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Indicators and SEA: Chinese and European Experiences and Guidance

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Abstract: Indicators are widely used in SEA to measure, communicate and monitor impacts from a proposed policy, plan or programme, and can improve the effectiveness for the SEA by simplifying the complexity of both assessment and presentation. Indicators can be seen as part of the implementation process helping to understand, communicate and, integrate important environmental issues in planning and decision-making. On the other hand, use of indicators can also limit SEA effectiveness, if the ones chosen are biased or limited, if the aggregation gives incorrect interpretation and if the information requirement for different target groups is not addressed.

The paper firstly considers Chinese experience with use of indicators in SEA and secondly presents a comparative study of national systems and guidelines. The study takes a point of departure in the Chinese system, and compares this to Great Britain and Denmark. Great Britain represents a centrally guided SEA indicator system, while Denmark represent a SEA tradition with no formal indicator system in place.

The paper explores and identifies the challenges and opportunities in using indicators in Chinese SEA: insufficient in indentifying the social and economical issues; difficulties in practice due to the low availability of data and availability of information. There is space for improving the Chinese SEA system especially when it comes to treating and using indictors in a process as well as in communicative perspective.

Developing indicators is both a political and professional process, and the paper finally discuss the need of selection criteria mentioned in the guidelines, and also gives some ideas on how to tackle the development of indicators being explicit about it both as a political and a professional process.

Introduction

The main purpose of SEA is to facilitate systematic consideration of potential environmental impacts in strategic decision-making and ensure the consequences are fully included and appropriately addressed at the earliest stage of decision-making possible (Partidario M, 1999, Lee and Walsh, 1992; Therivel *et al.*, 1992; Sadler and Verheem, 1996). One of the means for achieving this is the use of indicators as a tool for measuring and representing environmental conditions, predicting impacts and for monitoring.

Indicators can be a useful tool by which the complex impacts and relationships arising from a given policy, plan or programme can be measured and presented more simply. The questions of how inclusive the indicator system will be in relation to environmental, economic and social indicators should be addressed as should how to find the appropriate level of aggregation. Developing and designing indicators also raises the question of participation, not only by the general public but also from experts and decision makers.

The criteria for indicator selection is challenging as the indicators used in SEA "…will affect what baseline data are collected, what predictions are made and what monitoring system are set up. Poorly chosen ones will lead to a biased or limited SEA process…" (Therivel,2004). Developing indicators in

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SEA is a complex task and with still more SEAs being applied around the world, there is a growing need to establish appropriate indicators that facilitates that objectives and targets of the SEA, be addressed properly facilitating informed judgments of decision makers regarding policies and programmes.

Appropriately selecting indicators and their level of aggregation appropriate for SEA can be part of ensuring that the effective application and promotion of that the results of SEA being better integrated into decision-making. Developing an indicator system is the first step in the process of simplifying SEA. The next step is communicating of how to use indicators in planning and decision-making. Indicators thus should pave the way for an easier implementation process providing the practitioners, the public and the decision makers an appropriate instrument to ensure a more effective and neutral SEA. Studies of the implementation process of SEA have so far only provided sparse understanding of how indicators influence implementation and thus the role of SEA in planning and decision-making.

This paper focuses on Chinese experiences on applying indicators and what opportunities and limitations this brings to the SEA process. First the indicators in SEA is presented and discussed. Secondly, a documentary analysis of national guidance in China, Great Britain and Denmark is presented and discussed. This analysis describes the different indicator systems and their experiences with their use in SEA are briefly touched upon.

Indicators, decision-making and SEA

An indicator is a measure used to illustrate and communicate complex phenomena in a simple way) (EEA, European Environment Agency, 2005). The IETF (Indicators for Evaluation Task Force, IETF, IJC) emphasise the technical aspects of using indicators: "*An indicator provides a clue to a matter of larger significance or makes perceptible a trend or phenomenon that is not immediately detectable. It is a sign or symptom that makes something known with a reasonable degree of certainty. It reveals, gives evidence, and its significance extend beyond what is actually measured to a larger phenomenon of interest.*" (IETF, IJC, 1996). According to EEA (2005) communication is the main function of indicators by promoting information exchange regarding the issue they address. Communication demands simplicity while indicators always simplify a complex reality by providing information about phenomena that are typical or critical. They focus on certain aspects which are regarded relevant and on which data are available. But their significance goes beyond what is obtained directly from the observed properties. The political aspect is also raised: "*In the environmental field indicators are being used in an increasing number of instances as tools to maintain an updated understanding of the condition of the environment and therefore provide the possibility of better political steering.*" (Kørnøv L. and Hvidtfeldt H., 2003)

In the process of communicating to decision makers and the public, "*indicators provide information in a more quantitative form than words or pictures alone… a simpler, more readily understood form than complex statistics or scientific data"(*Hammond A. et al 1995*)*. They point to that indicators improves information communication about progress toward goals with two characteristics, 1) it quantifies information so its significance is more readily apparent; 2) it simplifies information about complex phenomena to improve communication.

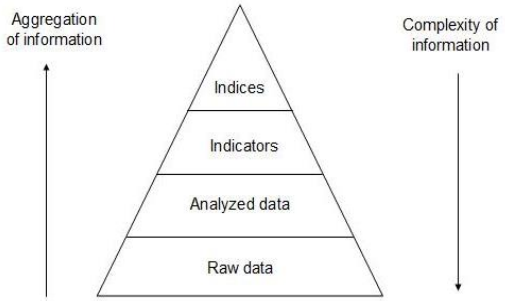

Figure 1 The information Pyramid (Hammond A., *et al*, 1995)

The relationship between information and indicators can be shown as an information pyramid. Indicators and highly aggregated indices are at the top of the pyramid, and the basis is primary data and analyzed data (See Fig. 1). Indicators represent an empirical model of reality, not reality itself, but are analytically sound and have a fixed methodology of measurement.

Indicators and decision-making

Indicators are indispensable to decision makers as they provide aid in both a direct and indirect way. In the decision-making process, indicators are used for three major purposes: 1) to supply information to enable decision-makers to make better, well-informed decisions; 2) To support policy development and priority setting by identifying key factors important to environment or society and; 3) to monitor the effects of policies, plans and programmes in responses to the impact thus also raising public awareness on environmental issues (EEA, 1999).

Based on the quantity of information incorporated in the individual indicator a distinction can be made between three types of target groups contributing to the decision-making process. These are illustrated in Figure 2 and covers:

- ***Scientists and researchers*** who are most interested in raw data that can be analyzed statistically. They prefer high information load per message conveyed;
- ***Decision makers*** who prefer data that are related to policy objectives, evaluation criteria's, and target and threshold values. The information should be condensed to a fairly small load per indicator;
- ***The public*** who is assumed to prefer a seemingly unambiguous message, free of redundancy and as a single bit of information (Braat L., 1991).

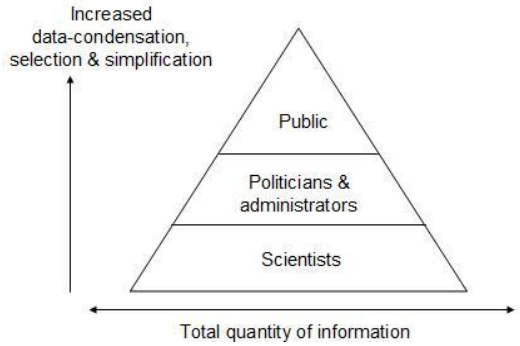

Figure 2 Relationship between aggregation level of indicators and the user hereof (Braat L. 1991)

This classification of relevant stakeholders is also found to be of relevance within the SEA community (Therivel, 1996). The role of the different target groups and their different needs for indicators are also in focus in the characteristics of successful indicators in decision-making processes presented by Hammond A. et al (1995). They argue that indicators must be *user-driven*, being useful to the intended users by conveying meaningful information in an understandable form. Indicators should also be able to reflect the goals to be achieved, i.e. *Policy-relevant* and thus pertinent to these concerns. Thirdly indicators should not just be technically relevant, but also at their *highly aggregated* level of integration be easily interpreted in terms of environmental or societal trends or progress toward policy goals; - and being so few in numbers that decision makers and the public readily accept them.

A profusion of indicator systems - relevance for SEA?

To date many sets of indicators have been developed. The OECD has been one of the main actors over the past 15 years with the core set of environmental indicators reflecting the main environmental issues in OECD countries and the key environmental indicators served for informing the general public and provide key signals to policy-makers (Donnelly A, *et al*, 2007) . The related activities in EU started in 1990s and were speeded up after the European Council activities with Environmental Policy Integration (EPI) in Cardiff in 1998 (EEA, 2005). The European Environment Agency has also

developed a core set of environmental indicators, which provide a manageable and stable basis for EEA reporting, also being used in other European and global indicator initiatives (EEA, 2005). Each indicator set are based on different criteria's or covers different geographical areas. Table 1 lists a selection of relevant international environment-related indicator sets.

Table 1 International environmental indicator sets Overview (EEA, .2005)

Targets	Indicators
Eurostat's Sustainable Development Indicators (SDI), 2002	A set of sustainable development indicators related to the EU sustainable development strategy.
OECD's different sets of environmental indicators	OECD key environmental indicators (KEI) OECD core environmental indicators (CEI) OECD agriculture-environment indicators OECD energy-environment indicators OECD transport-environment indicators OECD sustainable household consumption indicators
UN Commission on Sustainable Development (UNCSD)	A list of 134 SDI related to Agenda 21 including economic, environmental, social and institutional was launched in 1996. A core set consisting of 57 indicators was proposed in 2001.
WHO Environment and Health (EH) Indicators	A set of environment and health indicators for EH monitoring in EU countries was identified in 2003. Pilot study was started on the feasibility of 45 indicators in EU Member States in 2004.
European Common Indicators	A European common set of local sustainability indicators with 10 indicators comes from a joint initiative from the EC (Environment DG) and EEA.

The existence of this large number of indicator sets is not stopping new and local indicator from being developed. In relation to SEA most countries prefer to develop their own approaches or sets of indicators instead of adopting one of those already globally accepted.

In their study of how to select environmental indicators for SEA Donnelly et al. (2006) found that the existing sets of indicators at EU, national and local levels would be useful in providing important data sources and methodologies for indicator set development, however, in practice their use in SEA are still limited. For example, not all sectors or environmental media required in SEA are covered by existing indicator sets. So it might be hard to simply transfer current available information to SEA. There is thus a need to develop indicators specifically for the SEA process. In the meantime SEA practitioners should be encouraged to develop or compose their own indicator sets that are specific to proposed PPPs by concentrating on relevant and significant issues targeted in the scoping phase of SEA (Donnelly et al., 2006).

Appropriateness of indicators for SEA

The difficulties in establishing useful indicators stem largely from the complex multidimensional nature of the environment and society, which can be impacted at multiple scales (Scholes and Biggs, 2005). There are also practical difficulties in measuring and collecting data on these indicators.
For impact assessment specifically Cloquell-Ballester *et al.* (2006) points out that currently the main problem in supporting decision-making is how appropriate indicators are in ensuring high objectivity. To address this, the authors suggest that indicators should be validated and accepted beforehand by all participants and stakeholders.

Kurtz et al (2001) made a review of the technical guidelines made by US EPA (Environmental Protection Agency) in order to evaluate how indicators contributed to the monitoring programmes. They showed that the guidelines functioned as framework for addressing questions about indicator

selection and also provided direction for research on indicator development. Although this study was not related to SEA directly it could however be an inspiration to SEA on how to organise the guidelines in the following four phases: 1) conceptual relevance; 2) feasibility of implementation; 3) response variability, and 4) interpretation and utility. The authors also points to that the applicability or effectiveness inge whether an indicator is acceptable vis-à-vis the objectives and resources in the specific programmes.

After reviewing the current studies addressing the relation between indicators, SEA and decision making, the methodology for exploring opportunities and limitations of using indicators in SEA is presented in the next paragraph, including the analysis of national SEA guidelines.

Methodology

To indicate the opportunities and challenges for using indicators in the Chinese SEA system, this paper makes a comparative study of China and two European countries, Denmark and United Kingdom respectively, which all have quite similar laws, regulations and guidance's on SEA.

The comparison is based upon a documentary study of national guidelines in the three countries and analyses and discusses their different performance seen in relation to the legislation and technical guidance or requirements for making indicators in SEA.

There is no specific guideline for the use of indicators in the SEA process in China. This paper analyses *Technical Guidelines for Plan Environmental Impact Assessment* (2003, hereinafter referred to as the *Technical Guidelines*) which was launched on 1st Sep. 2003 by the former State Environmental Protection Administration (now named Ministry of Environmental Protection of China) and the *Chinese Plan Environmental Impact Assessment Regulations* which was launched on 1st Oct. 2009 by Ministry of Environmental Protection of China. Plan-EIA as called in China is equivalent to an SEA. The aim of this documentary study is to find out the official basis for using indicators in SEA on the level of regulations as well as the technical requirements as formulated in the guidelines.

Reason for comparison and cases

The reason for choosing Denmark and United Kingdom (UK) as case countries is to put the Chinese SEA system and experiences into perspective. UK is characterised by a centrally guided environmental assessment system. This is illustrated by the proactive role the central administration has taken in developing guidelines for SEA and the use of. The characteristics of the UK system are: A comprehensive and stringent national guidance in relation to both SEA and sustainability appraisal; High aggregation level of indicators and a broad scope regarding sustainability.

In sharp contrast to the British system is the Danish SEA system. Denmark represents a case with the characteristics: Limited national guidance only involving examples of which indicators to use and how, low aggregation level and a narrow focus in relation to sustainability with a strong emphasis on the biophysical environment. China stands between these two approaches.

Chinese experience with use of indicators in SEA

The *Environmental Impact Assessment (EIA) Law* (The standing committee of the national people's congress, People's Republic of China, 2003) was put into force on 1st Sep. 2003 in China. As the starting phase of SEA, Planning-EIA in China collected some experiences by being practiced within a number of cases. This has formed the basis for the recent *Planning-EIA Regulation* that came into force 1st Oct. 2009.

As a multi-dimensional tool, by which the impact of implemented policies and plans can be measured, indicators are used widely in Chinese SEA. In order to ensure the objectivity and effectiveness of SEA, the *Technical Guidelines* suggests a procedure for how to identify indicators that can guide the SEA

practitioners in selecting indicators. Figure 3 shows this procedure recommended in *Technical Guidelines*.

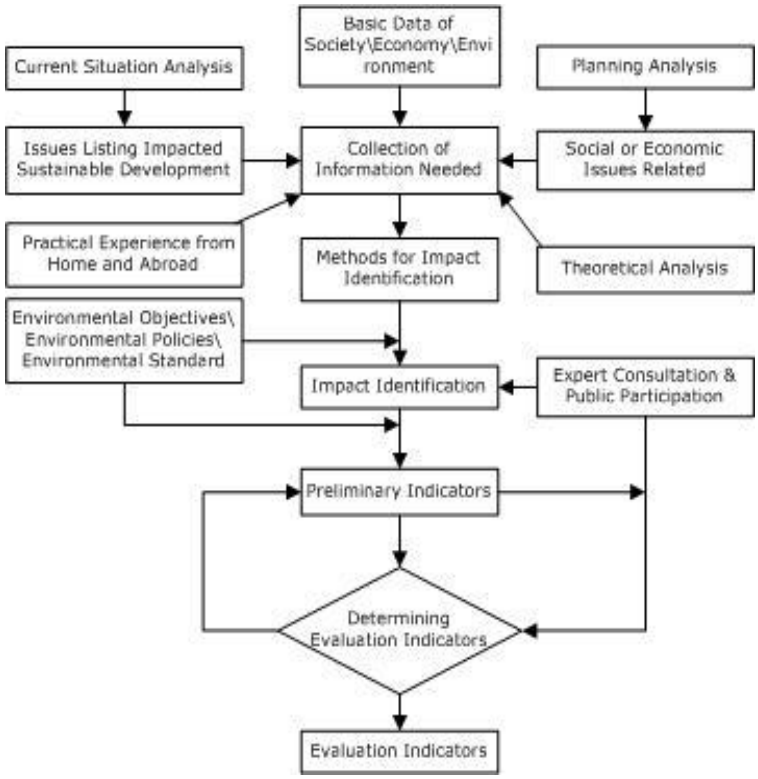

Figure 3 Flowchart for Indicators Identification Process in the Chinese System (According to Technical Guidelines for Planning-EIA in China, 2003)

In order to identify the potential impact, requirements and recommendations are made for deciding a list of indicators. The *Technical Guidelines* lists environmental objectives for plans on different levels or for different sectors where SEA is used. Based on these objectives, the *Technical Guidelines* gives a recommended list for which indicators to use in the assessment process (Table 2). The selection and use of indicators in the Chinese SEA process reflects the special concern for sustainable development in current Chinese policies.

Table 2 Recommended Indicator List according to the *Technical Guidelines for Planning-EIA*

Sub-system	Targets	Indicators
Environment	**Water capacity**	Water Quality and Purity
	Water quality	Reuse of Industrial Water
	Air quality	Quality of air
		Emission of SO2
	Land use efficiency	Land Reclamation
	No limit values exceed	Coastal water quality
	Waste use	Treatment of waste
		Recycled industry waste
	Meet national or regional targets	Urban public green space per capita
Economic	**National / regional development goal**	GDP Growth
		Income per capita
	Industrial Structure	Industrial growth
Nature Resources	**Local water resource capacity**	Water Quota
		Water Reuse Rate
	Added-value per unit water	Irrigation Efficiency
	Added-value	Energy consumption
		Natural gas usage
	Per unit energy	Area with central heating
Social	**Public**	Participation of public

concern	Education on environment

Several Chinese scholars have studied the Chinese SEA system. Most of the research on SEA in China has though focused on the concepts and theory (Che et al., 2002), the legal requirements, key elements and procedures (Zhu et al., 2001), while no study on the use of indicators Chinese SEA has been published in English.

The principles for classifying and selecting indicators for SEA were discussed in Bao C et al (2001) and they proposed a method for indicator selection and how to use weighing of the indicators. In a case study on SEA of Chinese Energy development, the authors recommended an indicator system for the Chinese energy strategies. According to Zhao W.J et al (2003) the current research on SEA focuses on the question "how to assess" while the indicator is about the question "what to be assessed". Indicators are useful for addressing these priorities and thus for stimulating the public to participate in SEA. Their framework for selecting and using indicators in SEA is based on the Driving Force-State-Response (DPSIR) model.

In another case study made by Guo H.L et al (2003) on a Regional Plan, they also points out that the DPSIR model is very useful in simplifying the complex relationship between human society and the environment system thus providing a basic framework for indicator use. Contrary to this Fan H.B and Zhou J.X (2008) points out that the DPSIR framework is not perfect because of its oversimplification of cause-effect chains of reality, since the reality is much more complex than assumed here. So the indicators based on the DPSIR model should be adjusted according to the context of the SEA to improve the effectiveness of indicators. So an integrated assessment calls for more studies on the inter-relationships of indicators. Likewise the ***Technical Guidelines for Planning-EIA in China (2003)*** are too general to guide the practice without giving any guide on indicator use for more specialized plans such as a Watershed Plan. Guo H.L et al (2003) also points out that most indicator studies in SEA has been limited and only on a general level using a general framework without much guiding for the practice in China so foreign experience cannot be transferred directly in China due to the differences in context.

Comparative Study

The comparative study between China and two European countries (Denmark and UK), indicates the challenges for using indicators in the Chinese SEA system. The study analyses and discusses their different performance from the perspective of legislation, technical guidance and/or requirements for choice and use of indicators. Table 3 gives a brief review of this comparison.

Table 3. Brief review of legislation and guidance on indicators use for SEA in China, Denmark and Great Britain

	China	***Denmark***	***Great Britain***
Law/ Regulation	The EIA Law, 2003; Planning-EIA Regulation, 2009	Act on environmental assessment of plans and programmes. (No 936 2009) (The Ministry of Environment, 2009) Statute on environmental assessment of plans and programmes (No. 1102, 2009) (The Ministry of Environment, 2009)	Policy Appraisal and the Environment, 1991. (Department of the Environment, 1991)
Guidance /Guideline	Technical Guidelines for Plan EIA, 2003	Guidance on environmental assessment of plans and Programmes, 2006 (Ministry of Environment, 2006) Best Practice Collection, 2007 (Ministry of Environment, 2007)	Planning Policy Guidance Note 12 (PPG12), 1992 (The Department of the Environment,1992) Development Plans and Regional Guidance (DoE

			1992) (The Department of the Environment,1992) Policy Guidance Note 95/1 Strategic Environmental Assessment (SNH 1995) (Scottish Natural Heritage, the Scottish authority for nature conservation, 1995)
Use of indicators required	Formally required by Technical Guideline	No formal requirement - Informally confined	No formal requirement - Informally promoted
Number of indicators presented	No comprehensive indicators list on general level; 6 different sets recommended for specific plans with numbers varying from 17-53	None Examples of 46 environmental objective representing diffuse and low aggregated indicators	46 examples of SEA indicators. In addition comes a large number of indicators in other guidance of relevance for SEA
Guidance related to indicators' use	1. A procedure for indicators identification. 2. A recommendation list for the indicators used in different levels and sectors.	1. Indicators are presented as an option for baseline study, impact assessment and monitoring	1. Setting environmental targets and carrying capacity 2. It suggests using response indicators to show how response to environmental problems rather than pressure or state.

From the perspective of legislation and guidance, China issued the related laws and regulation almost in the same period as Denmark, while UK issued its Guidance on SEA already in 1995.

The three countries have guidance in place for SEA, and for China and UK the guidance generally covers the use of indicators in SEA practice. The UK guidance, contrary to the Chinese, pays more attention to the process and communicative side of the use of indicators.

In the Danish and UK SEA system indicators are not formally required. However, the two countries show big differences in the use of indicators. The Danish system, through its limited use of indicators as an instrument in SEA and its limited reference to indicators, is in practise confining the use of indicators. The Danish guidance mention indicator 5 times and only in relation to 'monitoring' and 'setting up local goals for environmental assessment':

> *"To make sure monitoring in itself will not be a very comprehensive task, it is important when setting the monitoring program to select as few and simple indicators as possible and preferable building upon information from already existing monitoring programs." (Ministry of Environment, 2006, 24)*

> *"For each environmental objective indicators can be selected, which are measures of an environmental issue over time and space. Indicators can typically be used when environmental baseline shall be described and monitored. Goals and indicators can be used, when environmental impacts are assessed." (Ministry of Environment, 2006, 30)*

The wording chosen emphasizes that the choice of indicators is optional at all, and a minimalistic approach when they are used in the SEA process on which and how many indicators to select.

The British guidance, 'A Practical Guide to the Strategic Environmental Assessment Directive', is in contrast to the Danish case informally promoting the use of indicators although the use is not mandatory. The guidance mentions indicators 69 times and gives extensive information on developing

SEA objectives and related indicators. The information includes 46 examples of indicators related to the concept of environment put forward in the EU Directive, but at the same time stating that "Responsible Authorities wishing to cover the full range of sustainable development issues in their assessments are free to broaden the scope of the assessment to include social and economic effects of their plans and programmes in addition to environmental effects." (Office of the Deputy Prime Minister: 2005, p. 20). The comprehensiveness in relation to sustainability and use of indicators is supported by an extensive list of sources for indicators and explicit guidance on how to develop and use indicator in the different stages in the SEA process.

In China, The technical guidelines itself is a recommended one, which means it is not legally formal, but can be said to be technically formal. It has been a standard criterion for Chinese SEA practice, and it is common that SEA cases are evaluated against this guideline on the evaluation stage by the experts committee. According to the technical guidelines, indicators are formally required to be used in SEA process and have to be described in the final report; however, there is no formal requirement for which indicators to use and how to do it:

> *"The main content of in the impact assessment part are…setting up environmental objectives, targets and both qualitative and quantitative indicators…" (Technical Guidelines for Planning-EIA, 2003, p. 3)*

> *"Based on the identification of potential impact and environmental targets, according to national and international experience, indicators should be selected…"(Technical Guidelines for Planning-EIA, 2003, p. 5)*

The guideline does not give a comprehensive list of indicators list instead; it gives 6 different sets for 6 specific kinds of plans mentioned in the appendix:

1. Region Development Plan 27 indicators
2. Land Use Plan 19 indicators
3. Industry Plan 31 indicators
4. Agriculture Plan 17 indicators
5. Energy Plan 19 indicators
6. Urban Plan 53 indicators

And most of those indictors listed in the appendix are related to environmental target, natural resource and sustainability, very few the concern the social and economy aspects. Beside most of them are single indicators which can only provide limited information, and very few are comprehensive or integrated.

Analysis on Chinese Technical Guidelines also shows that indicators are seen as an essential part in the SEA process in China. The underlying reason might be that currently decision-making in planning strongly depend on the information included and even behind the indicators used in a SEA:

> *"The description for at least 9 parts (scoping, PPPs description, environment baseline, impact assessment, alternatives and immigration, experts consult meeting and public participation, monitoring and follow-up evaluation, difficulties and uncertainty, implementation) should be included in the final SEA report, in which the scoping part should describe clearly the ….environmental objectives and assessment indictors…" (Technical Guidelines for Planning-EIA, 2003, p. 12)*

A general recommendation from the analysis of the national guidance is a lack of explicit reflection on the challenges in identifying suitable indicators for SEA and how it influence the process and its outcome. This is also related to the politics embedded in the use of indicators in SEA.

Discussion - The politics of indicators

Developing and using indicators is both a political and professional process. The professional process is related to the technical components like e.g. cause-effect relationships, data aggregation and data availability. The political process, be it either formal or informal, is related to the question whether to use indicators or not, which indicators to use and who is going to be involved in this part of the SEA process. The political process is based on personal and political values potentially influencing the effectiveness of SEA, hereunder the communication and the use of SEA by different stakeholders involved in the SEA.

One example from the three cases is the Danish Guidance in which it is underlined explicit that the use of indicators is not mandatory and if used – they need to be few, simple and based upon existing knowledge. From the political side it is emphasised that the central administration needs to economically compensate the local authorities' part of their SEA work if indicators is required. The reasoning behind this attitude though remains invisible.

Another example of politics of indicators is the British guidance in which openness towards stakeholders is emphasised as important:

> *"It may be useful to develop SEA objectives, indicators and targets in consultation with the Consultation Bodies and relevant stakeholders, and review them in the light of baseline information and any problems identified." (Office of the Deputy Prime Minister, 2005, p. 29).*

The inclusiveness is also being supported by Cloquell-Ballester et al. (2006) and Kurtz et al. (2001) arguing that the complexity in choosing and using indicators require different actors to be involved in the process. They hereby indirectly touch upon the politics of indicators.

The Chinese Technical Guidelines also suggest who should be involved in the decision-making on indicators. Besides the SEA team, the external experts and the public are encouraged to participate in the indicator selecting, while there is no description implying to what extent they will give impact on the final list:

> *"Based on …theoretical analysis and national and international experience, indicators should be selected by taking the results of external experts consult meeting and public participation into consideration, adjust it if necessary during the assessment." (Technical Guidelines for Planning-EIA, 2003, p. 5)*

The Chinese and British SEA guidelines are suggesting an inclusive selection process and thereby indirectly recognise that knowledge production through indicators in SEA is also a political process. A general note to the national SEA guidelines is though that indicators are presented in a way in which they apparently seem certain and objective. This lack of explicit discussion of norms and the implication related to indicators in assessments is also discussed by Rametsteiner et al. who in a case study of sustainability indicator development processes found that "…political norm creation dimension is not fully and explicitly recognized in science-led processes" (2009). The risk is that the knowledge of subjectivity and uncertainty involved in selection and use of indicators is not explicitly presented and discussed. The politics of indicators, and biased attention they generate, is thereby not fully recognised and tackled.

Conclusion

As indicators become widely used in Chinese SEA, it is increasingly important to critically examine how they are produced and how the focus of knowledge they create is affecting decision-making. By comparing Chinese experience in using indicators in SEA with the European countries, this paper explores its challenges and opportunities. By the documentary and comparative study, the paper analyses the indicators in SEA from political and professional perspectives. Regarding the professional aspect, experience from Great British is, with an intensive SEA indicator system, they

encourage including social and economic effects of PPPs in addition to environmental effects. From the political perspective, numerous indicator lists and complex process in selecting implies its lack of economic consideration. In contrast, Denmark gives an example in complexity controlling regarding indicators in SEA by strongly informally limiting the use due to resource considerations. The Danish case is clearly exemplifying the politics involved in the process of selecting and using indicators in SEA.

When comes to China, currently there is strong demand from decision-making for the use of indicators in SEA to provide condensed information. There are though several challenges related to this. Firstly, from the professional perspective, most indicators recommended and currently used reflect environmental concerns and insufficiently indentifying the social and economical issues. As a result of which, the conclusion provided by SEA hardly support its original aim i.e. integrating environment into development. Secondly, to a certain extent, SEA practitioners have flexibility in indicators selection, so how to avoid experts' bias? How to deal with the difficulty in practice due to the data and information availability? To answer these, a criterion is needed to guide the indicator selecting and use in China. Lastly, from the political perspective, there is potential for guidance to explicitly and transparently deal with both the scientific and political process – and thereby both the knowledge production and norm creation involved in selection and using indicators in SEA.

References

Bao C, Lu Y. Study on the establishment and verification of indicator system for strategic environmental assessment. Shanghai Environmental Sciences. 2001;(20) 3: 113-115.

Braat L. The predictive meaning of sustainability indicators. In research of indicators of sustainable development (Kuik, O., Verbruggen, H. (eds)), 59-60. Kluwer Academic Publisher. Dordrecht 1991.

Che, X., Shang, J., Wang, J. (2002). Strategic environmental assessment and its development in China. Environmental Impact Assessment Review, 22, 101–109.Cloquell-Ballester V-A, Monterde-Diaz R, Santamarina-Siurana M-C. Indicators validation for the improvement of environmental and social impact quantitative assessment. Environ Impact Asses Rev 2006;26: 79-105.

Chinese Plan Environmental Impact Assessment Regulations. Ministry of Environmental Protection of China, 2009.

Department of the Environment. 1991. Policy Appraisal and the Environment, London: HMSO.

Donnelly A, Jones MB, O'Mahony T, Byrne G. Decision support framework for establishing objectives, targets and indicators for use in SEA. Impact Assess Proj Apprais 2006b;24(2):151–157.

Donnelly A, Jones MB, O'Mahony T, Byrne G. Selecting environmental indicator for use in strategic environmental assessment. Environ Impact Asses Rev2007; 27: 161–175.

EEA. EEA core set of indicators, Guide. EEA Technical report: No. 1/2005; 2005.

EEA, European Environment Agency. Environmental indicators: Typology and overview. Technical report No 25, 1999.

The standing committee of the national people's congress, People's Republic of China, The Environmental Impact Assessment Law, 2003.

Fan H.B, Zhou J.X. Framing Indicator System of Strategic Environmental Assessment, A Case of Watershed Planning. Environmental Science and Management. 2008;33(11): 191-194.

Guo H.L, Huang Y.Y, Ma W.C., Yu Q., Chen L.M. A Study on the Indicator Systems for Strategic Environmental Assessment. Journal of Fudan University (Natural Science). 2003;42(3): 468-475.

Hammond A., A. Adriaanse, E. Rodenburg, D. Bryant and R. Woodward. Environmental indicators: a systematic approach to measuring and reporting on environmental policy performance in the context of sustainable development. Washington D.C. World Resource Institute. 1995.

IETF. Indicators for Evaluation Task Force. IJC. International Joint Commission. Indicators to evaluate progress under the Great Lakes Water Quality Agreement, International Joint Commission, Canada/USA, 1996.

Kurtz J, Jackson LE, Fisher WS. Strategies for evaluating indicators based on guidelines from the Environmental Protection Agency's Office of Research and Development. Ecological Indicators. 2001;1:49–60.

Kørnøv L., Hvidtfeldt H. The Danish experience of Strategic Environment Assessment. In Environmental Assessment of Plans and Programs: Nordic experiences in relation to the implementation of the EU directive 2001/42/EC (Tuija Hilding-Rydevik), 33. Nordregio, Stockholm, 2003.

Lee N, Walsh F. Strategic Environmental Assessment: an Overview. Project Appraisal 1992; 7(3):126-136.
Ministry of Environment, Denmark. Act on environmental assessment of plans and programmes, 2009.
Ministry of Environment, Denmark. Best Practice Collection,2007.
Ministry of Environment, Denmark, Guidance on environmental assessment of plans and Programmes, 2006.
Ministry of Environment, Denmark. Statute on environmental assessment of plans and programmes, No. 1102, 2009
Office of the Deputy Prime Minister, ODPM, Scottish Executive, Welsh Assembly Government and DOE Northern Ireland. A Practical Guide to the SEA Directive, 2005.Partidario M. Strategic environmental assessment-principles and potential. In: Petts J, editor. Handbook of environmental impact assessment. Environmental impact assessment-process, methods and potential, vol. 1. Oxford: Blackwell; 1999.
Rametsteiner, Ewald, Helga Pülzl, Johanna Alkan-Olsson and Pia Frederiksen. Sustainability indicator development—Science or political negotiation? Ecological Indicator. 2009. In press.
Sadler B, Verheem R. Strategic Environmental Assessment: Status, Challenges and future Directions. Ministry of Housing Spatial Planning and the Environment, The Hague, 1996.
Scholes, R.J., Biggs, R. (2005). A biodiversity intactness index. Nature, 434, 45–49.
Scottish Natural Heritage, the Scottish authority for nature conservation. Policy Guidance Note 95/1 Strategic nvironmental Assessment (SNH 1995), 1995.
SEA-Directive: Directive 2001/42/EC of the European Parliament and of the Council of 27 June 2001 on the assessment of the effects of certain plans and programmes on the environment. Official Journal L 197/30 of the European Communities of 21.7.2001.Technical Guidelines for Plan Environmental Impact Assessment (2003). Ministry of Environmental Protection, China.
Thérivel, R. (2004). Strategic Environmental Assessment in Action, 276. Earthscan Publications, London.
Therivel R. The practice of Strategic Environmental Assessment. London: Earthscan Publication Ltd. 1996.Therivel, R., et al. (1992). In: Strategic Environmental Assessment. Earthscan Publications, London.
The Department of the Environment. Planning Policy Guidance Note 12 (PPG12), 1992
The Department of the Environment, Development Plans and Regional Guidance (DoE 1992), 1992.
The standing committee of the national people's congress, People's Republic of China, Environmental Impact Assessment Law, 2003.
Zhao W., Dong D., Long Z., Wang X., Jiang B. Study on the Framework of Indicator System for Strategic Environmental Assessment. Scientia Geographica Sinica. 2003;(23) 6:751-754.
Zhu, T., Wu, J., Chang, I. (2005). Requirements for strategic environmental assessment in China. Journal of Environmental Assessment Policy and Management, 7 (1), 81–97.