development (UN

1992), agreed at the 1992 United Nations Conference on Environment and Development (UNCED), states:

Environmental impact assessment, as a national instrument, shall be undertaken for proposed activities that are likely to have a significant adverse impact on the environment and are subject to a decision of a competent national authority.

EIA was identified as an implementing mechanism for the UN Convention on Climate Change and Biological Diversity. Agenda 21 proposes that governments should:

- Promote the development at the national level of appropriate methodologies for making integrated energy, environment and economic policy decisions for sustainable development, inter alia through environmental impact assessments (9.12[b]);
- Develop, improve and apply environmental impact assessments to foster sustainable industrial development (9.18[d]);
- Carry out investment analysis and feasibility studies, including environmental impact assessment, for establishing forest-based processing enterprises (11.24[b]); and
- Introduce appropriate environmental impact assessment procedures for proposed projects likely to have significant impacts upon biological diversity, providing for sustainable information to be made widely available and for public participation, where appropriate, and encourage the assessments of the impacts of relevant policies and programmes on biological diversity (15.5 [k]).

Since the UNCED in 1992, there has been a substantial increase in mandatory and other EIA procedures in developing countries. This is one of the most striking and possibly most under-appreciated trends in the field. Approximately, 70 developing countries had EIA legislation in place, and others were in the process of drafting or amending statutes (Sadler 1996, 31). Donnely et al. (1998) could introduce the guidelines of 94 developing countries (37 in Africa; 36 in Asia/Pacific/Middle East; 6 in Caribbean/West Indies; 15 in Latin America). Wood (2003) reviewed the strengths and weakness of EIA in 110 developing countries, and pointed out

the weak legal basis of EIA and weak EIA enforcement. More recently, strategic environmental assessment (SEA) has been vigorously promoted to extend impact assessment to higher level decision-making at policy, programme and plan levels (Sadler 2011). In developing countries Vietnam introduced SEA process in 2005 and Indonesia enacted SEA through its Environmental Protection and Management Act in 2009 (Table 1 and Table 2).

Table 1. History of EIA in the world and developing countries

Year	Major events of EIA evolution
1969	Passage of the National Environmental Policy (NEPA) in the USA
1971-1976	Expansion of NEPA-style legislation into 23 U.S. states
1972	The UN Conference on the Human Environment in Stockholm; the Cabinet Decision 'Environmental Preservation Measures for Public Works' in Japan
1973	The introduction of Environmental Assessment and Review Process in Canada (legally binding in 1989)
1974	The Environmental Protection Act in Australia; the Environmental Protection and Enhancement Procedures in New Zealand; and the National Code of Renewable Natural Resources and Protection of the Environment in Colombia
1978	The introduction of EIA by presidential decree No. 1586 in the Philippine; and by the revision of the National Environmental Quality Act in Thailand
1981	The National Environmental Policy Law 6938/81 in Brazil; the Environmental Protection Law in China; and foundation of International Association for Impact Assessment (IAIA) in Toronto
1982	The Environmental Protection Law in Mexico
1983	The Environmental Protection Ordinance in Pakistan
1984	The first operational policy statement on environmental aspects of the World Bank's work (Operational Manual Statement: OMS 2.37)
1985	The Council Directive 85/337/EEC on the assessment of the effects of certain public and private projects on the environment in European Communities (EC) Recommendation of the Council on environmental assessment of development assistance projects and programmes of the OECD
1986	The AMDAL process in Indonesia
1987	The United Nations World Commission on Environment and Development (WCED)
1988	Proposal of the introduction of EIA to Japan's official development assistance (ODA) projects by the Japan International Cooperation Agency (JICA) Environmental Cooperation Study Group
1989	Operational Directive (OD) 4.00 of the World Bank-Annex A: Environmental Assessment (amended as OD 4.01 in 1991)
1990	The first Environmental Guidelines for JICA Infrastructure Projects
1992	The United Nations Conference on Environment and Development (UNCED)
1992-2000	Many developing countries introduced EIA legislation
1997	The EIA Law in Japan
1997	The Council Directive 97/11/EC amending Directive 85/337/EEC in EC
2001	The Directive 2001/42/EC on the assessment of the effects of certain plans and programmes on the environment (EU Directive on SEA)
2002	The World Summit on Sustainable Development (WSSD)
2003	Environmental Assessment Guidelines of Asian Development Bank (ADB)
2004	The Environmental and Social Consideration Guidelines of JICA
2010	Revision of Environmental and Social Consideration Guidelines of JICA; The new Safeguard Policy Statement of ADB
2016	The World Bank Environmental and Social Framework

Source: Prepared by the authors.

Table 2. Timeline of EIA legislation in developing countries

Country	EIA legislation
1970s to 1980s	
Colombia	Decree 2811 of 1974 (the Natural Resources Code); Law 99 of 1993 to incorporate EIS in the legal code; EIA decree 1753 of 1994
Philippines	The National Environmental Policy (a presidential decree No. 1586) of 1978
Thailand	The revision of the National Environmental Quality Act in 1978; the Enhancement and Conservation of Natural Environmental Quality Act in 1992
Brazil	The National Environmental Policy Law (Law 6931 of 1981); the 1983 Executive Decree No. 88,351
China	Management Rules on Environmental Protection of Basic Construction Projects of 1981 (revised 1986); EIA Licensing System of 1986; Ordinance of Environmental Management for the Construction Projects of 1998; EIA Law of 2002
Mexico	The Federal Law on Environmental Protection of 1982; the Regulation on Environmental Impact Assessment of 1988
Oman	Royal Decree No. 10/1982 and repealed with 114/2001 on conservation of the environment and prevention of pollution and executive regulations in Ministerial Decisions 80/1994; and 18/1993
Pakistan	The Environmental Protection Ordinance of 1983; the Environmental Protection Act of 1997; IEE/EIA regulations of 2000
Turkey	Environmental Law (No. 2872) of 1983; EIA Directive 7/2/1993, 23/6/97, 6/6/2002, 16/12/2003, 17/7/2008, 3/10/2013, 25/11/2014
Indonesia	The AMDAL process of 1986 (Government Regulation No. 29); the Regulation No. 51 of 1993; The Regulation No. 27 of 1999; Environmental Protection and Management Act in 2009
Malaysia	Environmental Impact Assessment Order of 1987
Sri Lanka	Amendment of the National Environment Act No. 56 of 1988; the Coast Conservation Act No. 57 of 1981
Ghana	The National Environmental Action Plan in 1989; Environmental Protection Agency Act No. 490 of 1994; Minister instrument LI 1652 of 1999
1990s	
Tunisia	Enabling legislation: Law No. 88 of 1991; specific EIA legislation: Decree No. 362 of 1991
Nigeria	The EIA Decree No. 86 of 1992
Uzbekistan	Law on Nature Protection of 1992; Law of Environmental Review of 2000; Cabinet Regulation of 2001
Maldives	Environmental Protection and Preservation Act in 1993 (Law No. 4/93)
Vietnam	The Law on Environment Protection of 1993; the Law on Environment Protection (Revised) of 2005
Chile	The Environmental Act, Law No. 19,300 (EA) of 1994
Egypt	Law No. 4 on Environmental Protection of 1994 and amendments Law No. 9 of 2009; specific EIA legislation: Executive Regulations 1995 of Prime Minister's Decree 338, Prime Minister's Decree 1741 of 2005
Gambia	The National Environment Management Act of 1994
India	The Environmental Impact Assessment Notification S.O.60 (E) of 1994; EIA Notification of 2006
Tanzania	National Environmental Action Plan of 1994; National Environmental Policy and National EIA Guidelines and Procedures of 1997; Environmental Management Act of 2004; EIA and Audit Regulations of 2005
Bangladesh	The Environmental Conservation Act in 1995; the Environment Conservation Rules in 1997
Kuwait	Law 21/1995 as amended by Law No. 16/1996 on the establishment of EPA and Executive by Law 210/2001 of EPA
Uganda	The National Environment Act of 1995; EIA Regulations of 1998
Bahrain	Environmental Act 21/1996 on protecting the environment from pollution; Assessment Order 1/1998 for EIA regulations
Cambodia	The Law on Environmental Protection and Natural Resource Management in 1996; the Sub-Decree on Environmental and Social Impact Assessment in 1999
Cameroon	Environmental Law No. 96/12 of 1996; Decree No. 2005/0577/PM of 2005; Order No. 0069/MINEP of 2005
Lesotho	The National Environmental Policy of 1996; the Environment Bill of 1998;
Ethiopia	The Environmental Policy of 1997
South Africa	Mandatory EIA in 1997 (Environmental Conservation Act of 1989); EIA Regulations in 2006 (National Environmental Management Act of 1998)
Kenya	Environmental Management and Coordination Act of 1999; EIA and Audit Regulations of 2003; EIA Guidelines and Administrative Procedures of 2002
Lao PDR	The Environmental Protection Law of 1999; The EIA regulation of 2000 and upgraded into the EIA Decree of 2010
UAE	Federal Law No. 24/1999 for the Protection and Development of the Environment
2000s	
Saudi Arabia	General Environmental Law Royal Decree No. 34/2001 and Executive Regulations No. 3964/2003
Mauritius	Environmental Protection Act No. 19 of 2002 (amendment of EPA of 1993); Environmental Protection Act of 2008
Qatar	Law of Environment Protection No. 30/2002 on environment protection against pollution and Executive by Law 11/2005
Zimbabwe	Mandatory EIA in 2003 with the enactment of the Environmental Management Act (Chapter 20:27)
Rwanda	Organic Law of 2005 Article 64; EIA became mandatory in 2005.
Syria	EIA formally adopted through Decree No. 225 of 2008

Source: Prepared by the authors.

2.2 The role of donors and lending organizations

Donor countries and lending organizations have played a catalytic role in the introduction and application of the EIA system in developing countries. EIA appeals to international agencies and governments as a well-defined, internally integrated procedure and planning tool (Horberry 1985). In October 1983, the ad hoc group on “Environmental Assessment and Development Assistance” of the Organization for Economic Co-operation and Development (OECD) agreed on four objectives designed to: (1) identify the kinds of development projects most in need of assessment; (2) examine the constraints faced by developing countries; (3) examine the assessment experience of development aid agencies; and (4) make recommendations to the Environment and Development Assistance Committees for the improvement of assessments (Kennedy 1985). The OECD then published a series of documents designed to strengthen the EIA procedures in development assistance: (1) the OECD Council Recommendation on Environmental Assessment of Development Assistance Projects and Programmes in 1985; (2) the OECD Council Recommendation on Measures Required to Facilitate the Environmental Assessment of Development Assistance Projects and Programmes in 1986; (3) the Principles for Project Appraisal in 1988; (4) the OECD Council Recommendation concerning an Environmental Checklist for Possible Use by High-Level Decision-Makers in Bilateral and Multilateral Development Assistance Institutions in 1989; and (5) Good Practices for Environmental Impact Assessment of Development Projects in 1991 (OECD 1985, 1986, 1988, 1989, and 1991).

The World Bank made a public commitment to include EIA in their project appraisal process in 1986. This was recognition that many bank funded projects were failing due to environmental problems and a lack of fit with the social and cultural surroundings of the project communities. Taking advantage of the opportunity from the World Bank, regional donor and lending organizations began to incorporate EIA into their project appraisal procedures (Burdge 1991, Aw 1996, Kennedy 1999, OECC 2000, Smith & Schin 2004). Finally, the World Bank

adopted Operational Directive (OD) 4.00-Annex A: Environmental Assessment in 1989, amended it as OD 4.01 in 1991, and converted it into Operational Policy (OP) 4.01 in 1998 (World Bank 1993, 1997, and 2002). EIA became one of the standard procedures for use in the preparation and implementation of Bank-financed investment projects (Rees 1999). The policy of OD 4.01 provided specific points at which NGOs might officially participate in the EIA process. Using these points of entry allowed active NGO involvement early in the project cycle (Haeuber 1992). Donor agencies adopted EIA guidelines on recommendations by the OECD, and exchanged experience and knowledge. The OECD prepared practical guidance on development cooperation projects to improve coherence among donor agencies in environmental assessment in 1996. By 1996 OECD member countries had developed EIA guidelines on development cooperation, and had ensured coherence in EIA processes (OECD 1996). Recently, the World Bank reviewed the safeguard policies and approved a new Environmental and Social Framework on August 4, 2016 (World Bank 2016).

2.3 Efforts of EIA by the Japan International Cooperation Agency (JICA)

JICA, which assists and supports developing countries as the executing agency of Japan's official development assistance (ODA), established a study group for environmental cooperation in 1988, and proposed the introduction of EIA processes into the ODA project cycle, based on the OECD Council Recommendations of 1985 and 1986 (JICA 1988). The Overseas Economic and Cooperation Fund (OECF) in charge of Japan's ODA loans at that time, and JICA, prepared the first EIA guidelines in 1989 and 1990. The OECF guidelines were amended in 1995, and when the OECF merged with Japan Bank for International Cooperation (JBIC) in 2002, separate JBIC guidelines were prepared. On the other hand, the JICA guidelines were amended in 2004, and became mandatory. The part of the JBIC in charge of ODA loans merged with JICA in 2010, thus, JICA now fully covers the project cycle from preparation phase to monitoring phase. The JICA EIA guidelines were again amended in 2010, and widened the range of the EIA process in

the project cycle from preparation to monitoring (JICA 2010). The JICA guidelines in 1990 did not include rules relating to consideration of alternatives, public involvement, impact prediction, impact significance, mitigation or monitoring. Those processes were applied on a voluntary basis and, generally, the implementation was insufficiently well carried out. When the guidelines of 2004 were introduced, JICA established an advisory committee as a permanent third-party institution formed by external experts. This committee is a system unique to JICA, which seeks external advice on EIA in the decision-making processes of projects. The committee's meetings are held in a public forum. The advice given at the meetings is made public, therefore boosting the transparency and credibility of JICA's decision-making processes.

3. Literature review

A number of papers and reports identify the constraints on EIA systems in developing countries, including issues with legal and institutional frameworks, unclear EIA requirements, the poor quality of EISs and lack of information, public involvement and consideration of alternatives (El-Fadl & El-Fadel 2004; ECA 2005; Alemagi et al. 2007; Naser et al. 2008; Kolhoff et al. 2009; Kruopiene et al. 2009; Okello et al. 2009; Ruffeis et al. 2010; Clausen et al. 2011; Marara et al. 2011; Panigrahi and Amirapu 2012; Betey and Godfred 2013; Al-Azri et al. 2014; Heaton and Burns 2014). However, little is known about solutions for those constraints.

EIA is a process and its effectiveness can be viewed in terms of both procedural criteria and substantive outcomes (Sadler 1996; Cashmore et al. 2004). Procedural effectiveness can be judged by ascertaining whether EIA processes are undertaken in line with established expectations such as EIA legislation, and the quality of EIS reflects the procedural effectiveness of EIA (Sadler 1996; Morrison-Saunders and Bailey 2009). Substantive effectiveness is demonstrated through changes to the project plan or program being assessed to realize the goals of EIA (Theophilou et al. 2010). The quality of the EIS is one of three major dimensions of an

effective EIA system, which consists of: adequate institutional arrangements for EIA; the quality of the EIS; and the implementation of mitigation measures (Ortolano et al. 1987; Sadler 1996; Momtaz and Kabir 2013).

The quality of the EIS is an indicator of an effective EIA system, but the low quality of EIS is one of the constraints on EIA systems in developing countries (ECA 2005; Nadeem and Hameed 2006; Badr 2009; Ruffeis et al. 2010; Panigrahi and Amirapu 2012; Al-Azri et al. 2014). The factors influencing the quality of the EIS are: the experience of EIA practitioners; project size; and lack of information and guidance (Badr et al. 2011; Momtaz and Kabir 2013; Sandham et al. 2013; Chanty and Grünbühel 2015; Gwimbi and Nhamo 2016a). Those factors are thus affected by the level of funding, human resources, and information. A high level of funding and human resources should result in a better quality EIS than in the case of small amounts of these inputs. EIA practitioners must find more general and practical factors influencing the quality of the EIS other than an increase in the quantity of resource inputs. Currently, little is known about these. The constraints and recommendations of the EIA system show the time series changes over the past 30 years, and these changes could provide a clue to the removal of constraints. However, the time series changes in constraints and recommendations in developing countries have never been analyzed. QTA has merits to analyze text information quantitatively and to compare time series information. Accordingly, this study used QTA to analyze the constraints and recommendations of the EIA systems in developing countries over the past 30 years to understand the time series changes and to obtain the knowledge to suggest overall improvements to these EIA systems.

4. Data and methods

4.1 Documents of EIA evaluation in developing countries

The study focused on the peer-reviewed articles published in international journals, books, and conference papers concerned with EIA systems in developing countries. A search query of the EBSCO Environment Complete database was conducted for documents that contained “environmental impact assessment” or “EIA” in their title. This initial search returned 1,184 documents. These documents were manually screened to ensure each was relevant to the fields of interest. This reduced the total to 31. Because a database search cannot fully assemble all relevant documents, the authors added articles and books based on their previous experience in the field, bringing all documents reviewed to 82. These were spread across 11 journals, eight books, and four reports from international organizations from the period 1985 to 2016 (Table 3). Asian countries established EIA legislation at an early stage, so the documents in Asia first appeared in 1985 to 1990, and Asia contributed the most documents in each period, 43 in total. Next to Asia, Africa contributed 22, nine were from the Middle East, four from Latin America, and four were from the whole developing countries.

Table 3. Documents in periods, regions, journals and books between 1985 and 2016

Region, journal and book	1985-1990	1991-2000	2001-2010	2011-2016	Total
Region					
Asia	6	10	19	8	43
Africa	0	6	12	4	22
Middle East	0	1	5	3	9
Latin America	0	3	1	0	4
Whole developing countries	2	1	1	0	4
Total	8	21	38	15	82
Journal and book					
Environ Impact Assess Review	6	12	16	5	39
Impact Assess Project Appraisal	0	2	11	6	19
Books					
International Organizations	1	1	2	0	4
Int Dev Plan Review	0	1	1	0	2
J Environ Assess Policy Manag	0	0	2	0	2
The Environmentalist	0	0	2	0	2
Int Association Impact Assess	0	1	0	0	1
J Environ Manag	0	1	0	0	1
Int J Human and Social Sci	0	0	1	0	1
Environ Monitor Assess	0	0	0	1	1
Environ Natural Resources Research	0	0	0	1	1
J Environ Protect	0	0	0	1	1
Total	8	21	38	15	82

Source: Prepared by the authors.

4.2 Documents of EIS quality review in developed and developing countries

The study focused on a sample of 16 documents containing EIS quality reviews in developed and developing countries (Table 4). The authors collected these documents based on their previous experience. The number of documents from developing countries was five, and 11 documents from developed countries were added to complement the small volume of data. The first document was the EIS quality control in the United Kingdom (Lee and Brown 1992). The documents about the European countries and the United States appeared from 1990s to the 2000s. The first document from developing countries came 16 years after the first document in the United Kingdom, and was an EIS quality review from South Africa (Sandham and Pretorius 2008). Since that review in 2008, documents from Egypt, Bangladesh and Cambodia appear.

Table 4. Documents of EIS quality review in developed and developing countries

Period	Developed countries	Developing countries	Total
Before 2000	6	0	6
After 2000	5	5	10
Total	11	5	16

Source: Prepared by the authors.

4.3 Quantitative text analysis

The textual information of documents was changed to text data and analyzed using QTA via KH Coder, free analytical software (Higuchi 2014). QTA provides a quantitative overview of text data that accounts for quoted passages. A benefit of the method is that it allows analysts to search the data and find potential problems using coding rules, which overlooked or hardly noticed by a normal reading of the documents. The KH Coder shows an appearance ratio for each coding rule focused on a specific subject. The appearance ratio is calculated by dividing the number of paragraphs in which specific coding rule words appear by the total number of all paragraphs.

The coding rules of the study were prepared to focus on seven subjects: law and administration; capacity building; public involvement; monitoring; information; report quality; and alternative. They were identified as constraints on EIA system in more than 30 percent of the documents in total. These seven subjects were associated with a group of related words and their coding rules were prepared (Table 5). The constraints on EIA system and recommendations in developing countries mentioned in 82 documents, were summarized (Appendix 1), and this summary was used as raw data. The 82 documents covered about 30 years (1985 to 2016), and were divided into two parts; the first half up to 2000, and the second half after 2000; to analyze the change of the constraints and recommendations over a set period using QTA. There was a difference in the number of documents in the first and the second half (29 and 53), but it is possible to clarify the changes over 30 years using a chi-square test. Six documents were excluded from the analysis of recommendations because relevant descriptions were not present.

A sample of 16 documents covering assessment methods and factors influencing the quality of EIS were summarized (Appendix 2), and this summary was used as raw data in the study. The list of factors was compared by developed and developing countries, and before and after 2000 using QTA. The coding rules were prepared to focus on six factors influencing the quality of the EIS (experience, project size, legislation, information, guidance, and review). In the coding rules, experience is suggested by the words experience, overtime, consultant, proponent, attitude or awareness; project size by size or length; legislation by legal, legislation, legislative or regulation; information by data, information or baseline; guidance by guidance, training or research; and review by review, reviewer or rating. These words were selected from the words appearing in raw data. Articles, pronouns, figures, punctuation marks, and so on, were excluded from the analysis as they are unnecessary words. The difference with $*p<.05$ and $**p<.01$ was considered significant.

Table 5. Seven coding rules

*Law and administration
administrative, agency, authorities, authority, bureaucracy, bureaucratic, commitment, comply, cooperation, coordination, decentralization, enforcement, framework, fund, government, institution, integrate, integration, law, legal, legislation, license, link, linkage, modification, policy, policies, political, procedure, process, regulation, regulator, rule, system or treatment
*Capacity building
capacity, education, empowerment, experience, expert, expertise, guideline, knowledge, manpower, professional, qualification, qualified, research, resource, skill, skilled, trained or training
*Public involvement
awareness, communication, consultancy, consultation, debate, involvement or participation
*Monitoring
evaluation, follow-up, monitor or monitoring
*Information
access, baseline, data, inaccessible, information or map
*Report quality
report, review or quality
*Alternative
alternative

Source: Prepared by the authors.

5. Results

5.1 Differences between constraints and recommendations before and after 2000

The constraints and recommendations before and after 2000 are compared in Table 6. A number represents the number of documents and a percentage represents the appearance ratio. Law and administration, capacity building and public involvement were major constraints and major recommendations before and after 2000. Before 2000 there was no difference between the constraints and recommendations in terms of law and administration, information, and report quality. But, there was a difference in the four subjects (capacity building, public involvement, monitoring, and alternatives). The appearance ratios of these four subjects in the recommendations were lower than in the constraints mentioned. In particular, the difference of alternatives between constraints and recommendations was significant. Thus, there might be some problems about implementation of four subjects, particularly alternatives, before 2000.

After 2000 there was no difference between constraints and recommendations in terms of law and administration, capacity building, public involvement, and report quality. However, the differences in monitoring, information, and alternatives became large. In particular, the difference in alternatives was more significant than before 2000. Capacity building and public involvement showed a difference before 2000, but no difference after 2000. Information showed no differences before 2000, but a big difference after 2000. The chi-square value for the six subjects except for report quality was different before and after 2000, by which it is inferred that the problems of the EIA systems in developing countries changed after 2000.

5.2 Differences before and after 2000 in constraints and recommendations

The constraints and recommendations before and after 2000 were compared (Table 7). The appearance ratio of law and administration, monitoring, report quality, and alternatives in constraints increased, and those of capacity building, public involvement, and information

maintained or slightly increased after 2000. In fact, all seven subjects have been concerns in recent years. In particular, the appearance ratio of constraints on report quality nearly doubled after 2000, from 24 to 45 percent, which shows a growing more concern in recent times.

The appearance ratios of five subjects (capacity building; public involvement; monitoring; report quality; and alternatives) in recommendations increased, the ratio of law and administration was same, and that of information decreased after 2000. Particularly, the appearance ratios of capacity building and public involvement showed a large increase after 2000, both are major recommendations that have been emphasized in more recent times. In particular, the difference in capacity building before and after 2000 is significant, and was expected to improve the EIA system after 2000. The ratio of alternatives in recommendations was very low before and after 2000, as compared to those in constraints. There thus might be a big problem in consideration of alternatives.

Table 6. QTA results of constraints and recommendations (Significant at $*p < .05$, $**p < .01$)

Period	Law and administration		Capacity building		Public involvement		Monitoring		Information		Report quality		Alternative		Documents
1985-2000															
Constaints	22	76%	19	66%	19	66%	10	34%	11	38%	7	24%	6	21%	29
Recommendations	21	78%	13	48%	13	48%	5	19%	9	33%	7	26%	0	0%	27
Total	43	77%	32	57%	32	57%	15	27%	20	36%	14	25%	6	11%	56
Chi-square		0.00		1.09		1.09		1.09		0.01		0.00		4.28*	
2001-2016															
Constaints	47	89%	39	74%	38	72%	28	53%	21	40%	24	45%	20	38%	53
Recommendations	39	80%	39	80%	35	71%	17	35%	10	20%	20	41%	4	8%	49
Total	86	84%	78	76%	73	72%	45	44%	31	30%	44	43%	24	24%	102
Chi-square		0.98		0.23		0.00		2.70		3.58		0.07		10.79**	

Source: Prepared by the authors.

Table 7. QTA results before and after 2000 (Significant at $*p < .05$, $**p < .01$)

Period	Law and administration		Capacity building		Public involvement		Monitoring		Information		Report quality		Alternative		Documents
Constraints															
1985-2000	22	76%	19	66%	19	66%	10	34%	11	38%	7	24%	6	21%	29
2001-2016	47	89%	39	74%	38	72%	28	53%	21	40%	24	45%	20	38%	53
Total	69	84%	58	71%	57	70%	38	46%	32	39%	31	38%	26	32%	82
Chi-square	1.45		0.26		0.11		1.85		0.00		2.72		1.79		
Recommendations															
1985-2000	21	78%	13	48%	13	48%	5	19%	9	33%	7	26%	0	0%	27
2001-2016	39	80%	39	80%	35	71%	17	35%	10	20%	20	41%	4	8%	49
Total	60	79%	52	68%	48	63%	22	29%	19	25%	27	36%	4	5%	76
Chi-square	0.00		6.58*		3.12		1.50		0.94		1.10		0.98		

Source: Prepared by the authors.

5.3 Factors influencing the quality of EIS

The appearance ratios of the six factors were calculated for both developed and developing countries (Table 8). Experience and project size were the main factors, and the other four factors (legislation, information, guidance, and review) were secondary factors. Differences were not significant before and after 2000 in developed countries, and after 2000 in developing countries. In developing countries four out of five documents (80%) pointed out the experience as a main factor. This is because the experience of EIA practitioners could be very important under the constraints found in developing countries. The differences in information, guidance, and review were relatively large because of zero frequency in the data.

Table 8. QTA results of factors influencing EIS quality (Significant at $*p < .05$, $**p < .01$)

Group	Experience		Project size		Legislation		Information		Guidance		Review		Number of documents
Developed countries													
Before 2000	4	67%	4	67%	1	17%	2	33%	0	0%	1	17%	6
After 2000	3	60%	2	40%	2	40%	0	0%	1	20%	2	40%	5
Developing countries													
After 2000	4	80%	2	40%	1	20%	2	40%	2	40%	0	0%	5
Total	11	69%	8	50%	4	25%	4	25%	3	19%	3	19%	16
Chi-square	0.49		1.07		0.89		2.49		2.87		2.65		

Source: Prepared by the authors.

The appearance ratio of experience and project size appears to be high. In other words, the quality of the EIS of a large-scale project prepared by experienced EIA practitioners will be better than the quality of small-scale projects prepared by inexperienced practitioners. The quality of EIS focusing on large-scale projects was notable better than small scale ones. This may of course simply be a reflection of the level of funding allocated to EIA by both large and small scale projects (Gwimbi and Nhamo 2016a). The importance of knowledge was recognized in the first document from the United Kingdom (Lee and Brown 1992), and has been repeatedly verified since. EIA practitioners are sure to acquire experience with the passage of time, so the quality of EIS should have improved over the past 30 years, we find instead that the appearance ratio of report quality as a constraint increased over time (Table 7).

The weaknesses of EIS in South Africa were: lack of feasible alternatives; impact significance; mitigation measures and the magnitude of impacts; and the identification of impacts (Sandham and Pretorius 2008). The problems with EIS in Egypt were: consideration of alternatives; prediction of the magnitude of impacts; and public involvement (Badr et al. 2011). The review of EIA reports in India identified several key shortcomings: insufficient baseline data; inadequate allocation of resources (time and money); lack of expertise of EIA professionals; scant involvement of stakeholders; heavy reliance on qualitative analysis of impact significance; and inadequate consideration of alternatives (Panigrahi and Amirapu 2012). The factors leading to the poor quality of EIS in Bangladesh were: shortage of study time; inadequate baseline data; attitudes of consultants and proponents; lack of EIA experts; defective service procurement process; lack of adequate funds; weak terms of reference (TOR); and shortage of EIA team members (Momtaz and Kabir 2013). The six constraints for the poor quality of EIS in Cambodia were: little legislature to regulate consultants; political influence by local elites; limited time and access to baseline data; limited consultant expertise; financial constraints; and no serious trust in consultants by proponents (Chanthy and Grünbühel 2015). The weaknesses in developing countries range widely over law and administration, capacity

building, information, and consideration of alternatives. Thus, EIS quality cannot be improved simply by the factors of experience of EIA professionals and project size.

6. Discussion

6.1 The EIA system in developing countries before 2000

Before 2000 EIA was still in an early stage and it was not long since EIA became legislated in developing countries. Institutional problems were the most important barriers to the effective implementation of EIA (Lim 1985). EIA agencies usually lacked sufficient resources or political power, and EIA had little influence on planning and decision making in the Philippines (Abracosa and Ortolano 1987). Legislation, administration, and enforcement were priority issues to be addressed to make EIA more effective (Brown et al. 1991). An EIA agency could not enforce governmental agencies to implement mitigation measures; the perception of EIA held by decision makers was not well developed; and EIA regulations did not contain appropriate stages of public participation in Thailand (Tongcumpou and Harvey 1994). In Asia the relatively low status of EIA agencies in bureaucracy made it difficult for them to have sufficient influence to ensure the effective implementation of the EIA process. Strengthening legislation and administration was a priority for the implementation of EIA; and this required many items, including the promulgation of regulations; the organization of new institutions; the definition of appropriate conditions for the issuance of licenses; setting of environmental quality standards; recruitment and training of personnel; provision of material means and equipment; and the allocation of appropriate budgets (Lohani et al. 1997).

The other issues such as capacity building, public involvement, monitoring, and consideration of alternatives cannot be solved without adequate legal frameworks and administration. Lack of a legal framework and inadequate government capacity are concrete constraints for public participation (Kakonge 1996). Project proponents have no budget or

responsibility for implementing the mitigation measures and monitoring programs (Brown et al. 1991). The limitation in the consideration of alternatives was related to political constraints (Lim 1985). EIA was conducted at the latest project plan stage and there was little or no opportunity to consider alternatives (Nor 1991; Ebisemiju 1993).

6.2 The EIA system in developing countries after 2000

After 2000 many developing countries strengthened their EIA legislation. Malaysia, Turkey, and Thailand implemented EIA systems between the late 1970s and the 1980s, and have more than 30 years of experience in EIA practices. EIA legislation was introduced in Malaysia in 1987 and much progress has been made in enforcing compliance with the requirements (Briffett et al. 2004). The strength of the Turkey legal and institutional structure makes the EIA system strong as a whole (Coşkun and Turker 2011). The Thai EIA system has clear procedures and its EIA reports are available online as a database (Suwanteep et al. 2016). Thus, the constraints and recommendation after 2000 are different from those before 2000 (Table 6 and Table 7). The appearance ratio of report quality as a constraint has nearly doubled. An effective EIA consists of: (1) adequate institutional arrangements; (2) the good quality EIS; and (3) implementation of mitigation measures (Ortolano et al. 1987; Sadler 1996; Momtaz and Kabir 2013). The developing countries may come to the second stage to improve the quality of their EIS after adequate institutional arrangements are developed.

The appearance ratios of capacity building and public involvement in recommendations show a large increase after 2000 (Table 6). After a legal framework is prepared, capacity building and public involvement are ready to be improved, and they become more important after rather than before 2000. Failure of EIA in developing countries is often linked more to a lack of effective implementation – through lack of capacity – rather than serious imperfections in the EIA process (Alshuwaikhat 2005). The EIA regulations of public participation in Kenya are good but the practice is poor (Okello et al. 2009). Likewise, despite

major improvements to the policy and legislative framework, a significant gap between theory and practice of EIA remains in Vietnam (Clausen et al. 2011). And, even though the legislative provisions and guidelines for EIA are quite comprehensive in India, low levels of implementation of the mandatory requirements for EIA is resulting in the development and operation of many environmentally unsounded projects (Panigrahi and Amirapu 2012).

The differences between constraints and recommendations of monitoring, information, and alternative become larger than before 2000 (Table 7). Their needs are growing, but their implementation still faces difficulties. Adequate legal and institutional frameworks and capacity building to address them are still weak. For example, the consideration of alternatives is still absent from China's EIA system (Wang et al. 2003). Baseline data and information on the environment are missing or outdated due to limited resources in Ethiopia (Ruffieis et al. 2010), and a weakness remains in the legislation in Vietnam; there is no requirement for ongoing monitoring during project operation (Clausen et al. 2011). The legal infrastructure for EIA procedures is strong in Turkey, but the assessment of alternatives and the lack of public participation and environmental databases are weak points (Coşkun and Turker 2011). Similarly, the EIA system in the United Arab Emirates requires alternatives assessment and monitoring during construction and operation, but a full consideration of alternatives is not always evident and not all projects conduct monitoring (Heaton and Burns 2014).

6.3 Evolution of the EIA system over the past 30 years in developing countries

EIA legislation was established from 1980s onward in developing countries, following that of developed countries, and has been strengthened as they gained experience in EIA operations over the past 30 years. EIA legislation has been developed even though monitoring and consideration of alternatives are still weak in some countries. The present challenge is to implement EIA processes regulated by EIA law. The appearance ratios of seven subjects in constraints did not decrease, and were maintained or even increased after 2000. The constraints

don't seem to be solved. Capacity building and public involvement are however expected to improve EIA practices in developing countries after 2000. For example, weak public consultation and lack of information disclosure were identified as constraints, and enhancement of public awareness and local capacity to participate in the environmental assessment process were recommended (World Bank 2006). These recommendations could be true but they do not solve the constraints directly because the causes of these constraints are not clear. The causes about weak public consultation and lack of information disclosure should be clarified first, and recommendations should be proposed based on analysis results. The analysis and clarification of causes, which lead to the fundamental solution of constraints, are therefore required.

In this section we focus on the appearance ratio of report quality as a constraint nearly doubled from 24 percent before 2000 to 45 percent after 2000 (Table 7). Improvement of EIS quality is an issue of increasing importance in recent years. The factors influencing EIS quality did not show differences before and after 2000, or between developed and developing countries. Experience and project size could be factors but this knowledge would not be enough to improve the quality of EIS in developing countries. Proposed solutions for improving the quality of EIA reports are: more quality review research (Sandham and Pretorius 2008); independent EIS reviews, training, consultant accreditation, guidance, and database (Badr et al. 2011); accreditation and training, guidance, continuing research (Sandham et al. 2013); and improvements in consultant performance (Chanty and Günbühel 2015). These proposals may influence EIS quality, however, there is very little evidence to show that these proposals will improve it. A new and concrete method to improve EIA systems and EIS quality in developing countries is required.

6.4 Solving constraints on EIA system focused on improving the quality of EIS

Developing countries face issues in improving EIS quality at present. EIS is the fundamental indicator of an effective EIA system for the reason that the information presented in the reports

reflects the technical and scientific quality of the EIA process. The EIS document is the only way to incorporate and present scientific knowledge in an EIA study (Momtaz and Kabir 2013, 54). Procedural effectiveness evaluates whether the EIA process has been undertaken according to established expectations such as EIA legislation and the quality of the EIS reflects the procedural effectiveness of EIA (Sadler 1996). There is a clear relationship between the quality of EIS and the effectiveness of the EIA system (Wende 2002). The quality of EIS is useful in indicating the likely effectiveness of its proposed mitigation measures (Gwimbi and Nhamo 2016a). Available evidence suggests that mitigation measures were implemented and the EIS was of satisfactory quality (Gwimbi and Nhamo 2016b). The quality of EIS could also have a positive effect on monitoring.

Weaknesses in an EIS reflect the constraints of law and administration, capacity building, public involvement, monitoring, information, and consideration of alternatives. EIA practitioners collect environmental and social information, consider alternatives, reflect public involvement, predict impacts, propose mitigation measures and monitoring programs, and prepare an EIS according to EIA legislation and guidelines. The EIA authorities review an EIS, which is revised when necessary. The seven subjects must be consolidated into an EIS. The question of how to improve the quality of an EIS reflects on the EIA system as a whole, and it is sure to be more simple, and easier to find answers, if the influence of all seven is considered jointly, rather than increased efforts being made to find out answers of how to improve them individually.

6.5 Improving the quality of EIS using statistical analysis

Previous studies reviewed the quality of EIS based on the Lee-Colley method (Lee and Colley 1990; Lee and Colley 1992; Lee et al. 1999), and showed the portion of quality grades that were satisfactory and unsatisfactory. They then went on to discuss improvements in quality based on the portion of satisfactory and unsatisfactory. They did not use statistical analysis to find

determination factors influencing EIS quality (Cashmore et al. 2002; Canelas et al. 2005; Sandham and Pretorius 2008; Badr et al. 2011; Momtaz and Kabir 2013; Sandham et al. 2013). Experience and project size are the main factors influencing quality because the input quantity of funding and human resources is different. Little is known about determination factors other than the difference in input quantity for improving EIS quality. One reason is that the statistical analysis of quality grade data has not been utilized, and recommendations to improve quality are little in evidence. The statistical analysis of quality grade data could identify the determination factors influencing EIS quality, and enable the classification of satisfactory and unsatisfactory grades (Kamijo and Huang 2016).

For example, the consideration of alternatives is hardly focused on as a recommendation to the EIA system, or a factor influencing EIS quality, in previous studies (Table 6). But alternatives analysis and public involvement have been shown to be effective in improving the quality of JICA EIA reports. The effectiveness of a linkage between alternatives analysis and public involvement is thus emphasized. However, there have been few studies focused on that linkage. This new finding is based on statistical analysis (statistical test and path analysis with structural equation modeling). The statistical analysis is very useful tool for finding and verifying determination factors for improving the quality of EIS (Kamijo and Huang 2016).

6.6 Comparison with findings by previous qualitative case study

Previous qualitative case studies have identified the constraints on EIA systems, but recommendations were weak because the causes of constraints were not analyzed and clarified (Memon 2000; Vidyaratne 2006; Nadeem and Hameed 2008; Clausen et al. 2011; Panigrahi and Amirapu 2012; Momtaz and Kair 2013). This study proposed to improve the quality of EIS to solve the constraints on EIA systems with evidence data based on the QTA result of 82 documents. QTA has the merit of being better able to analyze large numbers of text documents and provide an understanding of their contents than the qualitative case study method. A

literature review using QTA allowed the quantitative overview of constraints and recommendations over the past 30 years, which hardly noticed in qualitative case studies, and led to a more concrete method for the solution of constraint problems. This study advances our knowledge to improve EIA systems in developing countries.

6.7 Limitations of the study

The study has some limitations, due to bias and research gaps in documents, oversight of related documents, and in the definition of coding rules; even though the study minimized subjectivity by collecting as many documents as possible using the search engine and manual labor, prepared the raw data and coding rules using the same authors, and compared the seven subjects before and after 2000.

7. Conclusions

This study shows that the constraints and recommendations of the EIA system in developing countries changed before and after 2000, and in particular, report quality has become a much more important constraint in recent times. Accordingly, this study focused on improving the quality of EIS in order to solve the constraints on the EIA systems of developing countries. Previous research identified constraints on EIA systems, but provided little in the way of solutions. This study is a first literature review that has used QTA to analyze the constraints and recommendations of EIA systems in developing countries, and by quantifying them provides a new finding of solutions. The review of previous studies using QTA advances the acquisition of knowledge to improve EIA systems in developing countries. This is because QTA has the advantage of analyzing textual information quantitatively and being able to deal with large numbers of textual samples; and the findings obtained are in a more general than those revealed by the qualitative case study method.

The quality of the EIS is an indicator of an effective EIA, and reflects other constraints, including public involvement, capacity building, information, and consideration of alternatives. The determination factors related to EIS quality and their solutions should be concrete recommendations to improve the EIA system. The statistical analysis could be a useful method to find these factors. There are many EISs in developing countries, but quality research is limited. More EIS quality review research is needed, and the use of statistical analysis is recommended to find the determination factors and solutions for improving their quality, along with qualitative analyses.

Appendix 1. Constraints to EIA practices and recommendations in developing countries (82 documents)

Country	Constraints to EIA practices	Recommendations
Asia		
Bangladesh (Momtaz 2002)	Less emphasis on monitoring; proper implementation dependent on the requirements of donor agencies; a lack of coordination among various organizations involved in environmental decision making; lack of implementation capacity; no code of conduct for consultants; a need for SEA; lack of political will	Monitoring in which NGOs and donors play major roles; all sectors guidelines; EIA review by independent bodies; community participation and consultation at an early stage of project development; introduction of SEA; development of simplified EIA procedures
Bangladesh (Ahmmed and Harvey 2004)	Little legislative control; a lack of institutional capability; no legal requirement for public participation and disclosure of information	Clear guidelines spelling out the procedures and steps of EIA legislation; capacity building at various levels; strengthening law enforcement mechanism; environmental guidelines and EIA officers at line agencies; formal linkages with universities, research organizations, and NGOs to share expertise; EIA matters as regular agenda of the meeting of the National Environment Committee
Bangladesh (Kabir and Momtaz 2012)	Inadequate time and funding; inadequate baseline data; lack of consultants' independence; poor TOR; absence of legal provision; inadequate best practice guidelines	Change of proponent's attitude; allocation of adequate funds and time; adequate consultation of department of environment about TOR; development and dissemination of adequate best practice guidelines
Bangladesh (Momtaz and Kabir 2013)	Lack of detailed scientific information; no significant improvement since 1995; weak legal provisions; no clear provision of public involvement; a bad influence from site clearance; inadequate judicial control; lack of guidelines; age-old environmental quality standard; absence of SEA; inadequate budget and manpower of administration; lack of expertise; inadequate interagency coordination (p. 21 and p. 44-51)	Amendment of EIA legislation including clear provisions of EIA requirements; enhancing capacity; decentralization of functions; up-to-date environmental database; attitudinal change of proponents; ethical codes of conduct and accreditation system; active participation of local community; donors control of funds based on environmental performance; systematic interagency coordination (p. 184-185)
Cambodia (Chanthy and Grünbühel 2015)	Little legislature about quality of EIA reports; political influence; limited time and access to baseline data; limited consultants expertise; financial constraints; no serious regard of or trust in consultants by proponents	Identifying and mandating the duties of consultants
China (Ning et al. 1988)	Lack of basic data; limited predictions of impacts on ecosystems	EIA at an early stage of project design; improvement of screening process; integration of various components; a wider range of mitigation; cumulative impacts; more public involvement
China (Mao and Hills 2002)	Political and bureaucratic intervention by local governments; a legitimacy crisis and conflict of interests for local Environmental Protection Bureaus; and massive resistance from enterprises and pro-growth government organs	Promoting rule-by-law and strengthening cross-agency coordination; integration into decision-making; adopting more regulatory instruments than the traditional command and control
China (Wang et al. 2003)	Weak enforcement; limited considerations of alternatives and public involvement; no transparent process of reviewing; weak monitoring on ecosystem and landscape impacts	EIA education and training; association with local NGOs
China (Suwanteep et al. 2016)	Deficient consideration of alternatives; limited length of time for public participation and limited access to the project development information	No recommendations

Appendix 1. (Continued)

Fiji (Turnbull 2003)	Rare considerations of alternatives; little public consultation; EIA reports to be considered confidential; inadequate reviewing EIA reports; no funds, vehicles, nor qualified staff to monitor mitigation measures; no legal power of EIA authorities	No recommendations
India (Paliwal 2006)	Screening and scoping processes not well defined; insufficient baseline data; inconsistent application of evaluation and predictive tools; improper monitoring and implementation; inadequate public participation; poor quality EIA reports and non-accountability of EIA professionals; lack of coordination and poorly defined decision-making process	Increase of accountability of the EIA experts; proper management of baseline data; improvement of monitoring; grouping of small scale industries; integration of environmental concerns into plans and policies; capacity building of stakeholders
India (Panigrahi and Amirapu 2012)	Inadequate capacity of EIA approval authorities; deficiencies in screening and scoping; poor quality EIA reports; inadequate public participation; weak monitoring; insufficient baseline data; insufficient allocation of resources (time and money); lack of expertise with EIA consultants and professionals; heavy reliance on qualitative analysis of impact significance; inadequate consideration of alternatives; sound legal provisions but weak administrative set up; lack of coordination	A strong political will and institutional capacity to enforce the law; good coordination among decision-makers, proponents, consultants, revenue/land acquisition department, planning and development authorities; introduction of EIA at policy and planning level to ensure an early consideration of major area of concern; establishment of independent EIA review bodies; strengthening of public participation; enhancement of mitigation, monitoring and institutional measures
Indonesia (Hadi 2003)	Lack of public participation; inappropriate techniques employed; poor quality EIA documents; lack of project information; too formal evaluation of EIA documents; low degree of communication; formal meeting for local people	Public meetings; appropriate public participation techniques including in-depth interviewing and a snowballing techniques; a forum for public review of EIA document
Indonesia (Purnama 2003)	Provisions for direct public involvement included in Regulation No. 27 of 1999; ineffectiveness in the public involvement process (formality, lack of public involvement culture and clear representational structure in the community; additional cost)	Development of guidelines on public involvement; cultural adoption of public involvement; the government role as referee to mitigate conflicts
Lao PDR (Wayakone and Inoue 2012)	Few trained and skilled personnel; inadequate public consultation; lack of environmental data; weak monitoring; no enforcement machinery; bureaucratic and easily derailed approval procedure; weak coordination between the parties concerned	Strengthen integrated coordination; effective public participation; public access to reports; systematic framework for EIA review; follow-ups; mitigation; systematic framework for consultant accreditation; introduction of penalties; raise public environmental awareness; improving capacity building; mandatory scoping
Malaysia (Nor 1991)	Inaccuracy of predictions; uncertainty; lack of follow-up audits; vagueness; being more descriptive rather than quantitative; being over cautious of private sector towards EIA; limited considerations of alternatives; EISs inaccessible to public scrutiny; lack of social impact analysis	Change of private sector's attitude towards EIA; EIA at an early stage; public access to EISs; social impact analysis
Malaysia (Memon 2000)	The management of forestry, water resources, mining, wildlife and fisheries is beyond the scope of EIA (regulation); lack of awareness of EIA (a stumbling block to development, a delay of project approval and implementation); no consideration of siting and technology; lack of baseline data; poor prediction of impacts; limited public participation (the tradition of participant democracy is weak); the absence of a framework for environmental planning	A political will and willingness openly to debate development proposals by a vibrant civil society and information access are prerequisites

Appendix 1. (Continued)

Malaysia (Briffett et al. 2004)	Much pressure on what is environmentally acceptable and what is economically desirable; accomplished fact of alternatives; proper scoping not often taken; lack of baseline data; weak impact prediction; limited implementation of mitigation measures and monitoring; limited public participation; concern about review process; weak integration of EIA into decision making; weak implementation of SEA	No recommendations
Maldives (Annandale 2001)	Not all significant actions are assessed; no open process of proposal referral; no alternatives analysis; no content guidelines; no use of public review process in practice; no monitoring process; no enough staff	Legal and administrative backing for the EIA system; involvement of regulators in the establishment of scoping guidelines; transparent government decision-making and approval; administrative support and a viable private consulting sector
Pakistan (Nadeem and Hameed 2006)	Weak public participation; lack of expertise; poor quality of EIA reports; inadequate identification, evaluation and mitigation of key impacts, and consideration of alternatives; no sufficient time to conduct a good quality EIA; questionable reliability of data	Development of EIA review criteria; establishment of independent review committees; promotion of public consultation culture; development of criteria to register EIA consultants; capacity building of responsible authorities; a high degree commitment to environmental protection
Pakistan (Nadeem and Hameed 2008)	Sound legislative provisions but weak administrative set up; weak coordination between proponents and EIA authorities; few EIAs; inadequate screening and scoping; limited scope of EIA report review; poor quality of EIA reports; weak public participation; inadequate implementation of mitigation measures and monitoring	Strong political will and institutional capacity to enforce 1997 Pakistan Environmental Protection Act; good coordination among related governmental agencies; independent EIA review bodies; a code of conduct and registration of EIA consultants; raising stakeholders' awareness; enhancement of implementation of mitigation measures and monitoring
Philippines (Abracos and Ortolano 1987)	Absence of controls to force through assessment (no judicial control, nor the power of competent agency); EIA at a late stage and little influence on planning and decision making; usefulness of EIA as a forward planning tool; EIA authority has no political power nor resource needed	Agency planners accept the practical value of EIA
Philippines (Ross 1994)	EIS system as a bureaucratic requirement for project approval; political interference; questionable practices by public servants; unsatisfactory treatment of projects in environmentally critical areas	Treatment of EISs for projects under construction (finding mitigation measures, feedback, and getting a stop order), EIA training course, focusing on the most important projects
Sri Lanka (Hennayake et al. 1997)	Long time of EIA clearance; not clearly defined scope of issues to be covered; lack of expertise of EIA sections; monitoring and evaluation; a poorly prepared EIA; database to be strengthened; more strategic levels of assessment; lack of alternatives consideration (p. 117-128)	Establishing a proper balance between the goals of environmental protection and economic development; capacity development of EIA review agencies; conceptual and on the job training; improving screening process; strengthening data base; integration of EIA into project planning cycle; more SEA (p. 117-128)
Sri Lanka (Zubair 2001)	Loopholes due to the list of prescribed projects; consideration of multiple projects in one area; consideration of unreasonable alternatives; conflicts of interest for the project-approving agency; shortcoming in provisions for public participation; lack of tolerance standards; problems with environmental data; inadequate post-EIA monitoring; apprehension of EIA violators; professional ethics for EIA consultants	EIA in early stage; widening the scope of projects subject to EIA; development of planning framework and zoning of territory; funding and personnel assignment to EIA authorities; EIA officials sensitized as to all environmental dimensions; increase of time given for public involvement; environmental data gathering; expansion of EIA regulations; stricter enforcement of EIA law; improvement of consultant licensing system

Appendix 1. (Continued)

Sri Lanka (Vidyaratne 2006)	Officers' lack of knowledge about EIA; different institutional culture and objectives to balance conservation and development; not legal approving under ex-post facto recommended conditions; unnecessary delays of project approving due to bureaucratism; inadequate screening criteria; political pressure to decision making; lack of finance; opposition to new initiatives from within the Ministry of Environment	Augmenting the capacities and efficiencies of EIA cell; EIA training; diversified criteria for selecting projects for EIAs (screening); created more knowledge for research and government
Thailand (Tongcumphu and Harvey 1994)	Institutional structure problems (weak enforcement and judicial control); EIA perception among agencies (depreciation of environmental values); EIA documents and reviewing process (high cost of EIA preparation and conflict of interests by reviewers); lack of public participation	Empowerment of EIA authorities; public participation into EIA process; reasonable honorarium for a review committee; training program concerning EIA process
Thailand (Kamchana wong 1998)	Lack of public participation; lack of basic data; lack of experience and expertise; a shortage of time; lack of monitoring and mitigation implementation	Improvement of EIA process; revision of consultant registration; decentralization for monitoring; environmental guarantee fund; capacity building of EIA experts; baseline data center; introduction of SEA
Thailand (Suwanteep et al. 2016)	Lack of local EIA authority	Empowerment of EIA system in national and local level authorities
Uzbekistan (Khusnutdinova 2004)	Unclear screening list; no legal requirements to consider alternatives and mitigation measures; absence of strict legal provisions for public participation; low level of environmental awareness; insufficient human and financial capacity of NGOs; weak monitoring; SEA on an ad hoc basis; weak institutional capacity (no involvement of key stakeholders, no qualified experts, insufficient training, low public awareness, no network of professionals; low level of finance); lack of EIA research	Revision and strengthening of EIA legislation; refining of screening list; development of sector guidelines; training of experts; national network of EIA professionals; dissemination of EIA information; research on EIA system; public participation in decision making; evolution EIA system
Vietnam (Doberstein 2003)	Weak EIA authorities; weak public involvement; weak monitoring; low quality of EIA studies; a lack of implementation capacity	Increase in staff numbers, staff skill levels, technical guidelines and EIA administrative processes; building capacity for SEA; coordinating capacity building initiatives by aid community; improving the EIA report quality
Vietnam (Doberstein 2004)	Ethnic minorities no merit; no use of indigenous knowledge; no guidelines on public involvement and social impact; a lack of capacity; resistance to public participation by many individuals at all levels	EIA decentralization and capacity building across line ministries; creation of in-house environmental management units; introducing planning model and widening capacity building
Vietnam (Clausen et al. 2011)	EIA at a meaningful stage in project cycle (late timing of EIA and lack of considerations of alternatives); limited capacity of EIA practitioners and appraisal department; weak capacity of line ministries; weak EMP; limited use of guidelines; limitation in application of scoping; limited public involvement and information disclosure; no legislation for monitoring; limited legislation of SEA; double system for two different approval processes of international funding agency and national government	Strengthening of technical skills of consultants; measures to increase pool of consultants; capacity building and resource strengthening within the government; increased enforcement of requirements for independence of appraisal authorities; improvement and dissemination of technical guidelines; strengthening of monitoring and inspecting authority; frequent monitoring and enforcement of financial incentives; expansion of public participation; improvement of screening criteria; clarification of use of SEA; consideration of socio-economic issues; requirements for alternatives analysis and cumulative impacts; clarification of requirements for timing and frequency of compliance monitoring

Appendix 1. (Continued)

ASEAN (Roque 1985)	Lack of basic knowledge and data and shortage of expertise; inadequate trained manpower and institutional shortcomings for compliance	Proposal of ASEAN model based on constraints of limited data and knowledge
Philippines, Korea, and Brazil (Lim 1985)	EIA for only a small number of projects; rare consideration of alternatives; no integration of EIA into planning processes; limited authority of the review agency; insufficient conscious of the intention of EIA. Philippines: Despite the well-structured procedures, the EIA system is not fulfilling the objectives; the problem of arbitrariness (review process and public participation); bureaucratic red tape; reluctance to integrate EIA into planning processes; a low level of accountability; deficiencies in data management; inappropriate monitoring mechanisms; a lack of manpower. Korea: a lack of technical expertise; absence of public view; lack of time for review process; EIA only for large-scale public projects. Brazil: a shortage of financial resources and manpower of EIA authority; lack of established rules; EIA for a very small number of projects which have significant impacts	The status of the review agency must be raised; the environmental concern of responsible agencies should be stimulated; procedural rules for EIA must define clearly the roles of related actors and their interactions
The US, Korea, Malaysia, Philippines, and Thailand (Lowry and Carpenter 1985)	Low government level of EIA authority; difficult participation in policy formulation and decision making; EIA not to cover the private sector investment	The EIA procedure generates and distributes more information about government activities and opens up the decision-making process to more diverse groups. Coordination of natural systems management is fostered by EIA process
Asia and the Pacific (ESCAP 1988)	Lack of adequate information, shortage of manpower, lack of expertise; shortage of qualified staff, lack of technical guidelines, insufficient information; lack of analytical capabilities, shortage of administrative resources, lack of institutional arrangements; lack of review, monitoring and enforcement powers (p. 4)	General (seminars, use of mass media, create environmental units in line ministries, coordination, information exchange, SEA, research, regional cooperation); EIA procedures (IEE, scoping, information, qualified experts, monitoring, public involvement); technical aspects (scientific basis, ecology, community and society, simulation/modeling, research, database, a team of experts); manpower (training, information exchange, ESCAP initiative) (p. 14-15)
Pacific and Southeast Asia (Brown et al. 1991)	Lack of skilled and experienced manpower; lack of suitable data and standards; inadequate political resolution; poor communication across sectors; limited resources and limited environmental mandates; inappropriateness of western impact assessment models; opposition from developers; limited public participation including NGOs; lack of EIA legislation and associated administration; lack of baseline data	Training; educating decision makers; developing relationship between environment and sector agencies; public participation; role of NGOs; EIA policy framework; legislation, administration and enforcement; screening and scoping; prediction and evaluation; sharing experience

Appendix 1. (Continued)

Philippines, Indonesia, and Sri Lanka (Smith and Wansem 1995)	Administrative framework (compliance and enforcement not strict enough; information not developed or distributed adequately; effectiveness of EIA systems not evaluated regularly); institutional needs (EIA authority too centralized; inadequate environmental career opportunities; inadequate funding; NGOs too weak); guidelines (lack of adequate technical and procedural guidance materials; inadequate dissemination of existing guidance materials); coordination (lack of adequate interagency coordination and cooperation mechanisms); monitoring and management plans neglected or not effectively enforced; timing, purpose and legal effects of public participation varied; overall deficit of trained and experienced environmental professionals; lack of physical resources (laboratories, data centers, monitoring devices); lack of baseline data (p. 13-30)	Facilitate public participation; make information available to the public; clarify participants responsibilities; provide training for all participants; link EIA to developing planning, programming and policy-making; collect and manage environmental data; link EIA to project permitting and licensing; prepare clear, concise EIA reports; create an EIA network; conduct EIA demonstration projects (p. 33-37)
Asia (Lohani et al. 1997)	Poor enforcement of EIA legislation; low status of EIA agencies; a shortage of qualified EIA practitioners; time pressures to quickly review the detailed EIA reports; lack of public participation; low quality of EIA reports; EIA at a late stage (p. 2-30)	Introduction of SEA; improvement in screening and scoping, EIA report quality and review, and environmental monitoring; inventories and database of best EIA practices; development of technical guidance; environmental information system; public participation and dispute resolution; EMP and monitoring; capacity building (p. 13-1)
Thailand, Indonesia, and Malaysia (Boyle 1998)	The low level of political and business support for EIA; low status of EIA agencies; lack of interagency cooperation; reluctant public participation; limited access to information; culture influence on ineffective implementation of EIA	No recommendations
Asia (Alshuwaikh at 2005)	Insufficient staffing, experience and monitoring, with evaluation inadequate and without enough baseline data; lower priority to environmental assessment; limited public involvement; lack of implementation capacity; lack of transparency, public participation, unified standards and clear implementation procedures for EIA	Use of SEA; training and research; public participation including the public and NGOs; simplified SEA procedures; extension of cooperation
East Asia and Pacific (World Bank 2006)	Weak enforcement; late implementation; insufficient consideration of alternatives; weak public consultation; lack of information disclosure	Early implementation; analysis of alternatives; public consultation; information disclosure; coordination between governmental agencies; allocation of separate budget for EIA; incorporation SEA; international assistance; enhancement of public awareness; training and capacity building
Africa Cameroon (Alemagi et al. 2007)	Inadequate baseline data; procedural flaws in scoping; absence of an appeal procedure in the EIA process; unclear proviso; incompetent personnel and over centralization of powers in the EIA review; constraints to effective public participation; inadequate education and training; lack of indicators to measure the progress towards ecological sustainability; exorbitant administrative fees	The need for indigenous knowledge; creation of a central databank; scoping guideline for sector specific projects; provision for appeal; decentralization of power; consistency in the use of certain proviso; communication and public consultation; capacity building and monitoring; reduction of administrative cost
Cameroon (Kengne et al. 2013)	Shortcomings in public hearing legal and regulatory framework; language constraint; limited access to information; inconvenient location of reading rooms; no opportunity for direct debate and consensus-building; no feedback to participants	Provision of information; reporting public hearing reports to all stakeholders; increasing public awareness of environmental issues; working stakeholders together and sharing information; an increase in time for public comments; public hearing guidelines

Appendix 1. (Continued)

Ethiopia (Tekelemicha el 2003)	No law or regulation that applies to all proposed development projects; limits of guidelines in their applicability; shortage of trained practitioners; a late stage of EIAs undertaken	Adequate and useful public involvement; setting time frame for various stages of EIA process
Ethiopia (Ruffeis et al. 2010)	Institutional weakness; lack of environmental awareness, political will, experts and expertise, baseline data and information, legal binding list of projects, guidelines, public participation, monitoring and post-auditing, time to review process. EIA report quality, and SEA	Improvement of EIA law; regulations; integration of EIA into decision-making process; enforcement of law; decentralization of EIA process; requirement of a loan granted, accountability; database of baseline information; training of personnel; and awareness
Eritrea (Zeremarian and Quinn 2007)	Lack of legal provision for EIA; inadequacy of resources; failure to make the EIA findings a key aspect of decision-making; lack of formal provision for SEA	Training and continuing professional development; establishment of a sound legal basis for EIA
Gambia (Kakonge 2006)	Sound and fair legal framework and administrative structure; misunderstanding of screening; limited scoping; the same group in charge of decision-making and appeals; limited EIA expertise; weak capacity for enforcement; irrational categorization	Private-sector participation; promotion of public involvement; private and public sector partnership; education for EIA practitioners
Ghana (Appiah- Opoku 2001)	Ignorance of EIA and illiteracy; lack of EIA methods, scientific data, and baseline information; lack of funding; lack of environmental awareness; institutional problems; lack of experts	Use of indigenous experimental knowledge; involvement of local people
Lesotho (Kakonge 1997)	EIA is not mandatory (no EIA law); lack of political will and environmental policies and legislation; financial limitation; lack of local expertise	Institutional framework of EIA; training of staff; regional cooperation; public participation
Lesotho (Mokhehle and Diab 2001)	Insufficient consideration of alternatives; evaluation, mitigation measures; monitoring requirements; and review of EIA reports are inadequately addressed.	
Mauritius (Ramjeawon and Beedassy 2004)	Absence of monitoring; inadequate screening; poor public participation and access to information; absence of clear criteria for consultants registration; lack of transparency and accountability for reviewing EIA and granting EIA licenses; absence of SEA; lack of expertise and trained staff; no environmental management plan; no consideration of alternatives; lack of baseline data; high priority to economic impacts; lack of information in EIA reports; license conditions too general or almost impossible to comply with	EIA follow-up mechanism; impact prediction audit; environmental management plan report; sector guidelines; a copy of EIA report at local government level; three levels of screening projects; opening of recommendations and consent conditions to the public; site inspections and monitoring by EIA officers; proper monitoring plans; research of SEA; policy commitment of human resource development
Nigeria (Olokesusi 1992)	EIA is not a mandatory requirement (no EIA law)	Integration of EIA with development planning; early incorporation of EIA in the project cycle
Nigeria (Olokesusi 1998)	Insufficient enforcement of EIA law; obscurity of EIA law; limited public involvement; limited access to EIA information	Public access to all information; reduction of bureaucracy, project cost, and delay; enhancement of public involvement; good EIA practices

Appendix 1. (Continued)

Nigeria (Echefu and Akpofure 2003)	Too many regulators with similar and identical responsibilities	Harmonization and clear allocation of responsibility; effective compliance monitoring and enforcement; stiffer sanctions and penalties; more investment in capacity building; improving the quality of EIA report; databank and baseline data; a strong and continuous political commitment at the highest levels; public involvement; regional cooperation; process of accreditation; capacity building of NGOs
Nigeria (Ogunba 2004)	No substantial public participation; non-binding regulations on implementation of monitoring and audit; low EIA enforcement on public sector projects; rare examination of alternatives; non-qualified consultants; no comprehensive best practice technical guides; lack of laboratory testing and research abilities; multiplicity of designated authorities for the approval of EIAs (overlap between three EIA systems); exclusion of some projects from EIA process; no wide circulation of guidelines; no recognition of people's right to public hearing nor to object to development	Modification of EIA evolution as being more appropriate to the rather complex situation (simple method); only one approach; formulating procedural guidelines; introduction a multi-disciplinary aspect into consultancy
Sudan (Ali 2003)	No legislation and institutional aspects of EIA; lateness of the EIA in the project cycle; inadequate time allotted for completion of EIA; composition of the EIA team and qualification of team members; fate of the accomplished EIA	Legislation of EIA; qualified institutions and personnel; quality of EIA; manuals: finance support; research and training; public involvement; open competition by consultants; enhancement of Sudan experts capabilities; enough time for EIA; inclusion of social and economic issues
Uganda (Kahangirwe 2011)	Limited local community involvement due to misconceptions and lack of awareness of the EIA benefits among most developers, and fear of cancellation of proposed projects; lack of capacity to conduct environmental audits and enforcement; weak institutional linkages and political interference	Local community involvement at screening, scoping and EIS preparation
Zimbabwe (MacDonald 1994)	No considerations of alternatives and monitoring; limited involvement of local community; short EIA documents (low quality); EIA reports not comprehensive nor detailed; EIA not institutionalized into the planning process; no formal requirement; much needed economic development; too high financial costs of EIA; no availability of data nor expertise	Simple and different EIA approach different from industrial countries
Africa (Kakonge 1993)	Inadequate environmental legislation; inappropriate institutional framework for coordination; a shortage of qualified manpower; inadequate financial resources; absence of public awareness of the need for EIAs; lack of suitable screening procedures	The legal framework for EIA; institutional reforms; popular participation
Sub-Saharan Africa (Kakonge 1996)	Lack of consultation; lack of communication between government and local people; lack of legal framework; inadequate government capacity to foster public participation; lack of transparency; late preparation of EIA	Monitored, participatory communications strategy; ensuring equitable socioeconomic benefits from the project; development of a legal framework for EIA; incorporating EIA into the project's decision-making process

Appendix 1. (Continued)

Africa (Economic Commission for Africa 2005)	Capacity constraints (administration, review EIA reports, monitoring, follow-up on implementation of EMPs, inadequate staff in numbers and expertise); low quality of EIA reports due to lack of necessary skills, information and data; weak assessment of alternatives; very weak public participation (no access to express the public views, absence of post-decision communication to the public); weak enforcement capacity of EIA authority; the classification of projects based on subjective judgments; slow application of SEA	Develop and strengthen institutional, legislative and regulatory frameworks; framework of a sustainable development policy; enhancing environmental assessment and management capacity; capacity building; public participation; credible and trusted EIA systems; EMP and follow-up; effective linkages of EIA with other environmental safeguards; introduction of SEA
Kenya, Rwanda, and Tanzania (Marara et al. 2011)	Low autonomy of EIA authority; very weak public participation; weak expertise in conducting EIA; low availability of environmental professionals	Developers should integrate EIA earlier into the project design process; public participation in the process should also be improved (a campaign of education through media, inviting the general public through newspapers, use of local language, incentives to motivate the public)
Egypt, Ghana, Mauritius and South Africa (Bety and Godfred 2013)	Lack of enforcement and inconsistencies between legal requirement and actual implementation; highly centralized, understaffed, inexperienced and poorly funded authorities; shortage of qualified and certified EIA professionals and consultancies; limited scope of EIA coverage and poor integration of environmental concerns into planning and decision-making; incorrect costing and inadequate financing of mitigation plans and EMPs; a general lack of post-decision monitoring; difficult access to accurate information	Public participation; access to EIA reports; EMP; financing mitigation plans and EMPs; impact monitoring; content of EIA report; guidelines; cumulative and global impacts; social considerations; capacity building
Middle East Egypt (Wahaab 2003)	Lack of ability to review EIA reports; insufficient attention toward assessing cumulative impact; lack of resources and technical skills to follow-up and conduct inspection; weak EIA laws and regulations; low levels of public environmental awareness; basic social need overriding basic environmental considerations	Monitoring to secure mitigation measures; frequent inspection visit; developing of zoning maps and establishing emissions/effluent standards for ecological zones; introduction of SEA
Egypt (Badr 2009)	Ineffective review system (lack of technical skill, absence of review checklist, lack of review time for complete EIA report); inadequate baseline data availability; consideration of alternatives not addressed effectively; no legal requirements for public participation; not effective public consultation in practice; environmental aspects considered to some extent in the decision-making process; no mandatory requirements for monitoring; a shortage of well-trained EIA professionals	Capacity building; consultants accreditation system; effective public participation and access to EIA reports; EIS review system; promoting environmental awareness; coordination between related agencies; follow-up and site inspections; cumulative impacts; baseline data; certificate valid for 2 years
Lebanon (El-Fadel et al. 2000)	Increased bureaucratic; EIA process consistent with the guidelines of international agencies and not in accordance with specific needs; deficient public participation; weak public access to documentation; weak environmental management and monitoring; weak law enforcement due to lack of clarity in responsibilities and coordination as well as insufficient deterrent value; very limited resources and staffing; limited introduction of cumulative environmental assessment and strategic environmental assessment	Capacity building; review of laws, regulations and enforcement; redefinition of roles and responsibilities of each institution; comprehensive database; guidelines and models

Appendix 1. (Continued)

Syria (Haydar and Padiaditi 2010)	Unclear and weak legal provisions; start of construction prior to EIA approval; exclusion of government projects from EIA; superficial consideration of alternatives; no guidance on scoping; unsatisfactory quality of EIA reports; difficult implementation of monitoring due to the lack of adequate staff and resources; regulations not to guarantee effective public involvement; poor involvement due to lack of public awareness and familiarity; absence of SEA	Strengthening EIA integration into planning and decision making processes; quality of EIA; public participation; monitoring and mitigation measure
Turkey (Coşkun 2011)	Weak application about alternatives; insufficient practice about observation and auditing and assessing the cumulative effects; lack of public participation, data base, mitigation, SEA, integrated approach between EIA system and planning procedures, and commission members' qualifications; no transboundary EIA application	Improvement about reaching the environmental data, public participation, assessing the alternatives, observation and auditing, SEA, the quality of EIA reports, and guide documents
United Arab Emirates (Heaton and Burns 2014)	Specification of alternatives in design, integration of EIAs into final decision-making, monitoring, public consultation, and impact monitoring are weak	Integrate EIAs in decision-making; accuracy of future reports; better impact monitoring; more public participation
Egypt, Turkey and Tunisia (Ahmad and Wood 2002)	Weak interagency coordination; weak effectiveness of the public participation specified in the EIA regulations; limited practice of implementation of mitigation measures; inadequate review of EIA reports; weak public participation; no sector guidelines; lack of EIA training for project managers and technical specialists; weak coordination between donors	Implementation of mitigation measures; improving the review of EIA reports; strengthening public participation; diffusion of best practice; strengthening interagency cooperation; preparing user-specific guidelines; providing EIA training; international donor agency assistance
Middle East and North Africa (MENA) (El-Fadl and El-Fadel 2004)	Weak regulatory enforcement; lack of legal requirements for EIA components and report content; highly centralized, understaffed, inexperienced and low budget authorities; lack of specification of sector responsibilities and weak coordination; lack of explicit legislation and legislated environmental standards; inadequate coverage of EIA and poor integration of EIA into decision-making; general deficiency in sector and technical guidelines; absence of monitoring and formal provision for SEA	Establishing a legal basis; recruiting and training staff; creating review system and guidelines; quality of reports; licensing of consultants, integrated decision-making; improving cost-effectiveness; improving public involvement; devolution of authority to local government
The Gulf Cooperation Council States (Al-Azri et al. 2014)	Weak coordination between the regulatory authority and other planning and control bodies; lack of guidelines; lack of legal provision for SEA; lack of monitoring system and implementation; absence of EIA review approach; lack of public involvement	Develop sector and technical guidelines; implementing SEA; establishing EIA review criteria; assignment of independent bodies for review; development of monitoring system; improving coordination; strengthening public participation
Latin America		
Brazil (Fowler and De Aguiar 1993)	Low priority to environmental concerns; lack of information on ecosystem; extremely short time; inadequate monitoring; limited public participation	Professional training
Brazil (Glasson and Salvador 2000)	Centralization of EIA; deficient scoping; inadequate alternatives; weak and rare public participation; limited control of EIA approval; rare cases of monitoring; bureaucratic process; strong political influence; lack of skilled personnel, material resources and data	Decentralization; use of universities; public participation; database; mandatory scoping; EIS review; monitoring, introduction of SEA

Appendix 1. (Continued)

Colombia (Toro et al. 2010)	Insufficient number of personnel; screening process is not compulsory; insufficient guidelines; no weighting to biophysical and sociocultural factors; SEA not included; insufficient monitoring; no incentives to encourage the use of EIA; no insurance policies	More specific guidelines; improvement of EIS quality; precise criteria of projects subject to EIA; proposal of a generic EIA methodology; analysis of alternatives; follow-up and control; public participation increased; environmental insurance policy; economic incentives to encourage use of EIA
Mexico (Pisanty- Levy 1993)	Public involvement only after the authorities issue their decision; inadequate means to force the developers to comply with the mitigation measures; lack of sufficient and adequate trained personnel; inadequate review process	Revising regulatory guidelines; intensifying formal and informal training; opening channels of public involvement and information access; exempting projects that do not have significant adverse impacts
Whole developing countries		
Developing countries (Kennedy 1985)	Low level of public awareness; lack of comprehensive legal frameworks; lack of strong and well-organized institutions; a shortage of trained personnel; poor availability of data; financial constraints	Financing the project to finance EIA as well; paying most or all of the costs of an EIA performed largely by developing country personnel
Developing countries (Biswas and Geping 1987)	Single-discipline domination in project planning; limited practical experience; insufficient awareness on environmental impact; difficulty of keeping trained people in the public sector; lack of baseline data (p. 216)	No recommendations
Developing countries (Ebisemiju 1993)	Serious flaws in legislative, administrative, institutional and procedural frameworks; technical barriers including unfamiliarity with EIA concept, methodologies and techniques, shortage of staff with experience, and lack of baseline data; extremely poor performance outcome; no consideration of alternatives	Introducing EIA; institutional arrangements; integration of EIA in the project cycle; simple, cost-effective EIA methodologies and techniques
Developing countries (Wood 2003)	Weak legal basis of EIA; limited coverage of EIA systems; weak consideration of alternatives; weak screening; no public consultation at scoping stage; a lack of trained human resources and of financial resources; inaccurate baseline socio-economic and environmental data and difficulty to obtain; poor EIA report review due to staffing shortage; little or no effect on decisions; no tradition of consultation and participation; limited informal monitoring; uncommon use of SEA; high costs of EIA system than benefits	Training and capacity building in EIA; diffusion of EIA experience; appropriate donor EIA policy and integration of requirements; increased political will

Source: Compiled by the authors from the sources listed in this table.

Appendix 2. A sample, assessment methods, and factors influencing the EIS quality (16 documents)

Country and author	Sample and assessment methods	Factors influencing the EIS quality
United Kingdom (Lee and Brown 1992)	83 EISs between 1988 and 1991; assessed using the Lee and Colley review framework (Lee and Colley 1990)	Regulations; the size of project; EIS length; the experience and use of consultants; quality improvement over time; bias within EISs
United Kingdom (Lee and Dancey 1993)	40 EISs between 1988 and 1991; assessed using the Lee and Colley review framework (Lee and Colley 1990)	The size of projects; EIA experience; EIS length
United Kingdom (Glasson et al. 1997)	50 EISs of pre-1991 and post-1991; assessed using the Lee and Colley review framework (Lee and Colley 1990) and European Union checklist (CEC 1993)	Project size, consultant and local authority experience, EIS length
United Kingdom (Hickie and Wade 1998)	14 EISs of flood and costal defense projects; assessed using the UK review system	Communication of information; standardized procedures and formats; a review system; the environmental action plan
European countries (Barker and Wood. 1999)	112 EISs between 1990 and 1996; assessed using the Lee and Colley review package (Lee and Colley 1992)	The legal requirements for EIA; the experience of the proponent, the consultant, and the competent authority; the existence of scoping; the length of the EIA report and cost of the EIA; the nature and size of the project
United States (Tzoumis and Finegold 2000)	19,236 draft EISs from 1970 to 1997; the rating scales used by the U.S. Environmental Protection Agency (EPA)	Very little learning from previous years of DEIS preparation in information quality; documents are not of higher quality now than in the past; no sharing information and resources for DEIS preparation
Greece (Cashmore et al. 2002)	72 EISs between 1991 and 1999; assessed using the Lee and Colley review package (Lee et al. 1999)	The nature and characteristics of a project; the length of an EIS; the use of consultants; the nature of the project proponent
United Kingdom (Badr et al. 2004)	50 EISs of 17 from the early period and 33 from the late; assessed using the Lee and Colley review package (Lee et al. 1999)	Improvement over time; EIA legislation; complexity of the task (lack of scientific rigorous in impact prediction, data availability); comparison with other disaggregated studies; differences between development types
Portugal (Pinho et al. 2007)	13 EISs of small hydropower projects between 1990 and 2003; assessed using various methods	The regulations and technical guidance; the EIA process; the institutional arrangements, the financial resources and the technical skills; environmental awareness of proponents; public involvement; type and size of project
United States (Tzoumis 2007)	1,732 draft EISs from 1998 to 2004; the rating scales used by the U.S. EPA	Training to DEIS preparers; review ratings; better monitoring of DEIS ratings

Appendix 2. (Continued)

South Africa (Sandham and Pretorius 2008)	28 EIS; assessed using the Lee and Colley review package (Lee et al. 1999)	The long history of voluntary EIA practice [experience]; the preponderance of small EIA projects [size]; the guidance provided; a lack of political will; limited research; EIA practitioners not being independent from developers
Estonia (Peterson 2010)	50 EISs between 2001 and 2005; assessed using the EC guidelines (EC 2001)	Individual and groups of reviewers
Egypt (Badr et al. 2011)	45 EISs between 2000 and 2007; assessed using the Lee and Colley review package (Lee et al. 1999)	Length of the EISs; the use of consultants
Bangladesh (Momtaz and Kabir 2013)	30 EISs between 1990 and 2008; assessed using the Lee and Colley review package (Lee and Colley 1992)	Shortage of study time; inadequate baseline data and access to data; attitude of consultant and proponents; lack of EIA experts; defective service procurement process; lack of adequate funds; weak TOR; EIA team
South Africa (Sandham et al. 2013)	26 EISs between 1997 and 2011?; assessed using the Lee and Colley review package (Lee et al. 1999)	Flexibility; accreditation; training, improved guidance; continuing research
Cambodia (Chanthy and Grünbühel 2015)	39 EISs between 2007 and 2011; assessed using a combination of the Lee and Colley review package (Lee et al. 1999), the EC guidelines (EC 2001), and others	Legislative procedure to assess the completeness and quality of EISs; political influence by local elites; limited time and access to baseline data for assessment; limited consultants' experience; financial constraints; no serious regard of or trust in consultants by the proponents

Source: Compiled by the authors from the sources listed in this table.

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Abstract (in Japanese)

要約

環境影響評価が途上国に導入されて 30 年以上が経過するが、その実践は不十分と指摘されている。1985 年から 2016 年間の途上国の環境影響評価をレビューした 82 文献を定量テキスト分析し、環境影響評価実践の制約要因と提言を分析した。2000 年前後で環境影響評価報告書の質が制限要因とする率がほぼ倍増した。本研究では、制約要因を解決するために環境影響評価報告書の質に着目することを提案した。なぜなら、報告書は環境影響評価システムの成果品であり、有効な環境影響評価システムの基礎的指標であるためである。また、報告書の質データを統計分析し、質に影響を与える決定要因を明らかにすることを研究手法として提案した。これらの要因が、証拠を示した上での具体的な提言となりうる。今後の研究として、途上国で作成された報告書の質の評価と、具体的な提言を示すための質のデータ統計分析の必要性を指摘した。



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