Building Back Greener

Assessing the Potential of Environmental Management Systems in Disaster Reconstruction

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While reading up on financing, management and assessing disaster relief and recovery, it happens that I get lost in the numbers, in the methodology and the framework. Remembering that behind all examples and cases in this context are very real human beings, and is very real human suffering is very humbling. Therefore I dedicate my thesis and all its work to the victims of the Nepal earthquake who are at the moment struggling with many of the things mentioned in this thesis.

Abstract

Environmental problems commonly occur in the aftermath of natural disasters. If not managed properly, they jeopardise the success of the entire recovery process. The humanitarian sector has realised this threat and is looking for ways to properly mitigate environmental problems while maintaining their necessary flexibility. The conventional industry broadly uses environmental management systems (EMS) like ISO 14001 to manage their impacts. This thesis aims to assess the potential of ISO 14001 in disaster reconstruction.

To this end, it first identifies the environmental problems and their underlying causes. Then it analyses the requirements of ISO 14001 to identify opportunities and barriers for implementing the standard. Based on this, it discusses the overall feasibility and effectiveness of ISO 14001 in disaster reconstruction.

The result of this research is that ISO 14001 has the potential to be an effective tool for improving the environmental impacts in the humanitarian sector. Its effectiveness depends however strongly on the quality of the implementation in the field and the context of the disaster. Its feasibility is reduced by a lack of donor support and questionable buy in by the field staff. Thus, it only seems interesting for larger organisations with stable funding and pre-existing environmental expertise.

Further research opportunities include a more practical evaluation of ISO 14001, as well as assessing the potential of other environmental management tools from the conventional industry in humanitarian emergencies.

Keywords: Disaster Management, Environmental Management, ISO 14001, EMS, Construction

Executive Summary

A single natural disaster can take the home or livelihood of millions in only a few minutes. The international community has in the past gone great lengths to improve the speed and quality of emergency aid for the affected populations. The environment is however a field that is often overlooked during the response. Lacking consideration of environmental issues can lead to significant problems in disaster recovery, such as delays, health hazards, or increased vulnerability to new disasters. The humanitarian sector recently became more aware of this problem and is looking into ways to make disaster recovery more sustainable in the long term.

The conventional industry has developed several tools to facilitate better environmental care over the past decades. The environmental management system (EMS) ISO 14001 is among the most popular ones. It aims to facilitate continuously improve an organisation's environmental performance by integrating environmental management into existing management structures. It consists of five main elements:

1. Developing an environmental policy
2. Identifying environmental aspects and developing objectives to address them
3. Implementing procedures to control environmental impacts (incl. communication, documentation, risk reduction, etc.)
4. Monitoring and evaluating the environmental aspects, correcting non-conformities
5. Regular management reviews to keep the system updated

Aim

The main aim of this thesis is to explore the potential of EMS in disaster reconstruction. To this end, it is first necessary to identify the environmental problems occuring in disaster reconstruction and their underlying causes. Then the requirements of an EMS (at the example of ISO 14001) need to be analysed in the light of the special circumstances of disaster reconstruction, to identify opportunities and barriers for implementing the standard. Finally, the appropriatenss of EMS is discussed, considering the findings from above.

Thus, the research questions (RQ) for this thesis are:

1. How are environmental problems managed in disaster reconstruction?
2. What are the main opportunities and barriers for implementing ISO 14001?
3. When can ISO 14001 be beneficial in disaster reconstruction? What could it look like?

Structure and Methodoloy

The first chapter introduces the background, scope and methodology of the thesis. In chapter two, common frameworks of humanitarian aid are introduced and, based on a literature review, the problems in environmental management are identified (see RQ 1).

Chapter three introduces ISO 14001 and the P-D-C-A-methodology. In chapter four, a new methodology is developed for analysing the opportunities and barriers of ISO 14001 in disaster reconstruction. It assesses each element of ISO 14001 according to its feasibility and effectiveness, as the two basic elements needed for facilitating improvement (RQ 2). This is based on a literature review and expert interviews.

Chapter five uses a feasibility/effectiveness-matrix to discuss the appropriateness of ISO 14001. The P-D-C-A-Framework is then used again to develop proposals for an efficient implementation (RQ 3). Chapter six summarises the outcomes and gives recommendations.

Main findings and recommendations

This thesis finds that EMS can be an effective tool for improving the environmental impact of disaster reconstruction. Its effectiveness depends however strongly on the quality of the implementation in the field and the context of the disaster. ISO 14001 also requires resources that most humanitarian organisations are not willing to invest.

Thus, ISO 14001 does not seem suitable for braod implementation under the current circumstances, however, more practical research is encouraged to further explore the potential. In the following the findings of each RQ are presented in more detail.

How are environmental problems managed in disaster reconstruction?

The most severe environmental problems in disaster reconstruction are the handling of disaster debris, raw material extraction, water and sanitation solutions, waste management, and sustainable livelihoods. Mitigation measures exist and have been applied in several cases, but are not mainstreamed among humanitarian organisations.

The underlying reasons for not including the environment more consequently in recovery projects have been investigated by several studies and found to be

1. lack of an overarching management framework,
2. lack of accountability concerning the consequences of environmental degradation
3. lack of environmental monitoring and evaluation
4. lack of sufficient donor pressure to integrate the environment in project planning

A short analysis of different environmental tools indicated that EMS may offer solutions to deal with these underlying reasons. The focus is then narrowed down on ISO 14001, as the most popular EMS.

What are the main opportunities and barriers for implementing ISO 14001?

The main opportunities are:

1. Better early recognition and integration of environmental aspects can be achieved through ISO 14001. These elements should already exist, however often seem not to be implemented by project management. An EMS can help facilitate their integration.
2. External material, such as environmental trainings, are freely available. Currently, they are however not fully taken advantage of due to time pressure and a lack of awareness. ISO 14001 can create a structured approach to make optimal use of available materials
3. Structures for monitoring and evaluation already exist, which would save resources when implementing environmental monitoring and evaluation.

The main barriers are:

1. Lack of donor and top management support is central. As long as donors do not require more environmental care, there is no 'business case' in investing in improving an organisation's environmental performance.
2. The increased amount of paperwork and bureaucracy necessary can reduce the field staff's willingness to adopt the EMS, which would render implementation ineffective.
3. Environmental stewardship is often more an issue of cross-organisation coordination between many different projects in the same area, than of inner-organisational management. In this case, ISO 14001 looses a lot of its effectiveness.

When can ISO 14001 be beneficial in disaster reconstruction? What could it look like?

This thesis investigated ISO 14001 from the points of feasibility and effectiveness in order to analyse whether this tool can generate improvement. Comparative criteria such as efficiency were outside the scope. Therefore it can only be assessed whether EMS have potential in the humanitarian field, not whether they are the most appropriate solution (best value for money).

The feasibility of implementing ISO 14001 seems currently rather low. Donors are not engaged in increasing pressure to implement environmental care, and field staff is not interested in adding the bureaucratic tasks to its agenda. Advantages pale in comparison (e.g. cheaper implementation through existing materials and structures; opportunities to generate funding through eco-DRR-projects).

The effectivity of ISO 14001 is good in theory, as it has the potential to tackle some of the underlying reasons why the humanitarian sector struggles with environmental issues. The success depends however on the quality of the implementation and the disaster context.

Considering both feasibility and effectiveness, it seems currently difficult to introduce ISO 14001 broadly in the humanitarian sector. EMS can however be an option for organisations that want to become environmental leaders in the sector. They should have secure access to funding and pre-existing expertise in environmental issues. Good candidates would be the implementing organisations of national development agencies such as GIZ (Germany), SIDA (Sweden), or USAID (USA).

If an organisation would decide to implement an EMS, some things should be considered:

- The scope should include the supply chain, and the entire life-cycle of the house
- Maximise the benefit from using external documents (GRRT, QSAND, PDNAs)
- Keep bureaucracy needs to a minimum (it should not significantly increase the share of time field staff is spending on paperwork)
- Environmental monitoring and evaluation should be integrated as far as possible into the existing structures (choose indicators with monitoring costs in mind)
- The management review should include results of evaluations right after the project, as well as long-term reviews on the environmental quality in host locations years later.

Recommendations and further research possibilities

At the end of this research, three questions for further action emerge:

1. What can happen to improve the frame for environmental care in recovery?
   Donor organisations should improve their standards concerning environmental care and provide more money for capacity building. Field staff needs to maintain an open mind for innovation and new ideas and technologies.

2. Can the mainly theoretical results of this thesis be confirmed in praxis?
   Further research on EMS in the humanitarian sector is encouraged. It should focus on practical approaches (e.g. in-depth case studies of reconstruction projects, reviews of the structure of specific organisations and their potential to implement EMS, etc.)

3. Are there othter (more efficient) tools for environmental management?
   The opportunities and barriers of other environmental management tools should also be assessed. This includes e.g. environmental markers, charters, and standards for corporate responsibility (ISO 26000). Both in-depth studies of individual tools and comparative studies could ad important knowledge to this sector.

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Abbreviations

ALNAP	Active Learning Network for Accountability and Performance in Humanitarian Action
AMEM	Alternative Model for Environmental Management
ARC	American Red Cross
CEP	Country Environmental Profile
DaLA	Damage and Loss Assessment
DfID	Department for International Development (United Kingdom)
DG ECHO	European Commission's Humanitarian Aid and Civil Protection department
DG DEVCO	Directorate General: Development and Cooperation
DRF	Disaster Recovery Framework
DRR	Disaster Risk Reduction
EC	European Commission
EIA	Environmental Impact Assessment
EFA	Environmental Field Advisor
EMAS	Eco-Management and Audit Scheme
EMS	Environmental Management System
ENA	Environmental Needs Assessment
EPA	Environmental Protection Agency (USA)
ESR	Environmental Stewardship Review

FEAT	Flash Environmental Assessment Tool
FEMA	Federal Emergency Management Agency
GFDRR	Global Facility for Disaster Reduction and Recovery
GIZ	Society for International Cooperation (Germany)
GRRT	Green Recovery and Reconstruction Training Toolkit
HPC	Humanitarian Project Cycle
IASC	Inter-Agency Standing Committee
ICRC	International Committee of Red Cross/Red Crescent Societies
IFRC	International Federation of Red Cross/Red Crescent Societies
IPCC	International Panel on Climate Change
ISO	International Standardization Organisation
JEU	Joint Environmental Unit
KfW	Bank for Reconstruction (Germany)
LCA	Life-Cycle Assessment
NGO	Non-Governmental Organisation
MEAL	Monitoring, Evaluation, Accountability and Learning
PDCA	Plan, Do, Check, Act
PDNA	Post-Disaster Needs Assessment
Pers. Comm.	Personal Communication
QSAND	Quantifying Sustainability in the Aftermath of Natural Disasters
REA	Rapid Environmental Assessment
RQ	Research Question
SIDA	Swedish International Development Cooperation Agency
SME	Small- and Medium-sized Enterprises
SRC	Spanish Red Cross
UN	United Nations
UN-ECLAC	United Nations Economic Commission for Latin American Countries
UNEP	United Nations Environmental Programme
UNHCR	United Nations High Commissioner for Refugees
UNISDR	United Nations International Strategy for Disaster Reduction
UN OCHA	United Nations Office for the Coordination of Humanitarian Affairs
USAID	United States Agency for International Development
USD	United States Dollar
WASH	Water, Sanitation & Hygiene
WFP	World Food Programm

1 Introduction

This chapter aims to provide the reader with background information on the topic, to demonstrate its relevance and to set the frame and focus points of the thesis. It starts with presenting the environmental challenges connected to humanitarian aid. It then introduces the ISO 14001 standard as a possible tool to overcome these issues. Furthermore, research questions are defined, and the scope and possible limitations are set. Last, it defines the target audience and introduces the structure of the thesis.

1.1 Background

Natural disasters cause great suffering and unimaginable destruction. According to the latest World Disaster Report, more than 1 million people were killed over the past decade in natural disasters, with direct economic damages amounting to more than USD 1.6 trillion. 90% of the casualties of disasters were accounted for in developing countries, making them exceptionally vulnerable to extreme events (IFRC, 2014).

Besides the sudden shock, disasters have far reaching implications on the long-term development of the impacted communities: man-made and natural resources are destroyed, eliminating livelihood, shelter and access to basic services such as clean water or basic health care for entire regions. Disaster vulnerability is a threat to sustainable development, and the damages caused by natural disasters are continuously increasing (IFRC, 2014). While there is no clear trend in the physical intensity of disasters in the past (Pielke et al., 2008), it is likely that meteorological disasters will increase in strength in the upcoming years due to climate change (IPCC, 2012). Higher damages are also caused by population increase and settlements in flood-prone areas (Pielke et al., 2008).

Every year around USD 10 billion are spent on mitigating the consequences of natural disasters (Jowett, 2010). This money is spent to rescue and take care of affected people and to help the communities to rebuild their settlements, regain livelihood, infrastructure and a dignified life. This activities often blend into development cooperation. Disaster recovery – the phase after the immediate emergency, which facilitates a region's way back to 'normality' – is often neither the core focus of humanitarian, nor of development aid and thus particularly under-researched (Lettierei et al., 2009) and under-funded. Many challenges are connected to disaster recovery. For example, the beneficiary community is often not being involved enough in the planning and implementation, which may lead to culturally unsuitable solutions or to the so-called 'dependency syndrome' where beneficiary communities can't get back to sustain life on their own (Lyons, 2009). Sometimes old vulnerabilities to natural hazards are simply rebuilt, which often means that the community is even more vulnerable to disasters than before (Shaw, 2014). In many cases, the recovery from the disaster is simply not sustainable.

Environmental sustainability is hereby an important factor. In the post-disaster context, when the pressure to act is high, it becomes difficult to consider environmental issues. This can cause plenty different problems during the reconstruction efforts. If sanitation facilities (e.g. septic tanks) are not considered sufficiently, waste water may pollute clean water resources, causing health hazards (e.g. Haiti earthquake 2010). When aid organisations equip coastal villages with new fishing gear, to restore their livelihood, size and technology of the gear need to be considered in the light of the threat of overfishing and a depletion of the fish stocks a couple of years later (as happened after the 2004 South-East Asia Tsunami). Other examples

include deforestation for housing reconstruction, which can lead to water pollution, loss of livelihood and increased flood risk; poor siting for new settlements can lead to human-wildlife conflicts; inappropriate building materials for the local climate can lead to raw material depletion (e.g. through excessive heating demands, frequent need for replacement, etc.).

The problem of environmental sustainability in disaster recovery has recently gained more attention in the field and in academia. Humanitarian organisations (e.g. IFRC or Oxfam) developed disaster recovery tools in which environmental issues find consideration. Examples include the development of rapid environmental impact assessments (REA), sustainability guidelines (green procurement, sustainable reconstruction, etc.), or training sets for green reconstruction activities (Green Recovery and Reconstruction Toolkit by the American Red Cross and the WWF). Nothing the less, recent studies still point to a lack of environmental mainstreaming in humanitarian aid (Barret et al., 2007; UNEP & UN OCHA, 2014).

The conventional (not disaster related) industry has plenty of experience with environmental problems. Before the 1990s, corporate environmental management was mainly seen as a cost factor, not able to provide benefits. Over the past decades however, many companies realized that by following up the flow of their materials and energy, or by assessing their risk factors for accidents and leakages, they could gain better control over their processes. That way, they can become more energy efficient and thus reduce consumption and costs. Environmental management systems (EMS) were introduced to guide companies in developing a culture of awareness and improvement. The most popular scheme worldwide became ISO 14001. Its aim is to continuously improve the environmental performance of an organisation through increased control over processes and activities. The standard is designed flexible so that any kind of organisation should be able to implement it (ISO, 2004).

The context of disaster management is very different from the context of conventional industries. However, many management tasks and problems encountered may be the same in both sectors. Therefore it should be worth investigating whether tools developed by the conventional industry, such as ISO 14001, can be used to help improving the environmental performance, and ultimately the overall effectiveness, of disaster recovery. To properly assess this, both the practical and theoretical background of disaster recovery and the conventional industry need to be evaluated, and the special needs of disaster recovery must be emphasized and properly accounted for in a potential approach to implement such a tool.

1.2 Problem Definition

Disaster management is a very challenging field of activities with many cases where decisions need to be taken quickly. Enormous amounts of raw materials are needed for the reconstruction of housing and infrastructure (Good, 2010). The availability of these resources is already strained due to the impact of the disaster itself (e.g. uprooted trees, saltwater intrusion in freshwater resources, topsoil loss, etc.). Additionally, people in these live-threatening circumstances tend to fall back to extremely unsustainable behavioural patterns (e.g. illegal tree and mangrove cutting) (ICRC, 2009).

Under these circumstances, environmental degradation and subsequent problems for livelihood, health and disaster resilience often interfere with the recovery process of communities. This degradation does not only destroy potentially globally unique ecosystems, but also undermine the overall objectives of the disaster recovery. Initiatives on greening disaster recovery do exist, but little research was focussed so far on assessing the potential of environmental management tools from the conventional industry.

1.3 Research objectives and research questions

This thesis argues that environmental problems in the humanitarian sector and in the conventional industry have partly similar causes. The conventional industry has developed several tools to respond to these root causes, one of them being ISO 14001. Therefore, the aim of this research is to investigate the applicability of ISO 14001 in the humanitarian sector at the example of housing reconstruction.

To reach this aim, three research questions (RQ) are drafted as foundation of the thesis:

1. **How are environmental problems managed in disaster reconstruction?**

2. **What are the main opportunities and barriers for ISO 14001 implementation in disaster reconstruction?**

3. **When (under what circumstances) can ISO 14001 be beneficial in disaster reconstruction and what could an EMS in disaster recovery look like?**

All these research questions are descriptive in nature. RQ 1 reviews which environmental problems exist, what can be done to mitigate them and why those mitigation measures have not been taken up more widely. RQ 2 builds upon the answers from RQ 1 and subsequently analyses the strengths and weaknesses of ISO 14001 under the special circumstances of disaster management. RQ 3, using the results from RQ 2, discusses if and how ISO 14001 has a potential for implementation in this sector and gives suggestions for integrating the framework in disaster recovery. This way the three RQs step by step build a holistic picture of the applicability of ISO 14001 in the humanitarian sector, as stated in the main thesis aim.

1.4 Data collection and methodology

The data collection for this master thesis is relying on two detailed literature reviews and complementary expert interviews. The first literature review on disaster recovery involves academic literature on post-disaster developments, as well as guidelines and evaluations from humanitarian organisations. The second review will use guidelines for the implementation of EMS to explain the structure of ISO 14001. Academic literature and environmental reports, statements, etc. by major contruction companies will be used to assess the application and the drivers and barriers of ISO 14001 in the conventional construction. Interviews with practitioners of humanitarian assistance, both from the field, from central offices and from donor organisations, will be used to evaluate the practical reality of disaster recovery.

For its methodology, different frameworks are used throughout the thesis. In chapter two, common frameworks of humanitarian aid are introduced. Chapter three introduces the P-D-C-A-methodology used in ISO 14001. In chapter four, a new methodology is developed for analysing the potential of ISO 14001 in disaster reconstruction. It assesses each system element in the ISO 14001 standard according to its feasibility and effectiveness, as the two basic elements needed for facilitating improvement. Chapter five uses a feasibility/effectiveness-matrix to discuss the appropriateness of ISO 14001. The P-D-C-A-Framework is then (still chapter five) used again to develop proposals for an efficient implementation.

1.5 Scope and limitations

Generally, the thesis scope focusses on the situation in the developing world. Disasters strike everywhere and good disaster management is also a challenge in developed countries. There

however, it is often possible to enforce sufficient environmental care even in the aftermath of a disaster. Public capacity is strong enough to maintain order even after extreme shocks. Thus, the scope focuses on environmental problems encountered in the developing context.

The whole field of disaster recovery is not only very wide, but also highly fragmented (many different activities carried out by many different organisations at the same time), so the focus needs to be scoped down to a specific task. Reconstruction of housing is an appropriate choice for three reasons: (1) it often is the financially most voluminous part of disaster recovery (Lyons, 2009), (2) it is resource intensive and has plenty of environmental impacts to investigate, and (3) there are many ISO 14001 certified companies in the conventional sector, as a basis for comparison.

The scope is only focussed on environmental sustainability. Even though social issues (e.g. corruption, gender issues, etc.) are of great importance, they are not in the focus of this thesis. Performing a different analysis focussed on e.g. ISO 26000, a standard for corporate responsibility, might be a possibility for future research. The scope is also concentrated on EMS for mainly two reasons: (1) the methodology of EMS provides steps to solve some of the key barriers for environmental stewardship in disaster reconstruction, and (2) there is a research gap concerning the applicability of EMS in disaster recovery (for a more detailed discussion on why this thesis focusses on EMS as environmental management tool, see chapter 2.6 and Annex B). ISO 14001 is chosen as the most commonly used and internationally known EMS.

This research also has several limitations. It investigates the applicability of ISO 14001 from an academic perspective through comparing the frameworks and its theoretical application. Interviews with practitioners have been carried out to check the theoretic results towards their practicality. There is however a need for a more praxis-oriented evaluation of the topic before a final conclusion can be drawn. Since environmental issues are a fairly new topic in disaster recovery, this study maintained a general focus, not opting for including an in-depth case study. This can be a research opportunity for the future.

Another potential limitation is the use of a new methodology for analysing the opportunities and barriers of ISO 14001 implementation. This limits the comparability of the results with those from other studies. Follow-up studies using a different methodology might produce different results. It should also be mentioned that the grading of the system elements, despite being based on a profound literature review and several expert interviews, is not undisputable. Other studies, looking at different material and interviewing different experts, might produce different results for some of the system elements.

1.6 Audience

This thesis is directed towards professionals in the field of humanitarian aid and specifically disaster reconstruction. The two main target groups are the management staff at headquarters of larger humanitarian organisations and the project planners and managers in the field. Staff of major humanitarian donor organisations (e.g. European Commission), are invited to use this as input for their application requirements for financial support of reconstruction projects.

Furthermore, this thesis is directed towards academics working with humanitarian aid to contribute to further research in innovative ways of making disaster reconstruction more sustainable. Last but not least, environmental managers with interest in using and applying knowledge in new and unconventional fields are invited to take notice of this work as well.

1.7 Disposition

The thesis is structured in six chapters. Chapter one sets the frame for the thesis and introduces the reader to the background of the research. The second chapter consists of a literature review on disaster recovery and the environment. It will introduce the theoretical background of disaster recovery. It will then identify the most common environmental problems occurring in disaster recovery and discuss their underlying causes, taking into account both academic research and project evaluations. RQ 1 will be addressed in this chapter. In the end, chapter two will briefly analyse the potential of different environmental management tools for alleviating the barriers to better environmental care in disaster reconstruction.

Chapter three will present the ISO 14001 standard and how it has been adopted in the construction industry. It will first present the structure and the underlying philosophy of ISO 14001. Then it will review the common environmental issues in construction and their mitigation methods, as well as the drivers and barriers for EMS implementation.

Chapter four contains the analysis part of the thesis. It first compares the findings of chapter two and three. Then, it will analyse the differences between disaster reconstruction and conventional construction and evaluate their impact on the implementation of the standard. It will review the existing structures in humanitarian organisations and analyse how effective and feasible the implementation of the individual system elements of ISO 14001 would. Thus, this section will review the main drivers and challenges of the implementing ISO 14001, as stated in RQ 2.

Chapter five will then discuss the findings of chapter four. It will evaluate arguments in favour and against using ISO 14001 in the humanitarian sector. Building up from there, it will present a possible way of implementing ISO 14001 in disaster recovery projects, taking into account the specific challenges and demands of the sector (RQ 3). The sixth and final chapter will summarise the results of the analysis and discussion, conclude the major findings concerning the research questions and provide acting recommendations and opportunities for further research. Figure 1-1 presents an overview over the structure of the thesis

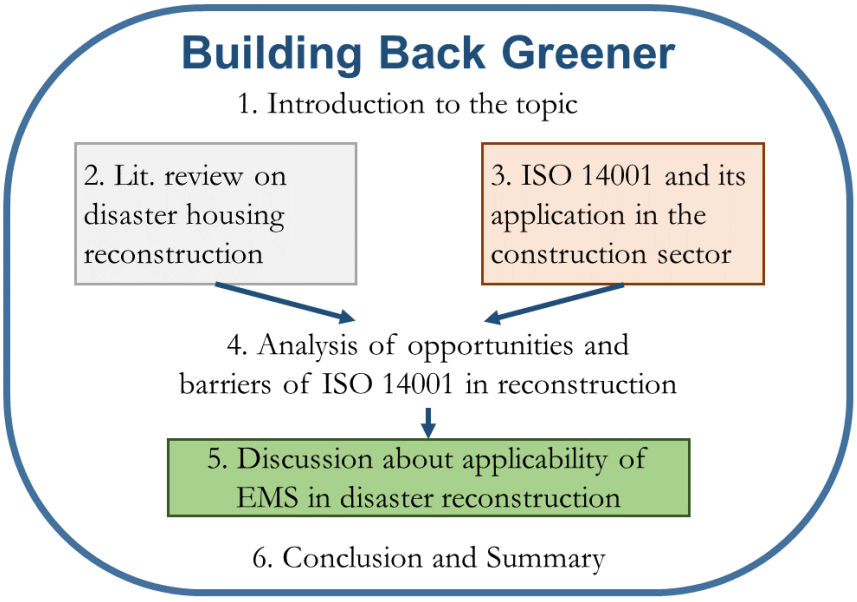


Figure 1-1: Conceptualisation of thesis structure

2 Disaster Reconstruction and its environmental impact

This chapter introduces the setting in which reconstruction after a natural disaster takes place. This includes disaster management in general and the tasks of disaster recovery in specific. After that, it will present the different tasks and phases of a reconstruction project and the environmental problems related to them, as well as mitigation strategies for these problems and to which degree these strategies are made use of. Then, based on several studies from the humanitarian sector, the thesis will review the barriers for better environmental stewardship in disaster reconstruction today. After that review, there will be a short, indicative analysis on which environmental management tool could mitigate these barriers.

2.1 The Disaster Management Cycle

The UN define a disaster as *"a serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources"* (UNISDR, 2007). Disasters can be divided according to their source. Different definitions have been used (e.g. Berren et al., 1980; de Boer, 1990), but the most commonly used typology is splitting disasters in technical (man-made) and natural disasters. The natural disasters are divided into five categories (1) biological disasters (e.g. insects), (2) climatological disasters (droughts, wildfires, etc.), (3) geophysical disasters (earthquakes), (4) hydrological disasters (floods) and (5) meteorological disasters (storms) (Below & Wirtz, 2009).

Disaster management is defined by the IFRC as "*the organization and management of resources and responsibilities for dealing with all humanitarian aspects of emergencies, in particular preparedness, response and recovery in order to lessen the impact of disasters*" (IFRC, 2015). That means preparing communities at risk for a disaster and, once it struck, minimizing the human suffering and supporting the community in rebuilding their lives.

The Disaster Management Cycle is a commonly agreed general theoretical framework for describing disaster management (Lettieri et al., 2009). It consists of three main phases: the first phase immediately after a disaster is the relief phase, in which the main priority is to provide rapid aid to those significantly affected by a natural disaster. The disaster recovery is the second phase, it is supposed to bring the disrupted area back to a regular, independent living situation. The third phase is disaster resilience, often split in two different phases – mitigation and preparedness. It aims at reducing the damage during the next disaster: mitigation through minimising a community's exposure (e.g. construction of dams), and preparedness through building local response capacity (e.g. evacuation plans) (see Figure 2-1).

Disaster relief (immediately after a disaster) often receives the most funding and academic interest. Over the past ten years, disaster relief has been significantly improved through measures such as pre-positioning of emergency supplies (Rawls & Trunquist, 2010), pre-negotiating deals with logistic companies (Kovács & Spens, 2007), or improved technological options, such as remote sensing (Trallli et al., 2005; Manoj & Baker, 2007). Spending for disaster resilience is still rather low, despite the European Commission estimates that every dollar spent on disaster risk reduction saves four to seven dollars in spending on relief and recovery (EC, 2014). The academic and practical attention to this topic is however growing, especially due to climate change adaptation. Disaster recovery is still under-researched (Lettieri et al., 2009; JEU, 2014; Shaw, 2014). Many tasks are in-between humanitarian and development work, not receiving the full focus of either. This thesis focusses on the reconstruction of permanent housing, which is one of the main tasks of disaster recovery.

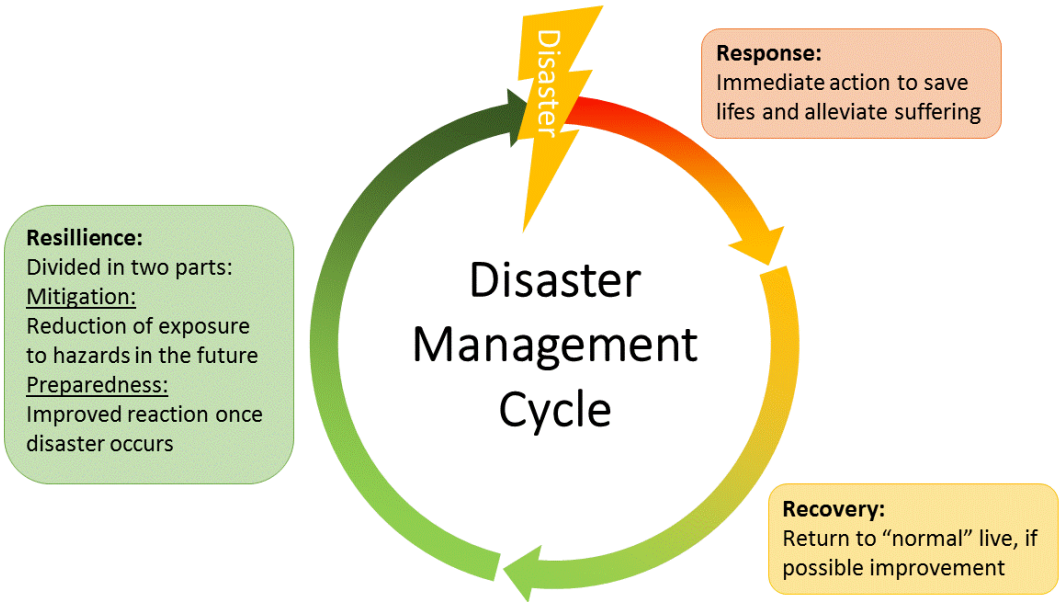


Figure 2-1 Disaster Management Cycle

2.2 Theoretical Frameworks and Concepts for Disaster Recovery

Disaster recovery is a difficult process with many tasks. Depending on the scale of the disaster and the availability of resources, the recovery process can take more than five years. With academic research on this issue being slim, this sub-chapter introduces different tools and concepts out of practical guidelines by platforms and actors in the field. It needs to be stated that there is no "one size fits all"-approach for disaster recovery. Every project needs its own considerations and has its own difficulties, depending on, for example, the type and scale of the disaster, the resources and capacities available, and the local context and the local needs.

2.2.1 Post-Disaster Needs Assessment (PDNA)

Most often the first step of disaster recovery is a post-disaster needs assessment (PDNA). A PDNA gathers information already during the relief operations to identify the overall amount of damage and to assess the financial resources needed for a full recovery in each sector (housing, livelihood, infrastructure, etc). It also presents the local context in which the recovery takes place and serves as a call for foreign funding from donor groups such as the World Bank or other countries (GFDRR et al., 2013). The PDNA is an essential part of disaster recovery, as it helps to make well-informed decisions from an early stage on.

The team conducting a PDNA usually consists of both local and international experts with multidisciplinary backgrounds, led by the national government of the host country. Once a team is set up, the first important task is to develop a baseline scenario of the pre-disaster conditions. After that, the damages and effects of the disaster can be assessed. Most often the DaLA-methodology (Damage and Loss Assessment) is used. Developed by UN-ECLAC in 1972 and since then continuously updated (UN-ECLAC, 2014), it assesses the direct damages and the indirect economic losses, e.g. through downtime of a production unit. For gathering data, usually site visits need to be conducted (due to time constrains, data needs to be extrapolated from an often rather small sample of site visits), but also modern technology can

be used for damage assessment, such as SMS surveys or remote sensing as used after the Haiti earthquake in 2010 (IFRC 2013).

Based on the damage assessment, the PDNA then estimates the funds needed for a full reconstruction, with separate estimations for each different sector. Usually this also contain a component for disaster resilience or development ("Building Back Better Factor"). Here it is also important to identify special challenges, such as conflicts in certain areas of logistical difficulties due to inaccessible areas. Finally, the PDNA indicates a strategy through prioritising different needs within each sector, for example through proposing re-settlements to reduce disaster risks (Government of Solomon Islands, 2014) or by promoting new agricultural technologies (Republic of Kenya, 2012).

Table 2-1 Differences between a PDNA and a DRF (Based on GFDRR 2014)

PDNA	DRF
One-off assessment	Flexible mechanism for recovery planning
Provides sector-based damage assessment	Builds up on PDNA
Prioritizes within sectors, with current capacity (non-dynamic)	Rigorous analysis on capacities and risks; criteria-based prioritization of issues
Preliminary overview over needs for recovery	Sustained engagement, helps transfer to normal

2.2.2 Disaster Recovery Framework (DRF)

Once the needs are established, the disaster recovery process can be planned. For guiding this process, the GFDRR developed a "Disaster Recovery Framework" in 2014. Other publications, such as the "Holistic Disaster Recovery"-guidelines by the Natural Hazards Center in the USA (Natural Hazards Center, 2005), the "National Recovery Framework" by the Federal Emergency Management Agency (FEMA, 2011), or academic case studies (e.g. Lyons, 2009; Ingram et al., 2006; Shaw, 2014) are covering similar issues, however with a more narrow focus (specific country or recovery issue). Therefore, much of the following analysis is based on the GFDRR's DRF guidelines. Table 2-1 is describing the differences of the purpose and characteristics of the DRF compared to a PDNA.

An important step in planning the recovery is clarifying roles and responsibilities. This can be done through a stakeholder analysis. A central stakeholder is the national government of the host country. Usually, it is the government's task to coordinate the overall recovery effort. Part of this is for example developing a master plan for urban development, or setting building codes and standards. Create a strong legal mandate is essential to enforce the planned steps effectively. The government usually also is primarily responsible for providing the funds for the recovery.

Humanitarian organisations are also important stakeholders. They contribute the resources and know-how to carry out projects on the ground. It is important for them to act in accordance with the framework set by the national government in terms of standards and reconstruction plans. Coordination among the different organisations is a challenging issue as well. The transformative agenda from 2005 (partly as a reaction to the problems after the 2004 tsunami) created so-called clusters for different tasks in disaster relief and recovery that are coordinated by experienced and big humanitarian actors. The shelter cluster (responsible for

reconstruction) is coordinated by the IFRC and the UN High Commissioner for Refugees (UNHCR) (IASC, 2006). The cluster coordinates and monitors the activities of all humanitarian actors and serves as a platform for communication, avoiding duplication.

The most important stakeholder however is the affected population. Every guideline and article about disaster recovery canonically emphasizes the importance of a participatory approach that invites the affected population to be part of the decision-making concerning the recovery of their community. A central term is ownership building: the affected population needs to feel a sense of responsibility for and entitlement to the reconstruction process. Several studies showed that houses are lasting much longer if they have been constructed with the support and cooperation of the population (Lyons, 2009; IFRC, 2010; Schneider, 2012). Otherwise, there is the risk of the so-called "Samaritan's Dilemma", or dependency syndrome, in which beneficiaries of recovery operations become dependent on external aid instead of working on re-developing their independence. It is important for the participatory approach to allow also marginalised groups to be heard (e.g. minorities, women, disabled, etc.). Figure 2-2 shows the hierarchy and communication structure inside a disaster recovery.

Disaster recovery happens on many different levels and coordination between the stakeholders is a major task. The GFDRR's DRF identifies four main pillars of operation for setting up a functioning, cooperative scheme: (1) development of a shared vision (including strategy and standard setting), (2) setting up institutional arrangements, (3) financing the recovery effort and finally (4) managing the recovery process (including transparency, communication and ownership building) (GFDRR, 2014). Under this theoretical framework, the individual reconstruction projects can take place. The next chapter will review in detail the planning and implementation of housing reconstruction projects. Focus will not be on environmental issues, as they will be discussed in detail in the chapter afterwards.

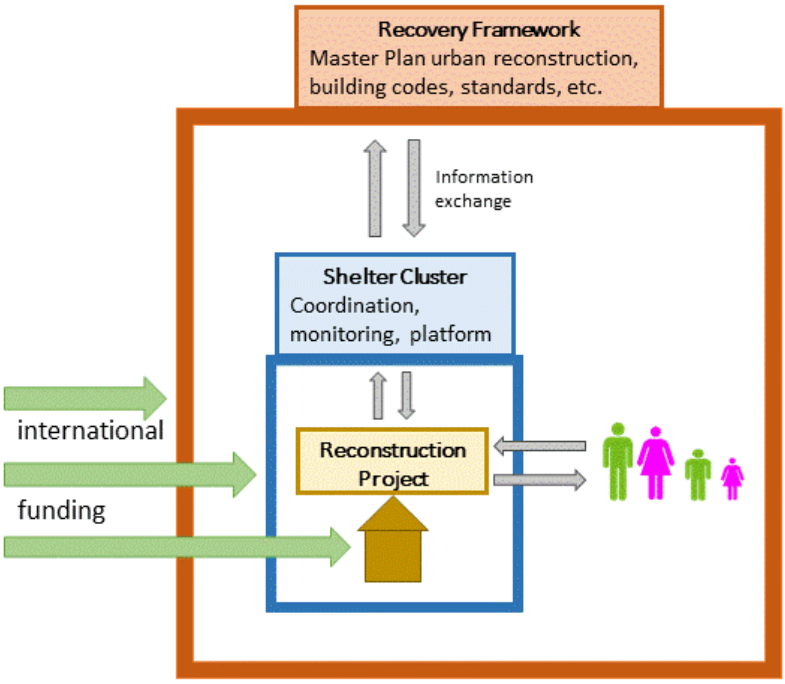


Figure 2-2 Exemplary scheme of a disaster recovery framework

2.3 Housing Reconstruction after disaster recovery

Housing reconstruction is a big task in disaster recovery. Depending on the type of the disaster, it often makes for the biggest part of the recovery costs (e.g. Gilbert, 2001; EC, 2013a). Humanitarian aid in this sector is highly necessary, but at the same time it is very difficult. A report by ALNAP (Active Learning Network for Accountability and Performance in Humanitarian Action) from 2003 called reconstruction the "least successful form of aid when compared to other humanitarian intervention sectors" (ALNAP, 2003). Since then, many things have changed in the humanitarian sector, and a lot of work went into improving the process of housing reconstruction. There are plenty of guidelines and handbooks that describe the process of post-disaster reconstruction (e.g. Oxfam, 2003; IFRC, 2010; Jha et al. 2010; SKAT & IFRC, 2012; Schneider, 2012). They deal with different focus points (e.g. sustainability, urban reconstruction, owner-driven reconstruction) but generally agree on a common framework. Four main stages are commonly identified in reconstruction projects, which will be presented in the following. See Figure 2-3 for an overview.

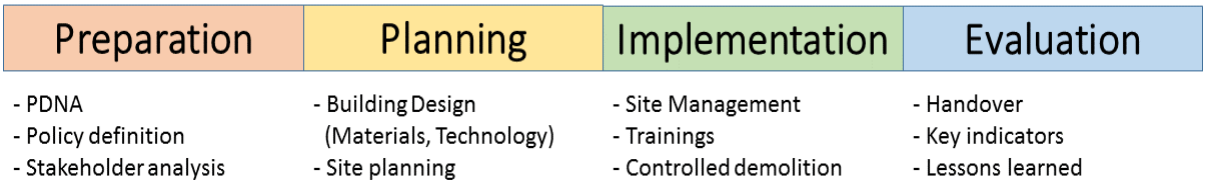


Figure 2-3 Project planning structure according to sector guidelines (e.g. Schneider 2012, Jha et al. 2010)

2.3.1 Preparation

The first stage of disaster reconstruction is the preparation stage. It includes first of all an assessment of the damages and needs in the form of a PDNA, as described above. For reconstruction, pre-existing buildings are separated in different damage categories (Jha et al., 2010): 'Affected' houses only need to be checked by an architect to reassure the often scared inhabitants that it is safe to return to their housing. 'Minor damages' mean that a house can still be inhabitable if quick repairs are applied (e.g. a tarpaulin over the damaged roof). 'Major damages' describes a house that is uninhabitable until massive repairs have taken place. If the house needs to be completely demolished and rebuilt, it falls into the category 'destroyed'.

After establishing damages and needs, the reconstruction policy needs to be defined. This very early step is perhaps already the most crucial in the whole process: mistakes or shortcuts in this task might render the whole project ineffective or even harmful (Schneider, 2012; SKAT & IFRC, 2012). One of the central aspects is the beneficiary selection process. Usually, the need for housing aid is much bigger than the project size, so groups of people need to be prioritized. This is a very difficult task with several open questions: how to treat people that were not affected by a disaster, but are having the same needs for housing (e.g. slum inhabitants)? What to do with people moving to disaster affected areas in the hope of benefitting from one of the recovery programs (urban squatting)? Should vulnerable groups (widows, orphans, disabled people, elderly, etc.) receive special treatment? There is not one right answer to these questions and tough decisions need to be made. Experience tells that it is essential to communicate the rules and criteria for beneficiary selection early and clear, and apply them consequently while being open for feedback and complains.

Another important part of the reconstruction preparation is the selection of an approach. There are two generic types of reconstruction: donor driven, where contractors provide the implementation; and owner driven, where cash grants and trainings are provided for the

population in order to allow them to manage the disaster recovery themselves. The donor driven approach has the benefit of accountability and easier quality control. It is however more expensive and may not sufficiently include the community. The owner driven approach is more inclusive and often cheaper, as the beneficiaries provide their own labour force. On the other hand, it is more difficult to manage the quality and standards of the built houses, and to control that the cash grants are actually spent on housing reconstruction and not on other items (IFRC, 2010). Additionally, if the housing is rented out, it is important to ensure that the landlord is not drastically increasing rents, making living unaffordable for the current tenants (SKAT & IFRC, 2012). Nothing the less, owner driven housing reconstruction is getting more and more common in humanitarian aid (IFRC, 2010). There are also opportunities in developing a hybrid between the two solutions, i.e. owners are in charge of performing easier, labour-intense tasks, while contractors are handling the structural work under the supervision of the humanitarian organisation (Schneider, 2012).

A third issue in reconstruction planning is the question whether to rebuild in the same site or to relocate the population. Rebuilding in the same place is often much easier for the population and reduces the trauma. Often, however, re-settlement might be necessary in order to decrease disaster risk, or due to a public urban master plan (especially for slum residents). In this case, the resettlement process needs to be carried out in very close cooperation with the beneficiaries. Re-settlement areas are often low economic value-areas with a lack of infrastructure, economic opportunities, and education facilities. Humanitarian organisations need to deal with the fears of the beneficiaries, so that the new sites are being accepted and not abandoned after a short time. For this, a lot of efforts also need to go into proper site selection. Land titles are often an issue in this matter. (Jha et al., 2010, SKAT & IFRC, 2012).

2.3.2 Planning

Once the preparation phase is over, the more detailed planning stage can be started. This phase focusses on the physical aspects, such as site planning. Projects need to ensure compliance with the overall development master plan (especially in urban reconstruction), and fulfil the standards set by the local government (minimum distances to streets, maximum heights of buildings, etc.) (SKAT & IFRC, 2012). It is also important to use space economically. The connection of infrastructure and services needs to be planned as well. This includes, but is not limited to water provision, waste management and sanitation. While the cost of construction of infrastructure is often accounted for, financing the maintenance and service after the project is very often not considered. This often constitutes an issue in re-settlement areas (SKAT & IFRC, 2012; Schneider, 2012; KfW, 2013).

The individual buildings also need to be designed. Architects develop the shape and structure of the house, ideally considering disaster risk reduction methods. Also the local climate needs to be considered: tropical climates demand an elevated location and a natural air flow, while in dry climates the exposure to the sun should be minimised and the ground should be used as a cooling source (Schneider, 2012). Building materials need to be selected: here it is important to try to support the local economy and procure materials from nearby sources. At the same time, organisations must keep in mind the consequences of a suddenly drastically increased local demand (e.g. sustainability, inflation, social structures, culture). A good opportunity can be to re-use disaster debris as much as possible. Generally, the material procurement process needs to be transparent and combat corruption. Most humanitarian organisations have procurement guidelines to facilitate this process (SKAT & IFRC, 2012).

The choice of a building technology is another decision in the planning stage. Guiding principles should be cost reduction, practicality, environmentally appropriateness, and quality.

The main choice to be made in this context is between prefabrication and on-site construction. While prefabrication holds the advantages of a better quality control and quicker delivery, it is not available everywhere and does not support the local economy. It needs to be ensured that the materials used are locally accepted and repairs can be conducted by the beneficiaries without external help (Schneider, 2012). Important elements that need to be considered are the foundation (to be selected early, influences overall design), the supporting frame (the skeleton of a building, mostly made of concrete, timber or steel), the floor, walls and openings (such as windows or doors), and the roof (especially important for disaster risk reduction concerning both earthquakes and storms) (IFRC, 2010).

Retrofitting and repairs of existing housing can be valid alternatives to rebuilding. Retrofitting means giving an existing building a new purpose, which can be very valid for infrastructure such as hospitals or schools. Repairs are often preferred for housing, as it allows the beneficiaries to return to their old house which they are used to. It saves raw materials for construction and can avoid re-settlement. However many factors, such as time, resource needs, disaster risk reduction and land titles need to be considered when making this choice.

2.3.3 Implementation

The implementation phase concerns the time when the actual reconstruction takes place. Most generally, it is important to stick to the generic standards of project management: the need to stay inside of a budget, to avoid delays and to stick to the original planning and only make adjustments if necessary (SKAT & IFRC, 2012). Proper site management is important for reducing waste (expensive), guaranteeing workers' safety and to secure good quality construction work. The beneficiaries and the public authorities need to be informed about the progress of the work. Often beneficiaries can support the progress of the project by providing cheap labour force for simple tasks such as guarding the construction site, painting the houses, carrying materials etc. (IFRC, 2002).

Trainings are an essential step in improving the implementation of reconstruction projects. Especially owner-driven reconstruction projects need a lot of training support to facilitate efficient spending of the cash grants, but also donor-driven projects need trainings both for humanitarian workers (disaster management in general struggles with a very high turnover of staff, at each disaster there is a high share of new helpers in the projects that need trainings), and for local workers. Trainings for locals should if possible also contain a vocational aspect to enable the creation of livelihood opportunities in the future.

Another important aspect of reconstruction implementation is the process of controlled demolition. Often land needs to be cleared for reconstruction. It is essential for aid organisations to only move into properties if the permit of either the land owner or the government are given in written from (Schneider, 2012). Additionally, it needs to be secured that disaster debris is re-used efficiently. Depending on the purity, quality and state of the debris, it can either be a source of cheap construction material or require expensive and time-intense measures to improve the debris' quality to an acceptable degree.

2.3.4 Monitoring and Assessment

The final step in the course of a project is the monitoring and evaluation. Monitoring is partly also accredited to the implementation state (Oxfam, 2003), but generally this task is considered large enough to form a separate section.

Quality control is a central issue that has often not been enforced thoroughly enough, also due to capacity limitations and the need to build fast (one quarter of the 50 000 homes built after the tsunami in South-East Asia were of 'questionable quality', according to a financial times article (Aglionby, 2006); a 2006 report by Save the Children found that, out of the 571 houses completed in their projects, 371 houses needed to be replaced and 200 needed repairs (Roseberry, 2008)). Good quality construction reduces the need for expensive and difficult corrective measures later on.

Before the hand-over, it is important to explain the need for and the system of maintenance of the house. The procedures for maintenance and repair need to be understandable, affordable and based on locally available materials in order to ensure a long lifetime of the house. It also needs to be clarified who is (financially) responsible for the maintenance and repair of bigger issues, in order to not raise false expectations among the beneficiaries (Schneider 2012).

Finally, it is also important to draw the right conclusions to ensure learning for future projects (Lettieri et al., 2009). One way to do this is using key indicators that measure the performance of a project. Evaluation should continue until several years after a disaster to see whether the housing was accepted by the local community, whether new problems arose (lacking infrastructure, livelihood etc.) or whether building faults became visible later on.

2.4 Environmental implications of disaster reconstruction

After assessing the general context and the specific tasks of disaster reconstruction, this sub-chapter will review the impacts of disaster reconstruction on the environment. This review is based on academic articles, disaster case studies and reconstruction guidelines.

There are four different ways in which disasters and disaster recovery interact with the environment. (1) First of all, the environment has significant influence on the disaster. It can protect areas from storms or floods, but also increase vulnerability or present a hazard in itself (e.g. fire). (2) The disaster itself also affects the environment, for example through salt-water intrusion at coastal areas, or through mangrove or forest damages. (3) The environment then influences the recovery process, for example through the availability of natural resources for reconstruction. (4) Last but certainly not least, the recovery affects the environment through the extraction of natural resources, through construction waste, and through transport. (Srinivas & Nagasaki 2008) (See Figure 2-4).

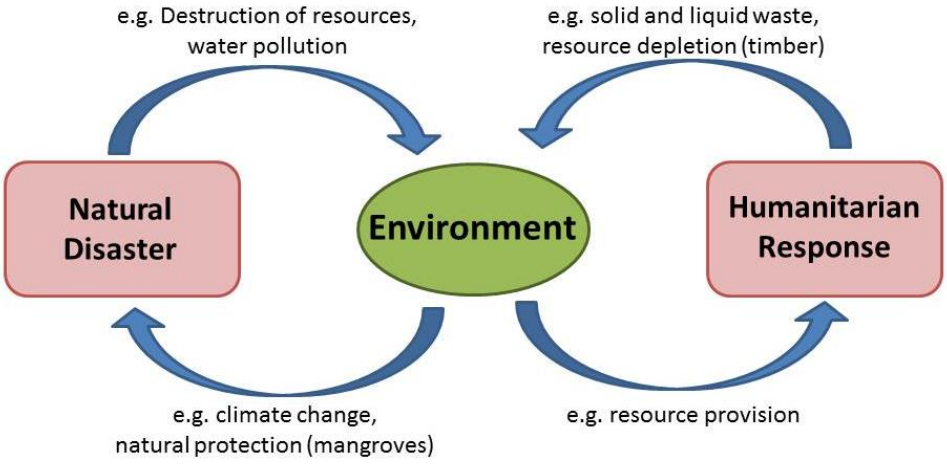


Figure 2-4 Interaction between disasters, response and environment (after Srinivas & Nagasaki, 2008)

All these interactions are important to keep in mind, however the focus of this thesis is on the effects of housing reconstruction on the environment. The other areas are therefore only partially considered: it is for example important to know the effects of a disaster on the environment to make the disaster recovery more effective. Therefore, an environmental needs assessment (ENA) should be part of every PDNA after major disasters (GFDRR et al., 2013). In combination with the cultural background and long-term environmental trends in the region, the PDNA can give an estimation of the local availability of natural resources.

The decisive aspect of those four is however the interaction of the reconstruction with the environment. What can be done to capitalize on opportunities and to minimize the harmful effects (see RQ 1)? There are several guidelines, handbooks and training materials by humanitarian and environmental organisations about environmental impacts during construction and how to avoid them. These are reviewed in the following section, combined with practical examples of environmental problems out of case studies in academic articles and review reports. A summary of the main causes and impacts can be found in table 2-2.

2.4.1 Disaster Debris

Especially in urban settings, there can be extreme amounts of debris (up to fifteen times the annual amount of waste generated without the disaster (Reinhart & McCreanor, 1999)). Debris is very heterogeneous: small parts like broken glass and tremble need to be cleared just like large steel beams. Additionally, there is potentially hazardous material among the debris (e.g. asbestos, heavy metals, etc.) that can cause a health hazard to the population through air, soil or water pollution. Organic waste can be a breeding ground for diseases (Brown et al., 2011). Disaster debris management is not always the task of the shelter sector. Sometimes, it is managed as part of livelihood support. However, since it's impossible to rebuild without previously clearing the debris, it will be considered an aspect of housing reconstruction.

The enormous amount of disaster debris can serve both as a challenge and as an opportunity for reconstruction. On the one hand disaster debris can be a source for construction material. Quality and purity of the debris are decisive when assessing its reusability (Schneider, 2012). Rubble, fly ash etc. can be used as aggregate for cement and as filler for concrete (Good, 2010). Uprooted trees can often be used for reconstruction (Matcalife et al., 2008): After the South-East Asia tsunami, circa 17 000 m^3 of wood could be recovered (however not nearly enough to meet the enormous need) (EuropeAid, 2008). Thus, pro-active waste management can be an opportunity to save natural resources.

At the same time waste management is an enormous challenge for disaster managers. Clean-up teams often prioritise the business and industrial areas before the residential areas in order to stimulate the economy and livelihood generation (personal communication). As a consequence, debris in residence areas is not cleared, causing pollution to soil and water, resulting in health hazards for the population. Also, waste management sites, mainly landfills, often do not have the capacity for absorbing such high amounts of waste, even temporarily. Often standards are compromised or interim waste storage areas are designated (Brown et al, 2011), which can bare serious environmental risks. However, interim storage at designated areas, even if not fully controlled, is still a much better solution than non-action, which results in uncontrolled burning or similar harmful practices (ICRC, 2009). There have also been cases of humanitarian organisations dumping waste uncontrolled, despite proper waste storage sites being assigned (SRC, 2006). Such activities can make expensive and time-intense projects necessary to restore agricultural land, as happened after the tsunami 2004 (UNEP, 2007).

2.4.2 Raw material sourcing for housing reconstruction

After a disaster, the demand for raw materials all of a sudden increases drastically ("*from a new build market of 200 homes a year to the urgent demand of 120 000 in a day*" (Roseberry, 2008)). At the same time, the availability of natural resources is reduced due to the effects of the disaster on the environment (Srinivas & Nagasaki, 2008). Additionally, the affected population often lost their livelihood, and thus engages in harmful practices such as illegal logging, which can generate high incomes through the black market. Therefore, it is of crucial importance that humanitarian organisations deal appropriately with the environmental hazard of over-extraction of natural resources.

The main components of housing construction are the foundation, the frame (works as the skeleton of the building), the walls, openings (doors, windows), floors and the roof. The most common materials used for these parts in post-disaster situations are timber, concrete, cement, clay bricks, stone, sometimes earth blocks, partially steel components, and imported goods such as plastic parts (Schneider, 2012). Chemical bonding agents and finishing products are most often imported, as their weight is not too high and since they often require industrial production facilities (Good, 2010). Both the material choice and the sourcing are of great importance when it comes to environmental sustainability. Besides the environmental factors, projects should also try to stimulate the local economy by using locally sourced products, and need to consider local traditions and culture when choosing design and materials. Therefore, humanitarian organisations have a thin line to walk between different interests and factors, and environmental considerations are only one out of many concerns during disaster recovery.

Timber is often the most used reconstruction material, where it is available easily. However, as mentioned above, it is often sourced uncontrolled and illegally. Most big humanitarian organisations have established procurement guidelines (either general or specifically for timber), demanding only certified sustainable timber to be used (e.g. Oxfam, (date unknown); IFRC, 2009). It is however fairly easy to falsify certificates: In the past, organisations often have abstained from detailed background checks on their suppliers for the sake of quicker reconstruction. That caused organisations to unknowingly use illegal timber in their projects on a broad scale (Zuo et al., 2009). The amount of illegally used timber after the South-East Asia tsunami 2004 was so dramatic that after half a year of reconstruction many organisations decided to completely abstain from using timber in their projects, and the Aceh regional government issued a complete moratorium on logging trees (Roseberry, 2008). Another issue to consider about timber usage is the use for cooking and heating. Inefficient stoves and ovens often cause overconsumption of firewood, leading to gradual deforestation (ICRC, 2009, Schneider, 2012). Introducing efficient stoves and fuels can be an opportunity for sustainable development (WFP, 2012).

Not only timber, but also sand, earth, and clay are often sourced uncontrolled. The extraction of sand as an aggregate for concrete and of clay as raw material for bricks can cause costal and soil erosion, and, as a consequence, pollution of water bodies, increased flood and landslide hazards and land degradation (for e.g. agriculture) (Good, 2010; Schneider, 2012; KfW, 2013).

Clay bricks, concrete, cement, and steel have the additional drawback of being highly energy intense during their production. Clay bricks need to be burned for several hours/days, depending on the demanded hardness (Berge, 2009). In post-disaster situations, the kilns used for this are often very inefficient and use firewood as burning material. That way, a shift away from timber towards clay bricks as construction material by some organisations after the South-East-Asia tsunami resulted in a more than double as high use of wood per house constructed (Good, 2010). Concrete and cement also require high amounts of energy, plus they emit high amounts of carbon dioxide as part of the chemical reaction (Berge, 2009). Steel

is the by far most energy intense building material concerning extraction and treatment (Berge, 2009; Good, 2010), and should only be used if necessary.

It is often tricky to mitigate these adverse effects, since the demand for reconstruction needs to be satisfied one way or the other, and each solution has an impact on the environment. Therefore some trade-offs will be necessary (local economy support, carbon footprint, reconstruction speed, etc.). The most important action, which is agreed upon by all guidelines on sustainable (re-)construction is to choose materials with the entire life-cycle of the product in mind (Berge, 2009; Good, 2010; Klenk, 2010; Jha et al., 2010; Schneider, 2012; Skat & IFRC, 2012). Secondly, it is important to control the entire supply chain of the materials used (Zuo et al., 2009; Good, 2010; Schneider, 2012). Certificates may not be trusted, and quarries and plantations should therefore be visited to verify their sustainability. Illegally sourced timber should be avoided by all means. Importing sustainable timber can be an option (Roseberry, 2008), however does not support the local economy. Additionally, import channels are often clogged in the aftermath of a disaster and transportation has its own environmental impacts (Kovacs & Spens, 2007).

2.4.3 Water supply and sanitation

It is an essential task to provide save water supply and sanitation in reconstructed houses. These issues, however, also have severe environmental implications. A major hazard is over-consumption of water (drinking, agriculture, construction, etc.). Over-extraction happens when there is a lack of coordination between several projects (Navaratne et al., 2010). A second threat to water resources is pollution. Pollution can happen through improperly built sanitation facilities (see below), through failed waste and disaster debris management, through improper rehabilitation of wells, or through over-extraction of drinking water in coastal areas, causing salt-water intrusion (Navaratne et al., 2010; Schneider 2012). It is also important to assess the indirect effects of activities such as road construction, agriculture, mining, etc. They might affect the availability and quality of water further downstream (Navaratne et al., 2010).

Mitigation of water supply issues can happen through a so-called "watershed management approach", or "integrated water resource management". Humanitarian agencies tend to focus rather on communities than on regions, which causes cumulative effects of extraction at multiple points in one watershed to go unnoticed (Navaratne et al., 2010). The water, sanitation and hygiene cluster (WASH) therefore should manage the watershed resources, and reconstruction projects should consult with the cluster lead to account for cumulative effects of several projects. A positive example for this is the Indonesia Watershed Forum that was established after the South-East-Asia tsunami (WWF, 2011). There are also some ways of reducing water consumption after the reconstruction project, for example by installing rainwater catchment systems in houses or by deploying systems for recycling grey water (used water that is only lightly polluted) (Schneider, 2012).

Sanitation is an extremely important and very difficult health issue in post disaster situations. The most drastic example is from the Haitian earthquake, where insufficient sanitation and hygiene in the aftermath of the disaster led to the worldwide biggest cholera outbreak in history, costing 8540 lives (UN, 2014). In reconstruction, the sanitation technology chosen for houses needs to be fully understood and accepted by the community. The beneficiaries also need to be able to maintain the systems in the long run (e.g. emptying tanks). If one of these conditions is not fulfilled, the whole system might be rendered useless (Navaratne et al., 2010).

There are plenty of different solutions of varying degree of technological complexity to choose from. One of the cheapest and most environmental friendly solutions especially for

rural areas are constructed wetlands that clean the water flowing through them by absorbing organic and non-organic particles (Skat & IFRC, 2012). Anaerobic filters and bio filters are other alternatives (mainly apprpriated for pre-treated water). They are however more complex and thus often pre-fabricated. These systems might not be accepted everywhere, and of course have their own environmental impacts during production (Schneider, 2012). Dry composting toilets enable the reuse of human excreta as fertilizer (an ancient practice in a new technology). If properly planned and developed, this can be a very beneficial practice, however cultural barriers to it exist in many places (Schneider, 2012). In more urban settings, the most common option is a centralized treatment of human waste and wastewater (Skat & IFRC, 2012). Here it is important to ensure that the community is able to maintain the functionality of the pipes and the wastewater treatment once the aid organisations have left.

2.4.4 Waste management

There are two different kinds of waste that need to be considered during housing reconstruction: waste produced during construction and domestic waste from households after construction. Construction waste includes both the waste developed on site, but also during the sourcing of raw materials. Big humanitarian organisations have rather strict standards ("do no harm"-principle) concerning the direct effects of their own activities. These standards are however often not communicated or enforced among suppliers and sub-contractors (Zuo et al., 2009; Good, 2010).

Literature and case studies mainly focus on disaster debris management, and not on the development of waste during construction. While both the amount and the hazard of disaster debris are much higher, the added impact of construction waste must not be forgotten. The first option to counter that problem is waste avoidance. By using the same materials for different parts and by using standardized sizes and forms, high amounts of waste can be avoided in the first place or reused later in the process (Klenk, 2010, Schneider, 2012). Other mitigation methods are strict control mechanisms for the suppliers (Good, 2010) and proper site management with regular transport of waste to interim storage sites (Schneider, 2012).

Another significant risk, especially in rural areas, is the introduction of new forms of waste during the recovery (e.g. plastic, medical waste, etc.) since local waste handling might not be suited for their environmental impacts. Humanitarian organisations need to make sure that their materials and packaging are adapted to the local culture (Tran & Shaw, 2007; ICRC, 2009). Domestic waste management also needs to be considered when reconstructing housing. This is especially critical in resettlement cases where whole districts need to be connected to the waste management system (that was often already flawed before the disaster) (Skat & IFRC, 2012). Organisations also need to be careful to not disrupt informal waste collection systems that serve as livelihood for the poorest parts of the society (pers. comm.).

2.4.5 Livelihoods

Livelihoods are not the main focus point of this thesis. It is however also an issue of some importance for reconstruction, especially in the case of re-settlement. The disaster itself or subsequent resettlement often forces people to a change of livelihood (e.g. loss of opportunity for fishery). If projects do not account properly for this issue, the people might engage in environmentally harmful practices such as illegal logging (Van Breda et al., 2010). Instead, reconstruction projects should support sustainable livelihood promotion, such as eco-friendly production of construction material (Roseberry, 2008), ecotourism, or sustainable agriculture.

Table 2-2 Overview over the different environmental impacts of housing reconstruction

Source of impact	Type of impact	Example	Mitigation
Disaster Debris	Opporuntity for re-use	e.g. Haiti Earthquake: 20% of debris recycled (UNDP, 2012)	Re-use as much as feasible to save resources (trade-off with speed)
	Water & soil pollution through hazardous materials (chemical spills, etc.)	Sout-East Asia tsunami (UNEP, 2007)	Clean-up needs to be quick (non-action with worse impacts than intermediate solutions)
	Uncontrolled dumping and burning (air pollution)	South-East Asia tsunami (SRC, 2006)	close operational control
Raw material sourcing	Deforestation for timber as construction material	Sout-East Asia tsunami (Roseberry, 2008)	avoid timber if cannot be sources sustainably
	Deforestation for firewood to burn clay bricks	Sout-East Asia tsunami (Good, 2010)	control the supply chain, avoid clay bricks
	Deforestation for domestic firewood	e.g. Sudan (ICRC, 2009), Philippines (WFP, 2012)	Installing efficient stoves and ovens
	Coastal erosion due to uncontrolled sand mining	Sout-East Asia tsunami (Good, 2010; KfW, 2013)	control supply chain and suppliers
	Steel difficult to handle and energy-intense to produce	(Berge, 2009; Schneider, 2012)	avoid usage if possible
	impact of transportation of imported goods	(Berge, 2009; Schneider, 2012)	try to use local products in sustainable amounts
Water supply and sanitation	Over-extraction of water due to miss-coordination	Indonesia (Navaratne et al., 2010)	Watershed management approach, rainwater catchment installations
	Health hazards due to bad sanitation	Haiti cholera outbreak (UN, 2014)	Install appropriate sanitation options
	Incapability to maintain sanitation solution (e.g. empty tanks)	Afghanistan (UNHCR et al., 2012)	Make sure technology and maintenance of sanitation are understood and accepted by beneficiaries
Waste management	Pollution due to construction waste (on site and at resource extraction)	South-East Asia tsunami (Zuo et al., 2009; Klenk, 2010)	ensure compliance of contractors, maintain proper site management
	introduction of new forms of waste (e.g. plastics) during recovery work	Vietnam Floods (Tran & Shaw, 2007)	ensure to not introduce waste the system in the host country can't process
	Management system for domestic waste often fails (esp. in resettlement projects)	Sout-East Asia tsunami (Lyons, 2009)	Make sure waste management systems are in place, be careful not to destroy livelihoods of inofficial waste collectors
Livelihoods	Displaced population forced into unsustainable practices (e.g. illegal logging)	Sout-East Asia tsunami (Van Breda et al., 2010)	Mind livelihood opportunities during site selection; give incentives for sustainable jobs (e.g. eco-friendly production of consutruction material)

2.5 Barriers to mitigating negative environmental consequences of disaster reconstruction

All these issues need to be considered and environmental harm needs to be minimized if the disaster recovery is supposed to be successful. Some mitigation steps named above are rather simple and straightforward, and simply need awareness among the reconstruction project team. Others are more complex and include trade-offs between environmental factors and other interests, such as fast implementation or project costs.

When evaluating the degree to which named mitigation measures are implemented, and which results the recovery efforts produce environmentally, the picture is often rather disappointing. Environmental sustainability is usually not an thematised in the humanitarian sector's post-project evaluations. Out of the 36 reviewed reconstruction evaluations or case studies by big humanitarian organisations (among others: IFRC, 2002; Spanish Red Cross, 2007; Wilson & Reilly, 2007; UNHCR et al., 2012; Jordan, 2012; Mountfield, 2013; KfW, 2013; UNHCR et al., 2014), only eleven specifically mentioned environmental issues. Seven of them pointed out positive efforts in the mitigation of environmental issues, four others mentioned problems or negative aspects. Generally, however, environmental issues were not or only very superficially reviewed (see Annex A for a detailed listing of the evaluations).

Academic literature on the impacts of disaster recovery is often rather critical towards the work of the humanitarian sector, reporting dramatic consequences for local ecosystems, biodiversity, and the recovery success itself (among others Ingram et al., 2006; Tran & Shaw, 2007; Roseberry, 2008; Lyons, 2009). Since the humanitarian sector is not emphasizing the issue of environmental degradation in their reviews, and since the academic literature available finds mostly negative results, there is reason to assume that many environmental mitigation techniques are not, or only to an unsatisfactory degree, mainstreamed in practice.

Three large studies by the humanitarian sector, two by the British Ministry for Development (DfID) (Barett et al., 2007; Kelly, 2013), and one by a joint environmental unit of UNEP and UN-OCHA (JEU, 2014) investigated the barriers for a broader and more aware approach to environmental issues in humanitarian operations. As housing reconstruction is a part of humanitarian activities, the findings of these reports can be considered valid for this area. The following section will review the findings of these studies in order to develop a list of underlying root causes for insufficient environmental management in housing reconstruction.

The DfID study from 2007 identifies three main root causes for environmental mainstreaming. (1) Lack of coordination, (2) lack of prioritization and awareness, (3) lack of effective policy frameworks, including monitoring and evaluation. The lack of coordination issue addresses the cluster system, in which the study finds gaps of accountability and leadership in environmental issues. To solve this, it promotes the deployment of a humanitarian coordinator that is responsible for overall environmental problems, and an increase in resources spent for environmental issues. The lack of awareness is traced back to a lack of environmental requirements by the humanitarian organisations and their donors, insufficient reporting and the high turnover rate for staff (i.e. insufficient training and experience). The lack of policy frameworks for environmental mitigation roots, according to the study, in a low number of effective tools and standards for environmental management. The few existing tools are not well adapted by the humanitarian community: only two out of nineteen organisations surveyed used existing guidelines as they were. Barriers for using such tools include perceived complexity, lack of standardization, and lack of evidence of success. In this context, Barett et al. (2007) also identify the absence of environmental performance indicators, monitoring and evaluation as barriers.

The second DfID study (Kelly, 2013), lists all the agencies and organisations involved in the humanitarian-environmental nexus and gives an overview over existing tools and methods for environmental integration. This study recognises a broad and increasing effort by the humanitarian sector to improve tools and capacities to mitigate environmental problems. However, the study also finds significant shortcomings: (1) a more strategic approach on a sector-level would be needed (starting with a definition on what the term "environment" covers), (2) follow-through by donors is missing, (3) need for improved monitoring and evaluation to create a better evidence base, and (4) lack of accountability for the consequences of environmental problems caused by humanitarian organisations.

The study by the Joint Environmental Unit of UNEP and UN-OCHA (JEU, 2014) set out to review the findings of the first DfID-report (Barett et al., 2007) and add new developments to the list. They acknowledge recent initiatives, such as the introduction of an environmental marker by UNEP to grade the environmental performance of projects during their funding application (see chapter 2.6.1.), or the deployment of environmental field advisors (EFAs). Overall however, they find that no big steps forward have been taken since 2007 and that many problems are still existent in the same way. The main problems identified are (1) a lack of system-wide accountability and responsibility, (2) lack of effective mechanisms for environmental mainstreaming at every stage of the project cycle, (3) lack of evidence base and advocacy, and (4) too little donor support and requirement for environmental considerations.

In a synthesis of the three reviewed studies, four central root barriers for a better inclusion of environmental issues in humanitarian aid will be used for the next chapters of this thesis:

(1) Lack of an overarching management framework to improve coordination and control
(2) Lack of accountability for environmental problems in the current system (the problem of a cross-cutting issue: if it's everybody's responsibility, it's nobody's job)
(3) Lack monitoring and evaluation, in order to create an improved evidence base, and
(4) Lack of sufficient pressure from donor organisations to only fund projects if they screened their environmental impact and accounted for negative consequences. (See Figure 2-5)

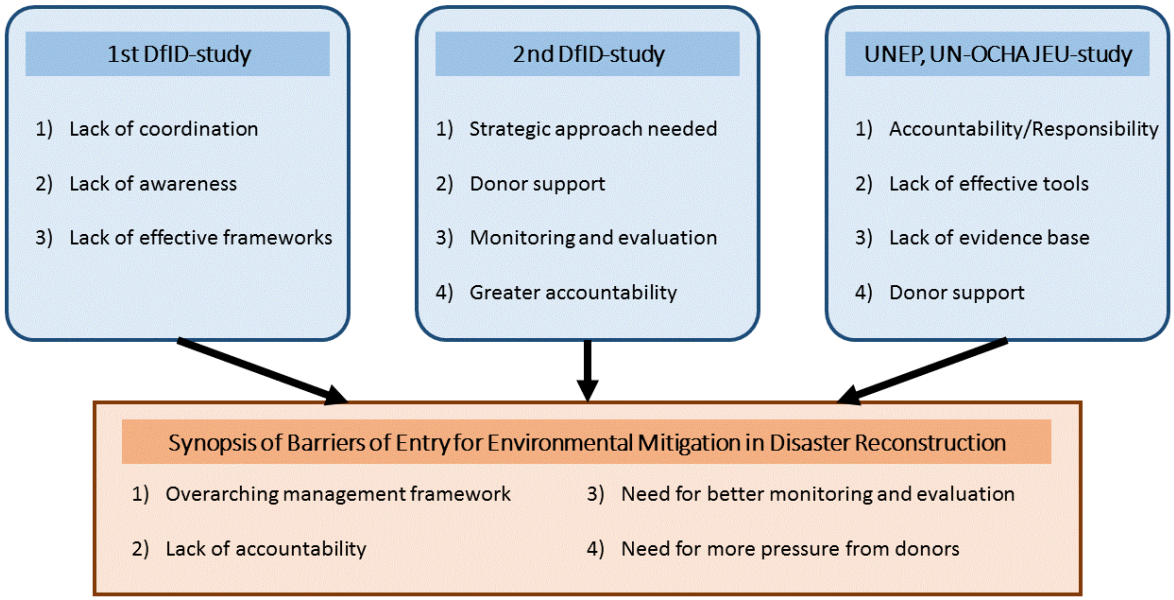


Figure 2-5 Barriers to entry for environmental considerations in disaster reconstruction

2.6 What possible tools could be applied to improve environmental performance during disaster reconstruction

The last section of chaper 2 is a bridging element towards the next chapter. It uses the findings from above in order to perform an indicative analysis of which environmental tools could be used to overcome the existing barriers in environmental mainstreaming in the reconstruction sector. For this, the sub-chapter will first introduce different possible tools from the conventional industry and from the humanitarian sector (mainly using Starkey, 1998), and then evaluate to which degree they could tackle the barriers described above.

2.6.1 Environmental marker

The environmental marker is a tool for donor organisations such as the European Commission or the World Bank. When humanitarian organisations apply for funding for their projects, the environmental marker grades the project on whether they screened for environmental impacts and whether they applied measures to mitigate them. That can be a powerful way to incentivise project managers since funding is becoming scarcer every year (EC 2014a). UNEP recently introduced a methodology for assessing and grading the environmental performance on a scale from A to C, describing the environmental impact, with a possible (+) if mitigation or enhancement measures are taken (UNEP, 2014).

Application of his marker is not very wide spread yet, but previously introduced markers, such as a gender-marker or DRR-marker have gained broader acceptance. Among others the world's biggest donor for humanitarian operations, the European Commission, introduced both markers (gender marker in 2014 and DRR-marker in 2015) as standard requirements for funding applications. An evaluation of the gender marker showed that it was effective in increasing the attention paid to the issue, but gave no indication that this translated to actual policy changes (Steets & Meier, 2011).

An environmental marker would increase donor pressure to include the environment into project planning early on (JEU 2014). However, project application texts might not be realised accordingly in the field (pers. comm.). Also, it does not improve coordination between projects. Finally, the personnel both at field level and in the donor offices would need to be trained well enough to also identify underlying, hidden environmental issues (pers. comm.).

2.6.2 Environmental cluster

There are currently eleven clusters in humanitarian aid. Cross-cutting issues, such as the environment are supposed to be the responsibility of everyone. This can lead to environmental issues being neglected. Introducing an environmental cluster would assign clear responsibility and accountability and give more authority to the issue. It also could help improve the monitoring and increase the evidence base quickly.

On the other side, an environmental cluster would need to interfere constantly with the work of relief and recovery projects, so that it would inevitably come to power struggles and coordination problems when reconstruction projects want to move along while the environmental cluster would demand changes or further assessments (pers. comm). It also would release other clusters of their responsibility to consider environmental issues in the first place.

2.6.3 Life-Cycle Assessment (LCA)

Life-Cycle Assessments (LCAs) measure the environmental performance over the whole life-cycle of a product or service. This includes sourcing, production, usage and demolition of all components used in a house. It collects the impacts on the environment on different levels (e.g. climate change, biodiversity, ozone layer depletion, etc.), and optionally develops a final overall score concerning all environmental impacts. This allows a very detailed picture of the impacts on different levels and allows for a long-term comparison and a strong evidence base. It also aids the transition from recovery to development as it includes future usage of e.g. firewood. It is a good tool to compare different design options.

On the downside, it is a rather time-consuming and expensive tool, if it is performed to the depth that is necessary to make informed decisions based on it. There are also a lot of uncertainties involved that depend on user behaviour. It also does not tackle several of the above identified root causes, such as coordination or accountability. The very context-specific nature of disaster reconstruction might also become a challenge for LCAs, as inclompete information and uncertain behaviour patterns make it hard to precisely assess future impacts.

2.6.4 Environmental Impact Assessment (EIA)

Environmental impact assessments (EIAs) are ex-ante studies of the severity of environmental impacts of a suggested project. They are supposed to be holistic, taking all aspects into account and thus deliver a good picture of what would happen ecologically if a certain project is carried out. It identifies problematic areas and allows for the inclusion of mitigation measures. Independent EIAs are compulsory for bigger construction projects in many countries (Kelly, 2007).

The humanitarian community has already recognised their potential and developed tools that provide a quick, abbreviated version of an EIA that focusses on disaster reconstruction-specific needs: Rapid Environmental Assessments (REAs), Flash Environmental Assessment Tool (FEAT), Environmental Stewardship Review (ESR), and the above mentioned Environmental Needs Assessments (ENA) are the most common ones (Schneider, 2012).

These EIAs give a good overview over the situation and the consequences of a project in a short time. They are also well adaptable to the local context. On the other hand, no monitoring or accountability is provided through them. In praxis, they tend to become stand-alone efforts for environmental stewardship with little effects on the projects (Randall & Jowett, 2010).

2.6.5 Environmental Management Systems (EMS)

EMS provide an organisational structure for managing a reconstruction project with more care to the environment. This is done through including environment into the existing management processes in order to reduce the amount of parallel structures.

A main advantage of an EMS is its flexibility, as it can be applied in many different contexts. It also covers the whole spectrum of project management, from preparation to evaluation. Through its focus on continuous improvement, it can help creating the evidence base that housing reconstruction projects are currently lacking. On the other hand, examples out of the conventional industry showed that EMS also may only be a lip service to fulfil customer requirements. They also can turn out rather expensive to implement.

2.6.6 Environmental Charters

Environmental charters are voluntary standards or principles that an organisation subscribes to publically. There are plenty of such charters in the conventional industry, also known as "green clubs". The most prominent charter in the humanitarian field is the Sphere standards, introduced in 1997. The Sphere standard is no purely environmental charter. It sets general minimum requirements for humanitarian work, including the commitment to minimize environmental harm (The Sphere Project, 2011). An environmental charter could either extent the Sphere Standard or humanitarian agencies could develop a seperate one.

A charter would have the advantage of setting minimum standards and increasing the awareness of environmental issues. However there would be no real means to enforce these standards. It would also be difficult to agree on standards that both mean a significant environmental improvement, but also maintain the necessary flexibility (pers. comm.).

Table 2-3 Analysis of appropriateness of different management tools to address needs of reconstruction sector

	Environmental Marker	Environmental Cluster	Life-Cycle Assessments	Environmental Impact Assessments	Environmental Management System	Environmental Charters
Management framework	✗	✓	(✓)	(✓)	✗	✗
Accountability	(✓)	(✓)	✗	✗	✓	✓
Monitoring & Evaluation	(✓)	✓	✓	✗	✓	(✓)
Donor pressure	✓	✗	✗	✗	✗	(✓)
Practicality	✓	✗	(✓)	✓	(✓)	(✓)
Academic novelty	(✓)	(✓)	✓	✗	✓	(✓)

2.7 Choice of environmental management tool for further analysis

Table 2-3 analyses the potential of the different above presented environmental management tools to tackle the problems identified in sub-chapter 1.5. Additionally, two categories for practicality (i.e. estimated applicability in the housing reconstruction context) and for academic novelty (i.e. the degree to which the opportunities and barriers of this tool have already been assessed in the literature) have been added. The green colour means the tool may be able to tackle the problem comprehensively, yellow that it seems only partly suitable to tackle the issue and red that this tool probably can't be used to improve that issue. It is very important to state that this analysis is not comprehensive, but an indicative estimation based on the literature review above, indicating which tool(s) seems most promising for further analysis. The ratings given are very much debatable. Also, the fact that EIAs scored rather badly does not mean they are useless – quite the opposite: since they are already being applied in the humanitarian context, their methodology would probably not solve the problems that are yet to be faced. A commented version of this table can be found under Annex B.

The EMS scored strongest from an overall perspective, which is why this thesis will further investigate the potential of EMS in the housing reconstruction sector. The next chapter will investigate further the different EMS, their characteristics and requirements, and how they are applied in the conventional industry.

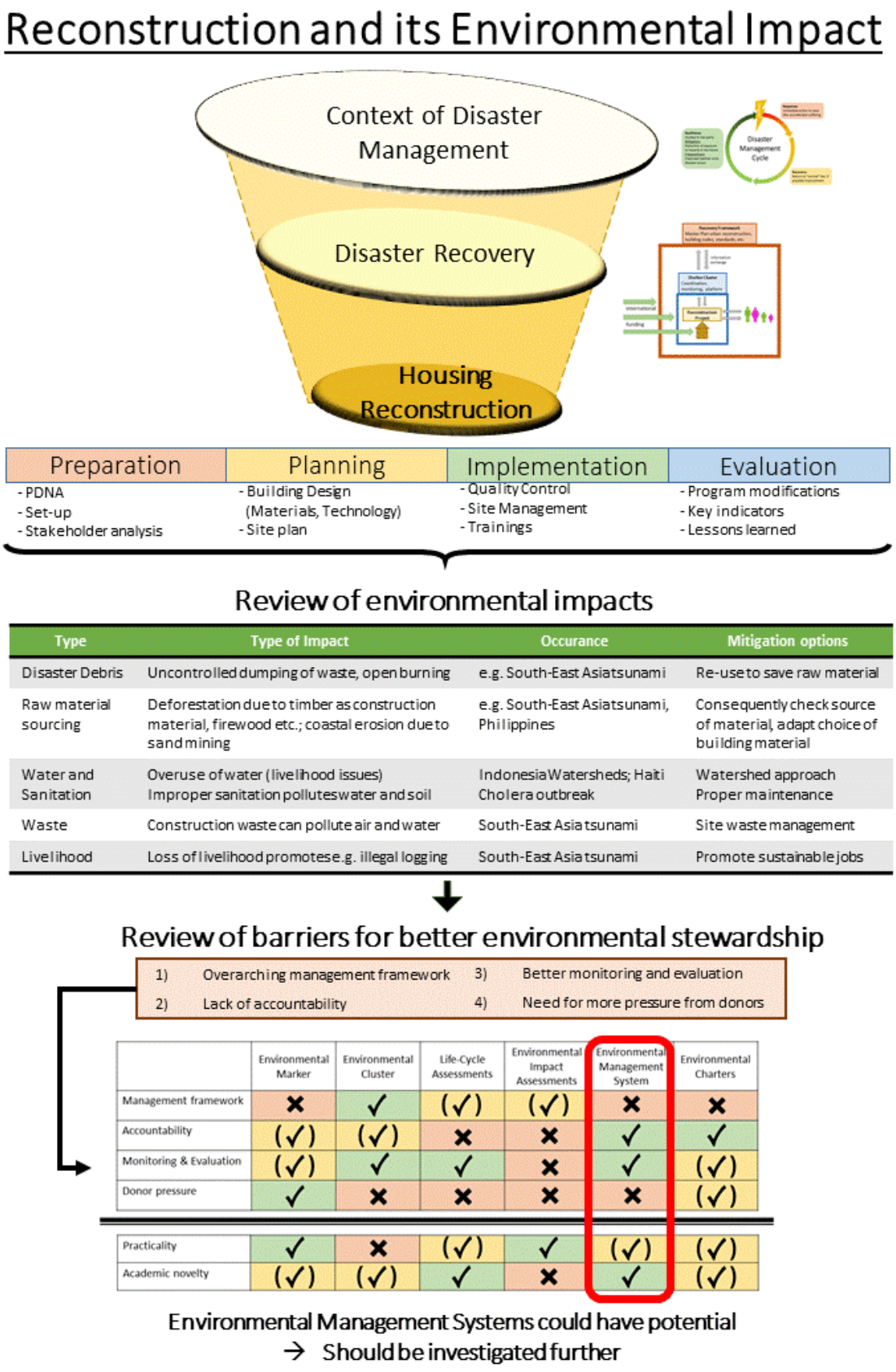


Figure 2-6 Overview of chapter 2: Disaster Reconstruction and its Environmental Impacts

3 ISO 14001 and its application

This chapter will introduce the concept and the methodology of EMS and focus then on the specific system elements and functioning of ISO 14001. Based on reviewing these elements, it will assess how companies in the conventional construction sector implement and use ISO 14001 to manage their environmental performance. This will be based on a review of reports and statements by construction companies, and academic papers studying ISO 14001 in the construction sector. The chapter will close with a short literature review of the main drivers and barriers to implement ISO 14001 in the conventional construction sector.

3.1 Environmental Management Systems

EMS have been vaguely defined in sub-chapter 2.6.5. This sub-chapter will go deeper into their functioning and methodology and present different EMS on the market. As described before, an EMS is a framework for considering the environment in the daily operations of an organisation. The US Environmental Protection Agency (EPA) defines an EMS as "a set of processes and practices that enable an organization to reduce its environmental impacts and increase its operating efficiency" (EPA, 2013). It is important to mention that it is no additional, stand-alone project, but a concept to integrate environmental thinking in the project management. It does not dictate a certain level of performance (like construction standards do), but makes use of management techniques to continuously improve from the level the organisation is on at that moment. While EMS are mainly adopted by manufacturing companies, non-manufacturing organisations can also have an EMS, however with a different focus: service-based companies should e.g. focus on their service's influence and on the customer's environmental performance (Brorson & Larsson, 2011).

According to Brorson & Larsson (2011), an EMS includes three main activities: (1) a systematic assessment of an organisation's activities which affect the environment (2) the development of measures for controlling these environmental aspects (e.g. objectives, trainings, measurements, audits), and (3) a corrective mechanism interacting with the two above elements to strive for continuous improvement. This is generally achieved with the so-called Plan-Do-Check-Act (PDCA)-methodology (see Figure 3-1). The PDCA-methodology focusses on continuous improvement through going through a cycle of assessing the environmental conditions, planning and implementing improvement activities, measuring the success of these activities and acting upon the now changed situation.

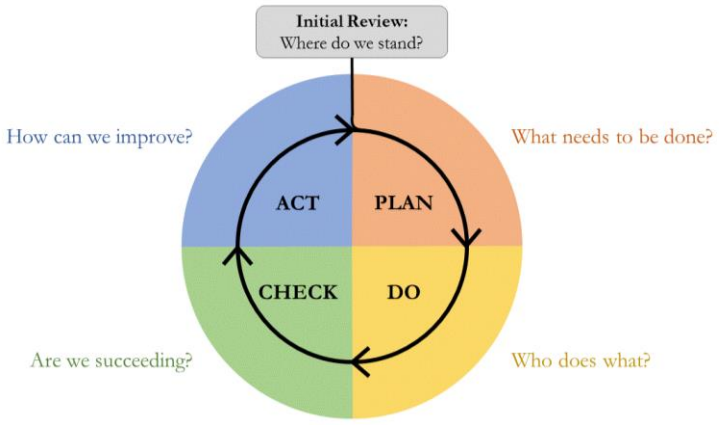


Figure 3-1 Plan-Do-Check-Act-Methodology (after Brorson & Larsson, 2011)

There are several different EMS. The most popular one is the ISO 14001, by the International Organisation for Standardization. Its first version was published in 1996, currently the 2004-version is in use. Later this year a new 2015-version will be published. Worldwide, more than 300 000 organisations have the ISO-certification in 171 countries, with a growing tendency (ISO, 2013). Many more follow the standard due to contractual obligations, however without official certification.

EMAS (Eco-Management and Audit Scheme) is another standard for an environmental management system, introduced by the European Commission, and thus mostly relevant for Europe. It dates back to 1993 and was last updated in 2009. Generally, it uses the same methodology as ISO 14001, however puts more focus on energy efficiency and demands from certified organisations to publish an "Environmental Statement", publicly describing their impacts on the environment (EC, 2013b). Close to 3000 companies registered to date, two thirds of which in Italy and Estonia (EC, 2015). AMEM (Alternative Models for Environmental Management) stands for other, smaller EMS models. They often specifically address SMEs that can't afford to implement big standards such as ISO 14001 or EMAS, and are academically still rather understudied (Kahlenborn & Freier, 2007). One example is the Ekoscan, by Ihobe (the Basque environmental management agency). More than 800 organisations have used the certificate, often as stepping stone to EMAS or ISO 14001. Ekoscan has the advantage of being simpler and cheaper than EMAS (Heras & Arana, 2010). See table 3-1 for a comparision between the three different types of EMS.

This thesis will focus exclusively on the implementation of ISO 14001 for three reasons: (1) ISO 14001 is used all around the world, also in less developed countries where the investigation for EMS in disaster reconstruction will be set; (2) ISO 14001 is well researched in its application in the conventional construction industry; and (3) ISO 14001 has a lot of consultants and experts specialized on its application, which would make an actual application easier for humanitarian organisations.

Table 3-1 Comparison between different EMS tools

ISO 14001	EMAS	AMEM
Biggest, most known environmental management system (+ 300 000 certificates in 171 countries	Well known and popular in Europe (around 3000 registrations)	Mostly unknown, not well researched systems; often stepping stone to EMAS or ISO 14001
Worldwide	European	Mostly National
Intended for all organisations	Intended for all organisations	Mostly intended for SMEs

3.2 ISO 14001 and its guiding methodology

This sub-chapter will review the methodology and requirements behind ISO 14001. For this, it will use the ISO guidelines for implementation (ISO, 2004), which direct their focus on the technical requirements, more than on practical implication. It will also make use of several implementation guidelines for ISO 14001 (e.g. Stapleton et al., 1996; Martin, 1998; Lear, 2005; Brorson & Larsson, 2011). As Brorson & Larsson provide the most detailed guideline, this will be the main source of the review. The focus will first lie on the technical guidelines, describing the basic thought behind the elements, added up with input from the guidelines concerning its practical application.

ISO 14001 has as its aim to guide an organization to develop and implement measures to control the impacts of their activities and fulfil all legal and other requirements. For this it uses a five stage approach: policy, plan, do, check, and act. This system should, if implemented properly, lead to a cycle of continuous improvement. Its scope can encompas all environmental aspects an organisation can influence. An environmental aspect is defined as an interaction with the environment (e.g. release of CO_2, discharge of wastewater with substance XY in it, etc.) while an environmental impact is the resulting change to the environment – positive or negative (e.g. climate change, eutrophication of rivers, etc.).

The EMS is divided into 17 system elements, each of them containing a set of requirements (55 overall). In the following, all system elements and their requirements are presented and explained (see also Figure 3-3). ISO's first system element is of a very general nature: it requires the implementation, maintenance and continuous improvement of an environmental management system with a defined and documented scope. What this system actually needs to contain in detail will be discussed in the following.

3.2.1 Environmental policy

[4.2] "Top Management shall define the organization's environmental policy" (ISO, 2004)

The environmental policy is there to set the overall direction. Top management should draft a document against which all environmental activities will be judged, basically a framework for all further activities that signals top management's commitment to environmental protection. It also must include a commitment to continuous improvement. This document needs to be appropriate to the scale and type of environmental impacts that occur, easy to understand and memorize, available to the public, and specifically communicated to all employees and contractors.

3.2.2 Planning

[4.3.1] "The organization shall […] identify the environmental aspects of its activities, [and] determine those aspects that have or can have a significant impact on the environment." (ISO, 2004)

Identifying environmental aspects can be done through an initial environmental review that analyses all the inputs and outputs of an organisation's work. Then, an objective system should be developed to determine which of those aspects have or can have a significant impact on the environment (Lear (2005) suggest a scoring system). A typical mistake is to render an aspect insignificant because of a low environmental impact. Not only is the absolute change in the environment of importance, but also the organisation's contribution to it (Brorson & Larsson, 2011). It is also important to not only account for the business as usual scenario, but to include different conditions (new development, modified activities (expansion), modified products or services).

Among the important issues to consider when mapping environmental aspects are: location, soil and groundwater, water usage, energy, chemical substances, air emissions, discharges to water, waste, uncontrolled situations, sub-contractor and suppliers, etc. (Brorson & Larsson, 2011).

[4.3.2] "The organization shall […] identify and have access to the applicable legal requirements and other requirements to which the organization subscribes" (ISO, 2004)

Organisations need to identify legal requirements on all levels (operating permits, product-based standards, environmental law, etc. (Martin 1998)) and analyse to which degree they apply to their environmental aspects. This task can also be included in the initial environmental review and should be accounted for independent of whether the legislation is enforced by the authorities or not.

Other requirements include agreements with customers and community groups (e.g. neighbourhood), standards of environmental charters, labelling schemes or other environmental commitments, and corporate or trade association requirements (ISO, 2004).

[4.3.3] "The organization shall establish […] environmental objectives and targets [and] a programme for achieving its objectives and targets" (ISO, 2004)

The environmental objectives set by a company should be in line with the commitments made in the environmental policy, reflected in more practical terms. They should be measurable and time-bound, but with a relatively wide horizon of several years (Stapleton et al., 1996). These objectives can be either for environmental quality (e.g. water quality objectives), result oriented (in comparison to a baseline scenario, measuring the success), or process-oriented (e.g. amount of training hours) (Brorson & Larsson, 2011). It is important that they are clear (minimize the risk of misinterpretation), positive (to not upset or demotivate the staff), reasonable, and communicated well (Brorson & Larsson, 2011).

Environmental targets are steps towards achieving the environmental objectives. They are supposed to be quantitative and achievable in a much shorter amount of time. Only fulfilling legal (or other) requirements is not enough, organisations need to commit to improve their performance beyond the legal minimum (Brorson, 2014a). The environmental programme, often called action plan, consist of the specific measures planned to reach the environmental targets, including timescales, budgets, and personnel responsible for it. To be successful, it should be dynamic and flexible. Continuous evaluation, adaption and reporting of progress are important activities (Brorson & Larsson, 2011). See Figure 3-2 for clarification on the interconnection of policy, objectives, targets and programme.

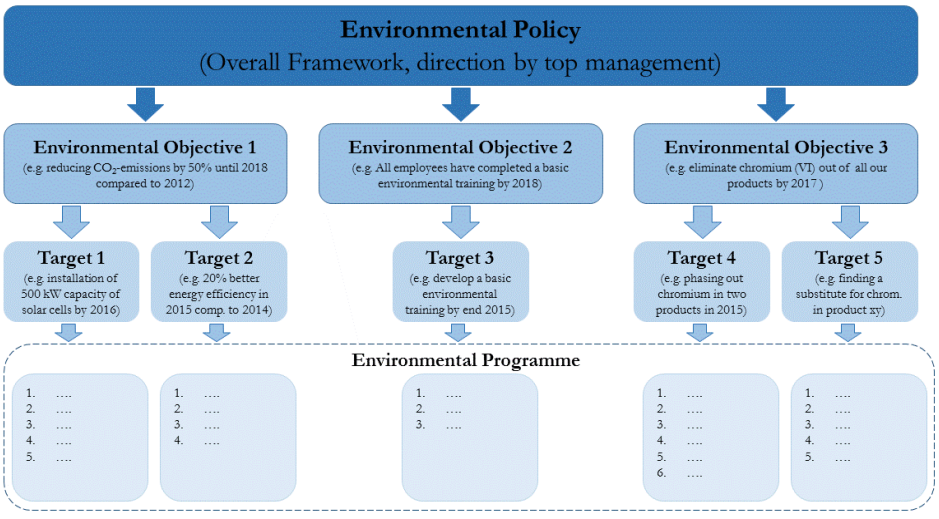


Figure 3-2 Connection between Environmental Policy, Objectives, Targets, and Programme in ISO 14001

3.2.3 Implementation and operation

[4.4.1] "The organization shall ensure the availability of resources essential to […] the environmental management system […]. Roles, responsibilities and authorities shall be defined, documented and communicated" (ISO, 2004)

For a successful and effective implementation of ISO 14001, top management needs to ensure that enough resources are available. It is not uncommon to hire a consultant to facilitate this process (Brorson & Larsson, 2011). Management also needs to clarify who is responsible for which actions and communicate this to everyone involved to ensure sufficient authority. ISO 14001 additionally demands a specific management representative who is responsible for the overall EMS. Other responsibilities may include: developing and maintaining the environmental policy, objectives and targets, managing stakeholder communication, procurement issues, environmental audits, etc. (Brorson & Larsson, 2011).

[4.4.2] "The organization shall identify training needs associated with its environmental aspects [and] provide training or take other action to meet these needs" (ISO, 2004)

All workers working on behalf of the organisation (including contractors) need to be appropriately educated in environmental issues. To ensure this, a training programme should be set up. The procedure for this should identify what are the existing competences, what are the needed competences and then address the gap between these two (Brorson & Larsson, 2011). Trainings need to be documented and assessed. Besides trainings, a general awareness programme should be set up (e.g. with competitions, reminding signs, etc.).

[4.4.3] "The organization shall establish […] a procedure for internal communication [and] receiving, documenting and responding to relevant communication from external interested parties" (ISO, 2004)

The own employees are the most important target group for an organisation (Brorson & Larsson, 2011). Thus, they need to be well informed about the EMS. Ways to communicate about the focus points, progress, challenges and opportunities include for example fixing environmental issues as an agenda point in meetings, special events (e.g. earth day), or an environmental newsletter. The organisation can decide whether it wants to communicate externally about its environmental aspects or not. External communication needs to be open and credible, especially towards neighbours and in case of an emergency (Martin, 1998).

[4.4.4] "The environmental management system documentation shall include the environmental policy, objectives and targets, description of the scope […], description of the main elements, […] documents, including records, required by this International Standard" (ISO, 2004)

The list in this element is rather straight forward and doesn't require much explanation. Concerning its practical implementation, complaints and external communication can often be important to store (Stapleton et al., 1996). Often general documentation is already well-established, and only needs to be coordinated with documentation of environmental documentation (Brorson & Larsson, 2011)

[4.4.5] "Documents required by the environmental management system and by this international standard shall be controlled" (ISO, 2004)

Control of documents means to develop a system to maintain the right documents in the right place. The aim should be to build up as little bureaucracy as possible while still enabling an efficient way of identifying and accessing the right documents (ISO, 2004). Nothing the less it is very likely that paperwork and documentation will have to be extended (Brorson & Larsson, 2011). For enabling proper control, documents shall have a document number, date, signature of approval, etc., and all documents should be revised regularly and removed when outdated.

[4.4.6] "The organization shall identify and plan those operations that are associated with the identified significant environmental aspects […] in order to ensure that they are carried out under specified conditions" (ISO, 2004)

This system element aims at gaining control over the environmentally crucial processes. For this, an organisation is required to establish procedures and instructions how these processes should be carried out, including criteria and parameters inside which the processes need to stay. Such procedures could be measuring of energy use or emissions, new processes or product designs (e.g. eco-design), green procurement guidelines, subcontractor requirements, etc. (Brorson & Larsson, 2011).

[4.4.7] "The organization shall […] identify potential emergency situations […] and how it will respond to them" (ISO, 2004)

There are many different kinds of emergencies and accidents possible that should be identified in the review. In the conventional industry (depending of course on the sector), often the focus lies on fire hazards and the release of chemicals (Brorson & Larsson, 2011). Measures to mitigate these hazards include creating awareness, performing a risk analysis, trainings, and mitigation and preparedness measures (firewalls, containment zones for chemicals, etc.). These measures need to be periodically reviewed and tested (ISO, 2004).

3.2.4 Checking

[4.5.1] "The organization shall establish […] a procedure to monitor and measure, on a regular basis, the key characteristics of its operations that can have a significant environmental impact" (ISO, 2004)

Monitoring and measurement are first and foremost necessary to proof the fulfilment of legal requirements (e.g. permits). For these measurements, the indicators are already set by the authorities. For all additional measurements, it is important to find suitable indicators and units in order to correctly interpret the results. Indicators can be absolute (not related to other figures), key figures (two figures in relation, measurement of added value), indexed (first valued set as hundred to identify development) or economic (cost/benefit of environmental work) (Brorson & Larsson, 2011). It is also important to check and calibrate the measuring equipment on a regular basis.

[4.5.2] "The organization shall establish […] a procedure for periodically evaluating compliance with applicable legal requirements [and] other requirements to which it subscribes" (ISO, 2004)

For an organisation to be able to demonstrate that it is in compliance with legal requirements, such as permits, is not optional but a legally demanded task. For ISO 14001, it is additionally demanded, that an organisation is able to demonstrate that it regularly evaluates its compliance with its objectives and the other standards for which it has subscribed. This can be done, depending on the indicator, through measurement results, audits, or other measures.

[4.5.3] "The organization shall establish […] a procedure for dealing with actual and potential nonconformity(ies) and for taking corrective action" (ISO, 2004)

Concerning nonconformities, it is essential to not only identify them, but also to determine their cause and to correct them at their roots in order to be effective. Nonconformities are usually discovered either through measurements and audits, or during the daily work routine. The corrective action needs to be appropriate to the scale of the nonconformity, from very un-bureaucratic (for daily work) to more elaborate and planned (for management assessments). It is also important to record the non-conformity and review whether the corrective action was effective (Brorson & Larsson, 2011). Instructions on when and how authorities are to be informed and the reporting of near-accidents are additional important features a system should have (ISO, 2004).

[4.5.4] "The organization shall establish and maintain records as necessary […] records shall remain legible, identifiable and traceable" (ISO, 2004)

Control of records encompasses a system of sorting, storing and retrieving records (such as measuring results, audit reports, training records, external communication, etc.). It is important to store the right things at the right places: the aim is not storing everything for ever, as records should not grow indefinitely. Often it is a problem that much information is created, however inefficiently stored (Brorson & Larsson, 2011). A functioning record storing system can help to keep important knowledge available for the company when key employees leave the organisation.

[4.5.5] "The organization shall ensure that internal audits of the environmental management system are conducted at planned intervals" (ISO, 2004)

Audits check the compliance of an organisation with the EMS and regulatory requirements. They have to be conducted at planned intervals, properly implemented and evaluated: ISO 14001 requires documented procedures for audits (what is measured how, by whom, how often, etc.). An audit needs to be conducted objectively and impartial. It can consist of checklists, document revisions, site inspections and interviews (Brorson, 2014b). The final product is an audit report for the top management. Generally, there are three types of audits: inspections, internal audits (either by staff from another department or by an external auditor), or formal audits (required for certification). (Brorson & Larsson, 2011)

3.2.5 Management review

[4.6] "Top Management shall review the organization's environmental management system at planned intervals" (ISO, 2004)

It is important that top management reviews and adapts the EMS regularly to make sure that the EMS keeps heading in the right direction. The management review is the part that closes the cycle of continuous improvement, by taking advantage of the input from audits, communications, measurements, and results on former objectives and targets, in order to draft new, relevant objectives, targets and programmes and maybe to adapt the environmental policy (ISO, 2004). The management review must cover the entire organisation, and might even change the overall scope of the EMS. The first review should not be held too early, in order to give the EMS time to unfold. Around one year is often seen as a realistic time between two reviews (Brorson & Larsson, 2011).

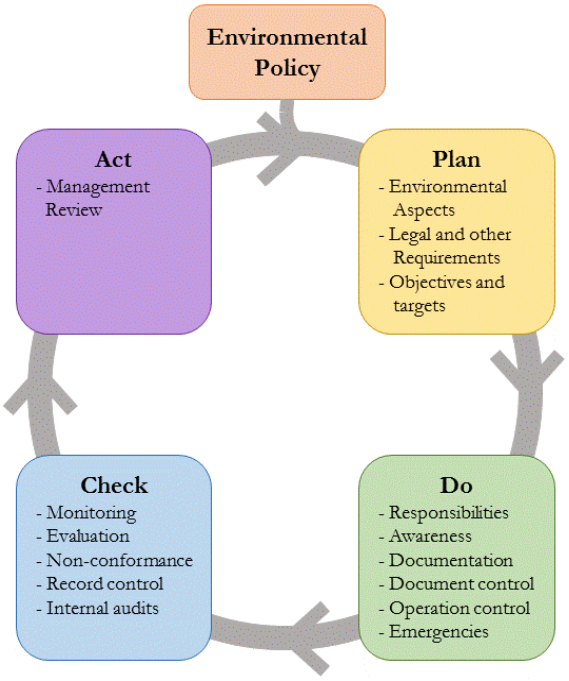


Figure 3-3 System elements of ISO 14001 in the P-D-C-A-Methodology

3.3 Adaption of EMS in the conventional construction industry

This chapter analyses how conventional construction companies that decided to get certified with ISO 14001 handled the requirements given in this standard. For this, a review of the published documents of several of the world's biggest construction companies are analysed (environmental policy, sustainability reports, environmental agenda). While this does not give a holistic picture of the internal implementation of an EMS, it gives some strong information about how their system is supposed to deal with e.g. environmental aspects, accidents, monitoring, etc. To make the picture more holistic, the review is also based on interviews with practitioners from the sector. It is structured according to ISO's methodology (see figure 3.3)

3.3.1 Policy

As environmental policy statements need to be published according to ISO 14001's requirements, it is not difficult to obtain material from the sector, which is very useful, as the policy sets the overall framework and direction of the EMS. As required in the standard, all environmental policies reviewed commit explicitly to continuous improvement. A decisive element is the scope: while some big construction companies explicitly include the entire life-cycle of their products (Skanska, 2011a; Vinci, (no date)), others do not (Hochtief, 2012; H+H Celcon, 2015). Also the responsibility for subcontractor's work is only included by some (e.g. Balfour Beatty, 2010; Skanska, 2011a; Hochtief, 2012; H+H Celcon, 2015). Early identification of environmental issues is also playing a crucial role in most policy statements.

Concerning the most important environmental issues, a common important focus point is energy efficiency and carbon emissions. This is not surprising, as the construction industry is (directly or indirectly) responsible for 30-40% of the global greenhouse gas emissions (Berge, 2009). Other re-current topics include focus on waste and raw materials, and partly water.

Some have very detailed descriptions including their objectives (e.g. zero waste) (Skanska, 2011a; Hochtief, 2012), while others formulate short and very generic (e.g. preserve natural resources) (Vinci, (no date); Balfour Beatty, 2010). Noise is a bigger topic in literature and during personal communication then it is in the environmental policies.

3.3.2 Planning

The early identification of environmental aspects is given a rather high priority in each specific project. It is one of the special circumstances in project driven sectors such as construction, that each project has new and different (significant) environmental aspects, while in static manufacturing, the aspects stay mostly the same (pers. comm.). At the same time, the industry is mostly based on a tendering system. Costs for developing a tender are therefore sunk costs without knowing whether the company will actually get the contract (especially in very competitive markets). That is why companies try to keep their costs for tenders as low as possible, so that EIAs are not as often performed as they should be, at least where they are not required by law. The ACS group wrote in its sustainability report that 61.6% of their tenders included an EIA. However 72% of their projects were carried out in ecologically sensitive areas. Two thirds of ACS's activities are ISO 14001 certified (ACS, 2013), so at least this corporation – the second largest construction group in the world (Phillips, 2015) – partly struggles with the early identification of significant environmental aspects in projects. Other corporations write about the goal of agreeing with their clients on environmental standards before the contract signing, however do not include numbers on how often this is happening (e.g. Balfour Beatty, 2014). Another strategy by construction companies is to develop two tenders, one with only the minimum requirements and one environmentally optimised, and leave it to the client to choose the degree of environmental protection (pers. comm.)

There is a clear commitment to compliance to environmental legislation in all policies and sustainability reports. Additionally, some organisations signed up (or are planning to sign up) to voluntary reporting schemes such as the Global Reporting Initative (GRI) or the Carbon Disclosure Project (CDP), compelling them to measure and publicly report certain forms of emissions (Vinci, 2013a; Hochtief, 2015; Skanska, 2015). Some also participated in the creation and promotion of new standards for green buildings: Skanska co-chaired the "greening the building supply chain task force" together with UNEP and is signatory of the Water 2014+ declaration (Skanska, 2015). Hochtief helped develop the Salmon State Construction Certificate for biodiversity in Seattle and is signator of the UN Global Compact (Hochtief, 2015). Vinci develops own eco-design tools under the "Blue Fabric" brand (Vinci, 2015). More and more projects are also under sustainable construction standards, such as LEED (Leadership in Energy and Environmental Design) or BREEAM (Building Research Establishment Environmental Assessment Method) (e.g. Bechtel, 2013; H+H Celcon, 2014; Hochtief, 2015; Skanska, 2015).

Environmental objectives, targets and programmes are mentioned in the sustainability reports, however rarely quantified publicly. All companies gave indication on their objectives, which mostly cover climate protection, waste management (both avoidance and diverting waste from landfills), and, to a lesser extent water management, natural resource protection, and biodiversity/ecosystem protection. Only Skanska, Vince and Hochtief partly publish quantitative objectives in their sustainability reports. Targets are not specified, usually only a statement is made that targets are either developed by or agreed with the individual business units. The environmental programme is not published.

3.3.3 Implementation

The roles, responsibilities, resources and authorities for implementing the environmental programme are not explained externally by construction companies. Balfour Beatty states the tasks of top corporat management (overall environmental policy), and individual operating company (implementing arrangements, ensuring compliance, etc.) (Balfour Beatty, 2010). It is often mentioned that the environmental unit is reporting directly to top management, and that it is responsible for complying the overall reporting. A hierarchy pyramid is sometimes published to demonstrate authorities (e.g. ACS, 2013).

The importance of awareness raising and trainings are mentioned in almost all policies and sustainability reports. More detailed numbers are however only rarely given. Vinci construction reported its total number of 13 700 hours of environmental training in 2013 – a steep increase of 35% compared to 2012 (Vinci, 2013b). Among them were weekly 15 minutes environmental session on the construction site to raise awareness of pressing issues such as efficiency or waste management. Skanska has as an objective to train more "top 1% manager" in environmental issues (Skanska, 2015). The ACS group's sustainability report mentions an emission reduction initiative that "saved 0 tonnes of CO_2" (ACS, 2013, p. 74) – most likely a typo.

Information on internal communication is – of course – not available. The extent to which corporations report to the outside differs. As mentioned above, not many communicate their environmental aspects and/or their quantifiable objectives and targets. Often reporting focusses on positive showcase projects. A common factor reported is the degree to which the organisations are EMS certified.

No detailed information is given on the system of documentation or documentation control in the construction sector. Proper documentation according to corporate standards can be a challenge to national companies (Skanska, 2015). The documentation control on the published documents themselves is partly weak: Balfour Beatty commits in its policy to annually review their environmental policy, the policy document available online is however from January 2010, signed by a chief executive that is no longer in charge (Balfour Beatty, 2010). Hochtief's environmental policy is given proper metadata (effective period, author, purpose, etc.), but the version currently available online expired in June 2014 (Hochtief, 2012). In general, there are many documents from different corporations without date, contact person/department or signature under the environmental policy.

Operational control is carried out by the national companies, and thus not focus point of the corporat sustainability reports. One of the tools mentioned, though, are specifications for subcontractors. Lam et al. (2010) did a detailed study on how the construction sector can improve its green specifications: the main conclusions include early stakeholder involvement, feedback and open public communication, and mainstreaming of the use of LCAs. Skanska developed a project-level carbon footprinting tool to control carbon emission in its projects which it is now trying to mainstream in its operations (Skanska, 2015). ACS reports waste reduction efforts in 95% of its projects; water reduction efforts in 53%; and biodiversity efforts in 55% of their activities (ACS, 2013).

Emergency preparedness and environmental risk monitoring are often mentioned. Companies developed tools to identify and manage risks. For example at Vinci, each group entity needs to prepare and update environmental incident prevention plans (Vinci, 2015). Bechtel (2013) focusses much of its sustainability report on workplace security.

3.3.4 Checking

Many corporations are still assessing all the different sources of their emissions (Hochtief, 2015; ACS, 2013). Only Vinci and Skanska are already fully measuring decisive emission parameters, such as carbon dioxide and water. While Vinci uses key indicators in relation to its revenue, Skanska reports in absolute terms (Skanska, 2011b). Balfour Beatty uses environmental fines as indicator for its compliance monitoring. Concerning evaluation, Skanska (2015) uses the most elaborate concept: it introduced a colour palette to evaluate the considerations in each project for different aspects, going from grey (compliance), over light green (beyond compliance) to deep green (e.g. zero waste, zero net-energy house, etc.).

For reporting non-conformance, Hochtief introduced a three level concept: massive incidents (irreversible effects, impact over 5 million €) are level 1 environmental damages, medium incidents (damage below 5 million, but above general deductible) rank as level 2 damages, and low-impact incidents as level 3. Hochtief had zero level 1 accidents, and four level accidents in 2014. Level 3 accidents are not registered on central level and dealt with locally (Hochtief, 2015). Skanska also introduced a new system for assessing non-conformances, and also mentioned challenges in reporting consistently as a worldwide corporation (Skanska, 2015).

There is no further information in the sustainability reports about record keeping policy. It can be assumed that the implementation is not drastically different from any other sector. Record keeping is mostly done by the national companies, not by the corporat head office. Many records are supposed to be accessible over the intranet. The ACS group reportedly performed more than 1800 internal audits in 2012 in all its sectors. Some companies specify their partner/consultant in ISO 14001 implementation and in auditing (H+H Celcon, 2014). Some state that the central level equips local companies with guidelines on how to prepare for an audit, and how to best make use of the audit results, without publishing these guidelines.

3.3.5 Management Review

The construction companies do not publish information on the processes of their environmental management reviews, neither do they publish which data they consider for it. For large cooperations, a good coordination of reviewing the right thing at the right level in the right time is very challenging, but necessary for continuous learning and successful EMS. Academic articles also suggest that management reviews should also be coordinated with the middle management to ensure that the decisions are practically feasible (Zhang, et al 2000). Figure 3-4 summarises the methods construction companies use to comply with the requirements of ISO 14001.

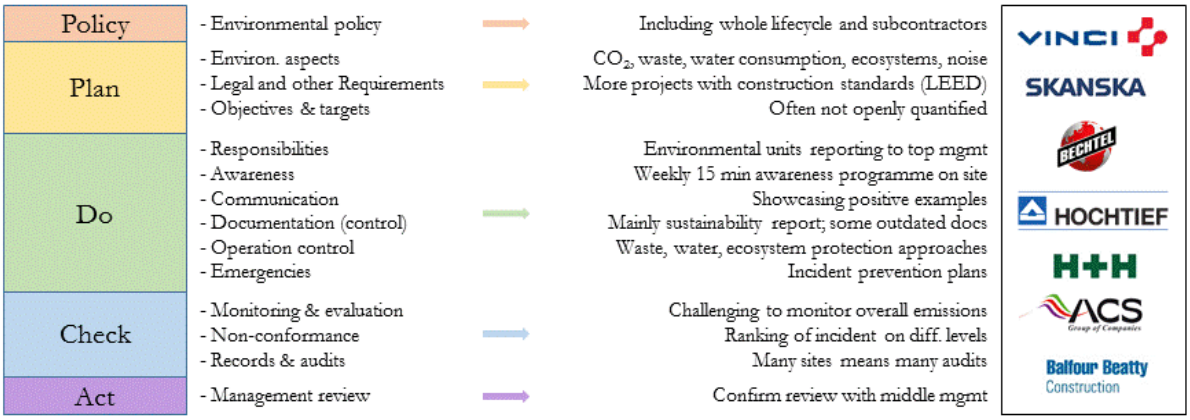


Figure 3-4 ISO 14001 in the construction industry (logos are copyright of the respective company)

3.4 Drivers and Barriers for adaption of ISO 14001 in the conventional construction sector

This subchapter reviews the literature on why construction companies decide to adapt ISO 14001. Construction has, behind electrics, the second most ISO 14001 certifications of all sectors (Turk, 2009), therefore it is a very interesting question why some decide to adapt, while others do not.

There is a lot of literature written and quite a lot of factors are generally agreed upon, but one of the central questions is not undisputed: do companies with ISO 14001 certification have a significant better environmental performance than comparable companies without? There are studies that conclude that ISO 14001 lifts the environmental performance over that of uncertified companies (e.g. Melnyk et al., 2003; Christini et al., 2004), other studies come to the opposite result (Barla, 2007), stating that it can be merely a lip service (Borial & Henri, 2012). General agreement is on the claim that ISO 14001 does not magically help by itself. Many studies state that its effectiveness ultimately depends on the commitment of senior management and the willingness of the entire organisation to integrate environmental concerns in the daily work (Nakamura et al., 2000; Barnsal, 2003).

What, however, are the underlying causes for construction companies to strive for ISO certification? What do they expect from it? And on the other hand, what are the barriers for other organisations to pass on certification?

3.4.1 Drivers

One of the main drivers to implement ISO 14001 is without doubt the expectation of reduced costs. Mostly, this concerns operating costs (ISO, 2013), for example concerning less material consumption due to higher re-use and recycling, and less energy and water consumption. Zutshi & Creed (2014) also identify benefits in reduced costs for delays, fines, insurances, complaints, etc. due to higher compliance with standards. Christini et al. (2004) talks in this context about risk reductions.

Another big driver where most literature agrees, is the stakeholder requirements that drive ISO implementation (Chavan, 2005; Turk, 2009; Campos, 2012; Zutshi & Creed, 2014). Especially the more and more strict regulation in many countries drives companies to introduce an environmental management system to facilitate the demonstration of compliance (Turk, 2009). This specifically concerns emerging economies, such as China or India, where environmental awareness is on the rise and legislation is getting stricter (and better enforced) at a high speed (Pun et al., 2001).

The access to new markets is another decisive driver for the implementation of ISO 14001. This is less valid for clients from the private sector, but many government-led projects demand ISO certification for tendering for their very voluminous projects (Pun et al., 2001). This also leads to subcontractors certifying to become eligible for contracts in government projects. Even in countries without demand for ISO 14001 and without very strict environmental legislation, large construction companies choose to certify in order to gain access to new, international markets (Turk, 2009).

Turk (2009) also identifies intrinsic motivation to 'do the right thing' and to become more sustainable as a driver towards ISO 14001. This argument goes in the same direction as Zutshi & Creed's (2014) environmental benefits and cleaner work site. These benefits can however also be partly quantified, e.g. in less sick days and higher worker satisfaction and motivation.

3.4.2 Barriers

Among the main barriers, the biggest one is likely to be the high costs of implementation for certification and consultancy (Turk, 2009; Campos, 2012; Zutshi & Creed, 2014). This is also why many organisations choose to implement the methodology of ISO 14001, but not have it officially certified, as the process is rather expensive.

Another big barrier, especially for small and medium sized companies (SMEs) is the increase of paperwork and operational costs (Zutshi & Creed, 2014). Those often seem to present high hurdles for companies, especially if they are not aware about the saving possibilities through ISO. Despite many studies showed that savings resulting from certification usually outweigh the additional costs (Christini et al., 2004), many companies mainly look at the cost factor. This barrier is one reason why most of the literature is arguing for better considering the needs of SMEs in the certification process (Turk, 2009; Campos, 2012; Zutshi & Creed, 2014)

Another, repeatedly mentioned barrier to broader implementation is the lack of client support (Christini et al., 2004; Turk, 2009; Zutshi & Creed, 2014). Except for the government and some specific clients, there is little commitment to making an EMS a requirement for construction works. The issues mainly focussed at from a client perspective is the environmental performance of the building during its lifetime (e.g. energy efficiency).

Christini et al (2004) sees another barrier in the subcontracting system, which would be very difficult to penetrate with environmental principles. Zutshi & Creed (2014) identify from their survey also a number of other reasons, such as a lack of trained staff, bad timing, or the fear that environmental trainings and adjustments would disrupt the work flow.

Table 3-2 Drivers and Barriers for implementing ISO 14001 in the conventional construction sector

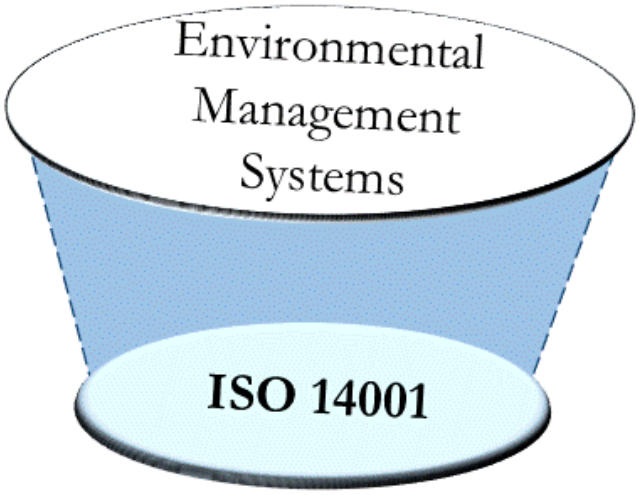
Drivers	Barriers
Lower operating costs, less fines, delays, etc.	High implementation costs
Stakeholder requirements and stricter legislation	Increase in paper work
Accessing new markets (esp. government contracts)	Lack of client support
Saver, healthier working place	Difficult to enforce in subcontracting system
Intrinsic motivation to environmental protection	Lack of trained staff, no good timing

3.5 Summary

To summarise, it can be stated that environmental issues in construction are becoming more important. Emerging economies increase their efforts in environmental protection, forcing construction companies to assess, control and minimize their environmental impacts. ISO 14001 is a tool to improve the environmental management of a company through a five step approach: an environmental policy, planning to tackle environmental issues effectively, proper implementation, monitoring, and regular reviews aimed at continuous improvement.

The system is implemented in the construction sector widely, mainly due to its cost saving potential and due to external pressures. Barriers are implementation costs and lack of client support. Many construction companies seem to struggle with some of ISO's requirements, but also came up with interesting solutions. ISO 14001 is a popular and handy tool for managing environmental issues, but needs professional implementation to be successful. See Annex C for a synthesis matrix of the literature reviewed. Figure 3-5 gives an overview over chapter 3.

ISO 14001 and its application



Policy	Plan	Do	Check	Act
- Environmental policy	- Environ. aspects - Legal and other Requirements - Objectives & targets	- Responsibilities - Awareness - Communication - Documentation - Document control - Operation control - Emergencies	- Monitoring. - Evaluation - Non-conformance - Record control - Internal audit	- Management review

Application in the Construction Sector				
- Including whole lifecycle and subcontractors	- CO_2, waste, water, ecosystems, noise - LEED, BREEAM - Objectives & targets not openly quantified	- Environmental units - Weekly awareness programme on site - Showcasing examples - Annual sust. report - Carbon footprinting - Incident prevention plans	- Challenging to monitor overall emissions - Ranking of incident on diff. levels - Many sites means many audits	- Confirm review with middle mgmt

Drivers	Barriers
Lower operation costs, less fines, delays, etc.	High implementation costs
Stakeholder/legislative requirements	Increase in paper work
Accessing new markets (esp. government)	Lack of client support
Saver, healthier working place	Difficult in subcontracting system
Intrinsic motivation	Lack of trained staff, bad timing

Figure 3-5 Overview chart: ISO 14001 and its application in the construction industry

4 Opportunities and Barriers for the Implementation of ISO 14001 in housing reconstruction

This chapter analyses what the main opportunities and barriers for the implementation of ISO 14001 in the housing reconstruction sector are. In order to do this, it will first bring together the findings of the two previous chapters in order to assess the level of comparability of disaster reconstruction and the conventional construction sector. After this, it will specifically analyses the differences between the two working fields, to point out the exceptional circumstances of disaster reconstruction. Then, as the core part of the analysis, the individual system elements of ISO 14001 will be tested on their feasibility and effectiveness in disaster reconstruction. Finally, based on the three above mentioned parts, the main opportunities and barriers for ISO 14001 application in disaster reconstruction will be identified.

4.1 Synthesis of the findings of both previous reviews

This sub-chapter is comparing the findings of the two previous chapters in order to see how comparable the situation for the application of ISO 14001 is between the conventional construction sector and post-disaster housing reconstruction. First it will look into how ISO 14001 helped conventional construction companies to improve their environmental performance, and then whether disaster reconstruction encounters the same environmental and management problems, so that ISO 14001 could work in a similar way there.

One conclusion of chapter 3 was that ISO 14001 can help the conventional construction sector to deal with environmental aspects. This is reflected in literature (e.g. Melnyk et al. 2003; Christini et al 2004; Campos, 2012), and also supported by findings from reviewing construction companies' sustainability reports. There is a clear correlation between the percentage of ISO 14001-certification of accompany (Skanska almost 100% (Skanska, 2015), Hochtief >80% (Hochtief, 2014), ACS group 66% (ACS, 2013)) and comprehensiveness of its monitoring and mitigation efforts. The same accounts for the clearness of their goals and objectives. When certification is not broadly pushed by the management (Balfour Beatty, 2014) or not at all applied (Bechtel, 2014), the sustainability reports contain much less tangible information, and often only data from flagship green projects.

When debating the environmental aspects identified in conventional construction and disaster reconstruction, one aspect central to both sectors is waste management. The focus of disaster reconstruction lies more on dealing with disaster debris, while the conventional sector focuses on construction waste avoidance, but the connected impacts and mitigation measures are very similar. Raw materials usage is mentioned by both sectors. However, while it is one of the biggest issues in disaster reconstruction, it is only of secondary importance for the conventional construction and often categorised with other aspects under "ecosystem pressures". Water issues are thematised by both sectors as well. Disaster reconstruction focusses on the usage phase of the house – to provide its inhabitants with sufficient water and proper sanitation – while conventional construction focusses on reducing the usage of potable water during construction. Carbon emissions are one of the main aspects in conventional construction, but are only very rarely mentioned in disaster reconstruction. Sivelihoods are only mentioned in disaster reconstruction.

When comparing the problems with managing the environmental impacts of conventional and disaster reconstruction, there are also some similarities: both the conventional sectors struggle with the monitoring of their environmental performance, mainly due to the diverse locations of their projects (e.g. ACS, 2013; Hochtief, 2014; JEU, 2014). In the humanitarian context,

coordination between different organisations is considered a problem, in the conventional construction, the challenge lies in the standardisation between different national branches of an international corporation. Disaster reconstruction is struggling with a lack of donor pressure for greening projects (JEU, 2014), which is very similar to the lacking client support in the conventional construction sector (e.g. Zutshi & Creed, 2014) (see 4.2.1 for a more detailed analysis). Lack of accountability, as in disaster reconstruction, does not seem to be a problem in the conventional sector.

The frameworks of housing reconstruction projects and of the ISO 14001 methodology are a third point of comparison. The two frameworks are constructed similarly, offering interesting potential for integrating ISO 14001 in the current project cycle of housing reconstruction. The planning phase, the implementation phase and the monitoring (checking) phase exist almost identically in both frameworks. ISO 14001 has additionally a policy phase and a review phase. The project management cycle for housing reconstruction includes a preparation stage, which is partly reflected in ISO's policy phase, and partly in its planning phase. Overall the frameworks used are very similar, but ISO 14001 has an approach more focussed on continuous learning – an approach housing reconstruction could benefit from. (see figure 4-1)

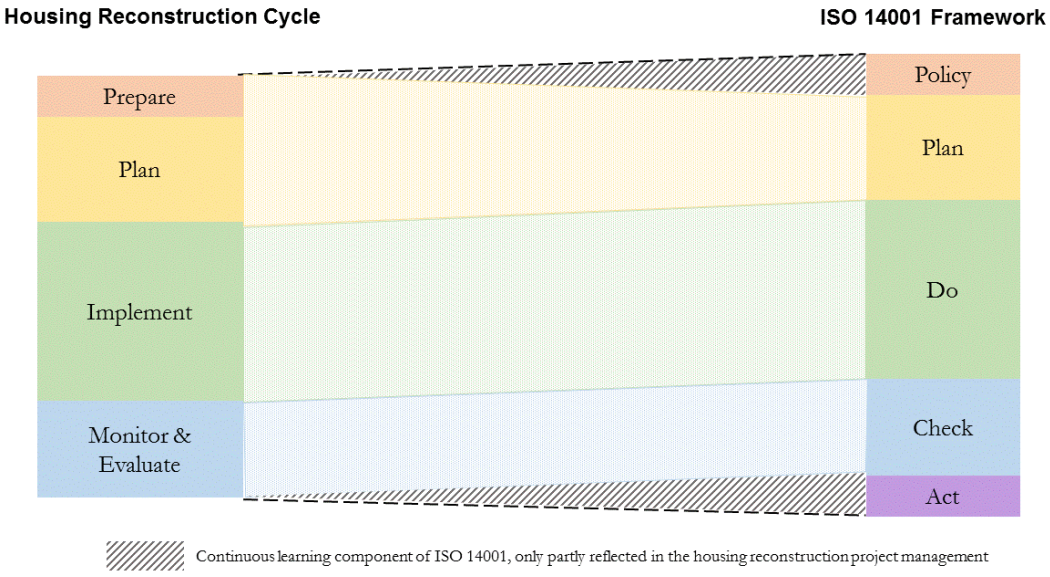


Figure 4-1 Comparison of the frameworks of the housing reconstruction cycle and ISO 14001

Overall, the environmental problems of disaster reconstruction and the conventional sector are of a similar type, however different in how they occur: environmental issues are more severe and basic in the humanitarian sector, which puts the focus rather on local problems such as resource extraction and water and waste management while global problems such as climate change are less prioritised. The same accounts for problems with environmental management issues: many are of a similar nature, but more severe in disaster reconstruction. Additionally, the framework for project management offers great entry points for ISO 14001.

These results encourage the idea that ISO 14001 could be used as a tool for better environmental management in disaster reconstruction, much in the way it was used in the conventional construction sector.

4.2 Differences between reconstruction and conventional construction

After looking into the similarities between the conventional construction sector and disaster reconstruction, this section will investigate the essential differences that can affect the viability of ISO implementation for housing reconstruction. These differences are identified based on the literature reviewed in the previous chapters, as well as on personal conversations with practitioners working in both sectors and based on personal analysis. A summary of these issues can be found in table 4-1.

4.2.1 Funding source

A very important difference to consider with significant implications on the overall project cycle is the source of funding. In housing reconstruction projects, the client funding the project will also be the owner of the finished house. This is very different in the context of disaster reconstruction: in this case the funder of a project is a donor organisation (or private person) while the beneficiary is someone else, adding a new stakeholder.

This brings up two main issues: first of all a different approach to monitoring and evaluation. While clients in the conventional sector usually only require the finished product (i.e. house) in good quality, donors in the humanitarian sector follow up strictly on all financial flows and activities, and evaluate the performance of their partner organisations (EC, 2014b). This means that humanitarian organisations usually need to implement systems for monitoring and beneficiary satisfaction evaluation. Even though disaster reconstruction projects often still struggle with following up on their work, the pre-existing monitoring and evaluation schemes can make it easier to integrate environmental issues (pers. comm.). The second main impact are the different interests of donors and beneficiaries. In theory, those should be aligned. In reality however, humanitarian organisations often need to minimse the costs per housing, in order to reach as many people as possible, while beneficiary interests are more long-term and quality oriented (pers. comm.). The process of linking disaster recovery to long-term development is still a task in need of improvement (EC, 2014c; pers. comm.).

In the conventional construction sector, ISO 14001 can be used to demonstrate environmental care towards clients (Orsato, 2009). It often is a requirement in the construction sector for participating in tenders (see chapter 3). This is not the case in the disaster reconstruction sector: an environmental management system is no prerequisite for getting project funding, often environment is not even thematised (EC, 2014d), even though this trend is very slowly changing (JEU, 2014). Therefore, ISO 14001 certification by itself does not offer a competitive advantage for organisations in the humanitarian sector at the moment. It can only facilitate changes driven by the own interest of an organisation to improve the environmental performance of its projects. As this can also be reached by applying the framework without being certified, the official certification is (currently) not necessary and only a cost factor. This thesis is therefore not investigating the potential of official certification, but the potential of using the framework of ISO 14001 as a mean to improve the overall environmental performance.

4.2.2 Role of the media

In the conventional construction sector, the media works as a whistle-blower to uncover environmental degradation. Negative media attention is one of the main reasons for companies to improve their environmental performance, and to get official certification to demonstrate its efforts for environmental protection (Orsato, 2009). The role of the media in disaster recovery is very ambiguous: first it is needed to generate awareness and funding.

Often, however, it turns on humanitarian organisations for not delivering aid quickly enough, not seldomly without considering the difficult circumstances in which these organisations are operating. Environment is usually not a big issue in the coverage, and the media is much more likely to criticise non-action (and careful planning) than environmental degradation (Lettieri et al., 2009). Also environmental NGOs are not as likely to go after humanitarian organisations as after conventional construction companies (pers. comm.). Thus the media does not incentivise environmental protection by holding humanitarian organisations accountable for their environmental performance.

4.2.3 Consequences of non-action

In the conventional sector, non-action is usually a valid option, often houses are rebuilt long before the end of their potential life-time (Berge, 2009). Sometimes additional living space is badly needed (e.g. in fast-growing urban areas), but often rebuilding is only a form of upgrading. In these cases, non-action or a renovation of the existing building could have less environmental impact than a completely new building. The energy use during the entire lifetime of the house needs to be considered when assessing the best solution (Berge, 2009).

In disaster reconstruction houses definitely need to be rebuilt. Many houses can be repaired, and sometimes existing buildings can be renovated to fit a new function (see chapter 2.3.2) (Schneider, 2012), but massive reconstruction activities are unavoidable. They also need to happen in a timely manner since living in camps and temporary shelters often causes environmentally harmful behaviour (for example in Haiti 2010) (UNHCR et al., 2012). Non-action also causes more self-reconstruction by the affected population – already the most common form of reconstruction. This often happens with much less environmental considerations (timber sourced from the black market, no proper solution for saniation and hygiene, no DRR standards, etc.). Slow, careful planning thus becomes a trade-off with the consequences of living in temporary shelters and leaving the repair to the affected population.

4.2.4 Other activities by the same organisation

Conventional construction companies usually are active in the construction sector only. Even if they are part of a larger corporation, the company that is being ISO certified is usually specifically focussed on construction (Christini et al., 2004). In disaster reconstruction many different tasks are taken over by a humanitarian organisation besides housing reconstruction. This makes it difficult to identify and work with the environmental implications of one sector in specific (e.g. concerning the environmental policy – should it be cast for housing reconstruction specifically, or should it include the environmental aspects of all activities)

4.2.5 Cumulative effects

In the conventional housing sector, different companies are competitors to each other. They do not have to address the environmental impacts of other organisations. It is the task of the government (central or local) to address cumulative pollution effects and ensure through limited permits that the overall pollution is not becoming too high. In disaster reconstruction, different organisations should work together as a group to alleviate suffering. Therefore they need to consider the work and environmental effects of other organisations in the same area. Additionally, there are generally much more cumulative effects, since the activities are concentrated in a small area (pers. comm.). This reduces the effectiveness of ISO 14001 in disaster reconstruction, as ISO is intended for individual organisations, not for managing the overall environmental impact of an entire sector.

Table 4-1 Differences between disaster reconstruction and conventional construction activities

Disaster Reconstruction	Conventional Construction
Donor (client) and beneficiary are not identical	Client and house owner are identical
Media rather criticising non-action	Media works as whistle-blower
Non-action has negative environmental affects	Non-action often means no impact
Broad spectrum of activities besides construction	Companies specialised on construction only
Cumulative effects need to be considered	Companies do not need to consider cumulative effects

4.3 Analysis of the system elements of ISO 14001 in post-disaster housing reconstruction

This sub-chapter will review how well each ISO 14001 system element would fit post-disaster housing situations. This thesis argues that two issues are decisive for analysing the potential of a system element. The first issue is how **feasible** it is for humanitarian organisations to implement and maintain procedures that fulfil this criteria. The second issue is how **effective** would this system element be in helping to improve the environmental performance of a project. Only an overall system that is both feasible to implement and effective leads to an improvement. Additional criteria such as efficiency are excluded, as they would demand a comparative analysis with other tools, which is not included in this work's scope.

To analyse the feasibility of a system element, the thesis considers three factos: (1) the requirements that need to be achieved (see chapter 3.2), (2) the currently existing procedures, and (3) the procedures demanded/suggested by guidelines and charters in the humanitarian sector. Based on this, it is assessed how big of a step it would be for humanitarian organisations to comply with ISO requirements. The analysis on effectiveness assesses each system element's potential to tackle one or more of the barriers to environmental stewardship in humanitarian aid, identified in chapter 2.5.

Based on this analysis, each system element of ISO 14001 will be graded with a plus (+), a zero (0), or a minus (-) for both its feasibility and its effectiveness. Based on these two grades, the requirement will receive an overall grade ranging from double-plus (++) to double-minus (--). Positively graded system elements are potential opportunities for ISO implementation, while negatively graded system element are potential barriers. After this sub-chapter, the thesis will further investigate both the positively and the negatively graded elements to see how serious the opportunity or barrier is and to identify patterns and groups.

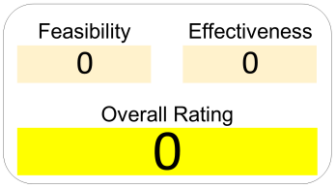
4.3.1 Policy

[4.2] "Top Management shall define the organization's environmental policy" (ISO, 2004)

There are generally only very few environmental policies published on the web pages of humanitarian organisations. IrishAid has an "Environmental Policy" (however not compact as required by ISO, but rather like a code of conduct (56 pages) (IrishAid, 2008)), the GIZ mentions the environment in their mission statement (GIZ, 2015), and the American Red Cross includes a section about the environment in their codes of ethics (ARC, (no date)). No agency reviewed for this work has a specific environmental policy. Other major organisations such as Care, WorldVision, Safe the Children, Oxfam (Oxfam, 2011; Oxfam, 2013) and others

do not have environmental statements in their major steering documents at all. Developing an environmental policy would not be that difficult, as it can be done independent from acute emergencies, at a time where most of the special circumstances of humanitarian aid do not apply, so that the challenge for drafting a policy is not bigger than for conventional construction companies. One additional difficulty lies in whether or not to focus specifically on construction or to include other humanitarian activities.

Generally, a commitment to environmental protection by the top management would certainly be a valuable signal that is currently not given in many organisations (pers. comm.). However, there are already many policies and commitments made that have not had significant effects in the field. This does not mean that standards and policies in humanitarian aid are ineffective. There is however a need for procedures to better follow up on the implementation of commitments made on paper (pers. comm.).

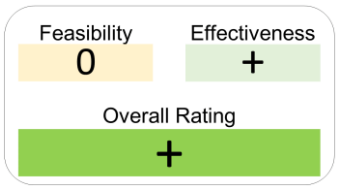


4.3.2 Planning

[4.3.1] "The organization shall […] identify the environmental aspects of its activities, [and] determine those aspects that have or can have a significant impact on the environment." (ISO, 2004)

In theory, the reconstruction sector could be able to use PDNAs – and specifically the environmental needs assessment (ENA) (see chapter 2) – to identify environmental issues in a post disaster context. In reality however, they are often not detailed enough and rather written to make donors aware of the financial needs of the recovery (pers. comm.). They can of course be useful nothing the less, but most often further investigation into the local post-disaster circumstances is needed (for example in the form of an EIA). The Haiti PDNA is a positive example, that contains much detailed information on the pre-disaster environmental situation, and the environmental problems to be expected (State of Haiti, 2010). Additionally to the PDNA, pre-disaster assessments on the environment often are available, for example the European Commission's "Country Environmental Profiles" (Palerm et al. 2007, EuropeAid 2011). Based on the combination of PDNA, pre-disaster environmental profiles, and experiences made with construction projects elsewhere, environmental aspects likely to occur can be assessed fairly precisely. Of course this work would need to be done in the middle of the busiest, most messy phase of the disaster relief, when resources are very scarce. The identification of environmental aspects is also part of the Sphere standard, and should therefore theoretically be part of every shelter project (The Sphere Project, 2011).

Identifying environmental aspects early and creating awareness for them can help to introduce mitigation measures already during project design, significantly reducing costs compared to project changes midway through implementation (pers. com.). The advantages of early inclusion have also been realised in conventional construction (see chapter 3). However, such early analyses (for example EIAs) are often stand-alone projects which do not find their way into the reconstruction activities (JEU, 2014). This can possibly be combatted by implementing other ISO 14001 system elements.

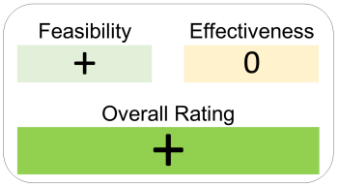


[4.3.2] "The organization shall […] identify and have access to the applicable legal requirements and other requirements to which the organization subscribes" (ISO, 2004)

Identifying legal requirements, such as building codes and city development plans, is a necessity in post-disaster situations. Reconstruction guidelines put emphasis on the point that humanitarian organisations need to co-operate with local authorities and may not start their activities without the consent of the government (Jha et al., 2010; Schneider, 2012). Other requirements and commitments can and should be readily identified by project managers before the project starts.

The most significant "other requirement", to which virtually every bigger humanitarian organisation commits, is the Sphere Standard (The Sphere Project, 2011). It is split into 'core standards' and more specific standards for water and sanitation, food security, health and shelter. The core standard demands systems for training, internal and external communication, vulnerability and risk analysis, etc. They do not specifically mention environmental issues. The standards for shelter contain – besides technical standards (minimum size 3.5 m^2 per person, technical/performance details) – several environmental standards, which are however kept rather general.

It is fairly easy to implement this requirement. Knowledge of both local regulations and corporate commitments should be the norm in humanitarian organisations anyways. It can be beneficial to remind projects of their environmental commitments (even if they are only vaguely). The true challenge however lies not in the identification, but in the enforcement of these commitments.



[4.3.3] "The organization shall establish […] environmental objectives and targets [and] a programme for achieving its objectives and targets" (ISO, 2004)

Introducing quantifiable environmental objectives early on can be a very tricky task, but has been done at different occations. Reconstruction activities start on day one after the disaster (Jha et al., 2010). As time passes, more information can be acquired, and projects might need to be changed significantly (EC, 2014b). Thus it is very difficult to set environmental objectives and targets in the beginning: the challenge is not to set any objectives, but to set realistic objectives that also can be followed up during the project (pers. comm.). Additionally, this requires resources early on that might not be available, and some might argue that environmental objectives would take away the focus from the people in need (JEU, 2014, pers. comm.). What possibly can be identified early on (i.e. after assessing the PDNA) are suitable environmental indicators. Environmental quality objectives are the most difficult to develop and follow up to, due to the cumulative effects of several projects.

QSAND, a tool for assessing sustainability in reconstruction developed by BRE and the IFRC in 2014, can help develop targets and a programme for environmental management. It provides a very comprehensive list of potential targets for many different environmental aspects and bundles these activities in groups to achieve different levels of sustainability (from a set of baseline measures up to level 3 sustainability for every significant aspect) (BRE & IFRC, 2014). Nontheless, drafting a realistic environmental programme will require resources, which are often not made available for cross-cutting issues such as the environment at this point. Environmental considerations would most often, in the best case, be integrated in the general planning process, but not as a separate programme (pers. comm).

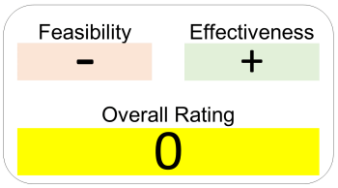
The benefit of having environmental objectives, targets and a programme could be significant: a realistic set of objectives would increase both the accountability and awareness of a project's environmental impacts. If chosen too premature, inappropriate environmental targets can threaten the overall effectiveness of the entire project. Developing long-term objectives and targets is therefore difficult, but can help improve the environmental impact through increasing accountability and awareness.

4.3.3 Implementation

[4.4.1] "The organization shall ensure the availability of resources essential to […] the environmental management system […]. Roles, responsibilities and authorities shall be defined, documented and communicated" (ISO, 2004)

Roles and responsibilities are already fairly well defined in the sustainable reconstruction literature, also concerning their environmental responsibility (e.g. Schneider, 2012; SKAT & IFRC, 2012). The project manager will have the general responsibility to account for environmental needs. It is possible and beneficial to have an environmental expert or field advisor (EFA) in the project team, as seen in Haiti after the earthquake (UNHCR et al. 2012). However, it is important to make sure that no conflict of authority between environmental expert and project manager develops and that the organisation accounts for the additional resources an EFA will need (financially and logistically). Providing the resources necessary for an effective environmental management system is the most pressing problem in the humanitarian sector. Many agencies claim they would like to increase their efforts, but do not have the funding available to do so (JEU, 2014).

Generally, a more detailed organisation structure, including environmental responsibilities in the job description of the project manager and others (e.g. procurement), would help to increase accountability inside of a project team. Adding these responsibilities in the job description would be an easy first step. Providing the resources for actually implementing the EMS is the real challenge. It again depends on top management and the donor organisations to make these resources available (pers. comm.).



[4.4.2] "The organization shall identify training needs associated with its environmental aspects [and] provide training or take other action to meet these needs" (ISO, 2004)

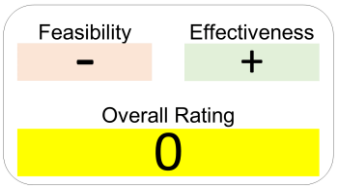
Environmental training programmes for the humanitarian context, and also specifically for housing reconstruction already exist (e.g. the Green Recovery and Reconstruction Training Toolkit (GRRT) by the American Red Cross and the WWF, or the environmental trainings by the Joint Environmental Unit (JEU) of UNEP and UN-OCHA). With these tools, the project management can be trained professionally, and fairly cheap, to an appropriate level of environmental awareness. Organisations however need to decide to take advantage of them as part of capacity building before a disaster. The bigger difficulty in training needs are the sub-contractors and local workers from the host country (pers. comm.). Since they are hired on a short term, partly (in owner-driven reconstruction projects) not even by the organisation itself, but by the beneficiaries, it becomes very difficult to assure they are properly educated (IFRC, 2010). A possibility to manage this would be to use good examples from the conventional construction, e.g. a 15-minutes weekly environmental session on site (ACS, 2013).

A well implemented training programme would effectively tackle the important issue of lacking environmental awareness. Humanitarian NGOs' field offices experience up to 80% annual turnover (Maiers et al., 2005). Training these new employees is an imperative for environmental stewardship. It would be fairly easily implementable for the project management level, and can be done step-by-step for local workers.

[4.4.3] "The organization shall establish […] a procedure for internal communication [and] receiving, documenting and responding to relevant communication from external interested parties" (ISO, 2004)

Humanitarian organisations are very active in exploring communication strategies and participatory approaches with their stakeholders, especially the beneficiaries. The communication systems inside the humanitarian sector are subject to intense research and development and have improved much over the past decade (Chapelier & Shah, 2013). Even though internal and external communication channels are well developed, inclusion of environmental issues might be difficult. There is a huge need for communication in post-disaster situations, and large amounts of information are being exchanged at all times (Chapelier & Shah, 2013). Even information about the primary progress of the projects is difficult to communicate effectively. In this context, it is not easy to gain support for increased environmental communication (Maiers et al., 2005).

Many humanitarian organisations publish annual reports. Most do not focus on environmental topics (Save the Children, 2013; Care, 2013). A possible benchmark is the GIZ (the organisation implementing projects for the German ministry of development), which publishes an annual sustainability report, communicating their emissions, water consumption, etc. on central level. They also have their headquarters certified according to the EMAS-standard (GIZ, 2014), and mention their "award-winning" internal communication: their policies are translated in seven languages, and their intranet is available in a low complexity version for access from regions with slow internet (GIZ, 2014). Due to the above (sub-chapter 4.2.2) described situation in which the media goes after non-action rather than after environmental degradation, communication here has ironically rather the role of justifying environmental care instead of emphasizing it (Lettieri et al. 2009). If successful, good communication can help improving the status of the environment in the humanitarian context.

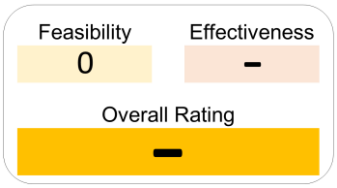


[4.4.4] "The environmental management system documentation shall include the environmental policy, objectives and targets, description of the scope […], description of the main elements, […] documents, including records, required by this International Standard" (ISO, 2004)

Documenting the most important papers (policy, environmental objectives, etc.) once they are drafted does generally not appear like a difficult task, especially for the humanitarian sector, who needs to document quite a lot of details already when applying for funding (EC, 2014d). Additionally, the humanitarian sector has impressive libraries on environmental guidelines, checklists, evaluations, etc. (Shelter Cluster, 2015). However, to describe how the different parts of the EMS work together (which is the aim of the requirement), would demand additional bureaucracy and resources. The above mentioned documents are drafted outside of the context of humanitarian emergencies. In post-disaster situations, there is often no space

for detailed documentation and many things happen in an uncoordinated way (pers. comm.) This concerns all sectors, not only the environment. A central documentation system can also not simply be required by the headquarters, since the field levels are far more autonomous and more heterogeneous in their needs than in conventional construction (Maiers et al., 2005).

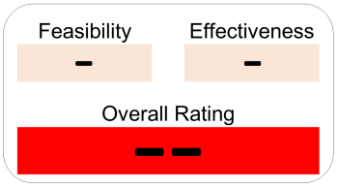
For larger reconstruction projects, some donors require an environmental management plan, which includes this kind of documentation (pers. comm). Thus documenting essential environmental processes during disaster reconstruction is not impossible. It is however not seen as a priority by many project managers. It is well understood that the documentation process is a bureaucratic necessity for continuous learning and for maintaining knowledge inside an organisation also after a project is completed or a project leader leaves. In the humanitarian context, however, it seems more important that the already available documents are actually accessed and considered by the right people (pers. comm.), which would rather support the importance of the communication element.



[4.4.5] "Documents required by the environmental management system and by this international standard shall be controlled" (ISO, 2004)

Controlling the documentation is even difficult in the conventional construction sector, where teams are working explicitly on maintaining the EMS (see sub-chapter 3.3.3). Documentation control is a very bureaucratic act that represents a barrier for implementation even for companies working in non-emergency situations (see sub-chapter 3.4.2). In the humanitarian sector, where decisions often need to be made quick and unbureaucratic, it would be difficult to make resources available for documentation control on field level.

It is very understandable how proper documentation in a post-disaster context can be beneficial for improving control over resource and material flows (e.g. concerning procurement or dispersion of cash grants to the population). The added value of an environmental documentation system beyond the donor requirements is however, compared to the efforts necessary for it, rather small and usually not pursued by headquarters or field staff (pers. comm.).

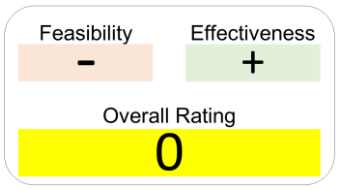


[4.4.6] "The organization shall identify and plan those operations that are associated with the identified significant environmental aspects […] in order to ensure that they are carried out under specified conditions" (ISO, 2004)

Operational control is often closely related to quality control and thus already present in post-disaster housing reconstruction to a certain degree. Guidelines suggest that quality management (e.g. concerning the size, design, and lifetime of the building) needs to be strictly supervised, and specifications and strict working conditions set in order to assure good quality homes (Jha et al., 2010; Schneider, 2012). Academic studies from the past (e.g. Roseberry, 2008) often claim this has not been implemented very successfully. (Self-)evaluations of housing reconstruction projects often give a more positive impression (e.g. KfW, 2013; UNHCR, 2014). Among the operational control measures with environmental significance, efficiency-increasing measures, such as waste avoidance, can be implemented broadly, if there is a drive for it from management side (pers. comm.). Operational control of purely environment-related factors, such as controlling the sustainability commitments of suppliers, is more difficult to realise due to the high time pressure and budget constrains during housing

reconstruction activities. Generally when there is a trade-off between environmental operation control and speed or costs, often the latter are given the higher priority (JEU, 2014).

Better operation control could be very effective to improve environmental care. Many of the environmental impacts described in chapter two are due to a lack of control on site and in the supply chain. Organisational guidelines for many of these aspects do already exist (e.g. UN-OCHA et al., 2009; Oxfam, 2012). Operational control could help enforce these guidelines.

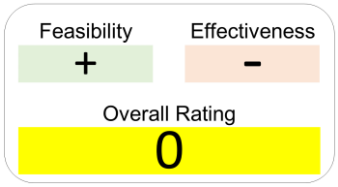


[4.4.7] "The organization shall […] identify potential emergency situations […] and how it will respond to them" (ISO, 2004)

It is certainly somewhat ironic for emergency aid organisations to discuss emergency preparedness. Planning for disaster risk reduction (fire, storms, earthquakes) in the finished buildings are central elements of housing reconstruction. Generally, DRR gains in importance with increasing focus on climate change adaptation in the donor community. Evidence for that is the introduction of the 'resiliency marker' by the European Union in their funding requirements in the beginning of 2015. Since then, all humanitarian projects need to include an explanation of how their project is going to affect the resilience of the population towards natural or man-made hazards (EC, 2014e).

The proper storage of materials (and waste) during construction can sometimes be difficult in post-disaster situations, as not enough suitable space is available (SRC, 2006). Generally, guidelines strongly recommend avoiding the use of hazardous substances and dangerous chemicals in the post-disaster context (e.g. IFRC & Skat, 2012). In cases where such substances are used, special attention needs to be paid to their storage. Sanitation facilities also need to be considered, to make sure that the potential pollution of a spill of human excrements would not pollute a critical mass of drinking water (The Sphere Project, 2011; Schneider 2012).

In most of the cases the DRR implemented nowadays is already sufficient to fulfil the ISO requirements. The precautionary measures for sanitation facilities and hazardous substances (especially waste) vary from project to project. If not taken care of properly, they can be the source of environmental hazards (SRC, 2006; UNHCR et al., 2012). Generally, the additional effectiveness and improvement through this system element however would not be significant.

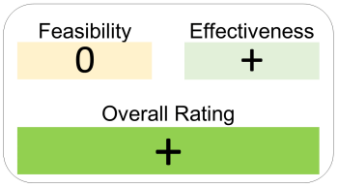


4.3.4 Checking

[4.5.1] "The organization shall establish […] a procedure to monitor and measure, on a regular basis, the key characteristics of its operations that can have a significant environmental impact" (ISO, 2004)

Monitoring schemes are, due to donor requirements, already implemented for several non-environmental issues. Currently, organisations mainly need to monitor and report their financial flows and the development of the project (EC, 2014d). One tool for monitoring of humanitarian aid activities is called MEAL (Monitoring, Evaluation, Accountability and Learning) (UNHCR et al., 2014). Even though environmental issues are currently not a part, it

is important that a monitoring system for project activities is already in place. Integrating environment into comprehensive tools such as MEAL can significantly reduce the implementation costs (pers. comm.). Nonetheless, environmental monitoring would require additional resources, which might be difficult to acquire. Costs and difficulties also depend on the choice parameters to be measured, the equipment necessary for the measurements, and the staff needed (as well as the amount of expertise). Often, important monitoring results can be achieved very cheaply with no or only little equipment (pers. comm.). The difficulty of monitoring a parameter should already be considered when choosing appropriate environmental objectives during the planning phase.

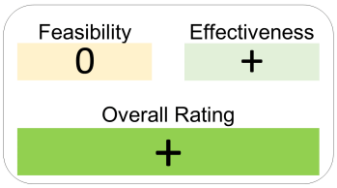


The lack of monitoring was identified as one of the crucial problems of environmental mainstreaming in humanitarian aid. Increasing the efforts here can have a significant positive impact compared to the relatively low costs of implementation.

[4.5.2] "The organization shall establish […] a procedure for periodically evaluating compliance with applicable legal requirements [and] other requirements to which it subscribes" (ISO, 2004)

Evaluations are, just like monitoring activities, often a part of donor requirements, which means they are already widely implemented in housing reconstruction activities (see MEAL). Additionally, the Shelter Cluster is accumulating information on shelter projects and publishes evaluation reports of emergency shelter, temporary shelter, and permanent housing projects approximately every two years (UNHCR et al., 2012; UNHCR et al., 2014). Environmental issues are however only rarely included yet. Integrating environmental issues in existing evaluation schemes would not be too difficult, but require additional resources. QSAND has been developed exactly for the purpose of evaluating the sustainability of a reconstruction project. The availability of these tools (including free manuals and e-trainings) is a huge opportunity for saving implementation costs, if they are properly applied.

Concerning feasibility, much depends on whether donors do require environmental evaluations. Some already do, but the majority not yet (JEU, 2014)). The European Union, for example, gives humanitarian organisations the option of applying for additional funding for evaluations for specific issues, such as the environment (EC, 2014d). A broad implementation of environmental evaluations could improve the evidence base, and create both environmental awareness and accountability.



[4.5.3] "The organization shall establish […] a procedure for dealing with actual and potential nonconformity(ies) and for taking corrective action" (ISO, 2004)

A comprehensive system for dealing with non-conformities is much more difficult to implement than monitoring and evaluation. Donors might demand back funding if conditions were not met, but that usually does not include environmental considerations (EC 2014b). Sustainable construction guidelines emphasize, that it is important to send ordered material back if it doesn't fulfil the quality or environmental requirements (Schneider, 2012). Considering the scarcity of building material and the common delays, it is however questionable how often this is actually followed through in reality.

Generally, it needs to be stated that a procedure to effectively track and eliminate non-conformities is very difficult to put in place during the project's implementation, when the need for work is far bigger than the supply. In this context, corrective actions (not only

environment-related) are happening undocumented (JEU, 2014). More environmental awareness can help strengthening this informal corrective system. Donor organisations, such as the European Union, often require mid-term evaluations (EC, 2014b). If these evaluations include environmental issues based on proper monitoring, then also more formal and documented corrective actions can be installed. Without donor pressure for better environmental control, humanitarian organisations may often be reluctant to document non-conformities, as they might fear negative consequences for their fundraising (JEU, 2014).

It is very important for the humanitarian sector to track its own shortcomings as quickly as possible. Often, there is little enforcement by the government concerning the environmental impact. Thus it is highly important that the organisations check and correct their non-conformities themselves as early as possible, since problems could grow rapidly otherwise.

[4.5.4] "The organization shall establish and maintain records as necessary […] records shall remain legible, identifiable and traceable" (ISO, 2004)

Donor organisations have lists of the records they require, thus there is some system of record control existing already in broad parts of the humanitarian sector. This however does not include environmental records. Maintaining environmental records would not be too difficult, but just as environmental documentation, mean additional costs and paperwork.

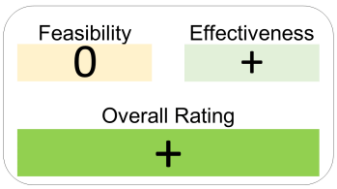
The effectiveness would be limited, as the main task of record control is to be able to demonstrate conformity with legal and other requirements to maintain the ISO 14001 certification. This is not an issue in the humanitarian sector at this point in time (see sub-chapter 4.2.1) and therefore not a significantly effective action point.

[4.5.5] "The organization shall ensure that internal audits of the environmental management system are conducted at planned intervals" (ISO, 2004)

In the humanitarian sector, an audit is widely understood exclusively as a financial review. These are regularly performed by different donor organisations (the European Commission has a very strong audit programme both for headquarter and field level). Sometimes donor organisations also audit operational performance (EC 2014b), but this is commonly called an evaluation in the humanitarian sector. For making implementation easier, these operational audits should be called reviews or evaluations. Auditing also has not the best reputation in the humanitarian sector, as it can imply investigations by the donor organisations on the spending policy and thus a threat to the financing of a project.

Including the environment into the operational performance reviews would offer, of course, some efficiency gains compared to the conventional construction sector that needs to establish an all new auditing/review system. However it would also be difficult mainly for two reasons: these reviews are financed and set up by the donor organisation, so the humanitarian organisation itself can not automatically decide on what will be reviewed (they might very well be included in the process, though). Also, the auditors would need to be educated in environmental issues. The GIZ is regularly performing internal environmental audits of their headquarters, as it is required to according to the EMAS-Standard, and publishing them online. These audit also include selected country offices, however not actual projects (GIZ, 2011).

An audit could help an organisation identify the criteria and aspects it is currently not fulfilling, and track structural and organisational problems in environmental care. Therefore it would be a valuable addition to the monitoring and evaluation activities, when it comes to checking the environmental performance of the organisation (Brorson 2014b). As there is no ISO-certification pending, a negative environmental audit would not have such a threatening potential. Therefore, for audits to be effective, interest and pursuit by the top management of the organisation are required.



4.3.5 Acting

[4.6] "Top Management shall review the organization's environmental management system at planned intervals" (ISO, 2004)

Top management review has more or less the same feasibility and effectiveness as the development of an environmental policy. On the one hand, for the top management there is no intense short-term pressure in which action has to be taken (compared to the post-disaster situation in the field, in which projects are carried out). Reviews can therefore be performed carefully over time, much like in the conventional construction industry. Effective reviews would however require a top management that is dedicated to environmental care – something which currently is not yet the case in many humanitarian organisations.

An environmental review can significantly benefit the continuous learning aspect of an EMS and help keeping the system focussed on the currently most pressing problems. At the same time, just like with the environmental policy, it needs to find its way into the actual field action of humanitarian aid and must not only become a lip service.

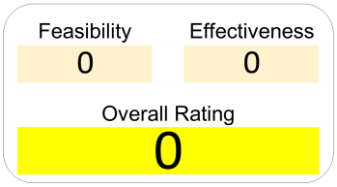


Figure 4-2 Summary of analysis of different ISO 14001 elements for post-disaster housing reconstruction

4.4 Results of the analysis of ISO 14001 system elements

This sub-chapter will summarize and interpret the analysis from the sub-chapters 4.1, 4.2 and 4.3. By looking for patterns and trends in the requirement analysis and connecting them to the special situation of disaster reconstruction, it will suggest the significant opportunities of how ISO 14001 could improve the reconstruction activities' environmental performance and the barriers that could make the application of ISO 14001 challenging or ineffective. The results are summarised in table 4-3.

4.4.1 Overall scores

All together the system elements of ISO 14001 are rated slightly positive in the context of disaster reconstruction. One double-plus and five plusses on the positive side as opposed to one minus and two double-minuses on the negative side result in a light overall surplus of two plusses, if all ratings were added together. Eight elements were rated with a zero. (table 4-2)

Looking into the different stages of the ISO-framework reveals some interesting patterns (see table 4-2). The top management elements (policy and management review) both scored completely neutral: their feasibility depends on the will of top management, and their effectiveness on their application in the field. The planning phase scored rather positive. This is because of the amount of openly available information, which makes implementation cheaper and easier. Effectiveness is increased through early inclusion opportunities, an area of improvement for disaster recovery. Implementation is the only phase with a negative average. The positive exception is the training and awareness requirement, while the problems mainly result out of the bureaucratic tasks of documentation and documentation control. The checking phase is also rated rather positive, with opportunities identified in building up on already existing structures for monitoring, evaluation and auditing.

Another very interesting aspect of the analysis is the different performance of feasibility and effectiveness ratings (see table 4-2). Effectiveness scored overall far better than feasibility. Out of the seventeen elements, only three gained a plus in feasibility (with each seven minuses and zeros). On the other side, ten elements scored with a plus in effectiveness, with only four minuses and tree zeros. Five elements were rated effective if implemented properly, but not very feasible to be implemented under the current circumstances. This supposes that ISO 14001 can be a helpful system for improving environmental performance if implemented properly, but under today's conditions it seems difficult to effectively implement this system.

The following section will identify the most significant opportunities and barriers for implementing ISO 14001 in the disaster reconstruction sector.

Table 4-2 Cross-cutting analysis of different aspects of the rating of ISO system elements in disaster reconstruction

Rating	All	Policy/ Review	Plan	Do	Check	Feasibility	Effectiveness
+	13	0	3	6	4	3	10
0	10	4	2	1	3	7	3
-	11	0	1	7	3	7	4
Overall	34	4	6	14	10	17	17

4.4.2 Opportunities for ISO implementation in disaster reconstruction

A main opportunity for improving the environmental performance of disaster reconstruction through ISO 14001 lies in the early recognition of environmental aspects and the systematic inclusion of them throughout the planning process. Reports on the environment (for example CEPs or PDNAs) and policies for specific reconstruction activities (such as timber procurement policies, debris recycling guidelines) are freely available, providing cheap and well-taylored expertise. While the resources are available, there is currently a clear gap in translating the knowledge in concrete action (pers. comm.). An EMS can help bridge this gap. Early inclusion of these environmental issues in the planning stage will save resources and increase the construction speed later on in the project by avoiding problems such as a scarcity of certain construction materials. The importance of such an early inclusion has already been recognised by the conventional construction industry (see chapter 3.3.1).

Another big, mostly untapped opportunity is the systematic and objective-focussed mainstreaming of environmental trainings and awareness raising. Many sources (both in literature and through personal conversation) confirm the need for a more structured approach to trainings. State-of-the-art training material is already available online for project management and central level staff. Additionally, it is possible to provide many of these trainings outside the hectic post-disaster context, as part of capacity building measures. It is also possible to take advantage of experiences from the conventional construction sector. For example a weekly 15 minutes awareness raising sessions on site can help to inform the subcontractors and workers from the host country that cannot undergo detailed environmental trainings due to time constrains.

A third opportunity for improving the environmental impact of reconstruction projects lies in adopting the already existing monitoring schemes of humanitarian organisations to improve the environmental monitoring and evaluation. Due to donor requirements, all humanitarian organisations have developed capacities and experiences concerning monitoring of financial and project management issues. This holds an advantage for implementing environmental monitoring and evaluation schemes more efficiently through integrating them into the existing structures. Additionally, since environmental problems in disaster reconstruction are more fundamental than in the conventional construction sector, much less (expensive) measuring equipment will be necessary (no air pollution analysis, no measurement of NO_x-concentrations, but visual surveys such as erosion control and forest status assessments). Auditing schemes are also already existent in the disaster reconstruction context and can be taken advantage of for including environmental audits. QSAND, a free tool specifically for evaluating the sustainability of reconstruction projects, can be used to further reduce and facilitate the implementation of monitoring and evaluation.

4.4.3 Barriers to ISO implementation in disaster reconstruction

A major barrier for implementing ISO 14001 in the disaster reconstruction context is the current lack of both top management support and donor involvement. The major barrier of conventional construction – the missing client pressure – also exists in the disaster reconstruction sector in the form of lacking donor pressure. Here, this is even more the case since contrary to conventional construction, ISO-certification is not a mean to access new markets and funds. In the conventional sector, public actors such as the government are demanding ISO 14001 or a comparable standard to qualify for contracts. This incentive is not given by donors in the humanitarian sector. Additionally, there is more and more competition for funds due to increasing needs for humanitarian aid and stagnating or shrinking budgets for

humanitarian aid (EC, 2015b). This is especially serious for independent organisations that acquire funds from different donors (such as the Red Cross, Save the Children, WorldVision, etc.), not as much for organisations implementing (almost all) projects for a national government (i.e. GIZ for Germany, SIDA for Sweden, etc.).

The top management of humanitarian aid organisations is currently also not pushing strongly for increased environmental awareness as main part of their agenda. Commitment and awareness seems to be stronger in the conventional construction sector. This is most likely not due to intrinsic values, but due to external pressure, e.g. from the media or environmental NGOs, that threaten the reputation of conventional construction companies. Such problems do not occur to the same extent in disaster reconstruction.

A second barrier for implementing ISO 14001 in disaster reconstruction is the increased paperwork and bureaucratic procedures for documentation, documentation control and control of records. If too many resources go into environmental documentation, the efficiency of a humanitarian aid programme will suffer. Increased documentation also reduces the motivation of field staff to use the system. In the humanitarian sector, lacking acceptance by field staff can be lethal to a new technology.

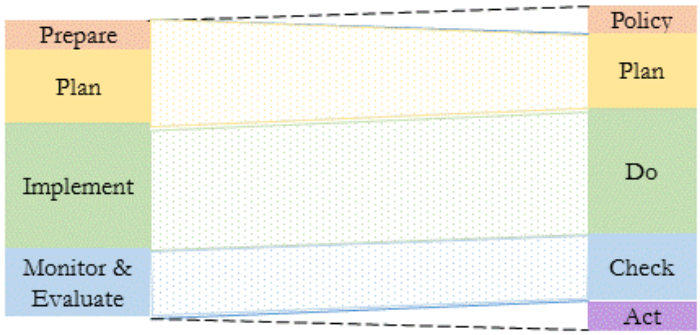
A third barrier of ISO 14001 is the fact that an EMS is not designed to help with inter-organisational coordination on a shelter level or to battle cumulative effects. The focus of ISO 14001 is on the organisation's own projects, not on the overall activities of the shelter cluster or even the overall recovery. Sometimes, path dependency from relief and early recovery decisions can give an organisation only very limited room for making own decisions in critical areas for the environment (e.g. concerning site selection according to a master plan of the central government, or people that decide they want to stay at the site of their temporary shelter, as happened on a massive scale in Haiti) (pers. comm.). The ISO 14001-framework might therefore, if only implemented by one organisation, turn out as a competitive disadvantage: it could increase the resources needed for a project, while not significantly reducing the cumulative environmental damage. This can be viewed as an example of the tragedy of the commons, where the optimal level for environmental care from the point of each individuum is lower than the optimal level from the point of the collective.

Table 4-3 Opportunities and Barriers of ISO 14001 Implementation in Disaster Reconstruction

Opportunities	Barriers
Early Recognition of environmental aspects and legal and other requirements by utilizing existing documents	Lack of donor and top management support
Structured approach to training and awareness raising	Increased paperwork and bureaucracy
Including environment into the already existing monitoring, evaluation and auditing structures	Cumulative effects and need for coordination with other humanitarian agencies

04 – Barriers and Opportunities for Implementing ISO 14001 in Disaster Recovery

Disaster Reconstruction			Conventional Construction	
Aspects	1) Debris & Waste	3) Water & Sanitation	1) Carbon emission	3) Water usage
	2) Raw Materials	4) Livelihoods	2) Waste	4) Ecosystems
Mgmt Problems	1) Framework	3) Monitoring	1) Coordination	3) Monitoring
	2) Accountability	4) Donor pressure	2) Documentation	4) Client support



→ Similar Framework, but ISO with a more continuous approach

Differences between disaster reconstruction and conventional construction

Disaster Reconstruction	Conventional Construction
Donor/Client and beneficiary not identical	Client = house owner
Media rather criticising non-action	Media as whistle-blower
Non-action has bad environmental affects	Non-action often means no impact
Broad spectrum of activities besides construction	Companies specialised on construction
Problems due to pollution of overall sector	Focus only on own pollution

Analysis of the applicability of ISO 14001 requirements in disaster reconstruction

Policy	Plan	Do	Check	Act
- Environmental policy: 0	- Environ. aspects: +	- Responsibilities: 0	- Monitoring: +	- Management review: 0
	- Legal and other Requirements: +	- Awareness: ++	- Evaluation: +	
	- Objectives & targets: 0	- Communication: 0	- Non-conformance: 0	
		- Documentation: -	- Record control: - -	
		- Document control: - -	- Internal audit: +	
		- Emergencies: 0		
		- Operation control: 0		

Opportunities	Barriers
Early Recognition of environmental aspects and legal and other requirements by utilizing existing documents	Lack of donor and top management support
Structured approach to training and awareness raising	Increased paperwork and bureaucracy
Including environment into the already existing monitoring, evaluation and auditing structures	Cumulative effects and need for coordination with other humanitarian agencies

Figure 4-3 Overview of chapter 4: Opportunities and Barriers for implementing ISO 14001 in disaster recovery

5 Discussion of the applicability of ISO 14001 in the Disaster Reconstruction sector

So far, this thesis investigated which environmental problems exist in disaster management and what their root causes in the project management are (chapter 2). It went on looking into the system of ISO 14001, its application in the conventional sector (chapter 3), and what benefits and problems this system would bring to the disaster reconstruction sector (chapter 4). After analysing these issues, this chapter will ask the final question: (under which circumstances) does it make sense to implement it in humanitarian aid? And if yes, how could an ISO 14001 system look like in disaster reconstruction?

To this end, this chapter will first discuss the pros and cons of ISO 14001 in the disaster reconstruction context based on the previous chapters. Then it will define under which conditions ISO 14001 (or an adapted version of the standard) could be implemented beneficially by humanitarian organisations. In the next sub-chapter it will propose suggestions for what to focus on when developing an EMS under the PDCA-methodology for the disaster reconstruction sector. Finally, it will pick up the analysis from the end of chapter 2 and discuss whether other environmental management tools could be more promising in the light of the results of this thesis.

5.1 Advantages and Disadvantages of ISO 14001

This sub-chapter is discussing the advantages and disadvantages of implementing ISO 14001 in the disaster reconstruction sector. For this, it will first focus on whether or not this system would, after the analysis, actually effectively tackle the problems with environmental stewardship in housing reconstruction raised in chapter two. Then it will discuss how feasible it actually is to implement such an overarching system in disaster reconstruction projects. And lastly, it will conclude under which circumstances ISO 14001 could be a viable option for disaster reconstruction. The results are summarised in table 5-1.

5.1.1 Feasibility

When discussing the feasibility of ISO 14001 in disaster reconstruction, the first thing to question is whether and how the financial resources can be made available. In what ways are donors willing to pay extra for knowing there is a system to ensure environmental stewardship? Literature and interviews (European Commission) both indicate that they are not at this moment. However, there are some exceptions of donor organisations that integrate questions about the environment in their funding application forms (JEU, 2014). Also, the European Commission included a marker for disaster resiliency in their application forms: since the beginning of 2015, organisations have to explain how they want to consider disaster risk reduction (DRR) and preparedness measures in their projects. There are two very significant similarities between DRR and environmental care: (1) environmental degradation almost always leads to increased exposure to natural hazards (e.g. land and coastal erosion, deforestation, water pollution); and (2) environmental restoration projects are often very cheap measures for disaster risk reduction (e.g. mangrove restoration, bio-shield against storms and tidal waves, trees against landslides). The resiliency marker can thus indirectly introduce environmental requirements from a donor perspective. However, DRR is not automatically synonymous with environmental protection (see for example dam construction, or destruction of mangrove swamps for flood protection infrastructure, re-settlement projects), and a resiliency marker does not replace pressure by donor organisations for better

environmental care. Only the resiliency marker is not enough to incentivise humanitarian agencies to implement a big, project-wide environmental system such as ISO 14001.

Another important problem for the feasibility is, as indicated in the analysis, the increase in bureaucracy and paperwork. Documentation and records can be useful and important, but they are very hard to implement in the disaster reconstruction sector. Especially using a common, formal system is a huge challenge: it would need to be stiff enough to avoid chaos and ad-hoc decisions, and to allow follow-up on the environmental activities later on, as well as allow comparative analysis between different projects, but at the same time needs to be flexible enough to cope with the rapidly changing, hardly predictable needs of disaster recovery projects. Many companies operating in the conventional sector use an intranet or other online tools for storing documents and making them quickly accessible everywhere. This often is no option for humanitarian organisations, since internet access is often unavailable or very slow in their location. Bureaucracy, even if theoretically effective, can also eliminate the interest and support of field staff, if they are given the feeling of being micromanaged by the 'white collar' headquarter staff.

This leads to another important aspect of feasibility – the autonomy of field level project managers. As written before, field staff has much more autonomy in the humanitarian context than they have in the conventional industry. This can have both positive and negative consequences. On the one hand, it can stop the implementation of any new system that headquarters want to apply. Meiers et al. (2005) have found several technological innovations for communication and documentation that were not used because the field staff considered them unfitting. On the other hand, an environmentally committed field staff can partly make up for a lack of top management commitment by allocating resources for environmental management inside the project. However, if the project staff is already willing and able to implement environmental management measures, it is likely that the project would also mitigate its environmental effects without ISO 14001.

The most important aspect that increases the feasibility of applying the ISO 14001-methodology in disaster reconstruction is the availability of existing material. Conventional construction companies usually have to start from scratch for implementing environmental management schemes (acquiring training opportunities, performing an own initial environmental review, setting up a new monitoring and evaluation scheme). In disaster reconstruction, much of the material is already available online and for free. And also during the project, the shelter cluster provides a platform for the exchange of knowledge and experiences that conventional construction companies would never share with their competitors. This makes the implementation of ISO 14001 significantly cheaper and easier.

5.1.2 Effectivity

As mentioned in sub-chapter 4.4.1, the effectiveness of the individual system elements concerning the environmental performance of the specific project is assessed to be rather positive. One of the main benefits for the disaster reconstruction sector of introducing ISO 14001 would be an increase in accountability. The system improves the early recognition of environmental aspects, and sets requirements for following up on them until the project is closed down. These include the development of objectives, targets, and a programme to manage them, including planning on how to make the necessary resources available, as well as developing a scheme to manage, monitor, and evaluate the development on these aspects. The central advantage here for the accountability is (1) the description of roles and responsibilities to assign internal accountability and (2) the integration of environmental aspects during the

whole project cycle increases the organisations accountability externally. Documentation helps to trace back possible problems and increases continuous learning.

Another critical benefit of a properly implemented ISO 14001 scheme would be the increase in environmental awareness. Implementing environmental training programmes for project management seems to hold a huge potential, considering the amount of freely available training material online. The need for better trainings is confirmed both by literature and by practitioners. Making systematically use of these training offers seems like a low-hanging fruit for improving the environmental performance of organisations. Much more difficult is increasing the awareness of environmental issues in top management. This commitment is a pre-requisite for a successful implementation of ISO 14001. The issue of environmental awareness can therefore be seen both as a pro and a con for ISO implementation: on the one hand, the standard can foster the environmental knowledge and awareness on project level, on the other hand, this framework can only be implemented if top management increases its commitment to environmental stewardship.

One of the biggest drawbacks of the programme is its lack of a good system for coordinating the environmental impacts between the different organisations. The severity of this depends on the disaster. In massive disasters, such as the Haiti earthquake 2010 or the South-East-Asia tsunami 2004, more than 100 different humanitarian aid organisations are active in the affected region (Roseberry, 2008). The size of the area affected is also important for assessing the need for coordination between different projects to protect the environment: if locally comprised disasters happen in urban areas (such as the Haiti earthquake), organisations work together in a much smaller area. If wide-spread disasters happen in rural areas (such as the Pakistan floods 2010), humanitarian aid organisations are working in very remote regions and different projects often have only little contact. Coordination is important nothing the less (e.g. for logistics or material consumption), but not as decisive as in the urban context. This problem would be mitigated if all, or a critical mass of humanitarian organisations would simultaneously take more care of environmental issues. This however can only happen through the pressure of donor organisations. For potential first movers, cumulative effects present a significant drawback in certain projects.

The increase of continuous learning is on the other hand an important plus when it comes to judging the effectiveness of ISO 14001. Compared to the conventional construction, there are only few experts working with housing solutions in disaster reconstruction. Both literature review and interviews with practitioners confirm the need for better learning processes in this sector, especially due to the high staff turnover. The shelter cluster lead (UNHCR and the IFRC) regularly compiles books of project evaluations, often without including environmental assessments (UNHCR et al., 2012; UNHCR et al., 2014) (see Annex A). When the environmental damage is not assessed by the humanitarian sector, it becomes difficult to make top management and donors aware of the problems. In ISO 14001, the monitoring, evaluation and auditing process enables to generate this database of environmental results – however only for projects that already implement environmental measures. Baseline scenarios could point out the effectiveness of a programme, however they require additional resources. A good way of creating positive evidence, is by emphasizing the use of ecosystem services for DRR and livelihood (e.g. through sustainable tourism, mangrove restoration both for sustainable fishing and tsunami protection, reforestation to avoid landslides, etc.) There is increasing academic and donor support in disaster risk reduction and adaptation to climate change, so funding can be generated easier through this.

A final aspect that needs to be discussed is the implementation quality. Until this point, the thesis has always assumed that in case of an implementation, it would be done thoroughly

with the support of all involved stakeholders. It is however very well possible that project managers and other decisive staff (e.g. procurement officers) are not interested in environmental issues, and do not properly pick up the programme in the field. Many academic articles found that ISO only works as well as it is accepted by the staff implementing it. This would account especially for the humanitarian sector, where the field staff enjoys a higher degree of independence from the headquarters than in the conventional construction sector. If the staff is not interested in its application, and thus are not properly following the requirements, the framework will only produce additional costs, without bearing the benefits.

Table 5-1 Advantages and Disadvantages of the application of ISO 14001 in Disaster Reconstruction

Advantages	Disadvantages
Feasibility	
Cheap implementation through use of existing material	Donor support and top management commitment
DRR as an opportunity to obtain funding	Bureaucratic tasks reduce interest of field staff
	Autonomy of field level
Effectiveness	
Significant increase in accountability	Lack of addressing coordination and cumulative effects
Awareness and Training programmes	Unsure quality of implementation in the field
Continuous Learning through evaluation and audits	

Summarising the results of this discussion, it can be concluded that ISO 14001 theoretically has the potential to address the shortcomings of environmental care in disaster reconstruction. In praxis however, the effectiveness of ISO 14001 strongly depends on the quality of implementation and the context of the disaster recovery. The thesis also found that ISO 14001 requires significant resources that most humanitarian organisations are not willing to invest. Therefore it seems that EMS in humanitarian aid deserve more research interest, but are not suitable for mainstreaming under the current circumstances.

Under certain conditions, however, an EMS could be an opportunity for facilitating better environmental care. The most suitable candidate for implementing and EMS would be a large humanitarian organisation with expertise in working with environmental issues. It would also need an environmentally committed top management and stable access to funding. These requirements lead to national implementation agencies such as the GIZ (Germany), SIDA (Sweden), or USAid (USA). These organisations already have a rather strong environmental commitment all over their organisation and can make the necessary resources available for becoming early implementers. The GIZ even has considerable in-house experience with EMS, since their headquarters are EMAS-certified. For testing an EMS in the field, they would need to cut down on environmental bureaucracy as much as possible in order to implement a version as slim as possible, in intense cooperation with the project managers. Additionally, it should be tested in a context where PDNAs, CEPs and other important documents are readily available and of sufficient quality, to minimize the implementation costs.

5.2 Guidelines for implementation of an EMS in disaster reconstruction

This sub-chapter develops recommendations for implementing ISO 14001 in disaster reconstruction. It is important to stress that these are only indications and ideas of how such an implementation could work, and they would obviously need to be revised by any organisation, both in the headquarters, and especially with the field staff. As mentioned before, the contexts of disasters and the structures and capacities in organisations are varying strongly. Therefore, there is no one-size-fits-all approach for applying an environmental management system. Investigating how an EMS could be implemented from the focus point of one specific organisation (in the form of a case study) is an opportunity for further research. Figure 5-1 summarises the different recommendations in the PDCA-methodology.

5.2.1 Policy

When designing an environmental policy, the management of humanitarian organisations should – in favour of credibility – broaden its scope to assess and reduce the environmental impact of all their operations, not only construction. They may however state that the focus is specifically on reconstruction projects. Top management should specify explicitly the need for continuous improvement, not only because it is an ISO requirement, but also because humanitarian organisations very much need to increase their focus on carrying on lessons learned from one project to the other, not least in the environmental sector.

The environmental policy should also focus the scope of the EMS on the opportunities identified in chapter four: the early recognition of environmental issues and the integration of them in the project planning phase, an increase of training and awareness programmes on all organisational levels, and a strengthening of the monitoring and evaluation of environmental problems. Additionally, the policy should include the activities of the suppliers and sub-contractors into the scope as part of the organisation's responsibility, just as paying regard to the entire life-cycle of the house (i.e. also considering lifetime and demolition). Last but not least, it seems appropriate to include a commitment to giving the necessary flexibility to the staff in the field to implement the programme elements in the most efficient way under the local context.

5.2.2 Planning

When identifying the environmental aspects, organisations should seek to make use of the existing PDNAs and ENAs, as well as of the pre-disaster environmental assessments of countries and regions. Of course it is necessary to check whether these documents are applicable in the region the project is supposed to take place, and whether the pre-disaster assessment is still valid after the disaster. Preparation measures for a more efficient aspect identification process include gaining knowledge of where to find these documents (e.g. web pages of UNEP, DG DEVCO (European Commission), the World Bank, etc.), and establishing contacts to those organisations in already before disasters strike, to access information easier and quicker once a disaster struck. It is important to review these documents and identify the existing issues before developing the design of the houses.

In order to identify legal requirements, dialogue with the host government is necessary. Usually it is the cluster lead that has the most contact to government officials and then communicates requirements and building plans to the organisations joined under the cluster. For other requirements to be identified as soon and swiftly as possible, it would be beneficial to make sure the Sphere Standard and other requirements the organisation signed up for (as

well as specific donor requirements in individual projects) are well-known by the project management team. If possible, it would be beneficial to have workshops or trainings identifying many of these requirements before reconstruction projects, as capacity building.

Regarding the environmental objectives, targets and programme, this thesis recommends that at least one environmental objective should be added to the official overall goals of the project (i.e. the goals stated for example in the funding application form), to increase the role of environment in the project. Environmental targets then should be added at different stages for different activities in order to facilitate reaching the objective. These targets could for example concern the training needs of local population, the procurement of raw materials, or the amount of waste generated. The right choice of indicators is difficult: environmental quality is the ultimately decisive factor, but such indicators are not easy to implement in regions with strong cumulative effects (see sub-chapter 5.1). It is also important to choose targets that are cheap to monitor. Developing an appropriate programme to reach these targets is a challenging task. The programme needs to be realistic in terms of resource and documentation requirements, but at the same time it needs to be effective in reaching the environmental targets and objects. It also should be designed flexible to adjust to changing circumstances.

5.2.3 Implementation

Developing the roles and responsibilities, and providing the resources necessary for the implementation of the environmental programme is a challenging task for the management. A quick step is to include environmental responsibilities into the job descriptions. This is easy, cheap, and can be effective for increasing accountability. The main challenge lies in providing the required resources in a timely manner at the right time. For this, good cooperation with the field staff is necessary. Management must also decide whether the deployment of a specialised environmental field advisor will be cost-effective for a given project or not.

Trainings and awareness should be a main focus of the EMS. A great opportunity lies in making use of the GRRT and the JEU's environmental trainings that are available online for free. Environmental trainings should also be part of an organisation's capacity building during "peace-times", especially for certain positions, such as project managers, staff in relevant positions (e.g. procurement), and staff at headquarters responsible for monitoring and evaluation. Opportunities for trainings in the host countries are limited by the huge pressure to move forward. Short, but regular environmental awareness sessions on site could be beneficial. It should not only be explained what needs to be done, but also why that is beneficial for the beneficiaries. The headquarters should – in cooperation with field staff – also develop a structured approach to document the trainings and collect feedback in order to improve.

Communication is another highly important issue. Internally it is crucial to listen to the concerns and input from the field staff. It is necessary to communicate the EMS and its benefits well, in order to get the whole project team behind the idea. Staff should be aware of the synergy potential and the long-term benefits an EMS can yield. Externally, the organisation should promote its efforts to the cluster and share its experiences with the new system. It can also use the evaluation results to lobby donors to increase demands and funding for environmental care. Environmental efforts should also be included in the annual report. Generally it is important to communicate smart: do not push as much information out as possible, but instead carefully decide on which significant pieces of information to focus on.

Documentation and documentation control requirements in the humanitarian sector should be kept as slim as possible. It is important to make sure that the proportion of time spent by

field staff on documentation is not significantly increased in order to avoid frustration with the programme. Organisations need to assess whether online, offline digital, or analogue documentation is the most effective way of storing data in the specific context. Concerning documentation control, it is more important to ensure that staff is aware of the most important documents than to simply add up documents into a library. There are literally hundreds and thousands of pages of guidelines and policy documents and codes of conducts by humanitarian organisations, donors and consultants that are not being regarded for one second in the field. Rather than spending resources on making all of them accessible for everyone at any time, it seems beneficial to sort out who needs to know what at which point.

Operation control is mainly in the hand of the project manager. Thus it is of high importance to educate the project manager well in environmental issues, in order to ensure that operational control will be maintained in the field. Micromanagement from central level is not effective in the humanitarian context. Proper site control to reduce waste and avoid water, soil or air pollution on site can increase efficiency, which makes it easier to implement. Management should however also make resources available to follow up on the suppliers to check whether they are following the requirements of an organisation. It is difficult in the post-disaster context to make these additional resources available, but it is the only way to ensure a sustainable raw material extraction. Possibly it can be done in cooperation with other humanitarian organisations receiving supplies from the same sources.

Projects can try to gain funding for environmental mitigation measures by putting them in context with disaster and emergency preparedness. Bio-shields, reforestation or dune restoration programmes can be developed as part of building back better programmes. Additionally, sustainable livelihood projects can be considered in connection to relocation programmes. The proper storage of environmentally sensitive materials (e.g. chemicals) depends, much like operational control, very much on the commitment of the project manager.

5.2.4 Checking

The difficulty of monitoring is very much depending on the programme's targets and indicators. If the right indicators are chosen, monitoring can become quite cheap and thus feasible. In situations without significant cumulative effects from other projects, environmental quality indicators should be chosen (as deforestation, water quality, etc.), since they better indicate the consequences of the project (measuring outcomes instead of outputs). If cumulative effects are an issue, the monitoring should be focused around the own impact (key indicators, such as percentage of sustainable timber used, amount of timber used per housing unit, etc.). Environmental organisations, especially UNEP, often have parallel monitoring programmes concerning the environmental quality. Besides that, environmental monitoring should be integrated as far as possible in the already existing monitoring system to create synergies.

The evaluation of the environmental performance of a project should take into account both the internal monitoring results and – if available – environmental reports of other organisations on the overall environmental quality (e.g. by UNEP). Diversifying sources creates a stronger evidence base. The monitoring results can then be compared to a post-disaster baseline scenario in order to identify in which ways the project had impacts on the environmental development (such a baseline-scenario often is part of PDNAs). Integrating environmental evaluation in the general evaluation both reduces costs and increases the reach of the information: both monitoring and evaluation can make use of tools such as MEAL or QSAND to save significant amount of resources in developing structures.

Non-conformities are still very difficult to assess systematically on a voluntary basis, as explained in chapter four. Often it can be the most feasible option to strengthen the informal correction measures for smaller problems on the site. For supplier and sub-contractor problems, a more documented way of assessing non-conformities is necessary, which often does not happen, partly due to the fact that demand for materials is far higher than their supply. For bigger planning and management issues, the real-time evaluation system can help identifying and correction larger non-conformities. It is a system implemented by the humanitarian sector to simultaneously to the project evaluate the progress, as the short time span of humanitarian projects otherwise would not allow for adjusting the project if problems occur (pers. comm.). Including environment here could help deal with non-conformities in a semi-formal, cost-efficient way.

Record control, just as documentation control, should be as slim as possible in the field. It needs to be enough to convince the donors that the environmental work done in the field was actually worth the potential additional costs for the EMS, however must not be overwhelming for the staff on the ground. Environmental audits should, if possible, be included in the regular audit procedures. Since these are however the responsibility of the donor organisation, there is a need to coordinate this issue with them. If the audit would need to be done by the organisation itself, the process might become quite expensive.

5.2.5 Acting

Environmental reviews by top management of humanitarian organisations should cover mainly two things: assessing how the objectives and targets of individual projects have been achieved – something feasible right after the final project evaluation – and summarizing the results of different projects several years after the end of the implementation, to see how effective the environmental stewardship actually is in improving the long-term recovery effort and whether the EMS is worth the resources spent on it. Additionally, a management review should – as in all other sectors – look at new developments and focus points in the sector and steer the EMS in the according direction.

Policy	Plan	Do	Check	Act
- Focus on biggest opportunities - Include suppliers & subcontractors - Respect flexibility	- Use ENAs, CEPs & other reports - Cooperate with host govenment - Env. objective incl. in main project objectives	- Responsibilities in job description - Structured trainings - Listen to field staff - Low bureaucracy - Funding through DRR	- Choose easy indicators - Evaluation with diverse data sets - Real-time evaluation for non-conformance - Audits through donor	- Review objectives - Long-time effectiveness

Figure 5-1 Guidelines for Developing an EMS for Disaster Recovery Projects

5.3 Alternative environmental management tools

After discussing if and under which circumstances ISO 14001 would be appropriate and how an EMS could be implemented, if humanitarian organisations would decide to test it, the thesis will now – in the end – go back to shortly discuss the analysis in the end of chapter 2. It will look into whether after the extensive investigation of opportunities and barriers for different system elements of ISO 14001, maybe another environmental management tool might appear more appropriate. It should be mentioned that a detailed comparison between the different tools is not the main focus of this thesis. A more detailed analysis and discussion of the potential of different environmental management tools in disaster reconstruction would be a research opportunity for the future.

The environmental marker has been mentioned in chapter two already. This thesis did not discuss it further because there is already a good amount of research on it (e.g. JEU, 2014), and since it is not facilitating the environmental action in the field, only in the donor-management relation, which may reduce its effectiveness (pers. comm.). While it is most likely not sufficient as environmental tool by itself, it can be a very valuable incentive to implement systems such as ISO 14001. As an analogy to the conventional sector, one can say that environmental markers, and other donor incentives for environmental care, can create the business case for implementing ISO 14001. Thus mainstreaming environmental markers (or similar measures) can become pre-requisites for the implementation of EMS in the humanitarian sector.

A second way to go would be to focus further on environmental charters. Several practitioners mentioned in conversations the possibility for first working on strengthening the general commitment towards environmental protection by the humanitarian sector through extending the Sphere standards to incorporate more environmental focus points. The commitment by itself would however also need to find a way into the actual work in the field. Therefore it would also classify as a first step to create the environment to introduce an EMS.

Another option worth considering is a different ISO certification. ISO 26000 is focussing on corporate responsibility, and thus also including social factors in their requirements, such as corruption or fair and safe working conditions, which are important issues in the humanitarian sector (e.g. Transparency International, 2010; IFRC, 2012). Further synergies could be achieved by integrating not only the environmental management, but also the social management into the main processes. ISO 26000 is of course even larger than ISO and has its own documentation aspects to deal with.

A fourth possibility for further research would be an ISO 14001 "light", in which a humanitarian organisation is only picking the system elements it is interested in, or choosing an EMS version more tailored to SMEs, which struggle with similar problems (paperwork, intitial investment) as humanitarian organisations (see chapter 3). "Cherry-picking" system elements could however dissolve the process of continuous learning.

Overall, there are a lot of interesting possibilities for research in a sector that, despite its huge significance both for ecosystem health and for the effectiveness of humanitarian operations, is yet rather under-researched, under-funded and under-recognised. Figure 5-2 summarises the outcomes of the discussion chapter.

05 – Discussion of the Applicability of ISO 14001 in Disaster Reconstruction

Pros and Cons for implementing ISO 14001 in disaster reconstruction

	Pros	Cons	Conclusion
Effectiveness	Significant increase in accountability	Lack of addressing coordination and cumulative effects	ISO 14001 can, if implemented well, effectively address environmental problems in disaster reconstruction
	Awareness and Training programmes	Unsure quality of implementation in the field	
	Continuous learning through evaluation and audits		
Feasibility	Cheaper implementation through use of existing documents	Lack of donor support & top management commitment	Sense of urgency (priority) too low for implementing ISO 14001, despite possibilities for cost reductions
	DRR as a possibility to generate funding	Bureaucratic tasks reduce interest of field staff	
		Autonomy of field level	

→ **Currently, implementation of ISO 14001 in disaster reconstruction seems not practically feasible, despite theoretical potential**

BUT

EMS could be feasible and effective for an organisation that meets a set of conditions:

1) Top Management support
2) Large, experienced organisation
3) Reduce bureaucracy in application
4) No complex disaster or conflict

Guidelines for Developing an EMS for Disaster Recovery Projects

Policy	Plan	Do	Check	Act
- Focus on biggest opportunities - Include suppliers & subcontractors - Respect flexibility	- Use ENAs, CEPs & other reports - Cooperate with host govenment - Env. objective incl. in main project objectives	- Responsibilities in job description - Structured trainings - Listen to field staff - Low bureaucracy - Funding through DRR	- Choose easy indicators - Evaluation with diverse data sets - Real-time evaluation for non-conformance - Audits through donor	- Review objectives - Long-time effectiveness

Research potential for other environmental management tools include

Environmental Marker	Environmental Charters	ISO 26000	ISO 14001 "light"
+ Creates incentive for EMS	+ Strengthening commitment	+ Increases synergy potential	+ Choice of best opportunities
– Does not manage field level	– Needs field application	– Bureaucracy	– Disrupt continuous learning

Figure 5-2 Overview of chapter 5: Discussion of the Applicability of ISO 14001 in Disaster Reconstruction

6 Conclusion and Outlook

This chapter will conclude the master thesis by reviewing the main findings and presenting an outlook on the possible applications of these findings and further research opportunities. For this, the chapter will first go back to the research questions developed in chapter one and summarise the results found in this thesis. Then it will look into the significance of these results for the humanitarian sector, and possible points for further research from here on.

6.1 Main findings

This thesis argued that environmental problems in the humanitarian sector have partly similar causes as environmental problems in the conventional industry. The industry has developed several tools to respond to these root causes, one of them being ISO 14001. In order to find whether and how ISO 14001 could be a useful tool for the humanitarian sector, this thesis approached the following three key questions:

1. **RQ: How are environmental problems managed in disaster reconstruction?**

The main environmental problems in disaster reconstruction are due to disaster debris, over-extraction of natural resources for construction materials, insufficient water and sanitation solutions, faulty waste management and unsustainable livelihood.

Disaster debris can be an opportunity for re-use or recycling of material, but can also pose a threat to soil and water if dumped uncontrolled. Overextraction of natural resources concerns mainly timber, causing deforestation (either for construction elements or for firewood). Mining activities can also have devastating impacts. Humanitarian organisations need to control the sustainability of their suppliers and find a balance between using local resources and importing materials. Over-use of water is mostly caused by a lack of coordination between different organisations operating in one watershed and can be tackled by better colaboration. Technologies for handling waste and sanitation need to be culturally accepted and maintainable by the local community to become sustainable solutions. Re-settlement of population groups can trigger unsustainable forms of livelihood. This needs to be integrated in the reconstruction planning.

Mitigation methods to the above described problems exist and have been applied successfully. They are however not mainstreamed in the humanitarian sector. Based on reviewing several analyses by actors in the sector, four main root causes for this lack of environmental stewardship in environmental mitigation have been identified:

1. lack of an overarching management framework both inside an organisation and between different organisation
2. lack of accountability for the environmental consequences of humanitarian operations
3. lack of environmental monitoring and evaluation
4. lack of sufficient pressure from donor organisations to include environmental stewardship considerations in humanitarian operations.

2. **RQ: What are the main opportunities and barriers for ISO 14001 implementation in disaster reconstruction?**

The benefits and shortcomings of ISO 14001 with regard to the above mentioned environmental problems in disaster recovery were analysed in three steps. First, the situation in the conventional construction sector was analysed and comparisons to disaster reconstruction were drawn. Second, the differences between disaster reconstruction and conventional construction were analysed, and third, all seventeen system elements of ISO 14001 were analysed concerning their individual suitability in the special context. Based on these analysis steps, three main opportunities and three main barriers were identified.

***Opportunities*:**

An EMS can create a system that helps recognising environmental aspects and requirements early on by utilizing existing documents from external sources (ENAs, CEPs). This early inclusion is supposed to be already happening under the current management systems, however there are gaps between the written policies and guidelines, and the reality in the field. A well-implemented EMS can help bridge these gaps.

Another opportunity can be a more structured approach to environmental trainings and awareness raising. The conventional industry spends a lot of money on educating their employees in environmental issues. For the humanitarian sector, such trainings are freely available online (e.g. JEU; GRRT; QSAND). Developing environmental training plans for project managers as capacity building measures and including awareness sessions on site for the host population during reconstruction are cheap and effective possibilities to mainstream environmental awareness.

A third opportunity consists of integrating environmental factors into the already existing monitoring and evaluation schemes. Due to the special context of humanitarian aid, disaster reconstruction projects already have detailed monitoring and auditing procedures in place. By integrating environmental issues into these structures, synergies can be generated that reduce the overall resources necessary for implementing ISO 14001.

Barriers:

A central barrier for implementing EMS in disaster reconstruction projects is the lack of donor support and top management commitment to environmental protection. Resources need to be made available for introducing such a scheme, but currently the funding conditions for humanitarian projects are not creating the 'business case' that would incentivise the introduction of environmental management tools.

Another barrier for implementing EMS is the unavoidable increase in paper work and bureaucracy in the field. Field staff in disaster reconstruction enjoys greater autonomy than in the conventional industry, and is usually sceptical towards systems that increase their documentation duties. Several tools from other sectors could not be introduced to the humanitarian field due to the lack of field staff buy in.

Last but not least, the impact of an EMS is limited to the organisation that implements it. Often, the main problems of disaster reconstruction are however the cumulative effects of hundreds of projects being conducted at the same time. This barrier won't be significant if a critical mass of organisations implement an EMS. However it can pose a serious problem for the first organisations to adopt environmental management tools.

3. **RQ: When can ISO 14001 be beneficial in disaster reconstruction and what could an EMS in disaster recovery look like?**

ISO 14001 and its methodology has the potential to address the environmental problems the humanitarian sector is facing. In praxis however, its success depends on the quality of implementation and the context of the disaster recovery. It also requires significant resources, both for capacity building and during project implementation, which humanitarian organisations are either not willing or not able to provide.

Thus, ISO 14001 can be an appropriate tool when a humanitarian organisation is willing and able to provide resources in order to become an environmental champion in the humanitarian sector. This might be interesting for large humanitarian organisations with secure funding. To facilitate implementation, the organisation should already have expertise in environmental mitigation methods. Prime candidates for this would be implementing organisations of national development agencies, such as the GIZ or SIDA. A context in which an EMS would be most effective, would be a geographically wide spread disaster, with only small cumulative effects. Freely available external documents would make implementation cheaper and easier.

When implementing an EMS in disaster reconstruction, there is no one-size-fits-all approach. Humanitarian organisations need to adopt their approach to the disaster and the local context. Some general guidelines can however be extrapolated from the results above:

The environmental policy should focus on the the opportunities identified above (pro-actively using available external material and creating synergies with existing project structures). It would need to include the impacts of sub-contractors and suppliers, as well as the entire life-cycle of the housing solution. During the planning stage the focus should be on maximising the benefit from external documents. At least one of the overall official project objectives should concern the environment. QSAND can be used to aid the drafting of an environmental programme according to the organisation's expectations.

In the implementation phase, the bureaucracy needs to be kept to a minimum and should not significantly increase the share of time field staff is spending on paperwork. This would increase the chances of staff buy in. Generally it seems important to develop the system in very close cooperation with the staff on the ground, and to put a great focus on communication. Disaster risk reduction measures can be used to generate donor buy in.

For monitoring and evaluation, it is important to integrate the environment as far as possible into the existing schemes. Indicators should be chosen with the resources in mind that are needed to monitor them. External data (e.g. by UNEP) can be a supplementary source for environmental evaluations. The management review should include results of evaluations right after the project, as well as long-term reviews on the environmental quality in host locations years later.

6.2 Outlook and further research opportunities

ISO 14001 is not going to fix all the complex and diverse problems related to environmental protection in disaster reconstruction. However, it can be an interesting option for certain organisations if resources are made available to properly implement the system. At the end of this research, three questions for further action emerge: (1) What needs to happen in the sector to improve the frame for environmental management? (2) Can the mainly theoretical

results of this thesis be confirmed in praxis? And (3) are there more efficient tools than EMS for managing the environment in the humanitarian sector?

What need to happen to improve the frame for environmental care?

First of all, it would be necessary to create a valid 'business case' for addressing environmental issues. This could mean to establish funding opportunities, which can only be accessed if environmental stewardship can be guaranteed. Or donor organisations could enforce environmental care through stricter minimum requirements, by increasing the accountability. These two incentives were main drivers in the conventional sector for companies to obtain certification (i.e. access to new markets and increasingly strict legal requirements).

Another way forward would be to increase research and development in documentation and communication on field level. Over the past decade, the technological advances made a whole new communication infrastructure possible. Better internet access and more durable electronic appliances, also in development countries under difficult conditions, can reduce the barrier posed by the documentation requirements and make ISO 14001 implementation more feasible. For this, however, top management and donors need to make more funding available for capacity development before disasters. Generally it is also important for the field staff to maintain an open mind concerning changing working processes, innovation, and continuous learning.

Can the mainly theoretical results of this thesis be confirmed in praxis?

The findings of this thesis need to be checked in a more practical approach. This approach could include in-depth case studies of different reconstruction projects. Goal of these case studies could be to identify the costs of a lack of environmental care both for the implementing organisation (e.g. delays, complains) and for the beneficiaries (loss of livelihood, disaster risk increase, health hazards, etc.). Also, studies on the organisational and practical structures of specific humanitarian organisations (possibly GIZ or SIDA) can be carried out to check the findings on feasibility and estimate the implementation costs for an organisation.

The result of these practical research in these two directions could help develop a cost-benefit-calculation to identify the potential of EMS in the humanitarian sector. To implement these studies efficiently, a strong partnership project between the academia and the humanitarian sector seems promising.

Are more efficient tools than EMS for managing the environment?

While this thesis looked into the effectiveness and feasibility of EMS in the humanitarian sector, it did not investigate its efficiency. It is very important to see whether other tools might bring the same benefit at lower costs. This encourages more precise analyses of environmental markers, environmental charters (e.g. the Sphere Standard), ISO 26000 (standard for corporate responsibility), and other tools. Once research has been done on these different tools, a larger comparative study may be interesting, investigating which of the different tools might have the largest potential in the humanitarian sector.

In a world where the threat of natural disasters and the need for sustainable recovery are expected to increase, it is crucial to develop tools to effectively mitigate the environmental effects of recovery operations. A lot more research can be done in estimating the potential of frameworks and tools (e.g. ISO 14001) from the conventional sector in the humanitarian context.

Bibliography

ACS Group. 2013. *Corporate responsibility report of the ACS group*. http://www.grupoacs.com/ficheros_editor/File/03_accionistas_inversores/03_informe_anual/2013/corporate_responsibility_report_acs_group_2013.pdf (accessed on 21.04.15)

Active Learning Network for Accountability and Performance in Humanitarian Action (ALNAP). 2003. *Humanitarian Action: Improving Performance through Improved Learning*. London, ODL

Aglionby, J. 2006. *Poor construction of tsunami victims' homes*. Financial Times, December 26, 2006

American Red Cross (ARC). ? . *Ethic Rules and Policies of the American Red Cross*. http://www.redcross.org/images/MEDIA_CustomProductCatalog/m4240154_ethics_rules_and_policies.pdf (accessed on 01.05.15)

Balfour Beatty. 2010. *Environmental Policy*. http://www.balfourbeatty.com/files/pdf/policies/environment_policy.pdf (accessed on 21.04.15)

_____. 2014. *Our Goals and Metrics – Blueprint for sustainable business*. http://www.balfourbeatty.com/files/pdf/hotspots/sustainability_blueprint.pdf#ref_sustainability_blueprint (accessed on 21.04.15)

Bansal, P. 2003. From issues to actions: the importance of individual concerns and organizational values in responding to natural environmental issues. *Organizational Science* 14, p. 510-527

Barett, E. Mirfitt, S. & Venton, P. 2007. *Mainstreaming the Environment into Humanitarian Response*. Environmental Recources Management Limited, funded by DfID. London. UK

Barla P. 2007. ISO 14001 certification and environmental performance in Quebec's pulp and paper industry. *Journal of Environmental Economics and Management* 53, p. 291-306

Bechtel. 2014. *2013 Sustainability Report – The Bechtel Difference*. http://www.bechtel.com/getmedia/c6f7fbc4-f5b9-4379-bef2-dd294d329448/FINAL-Bechtel_Sustainability_Report_2013/ (accessed on 21.04.15)

Below, R. & Wirtz, A. 2009. *Disaster Category Classification and peril Terminology for Operational Purposes – Working paper*. Centre for Research on the Epidemiology of Disasters (CRED) and Munich RE. www.cred.be/sites/default/files/DisCatClass_264.pdf (accessed on 09.04.15)

Berge, B. 2009. *The ecology of Building Materials*. Routledge

Berren, M. R., Beigel, A., & Ghertner, S. 1980. A typology for the classification of disasters. *Community Mental Health Journal*, 16(2), 103-111.

Boiral O. and Henri J. 2012. Modelling the impact of ISO 14001 on environmental performance: A comparative approach. *Journal of Environmental Management* 90 (2012) pp. 84-97

BRE Trust & International Federation of Red Cross and Red Crescent Societies. 2014. *QSAND – Quantifying Sustainability in the Aftermath of Natural Disasters – Guidance Manual 2014*. Watford. UK

Brorson, T. & Larsson G. 2011. *Environmental Management – How to implement an environmental management system in a company or other organisations*. ISBN: 978-91-631-9881-6

Brorson, T. 2014a. *Environmental objectives, targets and programs*. Lecture at IIIEE

_____. 2014b. *Introduction to environmental auditing*. Lecture at IIIEE

Brown, C., Milke, M. & Seville, E. 2011. Disaster Waste Management: a Review Article. *Waste management*, 31(6), 1085-1098.

Campos, L. 2012. Environmental Management Systems (EMS) for small companies: a study in Southern Brazil. *Journal of Cleaner Production 32* p. 141-148

Care. 2013. *Deliver Lasting Change – Care USA Annual Report 2013*. Care USA. Atlanta. USA

Chapelier C. & Shah, A. 2013. *Improving Communication between Humanitarian aid agencies and crisis-affected people – Lessons from the infosaid project*. Humanitarian Practice Network (HPN), London UK. ISBN: 978-1-909464-10-0

Chavan, M. 2005. An appraisal of environment management systems: a competitive advantage for small businesses. *Management of Environmental Quality: An International Journal 16 (5)*, p. 444-463)

Christini, G.; Fetsko, M. & Hendrickson, C. 2004. Environmental Management Systems and ISO 14001 Certification for Construction Firms. *Journal of Construction Engineering and Management 130(3)*: 330-336.

de Boer, J. 1990. Definition and classification of disasters: introduction of a disaster severity scale. *The Journal of emergency medicine*, 8(5), 591-595

Environmental protection agency (EPA). 2013. *Environmental Management Systems*. http://www.epa.gov/ems/ (accessed on 18.04.15)

EuropeAid. 2008 (?). *Demonstrating ESTs for Building waste Reduction in Indonesia – The DEBRI Project*. http://www.unep.or.jp/Ietc/Publications/DEBRI/DEBRI_2_Preliminary_Data_Report_on_Tsunami-generated_Debris.pdf (accessed on 15.04.15)

_____. 2011. *Guidelines on the Integration of Environment and Climate Change in Development Cooperation*. DG DEVCO, European Commission. Brussels

European Commission (EC). 2013a. *Evaluation of the European Commission's Humanitarian Action in the Shelter Sector*. DG ECHO. Brussels

_____. 2013b. *EMAS User Guide*. (2013/131/EU) http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32013D0131&from=EN (accessed on 17.04.15)

_____. 2014a. *General Guidelines for Operational Priorities on Humanitarian Aid in 2015*. Brussels. http://ec.europa.eu/echo/files/policies/strategy/strategy_2015_en.pdf#view=fit (accessed on 09.04.15)

_____. 2014b. *Audit Information to the FPA Partners*. DG ECHO. Brussels.

_____. 2014c. *General Guidelines for Operational Priorities on Humanitarian Aid in 2015*. Commission Staff Working Document. DG ECHO. Brussels

_____. 2014d. *Single Form Guidelines*. DG ECHO. Brussels

_____. 2014e. *General Guidelines for Operational Priorities on Humanitarian Aid in 2015*. DG ECHO. Brussels

_____. 2015a. *Emas Report*. http://ec.europa.eu/environment/emas/register/reports/reports.do;jsessionid=EgbOmHe2-e7RGLFxu02jlgE84bj21rwTuedAYqCsm-sYB-MIOEfZ!110822907 (accessed on 18.04.15)

_____. 2015b. *Financing Humanitarian Aid operational Priorities from the 2015 General Budget of the Euorpean Union*. Commission Implementing Decision. ECHO/WWD/BUD/2015/01000. Brussels

Federal Emergency Management Agency (FEMA). 2011. *National Disaster Recovery Framework*. Washington. http://www.fema.gov/media-library-data/20130726-1820-25045-5325/508_ndrf.pdf. (accessed on 09.04.15)

Gesellschaft für Internationale Zusammenarbeit (GIZ). 2011. *GIZ Environmental Audit 2010*. Bonn, Germany

_____. 2014. *Living Sustainability – GIZ Sustainability Report 2013*. Bonn. Germany

_____. 2015. *Identity*. https://www.giz.de/en/aboutgiz/identity.html (accessed on 01.05.15)

Gilbert, R. 2001. *Doing more for those made homeless by natural disasters*. Disaster risk management series no. 1. Washington, DC: World Bank.

Global Facility for Disaster Reduction and Recovery (GFDRR), European Union (EU) & World Bank. 2013. *Post-Disaster Needs Assessments Volume A Guidelines*. http://www.recoveryplatform.org/assets/publication/PDNA/PDNA%20Volume%20A%20FINAL%20for%20Web.pdf (accessed on 09.04.15)

Global Facility for Disaster Reduction and Recovery (GFDRR). 2014. *Guide to Developing Disaster Recovery Frameworks*. World Bank Group. Washington

Good J. 2010. Materials and the Supply Chain. *Green Recovery and Reconstruction Toolkit*. WWF and American National Red Cross.

Government of the Solomon Islands. 2014. *Rapid Assessment of the Macro and Sectoral Impacts of Flash Floods in the Solomon Islands*, April 2014. https://www.gfdrr.org/sites/gfdrr/files/Solomon%20RAI%20Flood%20.pdf (accessed on 09.04.15)

H+H Celcon. 2014 (?). *Building a sustainable future – H+H environmental and sustainability credentials.* Kent. United Kingdom

_____. 2015. *Environmental Policy*. http://www.hhcelcon.co.uk/sustainability/environmental-policy (accessed on 21.04.15)

Hers, I. & Arana, G. 2010. *Alternative models for environmental management in SMEs: the case of Ekoscan vs. ISO 14001*. Journal of Cleaner Production 18 (2010), pp. 726-735

Hochtief. 2012. *Group Directive – Occupational Safety and Health Protection, Environmental and Climate Protection*. OSHEP Center/Corporate Development

_____. 2015. *My Profit, our sustainability – Group Report 2014*. http://berichte.hochtief.de/kb14/data/pdf/gr14_en.pdf (accessed 21.04.15)

Ihobe. 2015. *Ekoscan*. (Webpage: http://www.ihobe.eus/Paginas/Ficha.aspx?IdMenu=efd4b9d2-acac-498b-a81b-7525bd6ea6f6&Idioma=es-ES) (accessed on 18.04.15)

Ingram J., Franco G., Rumbaitis-del Rio C. & Khazai B. 2006. Post-disaster recovery dilemmas: challenges in balancing short-term and long-term needs for vulnerability reduction. *Environmental science & policy* 9 (2006) p. 607-613

Inter-Agency Standing Committee (IASC). 2006. *Guidance Note on Using the Cluster Approach to Strengthen Humanitarian Response.* https://www.humanitarianresponse.info/system/files/documents/files/IASC%20Guidance%20Note%20on%20using%20the%20Cluster%20Approach%20to%20Strengthen%20Humanitarian%20Response%20(November%202006).pdf (accessed on 10.04.15)

International Committee of the Red Cross (ICRC). 2009. *Framework for environmental management in assistance programmes*. International Review of the Red Cross, Volume 92, Number 879 (September 2010)

International Federation of Red Cross/Red Crescent Societies (IFRC). 2002. *Rebuilding after Hurricane Mitch: Housing reconstruction in Honduras and Nicaragua.* http://www.recoveryplatform.org/assets/submissions/200909010435_honduras_hurricanemitch_shelter.pdf (accessed on 14.04.15)

_____. 2009. *Timber - A guide to the planning, use, procurement and logistics of timber as a construction material in humanitarian relief.* http://www.ifrc.org/PageFiles/95530/D.03.c.01.%20Timber%20Guidelines-EN.pdf (accessed on 15.04.15)

_____. 2010. *Owner-driven Housing Reconstruction Guidelines*. Geneva. https://www.ifrc.org/PageFiles/95526/publications/E.02.06.%20ODHR%20Guidelines.pdf (accessed on 10.04.15)

_____. 2012 (?). *Fraud and Corruption Prevention and Control Policy – by the International Federation of Red Cross/Red Crescent Societies*. https://www.ifrc.org/Global/Documents/Secretariat/Accountability/IFRC-Fraud%20and%20Corruption%20prevention%20and%20control%20policy.pdf (accessed on 07.05.15)

_____. 2013. *World Disaster Report 2013*. Geneva. http://www.ifrc.org/PageFiles/134658/WDR%202013%20complete.pdf (accessed on 21.05.15)

_____. 2014. *World Disaster Report 2014*. Geneva. http://www.ifrc.org/world-disasters-report-2014 (accessed on 09.04.15)

_____. 2015. *About Disaster Management*. https://www.ifrc.org/en/what-we-do/disaster-management/about-disaster-management/ (accessed on 09.04.15)

International Panel on Climate Change (IPCC). 2012. *Managing the risks of Extreme Events and Disasters to Advance Climate Change Adaptation.* https://www.ipcc.ch/pdf/special-reports/srex/SREX_Full_Report.pdf (accessed on 08.05.15)

International Standardization Organisation (ISO). 2004. *Environmental managmenent systems – Requirements with guidance for use.* SIS Förlag. Stockholm

_____. 2013. *The ISO-survey of management system standards 2013 – Executive Summary*. http://www.iso.org/iso/iso_survey_executive-summary.pdf?v2013 (accessed on 18.04.15)

IrishAid. 2008. *Environmental Policy for Sustainable Development*. https://www.irishaid.ie/news-publications/publications/publicationsarchive/2008/july/irish-aid-environmental-policy-for-sustainable-dev/ (accessed 01.05.15)

Jha A.K., Barnestein J.D., Phelps, P.M., Pittet, D. & Sena, S. 2010. *Safer Homes, Stronger Communities – A Handbook for Reconstructing after Natural Disasters*. The World Bank. Washington

Joint Environmental Unit UNEP/OCHA (JEU). 2014. *Environment and Humanitarian Action – Increasing Effectiveness, Sustainability and Accountability*. UNEP & OCHA. Geneva, Switzerland

Jordan, E. 2012. *Impact Evaluation of Post-tsunami Shelter Reconstruction, Nagapattinam, India*. BEDROC – Buildig and Enabling Disaster Resilience of Communities. Mortensen Center for Engineering in Developing Communities. University of Colorado

Jowett, E. 2010. Opportunities for Green Recovery and Reconstruction: An Introduction. *Green Recovery and Reconstruction Toolkit*. WWF and American National Red Cross

Kahlenborn W. & Freier, I. 2007. *Environmental management Approaches in Germany*. *Background Paper*. Nature Conservation and Nuclear Safety, Berlin

Kelly, C. 2005. *Checklist-Based Guide to Identifying Critical Environmental Considerations in Emergency Shelter Site Selection, Construction, Management and Decommissioning*. Joint Environmental Unit (JEU) UNEP/UN OCHA & Care International. Geneva, Switzerland.

_____. 2007. *On the Sequence of Disaster-Focused Environmental Impact Assessments*. Berfield Greig Hazard Research Ventre, University College London.

_____. 2013. *Mainstreaming environment into humanitarian interventions, a synopsis of key organisations, literature and experience*, Evidence on demand – Climate & environment infrastructure/livelihoods. DfID, UK

Klenk J. 2010. Construction. *Green Recovery and Reconstruction Toolkit*. WWF and American National Red Cross.

Kovács, G., & Spens, K. M. 2007. Humanitarian logistics in disaster relief operations. *International Journal of Physical Distribution & Logistics Management*, 37(2), 99-114.

Kreditanstalt für Wiederaufbau. 2013. *Ex Post-Evaluation Brief. Indonesia: Reconstruction assistance housing and residential construction and infrastructure assistance*. https://www.kfw-entwicklungsbank.de/PDF/Evaluierung/Ergebnisse-und-Publikationen/PDF-Dokumente-E-K_EN/Indonesien_Wiederaufbauhilfe_2013_E.pdf (accessed on 14.04.15)

Lam, P. Chan, E. Poon, C. Chau, C. & Chun, K. 2010. Factors Affecting the Implementation of Green Specifications in Construction. *Journal of Environmental Management* 91. p 654 – 661

Lear Corporation. 2005. *ISO 14001:2004 – Implementation Workbook for Facilities and Suppliers*.

Lettieri, E., Masella, C. & Radaelli, G. 2009. Disaster management: findings from a systematic review. *Disaster Prevention and Management: An International Journal*, Vol. 18 issue 2 pp. 117 – 136

Lyons, M. 2009. Building Back Better: The Large-Scale Impact of Small-Scale Approaches to Reconstruction. *Journal of World Development* Vol. 37 No.2 p. 385-398

Maiers, C. Reynolds, M. & Haselkorn, M. 2005. *Challenges to Effective Information and Communication Systems in Humanitarian Relief Organizations*. 2005 IEEE International Professional Communication Conference Proceedings.

Manoj, B. S. & Baker, A. H. 2007. Communication challenges in emergency response. *Communications of the ACM*, 50(3), 51-53.

Martin, R. 1998. *ISO 14001 Guidance Manual*. National Center for environmental decision-making, technical report NCEDR/98-06. Tennessee

Matcailfe D. Bratford M. Ford A. 2008. Cyclone damage to tropical rain forests: Species- and community-level impacts. *Austral Ecology* 33 p. 432-441

Melnyk, S. Sroufe, R. Calantone, R. 2003. Assessing the impact of environmental management systems on corporate and environmental performance. *Journal of Operations Management 21*, p. 329-351Natural Hazards Center Colorado. 2005. Holistic Disaster Recovery – Ideas for Building Local Sustainability after a Natural Disaster. Colorado

Mountfield, B. 2013. *Summative Evaluation of the relief and recovery response to the Pakistan Monsoon Floods* 2010. IFRC. Geneva

Nakamura M., Takuya T. Vertinsky I. 2000. Why Japanese firms choose to certify: a study of managerial responses to environmental issues. *Journal of Environmental Economics and Management* 42, p. 23-52

Natural Hazards Center Colorado. 2005. *Holistic Disaster Recovery – Ideas for Building Local Sustainability after a Natural Disaster*. Colorado

Navaratne, A. Tomasek, T. Rand, E. Water and Sanitation. *Green Recovery and Reconstruction Training Toolkit (GRRT*). WWF and American Red Cross

Orsato R. 2009. *When Does it Pay to be Green?* Palgrave Macmillan. ISBN: 9780230236851

Oxfam. 2003. *Guidelines for Post Disaster Housing*. http://www.ifrc.org/PageFiles/95751/B.d.03.%20Guidelines%20for%20Post%20Disaster%20Housing%20%20version%201_OXFAM%20GB.pdf (accessed on 10.04.15)

_____. 2011. *Program Standards at Oxfam: Working towards an agreed set of standards across Oxfam*.

_____. 2012. *Working together – OXFAM's Partnership Principles*. https://www.oxfam.org/sites/www.oxfam.org/files/oxfam-partnership-principles.pdf (accessed on 01.05.15)

_____. 2013. *Stichting Oxfam International Constitution*. https://www.oxfam.org/sites/www.oxfam.org/files/file_attachments/story/oxfam-constitution-2013_0.pdf (accessed on 02.05.15)

_____. ?. Oxfam Ethical Purchasing Policy. https://www.oxfam.org.uk/~/media/Files/OGB/What%20we%20do/About%20us/Plans%20reports%20and%20policies/Supplier%20Information/ethical%20purchasing.ashx (accessed on 15.04.15)

Palerm, J. Ledant, J. & Brinn, P. 2007. Environmental integration in European Commission development co-operation programming: experiences in the use of country environmental profiles. *Impact Assessment and Project Appraisal 23(3)*. pp 163-174

Phillips A. 2015. *Top 10 construction companies in the World*. ConstructionGlobal. http://www.constructionglobal.com/top10/25/Top-10-construction-companies-in-the-world (accessed on 21.04.15)

Pielke, A. Gratz, J. Landesa, C. Collins, D. Saunders, M. & Musulin, R. 2008. Normalized Hurricane Damage in the United States 1900-2005. *Natural Hazards Review* 2008 (9). pp 29-42

Pun, K. Hui, I. & Lee, W. 2001. An EMS approach to environmentally-friendly construction operations. *The TQM Magazine 13 (2)* pp 112-119.

Randall, J. & Jowett, E. 2010. Environmental Impact Assessment Tools and Techniques. *Green Recovery and Reconstruction Toolkit*. WWF and American Red Cross

Rawls, C. G. & Turnquist, M. A. 2010. Pre-positioning of emergency supplies for disaster response. *Transportation research part B: Methodological*, 44(4), 521-534.

Reinhart, D. R. & McCreanor, P.T. 1999. *Disaster Debris Management – Planning Tools*. Final Report: US Environmental Protection Agency Region IV, USA

Republic of Kenya. 2012. *Kenya Post-Disaster Needs Assessment – Drought 2008-2011*. http://www.gfdrr.org/sites/gfdrr/files/Kenya_PDNA_Final.pdf (accessed on 09.04.15)

Roseberry, R. 2008. *A balancing act: an assessment of the environmental sustainability of permanent housing constructed by international community in post-disaster Aceh*. Building resilience. i-Rec 2008

Save the Children. 2013. *Results for Children – 2013 annual review*. Save the Children. Fairfield, CT. USA

Schneider, C. 2012. *Sustainable Reconstruction in Disaster-Affected Countries – Practical Guidelines*. SKAT and United Nations Environmental Programme

Shaw, R. 2014. *Disaster Recovery: Used or Misused Development Opportunity*. Springer Science & Business Media.

Shelter Cluster. 2015. *Resources*. https://www.sheltercluster.org/resources (accessed on 02.05.15)

Skanska AB. 2011a. *Environmental Policy*. http://www.skanska.co.uk/cdn-1cc574af3ff374c/Global/About%20Skanska/Sustainability/Downloads/Skanska%20-%20EnvPolicy%20-%20IMS%20V10%20-%20130711.pdf (accessed on 21.04.15)

_____ 2011b. *Green Strategic Indicators*. http://www.skanska.co.uk/cdn-1cc5749c732c888/Global/About%20Skanska/Sustainability/Downloads/Skanska%20-%20GSIs%20-%20External%20version%20-%20IMS%20V11%20-%20130711.pdf (accessed on 21.04.15)

_____ 2015. *Skanska Sustainability Review 2014 – Extract of Annual Report 2014* http://group.skanska.com/globalassets/investors/reports--publications/annual-reports/2014/annual-report-2014.pdf (accessed on 21.04.15)

Spanish Red Cross (SRC). 2006 (?). *Evaluation of Specific Rehabilitation and Reconstruction projects implemented in the Special Tsunami Plan (PEM) framework*. http://www.ifrc.org/docs/Evaluations/eval07/Asia%20Pacific/Spanish%20RCtsunamiReconstruction07.pdf (accessed on 15.04.15)

Srinivas, H. & Nakagawa, Y. 2008. Environmental implications for disaster preparedness: Lessons Learnt from the Indian Ocean Tsunami. *Journal of Environmental Management* 89 (2008) p. 4-13

Stapleton, P., Cooney, A. & Hix, W. 1996. *Environmental Management Systems: An Implementation Guide for Small and Medium-Sized Organizations*. NSF International. Michigan

Starkey R. 1998. *Environmental Management Tools for SMEs: A Handbook*. Centre for Corporate Environmental Management (CCEM), Copenhagen

State of Haiti. 2010. *Haiti Earthquake PDNA: Assessment of damage, losses, general and sectoral needs*. https://www.gfdrr.org/sites/gfdrr/files/GFDRR_Haiti_PDNA_2010_EN.pdf (accessed on 09.04.15)

Steets, J. & Meier, C. 2011. *Evaluation of the Protection Standby Capacity (ProCap) and Gender Standby Capacity (GenCap) Projects*, Global Public Policy Institute (GPPi) http://old.gppi.net/fileadmin/media/pub/2011/steets-meier_2011_gen-cap-pro-cap_inception-report.pdf (accessed on 17.04.15)

Swiss Resource Centre and Consultacies for Development (SKAT) & International Federation of Red Cross and Red Crescent Societies (IFRC). 2012. *Urban Reconstruction Handbook*. IFRC

The Sphere Project. 2011. *The Sphere Project – Humanitarian Charter and Minimum Standards in Humanitarian Response*. http://www.sphereproject.org/resources/?keywords=&language=0&type=&aid=&mid=&category=22&subcat-22=23&search=1&page=5 (accessed on 17.04.15)

Tralli, D. M., Blom, R. G., Zlotnicki, V., Donnellan, A., & Evans, D. L. 2005. Satellite remote sensing of earthquake, volcano, flood, landslide and coastal inundation hazards. *ISPRS Journal of Photogrammetry and Remote Sensing*, 59(4), 185-198.

Tran P., Shaw R. 2007. Towards an integrated approach of disaster and environment management: A case study of Thua Thien Hue province, central Viet Nam. *Journal of Environmental Hazards* 7. P. 271-282

Transparency International. 2010 (?). *Preventing Corruption in Humanitarian Organisations – Handbook of good practice.* http://toolkit.ineesite.org/resources/ineecms/uploads/1038/Preventing_Corruption_in_Humanitarian_Ops.pdf (accessed on 07.05.15)

Turk, A. 2009. The benefits associated with ISO 14001 certification for construction firms: Turkish case. *Journal of Cleaner Production 17 (2009)* pp 559-569

United Nations. 2014. *UN Factsheet – Combatting Cholera in Haiti.* http://www.un.org/News/dh/infocus/haiti/Cholera_UN_Factsheet_24%20Feb_2014.pdf (accessed on 16.04.15)

United Nations Development Programme (UNDP). 2012. *Rebuilding Haiti* (article). http://www.undp.org/content/brussels/en/home/ourwork/crisispreventionandrecovery/successstories/reusing-debris-from-the-earthquake-to-rebuild-haiti.html (accessed on 17.04.15)

United Nations Economic Commission for Latin America and the Caribbean (UN-ECLAC). 2014. *Handbook for Disaster Assessment.* http://repositorio.cepal.org/bitstream/handle/11362/36823/S2013817_en.pdf?sequence=1 (accessed on 09.04.15)

United Nations Environmental Programme (UNEP). 2007. *Environment and Reconstruction in Aceh: Two years after the tsunami*. http://postconflict.unep.ch/publications/dmb_aceh.pdf (accessed on 15.04.15)

_____. 2014. *Environmental Marker – Short Guidance*. http://www.unep.org/disastersandconflicts/Portals/155/countries/sudan/pdf/Environmental_Marker_2014_short_guidance.pdf (accessed on 17.04.15)

United Nations High Commissioner for Refugees (UNHCR), UN-Habitat, International Federation of Red Cross/Red Crescent Societies (IFRC). 2012. *Shelter Projects 2010*. ISBN Number (Volume): 978-92-1-132426-6

United Nations High Commissioner for Refugees (UNHCR), UN-Habitat, International Federation of Red Cross/Red Crescent Societies (IFRC). 2014. *Shelter Projects 2013/2014*. http://reliefweb.int/sites/reliefweb.int/files/resources/Shelterprojects_2013-14.pdf (accessed on 02.05.15)

United Nations Office for Disaster Risk Reduction (UNISDR). 2007. *Terminology*. http://www.unisdr.org/we/inform/terminology (accessed on 09.04.15)

United Nations Office for the Coordination of Humanitarian Affairs (UN-OCHA), International Federation of Red Cross and Red Crescent Societies (IFRC) & CARE International. 2009. *Timber as a construction material in humanitarian operations*. http://www.humanitariantimber.org (accessed on 01.05.15)

Van Breda, A. Dufresne, C. McNevion, A.2010. Livelihoods. *Green Recovery and Reconstruction Toolkit*. WWF and American Red Cross

Vinci Group. No date. *Vinci's Environmental Policy*. http://www.vinci.com/vinci.nsf/en/sustainable-development/pages/vincis_environmental_policy.htm (accessed on 21.04.15)

_____. 2013a. *Vinci reporting coverage*. http://www.vinci.com/vinci/developpement_durable_2011.nsf/index/040102/$file/reportingcoverage_ar2013.pdf (accessed on 21.04.15)

_____. 2013b. *Vinci environmental training*. http://www.vinci.com/vinci/developpement_durable_2011.nsf/index/040102/$file/reportingcoverage_ar2013.pdf (accessed on 21.04.15)

_____. 2015. *Vinci annual report 2015*. http://publi.vinci.com/vinci/2014-vinci-annual-report.pdf (accessed on 21.04.15)

Wilson, P. & Reilly, D. 2007. *Joint Evaluation of Their Responses to the Yogyakarta Earthquake*. CARE, Catholic Relief Services, Save the Children and World Vision Indonesia

World Food Programme (WFP). 2012. *WFP Handbook on Safe Access to Firewood and alternative Energy (SAFE)*. WFP, Rome

World Wildlife Fund (WWF). 2011. *Freshwater*. http://www.wwf.or.id/en/about_wwf/whatwedo/forest_species/about_forest_species/freshwater/ (accessed on 16.04.2015)

Zhang, Z. Shen, L. Love, P. & Treloar, G. 2000. A framework for implementing ISO 14000 in construction. *Environmental Management and Health 11* (2), pp. 139-148

Zuo K., Potangaroa R., Wilkinson S. & Rotimi J.O.B. 2009. A project management prospective in achieving a sustainable supply chain for timber procurement in Banda Aceh, Indonesia. *International Journal of Managing Projects in Business*, Vol.2 No. 3, 2009, pp 386-400

Zutshi, A. Creed, A. 2014. An international review of environmental initiatives in the construction sector*, Journal of Cleaner Production (2014)* pp. 1-15

7 Appendix

7.1 Annex A: Evaluation of different shelter projects

The following annex documents the review of 36 housing reconstruction project evaluations after natural disasters in the humanitarian context. It identifies which organisations have been involved (if the name of the organisation is given), to what disaster the project responded to, and when, what kind of project was evaluated (whether it was specifically housing projects or general response/recovery projects; whether the project focussed on long-term housing reconstruction or on more short-term transitional shelters, whether the project encompassed the entire reconstruction or only provided support for owner-driven reconstruction (ODR), provided toolkits or individual parts for the beneficiaries).

Results indicate that only view projects include environmental issues in their evaluation. Many of the reports have mentioned issues that were related to environmental concerns, especially in the use of materials, however there was no specific interest in the effect on the environment nor did it become clear that environmental concerns influenced decisions at any point during the project. That must not mean environmental issues did not play a role during the project, but it indicates that the environment was not considered in the project evaluation.

7.1.1 Singular Case Studies evaluated by individual humanitarian organisations

#	Organisation	Disaster	Year	Evaluation	include env.?	Comments
1	IFRC	Giri cyclone	2011	reconstruction	no	-
2	IFRC	Haiti Earthquake	2011	shelter	yes	positive about initial efforts made to include
3	IFRC	Pakistan floods	2013	overall recovery	no	-
4	BEDROC	Tsunami India	2012	reconstruction	no	-
5	CARE et al.	Yogyakarta quake	2007	overall response	no	-
6	IFRC	Honduras cyclone	2002	reconstruction	yes	care in selecting material, technologies, sites
7	KfW	Tsunami Indonesia	2013	reconstruction	yes	just above acceptable; single problems (erosion) not jeopardizing overall effectiveness
8	Spanish Red Cross	Tsunami Recovery	2007	reconstruction	yes	overall due care paid, several problems identified
9	Chile government	Tsunami Chile	2005	reconstruction	yes	inclusion of environmental care for bio-shield
10	GUR	Haiti Earthquake	2012	reconstruction	no	-

7.1.2 Extracted from Shelter Evaluation Studies by Shelter Cluster Lead (UNHCR, IFRC, UN-Habitat), 2010

#	Organisation	Disaster	Year	Evaluation	include env.?	Comments
11	-	Afghanistan return	2009	transitional shelter	no	problem with sanitation, inefficient heating
12	-	Tsunami Chile	2010	reconstruction	no	-
13	-	Grenada Hurricane	2004	reconstruction	no	-
14	-	Haiti Earthquake	2010	combined	no	-
15	-	Indonesia earthquake	2009	Brick production	yes	no timber use for brick kilns included
16	-	Indonesia earthquake	2009	reconstruction	no	not sufficient training on house improvements (maintenance)
17	-	Mozambique Cyclone	2007	reconstruction	no	descriptions seem environmentally sound
18	-	Myanmar Cyclone	2008	reconstruction	yes	positive efforts: material selection, trainings
19	-	Pakistan floods	2010	reconstruction	no	bad material specifications
20	-	Pakistan floods	2010	reconstruction	yes	using mud as material to reduce env. impact
21	-	Philippines Typhoon	2010	ODR	no	-
22	-	Tajikistan Earthquake	2010	ODR	no	-
23	-	Vietnam Typhoon	2009	reconstruction	no	not culturally accepted by minorities

7.1.3 Extracted from Shelter Evaluation Studies by Shelter Cluster Lead (UNHCR, IFRC, UN-Habitat), 2013-2014

#	Organisation	Disaster	Year	Evaluation	env. incl.	Comments
24	-	Colombia Floods	2011	Village relocation	yes	environmentally-friendly water sanitation, sound planning approach
25	-	Cuba Hurricane Sandy	2012	Roofing kits	no	everything imported but timber; no comments about timber sustainability
26	-	Dominican Republic Hurricane Sandy	2012	Shelter response	no	
27	-	Haiti Hurricane Sandy	2012	ODR	no	

28	-	Fiji Cyclone Evan	2012	Transitional shelter	no	"Difficulties in sourcing timber locally" (not specified if due to env. care or no availability)
29	-	Nigeria Floods	2012	reconstruction	no	
30	-	Pakistan floods	2010-2014	reconstruction	yes	carbon reduction through replacing fired bricks and cement with mud, clay or lime (due to cost savings)
31	-	Pakistan floods	2012	Transitional shelter	no	
32	-	Pakistan floods	2012	reconstruction	no	
33	-	Pakistan floods	2012	Transitional shelter	no	Increase in cost of materials caused by bamboo shortages
34	-	Philippines Typhoon Bopha	2012	reconstruction	no	focus on material salvaged by population - no control on how material was gathered is mentioned
35	-	Philippines Typhoon Haiyan	2013	reconstruction	yes	Only fallen coconut trees were used, no cutting; control in collaboration with Philippines Coconut Authority, use of coconut lumber guidelines by GIZ
36	-	Philippines Typhoon Haiyan	2013	Transitional shelter	no	

7.2 Annex B: Environmental Management Tools Analysis Explanations

	Environmental Marker	Environmental Cluster	Life-Cycle Assessments
Management framework	Does not promote coordination between different agencies	Would be a clear coordinating agent (main task of a cluster)	Results can be shared and coordinated through shelter cluster
Accountability	Increases responsibility to stick to what was promised, but not to overall environment	Clear accountability with cluster, but even less accountability in projects	No influence on who is accountable for environmental degradation
Monitoring & Evaluation	If part of the fund application, likely to be part of the monitoring	Cluster would have great opportunities to create evidence base	LCAs are mostly based on ex-post analyses of used products
Donor pressure	Donor would directly see the environmental focus of the project	Donors would not be involved in organisational change	Donors would not be involved
Practicality	Already in use, similar markers have been successfully tested	Not practical due to overlapping responsibilities	In its regular form too extensive, but could be shortened like EIA
Academic novelty	Already in use, however only little research on it	Cluster system broadly discussed, but an environmental cluster not	Not really discussed in connection with housing reconstruction

	Environmental Impact Assessments	Environmental Management System	Environmental Charters
Management framework	Results can be shared and coordinated through shelter cluster	No influence on coordination between different agencies	No influence on coordination or management approach
Accountability	No influence on who is accountable for environmental degradation	Requirement to clearly name roles and responsibilities	Organisations make themselves accountable for the standards they sign up
Monitoring & Evaluation	Monitoring not affected (except for ex-post EIAs)	Requirement to monitor and evaluate environmental performance	Influence only if monitoring is part of the standard
Donor pressure	Donors would not be involved	Donors would only be involved in case of certification	Donors would be able to see which organisation signed up
Practicality	Already in use in a shortened form	Flexible tool, some requirements seem bureaucratic for special needs of this sector	Applicable, but difficult to set effective yet flexible standards
Academic novelty	Several tools, guidelines, manuals, analysis, etc. exist	Not really discussed in connection with housing reconstruction	Humanitarian charters have been discussed, but no focus on environment

7.3 Annex C: Synthesis Matrix for the literature review on conventional construction

	Christini et al., 2004 **EMS and ISO 14001 certification for construction firms**	Boiral & Henri 2012 **Modelling the impact of ISO 14001 on environmental performance**	Campos, 2012 **EMS in SMEs in Brazil**	Pun et al. 2010. **An EMS-Approach to environmentally-friendly construction operations**
Does ISO 14001 lead to better environmental performance?	Yes, ISO 14001 can help, small size however limits ability to establish EMS	No significant relation between environmental performance and ISO 14001	No clear statement, but generally positive towards ISO 14001; small size reduces applicability	Yes, ISO 14001 as an opportunity to improve business
What construction market is investigated?	Case study: Skanska's branch in the USA	Survey among 1500 Canadian manufacturing firms	Small Brazilian businesses	Housing sector in Hong Kong
What are the main drivers for becoming ISO certified	Compliance with regulations; open up new market segments; reduction of risks; less harmful impacts; continuous improvement	ISO 14001 can help as a structural framework if implementation will is there; ISO opens new markets	Knowledge building and operational control; importance of legal aspects	Compliance with legal requirements; improvement in efficiency; encouraging surrounding industry; increasing quality of life
What are the main barriers for ISO certification	Management and worker time (Plans, documenting, trainings, audit);	Effects of ISO are overrated; practices that are not required by ISO 14001 have the biggest environmental impact	Communication and setting objectives scored the lowest among the system elements	Can't be applied mechanically, needs hard work and commitment

	Turk. 2009 **The benefits associated with ISO 14001 certification for construction firms: Turkish case**	Zhang et al. 2000 **A framework for implementing ISO 14000 in Construction**	Zutshi & Creed. 2014. **International Review of environmental initiatives in the construction sector**
Does ISO 14001 lead to better environmental performance?	Yes, if implemented correctly, even though high implementation costs of ISO 14001 need to be analysed in detail	"Likely" to cause significant changes in the environmental footprint of a company	Environmental impact is becoming more and more important in the construction industry; ISO 14001 is the benchmark for an EMS
What construction market is investigated?	Turkish construction sector	No specific market researched	Review of articles about implementation of EMS worldwide
What are the main drivers for becoming ISO certified	Access opportunity into international markets most important; efficiency gains; standardization; image	Helps to implement sustainable development in business praxis; can also cause competitive benefits; implementation does not incur extensive burdens; possibility to reduce costs in production and operation	Better track record, image, marketing; lower operation costs through efficiency; encouraging stakeholder involvement; reduced costs in delays, fines, etc. environmental benefits such as cleaner work site
What are the main barriers for ISO certification	Top-management not open to research and criticism; long period of certification, high implementation costs; paperwork	-	Short-term costs in certification and consultancy; lack of client support and subcontractor cooperation; Training organisation, disruption of work flow; increase of paperwork and operational costs, lack of trained staff, no good timing

7.4 Annex D: Checklist Comparison between ISO 14001 guidelines and guidelines for sustainable reconstruction

This annex compares summarises in the left column the checklist developed by Brorson & Larsson (2011) in their guidelines for ISO implementation, and checks whether comparable claims are also made in guidelines for sustainable shelter and reconstruction literature. For this, one checklist is taken from a publication by Kelly (2005) on sustainable emergency shelter, the other one from Schneider (2012) on monitoring & evaluation in sustainable reconstruction. The ISO 14001 checklist is an over 120 pages long document, covering every issue, very detailed, while the checklists by Kelly and Schneider are only 15 respectively 8 pages long, thus it is not surprising that many points are not reflected in the second and third column. Additionally, both Kelly and Schneider come up with additional points in their checklist that are not included by Brorson & Larsson, and not mentironed in this table, as they are not directly related to environmental management system requirements.

Even though, partly due to the above mentioned reasons, many boxes in the second and third column remain empty, it is interesting to see that some important elements of ISO 14001 are already promoted by sustainable reconstruction literature in the sector, meaning that the step towards actuall having an EMS in the humanitarian sector might be smaller than it seems to people not familiar with either ISO 14001 or humanitarian aid.

7.4.1 Policy

Brorson & Larsson 2011	Kelly 2005	Schneider, 2012
Written procedure how to handle the policy?	-	-
Included in the env. management manual?	-	-
Stating the ambition level?	-	-
Representative for the company's operations?	-	-
Commitment to continuous improvement?	-	-
Actively informing stakeholders?	-	-
Known by employees?	-	-

7.4.2 Planning

7.4.2.1 Environmental Aspects

Brorson & Larsson 2011	Kelly 2005	Schneider, 2012
Written procedure who is responsible, how to handle?	-	Does the programme include measures to mitigate negative environmental impact?
Register of env. aspects?	-	-
Was there an initial env. review?	Site selection criteria	Biodiversity assessment? Site review?
Location?	Detailed site selection criteria	Was there a site review?
Soil and Groundwater?	Is there water available? Is there a drainage system? Is WASH-system sufficient?	Is WASH system sufficient? Special focus on sanitation solution?
Natural resources?	Can fuel be sust. collected?	-
Emissions to air and water?	Fuel efficiency of houses? Sust. disposal of sewage?	-
Waste management?	Sust. disposal of solid waste?	-
Uncontrolled situations & risks?	Flooding and landslides risks?	Is site resistant to natural hazards?
Procedure to identify changed environmental aspects?	Does the site plan provide for extension of the site?	Does the site allow for growth or connection to other areas?
Historic env. issues?	Detailed site assessment?	Is baseline data assessed?
Include indirect effects?	Is there a plan for sustainable usage of the shelter?	Effects on livelihood?
Assessment of significant environmental aspects?	-	-

7.4.2.2 Legal and other requirements

Brorson & Larsson 2011	Kelly 2005	Schneider, 2012
Written procedure on how to deal with these issues?	-	-

List of legal requirements?	-	How can national regulation best be addressed?
Planning and building laws?	Legal permits to use this site?	correct standards and appropriate quality?
Chemicals?	-	-
Waste?	-	-
List of other requirements?	Sphere requirements met?	-
Assigned responsible to monitor legal requirements?	-	-

7.4.2.3 Objectives, targets and Programme

Brorson & Larsson 2011	Kelly 2005	Schneider, 2012
Written procedure who is responsible, how to handle?	-	-
Is there an overview over env. objectives, targets & programme	-	-
Waste?	Can 100% of the materials used be recycled after usage?	Percentage of sites that used recycled materials?
Emissions?	Have steps been taken to limit air & water pollution?	Percentage of sites that used energy-efficiency measures?
Natural resources?	Do building designs minimize resource use?	Percentage of sites that used sustainable timber?
Chemicals?	-	To what extent do sites use hazardous materials?
Awareness raising?	-	-
Are objectives converted into measurable targets?	-	-
Are there programmes set up?	-	-
What indicators are chosen?	-	Percentages of sites?
Are the objectives being reviewed?	-	-

7.4.3 Implementing

7.4.3.1 Roles & Responsibilities

Brorson & Larsson 2011	Kelly 2005	Schneider, 2012
Written procedure who is responsible, how to handle?	Is there a site management plan?	Detailed list of tasks for each position
Is there an organisational chart?	Has a party committed to manage the site?	-
Overview over environmental responsibilities?	-	Are responsibilities clearly defined and executed?
Are tasks delegated to different people? Are they included in their job description?	Are residents represented on the site management committee?	Detailed list of environmental tasks for each task
Are environmental issues part of job performance assessment?	-	Detailed list of environmental tasks for each task
Is there an env. manager with contact to top management?	-	Task description for environmental expert
What tasks are included in the env. manager's assignments?	-	-

7.4.3.2 Training and Awareness

Brorson & Larsson 2011	Kelly 2005	Schneider, 2012
Written procedure who is responsible, how to handle?	-	-
Included in env. mgmt manual?	-	-
Is there an assessment what env. competence is needed for a job?	-	-
Are there env. introduction courses?	-	-
Is the training systematical?	-	-
Are sub-contractors included?	-	-
Is there a reward system acknowledging progress in the environmental field?	-	-

7.4.3.3 Communication

Brorson & Larsson 2011	Kelly 2005	Schneider, 2012
Written procedure who is responsible, how to handle?	-	How has the programme coordinated its activities?
Are there efficient channels for internal information?	-	Was the overall coordination mechanism sufficient?
Are environmental issues discussed regularly? Where?	-	-
Communication of env. aspects?	-	-
Guidelines for ext.communication?	-	Beneficiary involvement?
Instructions on grievances?	-	Are beneficiaries satisfied?
Is there an annual env. report?	-	-

7.4.3.4 Documentation

Brorson & Larsson 2011	Kelly 2005	Schneider, 2012
Written procedure who is responsible, how to handle?	-	-
Who has access to documentation?	-	-
Is the documentation system co-ordinated with quality system?	-	-
Is there an environmental library?	-	-

7.4.3.5 Documentation Control

Brorson & Larsson 2011	Kelly 2005	Schneider, 2012
Written procedure who is responsible, how to handle?	-	-
Well established templates?	-	-
Can documents be identified?	-	-
Are they reviewed periodically?	-	-

7.4.3.6 Operational Control

Brorson & Larsson 2011	Kelly 2005	Schneider, 2012
Written procedure who is responsible, how to handle?	-	Is an efficient quality control planned and conducted?
Instructions for all aspects with significant env. impact?	-	-
Instructions for health & safety?	Safe use of pesticides? Proper Sanitation & Hygiene?	To what extent is protection (helmet) given to workers?
Instructions for sub-contractors?	-	Are roles defined and understood in partnerships? Where were barriers?
Instructions for purchasing?	-	-
Instructions for suppliers?	-	-
Are the instructions distributed, translated, checked regularly?	-	Do the beneficiaries know how to maintain houses?

7.4.3.7 Emergency Preparedness

Brorson & Larsson 2011	Kelly 2005	Schneider, 2012
Written procedure who is responsible, how to handle?	-	Appropriate Design: is the house appropriate to withstand natural hazards?
Has there been a risk analysis?	Are the buildings earthquake/storm-proof?	Are the potential risks properly analysed?
Procedures for preventing accidents?	Does plan account for fire safety?	How does the project manager handle risks?
Location of hazardous substances?	Are pesticides being used safely if they are used?	-

7.4.4 Checking

7.4.4.1 Monitoring

Brorson & Larsson 2011	Kelly 2005	Schneider, 2012
Written procedure who is responsible, how to handle?	Is there a system to monitor environmental conditions?	Which Monitoring tools have been useful?
Are parameters chosen in relation to objectives & targets?	-	-
Are surveys of env. condition close to the site undertaken?	-	Are biodiversity assessments undertaken?
Are methods, location, purpose, frequency etc. documented?	-	How frequently is quality control/monitoring undertaken
Is accuracy guaranteed? (Blank tests, calibration of equipment)	-	Is the team sufficiently large to ensure proper monitoring?

7.4.4.2 Evaluation

Brorson & Larsson 2011	Kelly 2005	Schneider, 2012
Written procedure who is responsible, how to handle?	-	How do you evaluate the success of the programme? Which evaluation tools have been useful?
Evaluation of compliance with legal and other requirements?	-	To what extent are national standards met?
Evaluation of customer requirements?	-	To what extent have stakeholders been satisfied?

7.4.4.3 Nonconformity

Brorson & Larsson 2011	Kelly 2005	Schneider, 2012
Written procedure who is responsible, how to handle?	-	How are risky behaviours identified?
Procedure on how to report?	-	-
Procedure on how changes are	-	-

implemented?		
Procedure for reporting sub-contractors?	-	-
Procedure for complaints?	-	-
Procedure on how to deal with unexpected high consumption?	-	-

7.4.4.4 Record Control

Brorson & Larsson 2011	Kelly 2005	Schneider, 2012
Written procedure who is responsible, how to handle?	-	-
Records on measurements?	-	-
Product information included?	-	-
Near accidents included?	-	-
Survey of ecosystems included?	-	-
Audits included?	-	-

7.4.4.5 Internal Audit

Brorson & Larsson 2011	Kelly 2005	Schneider, 2012
Written procedure who is responsible, how to handle?	-	-
Does env. management manual reference to the audit system?	-	-
Is the env. audit combined with e.g. quality management?	-	-
Is an audit programme used (frequency, team, structure, responsibilities, follow-up)?	-	-
Are auditors trained in environmental issues?	-	-

7.4.5 Acting

7.4.5.1 Management Review

Brorson & Larsson 2011	Kelly 2005	Schneider, 2012
Written procedure who is responsible, how to handle?	-	-
Are changes assessed?	-	-
Is the success on targets and objectives an issue?	-	-
Are employees asked for their opinion?	-	-

7.5 Annex E: Explanations to the requirement analysis of ISO 14001

Policy

Feasibility	Effectiveness
Develop a Policy	
Not in place yet	Commitment by top management
Fairly easy to implement on centryl level	Already many policies and commitments made (without big effect)
seperate construction from other activities	

Plan

Feasibility	Effectiveness
Identify Aspects	
In theory able to use PDNA (ENA)	Can help significantly for project design
in practice PDNA often not detailled enough, rather call for funding	knowing problematic issues early on
pre-disaster env. assessments available	danger to be a stand-alone analysis
Legal and other requirments	
Legal requirements need to be identified anyway	remind organisations of their commitments
Other requirements can be identified pre-disaster	Commitments already exist but aren't enforced
Partly in place already	
Objectives, targets & programme	
Not easy to implement early, little knowledge	Would increase accountability
Individ. env. Programme needs many scarce resources	How to deal with cumulative effects?
Usually not in place yet	

Do

Feasibility	Effectiveness
Roles & Responsibilities	
Resources are scarce and difficult to provide	Would significantly increase accountability
Specific management representative (EFA?) difficult to bring in	Could lead to conflicts of authority in the field in case of trade-offs
Training & Awareness	
Training programmes and tools already exist	Would tackle the awareness issue
Little time to educate new workers	
See examples from conv. construction	
Communication	
Participation approach with beneficiaries	Media, donors,... want to see quick results
Difficult to convince about importance of environment	Opposite situation: need to justify environmental care
Cluster communication of critical importance	
Documentation	
Sust. reconstruction guidelines already exist	Necessary for continuous learning
Policy, targets, etc. can be documented easily	Limited effectiveness, especially in short term
Difficult to describe how EMS parts work together without much bureaucracy	
Documentation Control	
Difficult even in conv. construction	Many decisions made without consulting documentation
Mainly to be done in "peace times"	Limited effectiveness
Operation Control	
Very difficult due to extreme time pressure	Very important to better control processes
Need to take decisions quickly	Enforcement of existing guidelines (purchasing)
Partly in place for non-environmental issues	
Emergency preparedness	
somewhat ironic	Widely implemented
DRR nowadays part of most projects	In some situations improvement can help
proper storage of materials can be difficult	e.g. hurricane season preparedness

Check

Feasibility	Effectiveness
Monitoring	
implemented for non-environmental issues	Lack of it identified as crucial problem
Introduction would not be difficult or costly	Improvement in this issue could help a lot
However would still cost some resources	
Evaluation	
Evaluations are widely done (partly donor req.)	Would help creating an evidence base
Sometimes including environmental issues	Would aid continuous learning
wouldn't be too difficult (resources!)	
Nonconformity	
No system for dealing with nonconformity yet	Early recognition of problems is important
Fairly easy to implement on worker level	Less enforcement and control by government
Difficult to implement on project management level	
Control of records	
Many records required by donor organisations	Mainly there to proof conformity
not applicable for environment yet	not really needed in post-disaster context
maintaining env. records not too difficult, but additional bureaucracy	
Internal audit	
Already done due to donor requirement	Identifies failures to comply with requirements
quite easy to include environment into it	helps tackling structural problems
Needs qualified auditors	

Act

Feasibility	Effectiveness
Management Review	
Can be done in "peace times"	Can significantly benefit continuous learning
would require increased top management support	Need to find translation to everyday action

7.6 Annex F: List of interview partners

Overall, 22 experts from the field of disaster management or ISO 14001 application in the construction industry were interviewed. All interviews were conducted in a semi-structured way. Interview questions included the general working experience of the interviewee and more specific issues around both the conventional construction and disaster reconstruction, often circeling around the practical experiences with topics related to different system elements of ISO 14001. Due to secrecy reasons, the interviewed persons will remain unidentified.

Name	Given Name	Position	Expertise	interviewed
Block	Jozias	DG DEVCO	EU Policy in Development, Environment and DRR	25. Feb
Johannessen	Ase	Research Fellow at SEI	WatSan; Water and DRR; systems ecologist	29. Jan
Albert	Dominique	Deputy head of Department of Specific Thematic Policies at DG ECHO	Operations, donor management, screening, knowledge management, cross-cutting issues	27. Feb
Clark	Ian	Head of Department of Policy and Implementation Framework at DG ECHO	Donor management, policies, implementation of programmes, frameworks in humanitarian aid	20. Feb
Lund	Jesper	UN OCHA	Disaster Situation Leadership, Disaster Assessment, field experience	09. Apr
Hedberg	Marianne	Swedish Industry association representative for construction	Swedish Construction Sector; application of ISO 14001;	23. Mrz
Söderberg	Staffan	CSR Consultant, previous sustainability manager at Skanska	ISO 14001 deployment, ISO 26000, developing country context	05. Mrz
von Ölreich	Kristina	Swedish EPA	Introduction of EMS (ISO 14001) in public and governmental organisations and UN	19. Mrz
Brundiers	Katja	PhD Disaster & sust. Developm.	Disaster Recovery as a window for sustainable development	17. Apr
Taylor	Tim	Energy Efficiency & Consveration Authority New Zealand	Sustainable Reconstruction after Christchurch earthquake New Zealand	15. Apr
Brown	Charlotte	PhD	Sustainable Waste Management in Disasters	14. Apr
Nijenhuis	Rene	Humanitarian Affairs Officer JEU	Work with environment in humanitarian affairs, background in EMS/ISO	20. Apr
Thummarukudy	Muralee	UNEP Senior Officer DRR	Environment in the humanitarian sector; Post Disaster Needs Assessments	20. Apr

Name	Given Name	Position	Expertise	interviewed
Getman	Christie	Lutheran World Relief Programme Quality Senior Director	Advisoral Board in GRRT; Experience in different disasters worldwide	14. Mai
Wahlstrom	Emilia	UN-OCHA JEU	Disaster preparedness; Chemicals and waste management; consulting on ISO 14001	22. Apr
Charles	Kelly	UNEP Senior Officer, JEU	Over 20 years experience with environment and disaster reconstruction; worked with multiple guidelines and standards (e.g. GRRT, QSAND, etc.)	06. Mai
Hamza	Mo	Professor for Disaster Risk Management; University of Copenhagen	Disaster Risk Management & Recovery; Global Climate Adaption Partnership; Experiences in academia and field work	04. Mai
Andreuzzi	Fabrizio	UNDP – Crisis Response Unit	Programme Specialist – Rapid Response and Preparedness	18. Mai
van Breda	Anita	WWF USA	Sustainable Recovery; core team of GRRT development	22. Mai
Corsellis	Tom	Shelter Center	Overall perspective on disaster, shelter and standards	13. Mai