

Paper in Preparation

Submitted To: Journal of Environmental Planning and Management

Submission Date: 20 June 2014

Developing and applying a Decision Support Tool and Design Matrix for selecting and designing Economic Instruments for INRM

Abstract

This paper describes insights gained from applying two tools, developed by the Afrوماison Project, for the selection and local design of economic instruments as incentives for INRM. The Decision Support Tool proved helpful for stakeholders to select potential economic instruments, and the Design Matrix underscored the need to customize instruments to the local context. There is however no blueprint for implementing economic instruments. Governance systems, sustainability of funding, socio-economic and cultural contexts, for example, have significant influence on the viability of an economic instrument. Recommendations are proposed regarding best practice for implementing economic instruments as part of an INRM strategy.

Keywords: decision support tool; design matrix; economic instruments; incentives; integrated natural resource management; AFROMAISON project.

Authors: Fonda Lewis¹/Eduard Interwies²/Gregory Giuliani³/Yaniss Guigoz⁴/Stefan Görlitz⁵

1: Institute of Natural Resources, P.O. Box 100396, Scottsville, Pietermaritzburg, 3209, South Africa /+27 (0)33 [3460796](tel:3460796)/flewis@inr.org.za

2: InterSus - Sustainability Services/Chodowieckistr. 2/10405 Berlin/Germany/+49 30 - 44736342/interwies@intersus.eu

3: University of Geneva, Institute for Environmental Sciences, Forel Institute, enviroSPACE Lab., Battelle – Building D, 7 route de Drize, CH-1227 Carouge, 10 Switzerland/+41 22 379 07 09/gregory.giuliani@unige.ch

United Nations Environment Programme, Global Resource Information Database – Geneva, Châtelaine, Switzerland/+41 22 917 84 17/gregory.giuliani@unepgrid.ch

4: University of Geneva, Institute for Environmental Sciences, Forel Institute, enviroSPACE Lab., Battelle – Building D, 7 route de Drize, CH-1227 Carouge, 10 Switzerland.

United Nations Environment Programme, Global Resource Information Database – Geneva, Châtelaine, Switzerland/+41 22 917 83 98/yaniss.guigoz@unepgrid.ch

5: InterSus - Sustainability Services/Chodowieckistr. 2/10405 Berlin/Germany/+49 30 - 44736342/goerlitz@intersus.eu

Corresponding author: Fonda Lewis/Institute of Natural Resources, P.O. Box 100396, Scottsville, Pietermaritzburg, 3209, South Africa /+27 (0)33 [3460796](tel:3460796) / flewis@inr.org.za

1. Introduction - The Role of Economic Instruments and Incentives in INRM

The present article reviews insights and experiences gained in the AFROMAISON project regarding two issues: the selection of Economic Instruments (EI) best suited for a given context (in the AFROMAISON project, the focus was on integrated natural resources management (INRM))¹, via a Decision Support Tool, and the local design of the selected EI, i.e. the customization of it, via a Design Matrix.

INRM encompasses the concept that natural resources are not only important for direct use, but are critical in supporting basic ecosystem service provision, local economic development and social wellbeing. In so doing, it aims to contribute to the integration of landscape functioning (regarding the delivery, use and access to goods and services provided); livelihood and socio-economic development (including vulnerability to global change); and institutional strengthening and improved interaction between sectors, scales and communities (Gottret/White 2001; Hagmann et al., 2002).

The EU-funded research project AFROMAISON analyzed three groups of tools that can be used to tackle INRM challenges: a) tools for spatial planning, b) approaches for restoration and adaptation of natural resources, and c) economic instruments, on which this article is focused.

¹ INRM can be defined as “An approach that integrates research of different types of natural resources into stakeholder-driven processes of adaptive management and innovation to improve livelihoods, agro-ecosystems resilience, agriculture productivity and environmental services at community, eco-regional and global scales of intervention and impact” (Ochola et al. 2010).

An economic instrument can generally be defined as a tool that aims to influence the way people use natural resources and manage the environment (Panayotou, 1998). This is achieved by changing the extent to which people feel or experience the cost associated with the use of resources, or the consequences of their decisions about how to manage or protect the environment (Anderson et al., 2001).

Environmental degradation, driven by inefficient or wasteful use of natural resources, is widely associated with conditions where the private and social costs of this degradation are incomplete or distorted. This occurs, for example, in cases where the cost of the degradation of a resource is carried by society rather than by the individuals using the resource inefficiently (Panayotou, 1998). Economic instruments therefore aim to provide incentives that will induce a change in the behaviour of people to improve the way they use and manage natural resources. These incentives can act as catalysts to induce the uptake and implementation of resource and environmental management interventions. Incentives can take the form of rewards and benefits for responsible resource management practices, or corrective fees or penalties (dis-incentives) for irresponsible practices.

EI designed to promote improved environmental management can range in definition from narrow to broad economic instruments (Anderson et al., 2001):

- Narrowly defined, economic instruments would include those that link direct and proportional benefits with performance objectives or targets for achieving the desired condition of the natural environment or specific natural resources. For example, price-based instruments, such as tax differentiation through rebates for landowners achieving certain biodiversity conservation objectives, could effect change by land owners as a result of changing the affordability or profitability of certain conservation focused land management practices.

- Broadly defined, economic instruments include instruments that have only economically uncertain or indirect links for the agent or institution whose resource or environmental management behaviour is to be altered. For example, an information based instrument (such as sustainability reporting) would not in itself increase the cost of pollution to a polluter, but could nevertheless encourage a reduction in discharge levels of pollutants levels due to social pressure associated with public opinion.

Economic instruments can be clustered into three categories, and there are a range of instruments within each of these categories, for example:

- Rights based instruments,
- Ownership rights (e.g. strengthening ownership rights and use rights),
- Price based instruments,
- Market creation (e.g. tradable quotas, permits and shares),
- Fiscal instruments (e.g. tax differentiation),
- Charge systems (e.g. user charges, pollution charges),
- Financial instruments (e.g. subsidies, payments for ecosystem services),
- Environmental bonds and deposit refund systems (e.g. environmental performance),
- Legal, voluntary and information based instruments,
- Liability agreements (e.g. legal liability, non-compliance charges),
- Voluntary instruments (e.g. voluntary environmental agreements, environmental certification),
- Information based (e.g. labelling).

The suite of instruments that was considered in the AFROMAISON Project is not a

complete inventory of available economic instruments, but rather focuses on those that are likely to have the greatest relevance as incentives for INRM in the context of the AFROMAISON Project's objectives of INRM in developing countries.

2. Factors determining the Effectiveness of Economic Instruments

The effectiveness of economic instruments in providing incentives for improved resource use and management is not only determined by the value of the benefit (or its cost), but also by a number of other factors such as:

- The instrument matches or complements the social, political and economic contexts.
- The instrument incentivises an intervention that corresponds with the environmental challenge.
- The incentive is recognised as meaningful or worthwhile by the target agents or institutions whose behaviour or management approach needs to change (Bernstein, 1997).

Furthermore, in developing countries in particular, where financial resources are typically scarce and where the institutional capacity may be limited, there are a number of other criteria that also impact on the effectiveness of economic instruments, including:

- the cost-effectiveness of the instrument;
- its administrative feasibility;
- equity considerations;
- the consistency with other development objectives, and
- the instrument's flexibility and transparency.

It is therefore important that a conscious and transparent selection process is undertaken to ensure that the selected EI is a good "fit to the context". Poor "context-instrument matching" could result in the selection of an ineffective instrument that does not result in the desired behaviour change by the target agents or institutions, or that may even act as a perverse incentive and result in a change contrary to the desired response.

Many resource managers and decision makers have limited knowledge of the range of economic instruments and their application potential, which limits their ability to undertake the "context-instrument matching" process. To assist in addressing this challenge, the AFROMAISON project developed two tools to support the selection and design of the economic instrument(s) that will have the greatest potential to provide effective incentives (see figure 1 for how these tools fit into a selection and design process of EI in the context of INRM):

- A Decision Support Tool (DST) that aims to assist the process of context-instrument matching, and to support the selection of the economic instrument(s) that will have the greatest potential to provide effective incentives for interventions that result in improved environmental management. Fourteen economic instruments are included in this Decision Support Tool. While there are many other types of economic instruments, the 14 included in this DST²

² These consist of: property rights-based instruments (ownership rights, use rights), price-based instruments (tradable permits, user charges, pollution charges, performance bonds, tax differentiation, payments for ecosystem services, environmental subsidies) and legal, voluntary and information-based instruments (legal liability, non-compliance charges, voluntary environmental agreements, environmental certification, labelling).

were selected on the basis of their relevance to the INRM objectives of the AFROMAISON project³.

- A Design Matrix (DeMax), which is applied to inform (i) the assessment of the local potential to implement a selected economic instrument in a given context, (ii) key design considerations for the application of an economic instrument in a specific context, (iii) the evaluation of the likely impact and sustainability of the economic instrument in that context, and (iv) highlight potential flaws or barriers to the implementation of the selected economic instrument⁴.

³ This Decision Support Tool can be accessed on the Afromaison Project website at: http://afromaison.net/index.php?option=com_content&view=article&id=72&Itemid=184.

⁴ This Design Matrix can be accessed on the Afromaison Project website at: http://afromaison.net/index.php?option=com_content&view=article&id=85&Itemid=185.

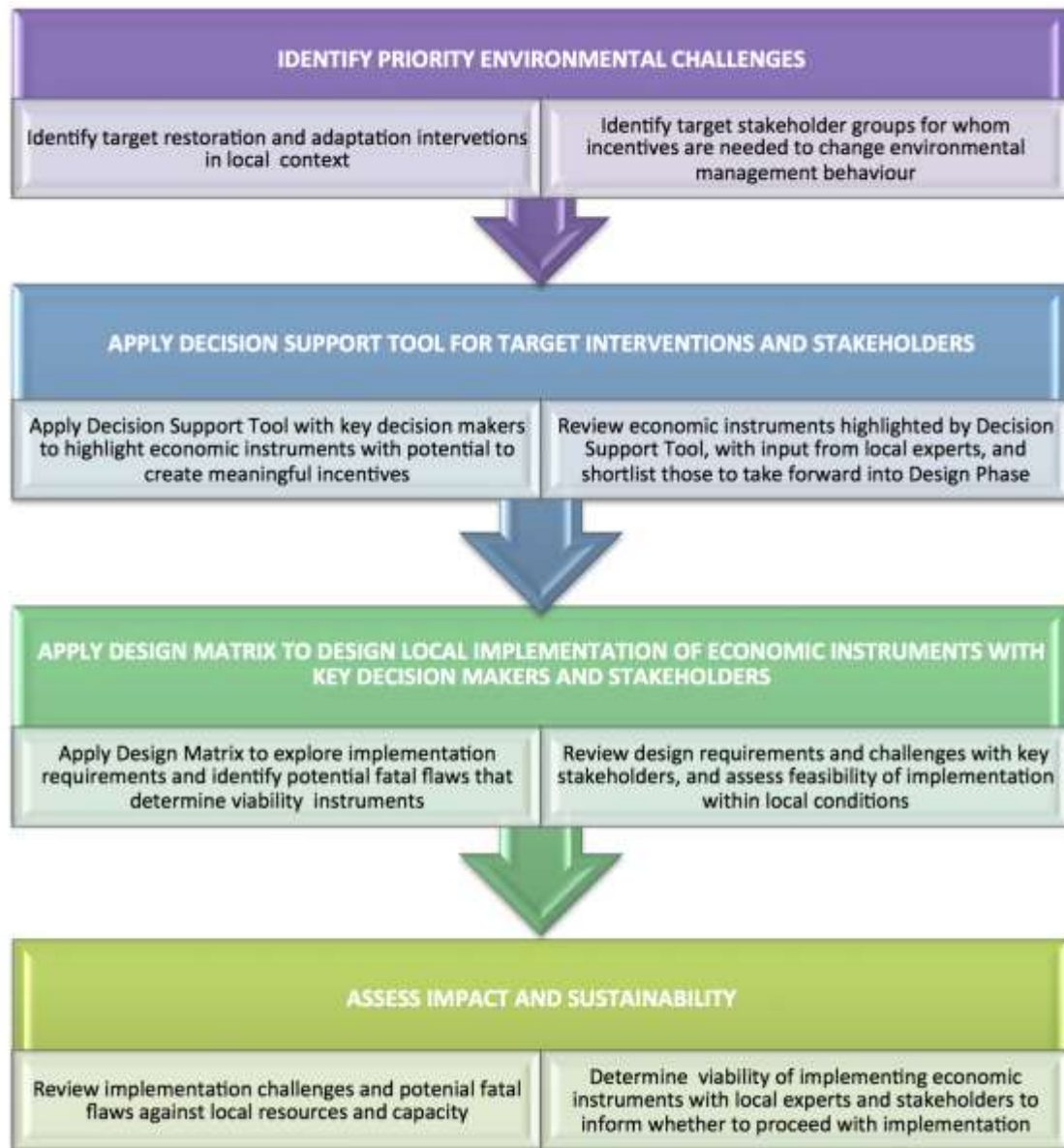


Figure 1: Overview of approach and tools for selecting economic instruments as incentives for improved natural resource management.

The development of the online based tools faced several technical challenges, which are described in chapter 3. Both tools were then applied across the five AFROMAISON case studies⁵ as an approach to select and design EI to create incentives for the

⁵ The five case studies were: Ethiopia (Headwaters of the Blue Nile), Mali (Inner Niger Delta), South Africa (uThukela District), Tunisia (Oum Zessar Watershed) and Uganda (Albertine Rift

sustainable land management restoration and adaptation interventions identified for priority environmental challenges (Dessalegn 2013; Lewis 2012; Lewis and Zunckel 2013; Sghaier et al. 2012; Sghaier et al. 2013; Zaré et al. 2013). The outcomes of the DST and DeMax processes in each case study were analysed to assess the potential impact and sustainability of economic instruments in terms of realising the INRM objectives in the case studies. From this analysis, conclusions were drawn on the potential contribution of economic tools and incentives to INRM strategies in developing countries, which are highlighted in this article in chapters 4 and 5.

3. The Development of a Decision Support Tool and Design Matrix for selecting and designing Economic Instruments

Originally, both DST and DeMax were developed as Excel forms, allowing users to select suitable economic tools that fit their needs and their context. However, it was difficult to work with Excel, because it requires having a dedicated software to run the tools, and it was impossible to use it in a web environment. Having simple to use tools (e. g, using wizards guiding users into selections) that require no specific software to use it readily available in both online and offline mode, can bring major benefits to users and greatly increases its outreach (McIntosh et al., 2011).

Consequently, it has been decided to completely rewrite these two tools using HTML and JavaScript. This allows developing applications that require only a web browser to be executed, that can run both online (e.g. on a website) and offline (e.g. that can be downloaded and run without an Internet connection), and finally the graphical

and Rwenzori Mountains). For more details on the case studies, see http://afromaison.net/index.php?option=com_content&view=article&id=14&Itemid=106.

user interface can be more user friendly (see figure 2) (Zeng et al. 2012; Hiltunen et al., 2009).

The DST has been developed to assist resource managers or implementing agents to "walk" through the set of selection criteria (economic, social, governance and environment) that will help to evaluate the alignment of EI with a the target context. It assists in the process of context-instrument matching with the aim of highlighting the EI that have the greatest potential to create meaningful incentives to change the behavior of people (Matthies et al, 2007).

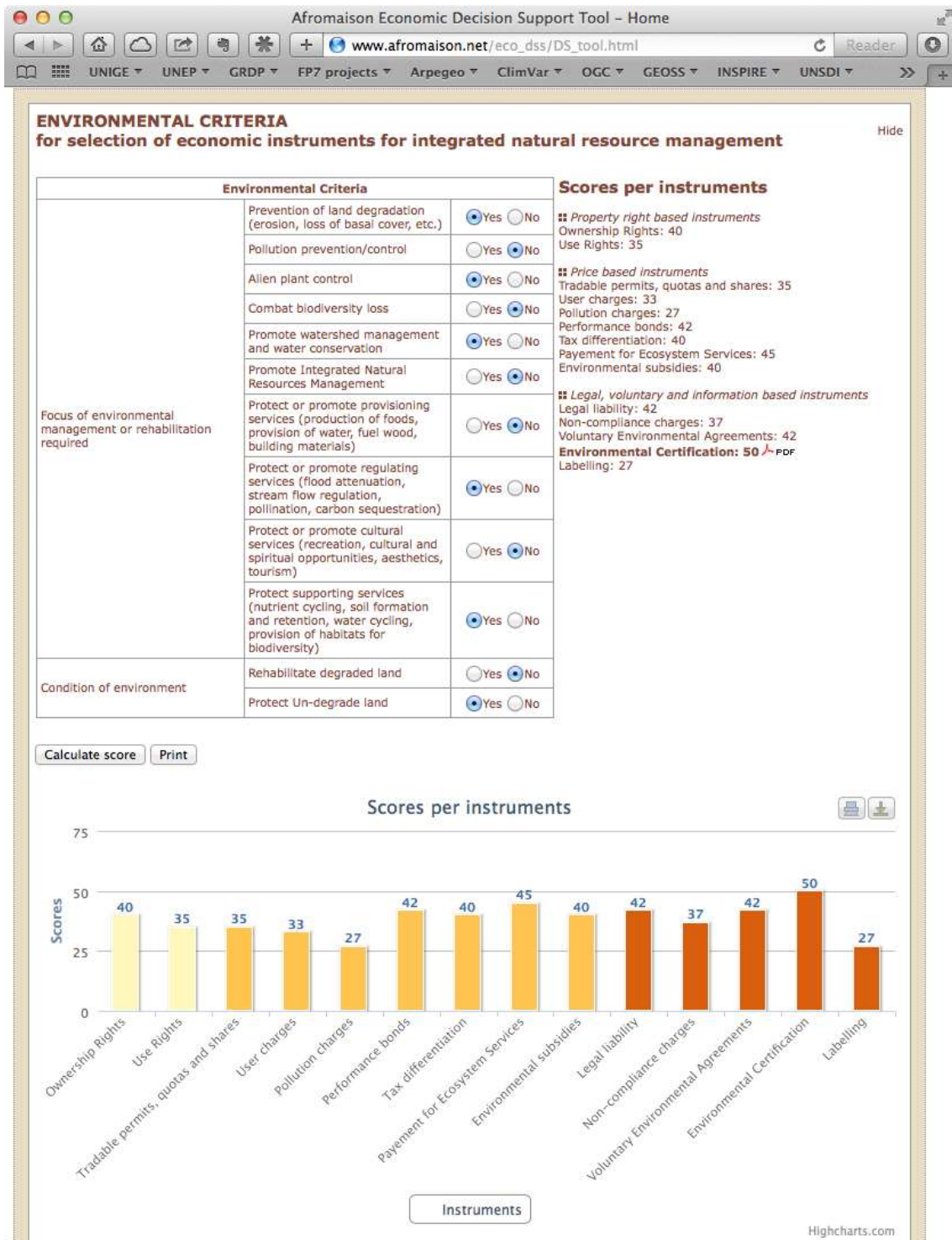


Figure 2: Decision Support Tool in HTML.

The user has to determine if a criterion is relevant to the context for which the instruments are being assessed (by selecting the "Yes" or "No" buttons). The relevant points are automatically allocated based on the selection made for each of the criteria

across the four categories. Once all the criteria have been rated, the score can be calculated for all the instruments for the given context by clicking on the "Calculate Score" button. The results are illustrated in text, as well as graphically per category. It is also simultaneously calculated for an overall score across all four categories (by expanding the summary scores section), which provides the opportunity to weight one or more of the categories more heavily than the others if needed.

Once relevant EI have been identified, a second tool can support the design phase of the implementation process. The DeMax prompts users to analyze and determine if a series of condition criteria are likely to be met, and evaluates the relevance of the criteria to the context. Notes on the local responses to the condition criteria are notes in the DeMax, and anticipated problems that might limit local implementation of the instrument are flagged. These critical flagged issues are summarized into a list that can then be used to guide the revisions that would be required to effectively implement the incentive. Once all the condition criteria have been rated, a cumulative score is calculated to provide a guide on whether or not the conditions for effectively implementing the incentive can be met in the local context.

If a solution to these critical flagged issues and potential barriers cannot be found (for example a modification to aspects of the instrument, or an intervention in the local socio-political environment), then it is unlikely that the instrument will be effective. An alternative EI would then need to be explored or an alternative mechanism to economic instruments would need to be explored. The outcome of the DeMax is therefore twofold:

- It provides an approach to evaluate the potential effectiveness and sustainability of an EI under specific local conditions.

- It provides a process to highlight flaws or barriers to the implementation of the selected EI in a specific local context that would need to be addressed in the design of the instrument, or the system to implement the instrument, if it is to be effective and sustainable.

In order to reach the widest audience possible, these tools are freely accessible and available online on the AFROMAISON website, where they can be also downloaded to be executed directly on desktop computers. Being free and open source (i.e. HTML and Javascript source code is directly editable), these tools can be shared with anybody and can be modified by users themselves to add new functionalities or correct potential bugs (Sen et al., 2011). DST and DeMax have been licensed under Creative Commons Attribution-ShareAlike (e.g. CC-BY-SA). In the case of DST and DeMax, users are free to share (e.g., copy and redistribute the material in any medium or format) and adapt (e.g., remix, transform, and build upon the material) for any purpose, even commercially (Scacchi et al., 2012). It has to be noted that both the tools are currently available both in English and French, which allows covering a wide geographic area. They can easily be extended to other languages for even wider outreach.

4. The Application of the Decision Support Tool and DeMax in the AFROMAISON Case Studies - Practical Experiences

After developing and initially testing the DST and the DeMax, both tools were applied and tested in stakeholder participation processes in the five AFROMAISON case studies. This application and testing offered valuable insights into the functioning of the tools, and on applying EI in the case studies' contexts. These insights are summarized in

the following, in an aggregated form for all five case studies⁶.

4.1 Selection of Economic Instruments - the Decision Support Tool

4.1.1 Approach to the Selection of Economic Instruments

The DST uses four sets of criteria to explore and then highlight EI that would likely provide the most meaningful incentives for the implementation of management or rehabilitation actions/interventions in a particular context:

- Environmental criteria describe the objectives/priorities for the environmental interventions that are to be incentivised by the EI. They also describe the context/conditions of the environment in which the management action or intervention is to be applied.
- Social criteria refer to the social context, describing the socio-economic profile and characteristics of the communities and agents that would be involved in implementing the economic instrument.
- Market criteria relate to the market conditions in the environment within which the instrument will be applied. They also address the market for, or in which, environmental goods and services are traded.
- Governance criteria relate to the institutional arrangement and structures, and their effectiveness in coordinating or controlling activity in society and in the environment.

The DST has four steps to help decision makers to "walk through" the set of selection criteria that will help to evaluate the relevance of the EI in a local context:

⁶ For more detailed descriptions, please visit the AFROMAISON website.

- Step 1: Select the management or rehabilitation action requiring incentives to encourage implementation: The environmental challenge and the associated restoration / adaptation interventions for which the incentive is required first needs to be identified. The stakeholders whose behaviour needs to be changed for the implementation of this intervention also need to be identified.
- Step 2: Apply evaluation criteria: This DST applies a scoring and ranking process for assessing the suitability of economic instruments against a series of criteria.
- Step 3: Score instruments likely to offer most meaningful incentives. The DST is programmed with points reflecting relative effectiveness of EI under different conditions. The points have been set on the basis of a review of the application potential of the instrument internationally. The combination of responses by the user to the questions relating to the criteria (i.e. the yes/no answers to local objectives/conditions in the local context) determines the score calculated for each instrument. The score for each EI is automatically calculated by the DST for each category, and then as a summary across all four categories. No weighting is applied in the calculations of the scores across the ecological, social, market and governance categories as the un-weighted score provides the user the opportunity to weight one or more of the categories more heavily than the others if needed for a specific context. The scoring system is designed so that instruments can be compared to each other, and the suitability of an instrument can be assessed relative to the scores of other instruments.
- Step 4: Review information sheets to gain more information on how instruments work and cases where they have been applied. Information sheets for all the instruments are included in the DST. The information sheets provide an

overview of the instrument, as well as examples of case studies in which the instrument has been applied around the world. The user then completes the DST process by reviewing the information sheets for the instruments that scored highest and, on the basis of the review, decide whether to take the instrument forward into the design phase.

4.1.2 Outcomes of the Selection Approach applied by the Case Studies

Of the 14 economic instruments included in the DST, 10 were highlighted⁷ by the case studies as having the potential to create meaningful incentives to address priority interventions and challenges in the local context. In many cases, a single economic instrument could potentially address a range of challenges, as a one-on-one relationship between EI and intervention was not required. In this way a cluster of restoration and adaptation interventions could be incentivised through a single economic instrument.

While the DST has the potential to highlight economic instruments that theoretically have the potential to create local meaningful incentives, the process also requires the input of local stakeholders and experts who can evaluate and compare the instruments highlighted by the process, to decide which instruments to carry forward into the design phase. The fact that an instrument scores relatively high does not mean that it is locally suited to provide a meaningful incentive. The expert and local knowledge of stakeholders provides an "informed filter" that can refine the list of economic instruments selected for the design phase.

⁷ These are: property rights-based instruments (ownership rights, use rights), price-based instruments (tradable permits, user charges, performance bonds, tax differentiation, payments for ecosystem services, environmental subsidies) and legal, voluntary and information based instruments (voluntary environmental agreements, environmental certification).

The DST helps to raise awareness about the range and types of EI that do exist beyond the potentially limited knowledge of local resource users and managers, and facilitates the selection of economic instruments that can implicitly contribute to a robust INRM strategy. However, the socio-economic and cultural characteristics of a user group (whose behaviour is being targeted by the interventions) has a strong influence on the potential effectiveness of an economic instrument. Therefore, one EI may provide a meaningful incentive for interventions for one group of stakeholders, but not for another group (which makes a strong case for applying the DeMax as well).

4.2 The Design of Economic Instruments - the Design Matrix

4.2.1 Approaches for local Design

After applying the DST to select EI which may provide meaningful incentives, the local implementation needs and opportunities of the economic instruments highlighted and selected during the selection phase were explored by each of the case studies via the DeMax tool. The DeMax comprises of a series of criteria that aim to inform:

- The assessment of the local potential to implement a selected EI in a given context.
- Key design considerations for the application of an EI in a specific context.
- Evaluation of the likely impact and sustainability of the EI in that context.
- Highlight potential flaws or barriers to the implementation of the selected EI.

The DeMax prompts users to analyse and determine if a series of condition criteria are likely to be met, and evaluate the relevance of the criteria to the context. These criteria address two aspects of implementation, namely (i) the potential impacts of the economic instrument on the local context, and (ii) the influence of the local context on the effectiveness of the EI. The DeMax criteria are classified into four categories, which

resemble the criteria used in the DST:

- **Social:** Criteria relating to influence from and impacts to the socio-economy and culture of the target groups/community who would implement the management intervention, and who may derive benefit from the incentive. These criteria also consider secondary impacts to surrounding groups or communities.
- **Ecological:** Criteria exploring direct and secondary impacts (positive or negative) accruing from the incentives generated by the economic instrument. It also addresses the potential for unintended impacts to other natural resources or interventions in the target area, or neighbouring areas.
- **Market:** Criteria concerning the influence of and impacts to markets and economic opportunities, both locally and in the broader economy.
- **Governance:** Criteria addressing policy and the influence of governance structures, institutional arrangements and capacity in supporting or hindering the implementation of the EI.

A fifth category of "Other Issues" includes criteria that aim to encourage retrospective consideration of overarching issues that could inform the implementation of the instrument, but which do not affect the overall cumulative score or recommendation from the DeMax.

The user has the opportunity to weight the contribution of scores for each criterion to the overall score to reflect the local priorities and conditions. Once all the condition criteria have been rated, a cumulative score is calculated to provide a guide on whether or not the conditions for effectively implementing the incentive can be met in the local context. The results are classified into three categories of further action:

- Proceed with minor caution and attention to aspects of implementation design.

- Proceed with caution and attention to likely requirements for significant modification to instrument or receiving environment.
- Do not proceed as the instrument is unlikely to match context and create meaningful incentives.

Critical issues relating to the condition criteria raised by the stakeholders participating in the DeMax process are captured into the DeMax template. These critical issues may relate to anticipated problems that might limit local implementation of the instrument, or to conditions that might be required to create an enabling environment for effective implementation of the instrument. Issues that are considered critical or potential fatal flaws to the implementation of the instrument are flagged, and the summarised list of flagged issues can then be used to guide the revisions that would be required to effectively implement the incentive.

If a solution to these critical flagged issues and potential barriers cannot be found (for example, a modification to aspects of the instrument, or an intervention in the local socio-political environment), then it is unlikely that the instrument will be effective. An alternative EI or mechanism would then need to be explored.

The outcome of the DeMax is therefore twofold as it provides:

- An approach to evaluate the potential effectiveness and sustainability of an economic instrument under specific local conditions.
- A process to highlight flaws or barriers to the implementation of the selected economic instrument in a specific local context that would need to be addressed in the design of the instrument, or the system to implement the instrument, if it is to be effective and sustainable.

4.2.2 Outcomes of the Design Approach applied in the Case Studies

Ten economic instruments were taken into the design phase across the five AFROMAISON case studies (see above, and footnote 7). The results of the application of the DeMax indicate that the local design and implementation requirements for the economic instruments differ from case to case. There is no blue-print for applying EI. Instead, economic instruments require local context matching and adaptation to ensure ecological, socio-cultural and economic suitability. EI that are applied without adaptation to the local context may be ineffective or could even generate perverse incentives that further undermine the local INRM objectives. Local design and application of economic instruments benefits from input by local stakeholders and context specialists to calibrate them locally.

The effectiveness of EI to create meaningful incentives is substantially enhanced by the adoption of a clustering and stacking approach (see chapter 5 for details).

The implementation of incentives for rehabilitation cannot be entirely isolated from the influence of other activities or drivers both within the meso-scale and beyond (i.e. regional or national). Externalities (e.g. associated with third party effects from the consumption of goods and services by groups who do not comply with local sanctions or incentives) can undermine the impacts and benefits generated through the economic instruments. The influence of outside markets can also create externalities that undermine or affect the significance of the incentives created locally. Implementing EI therefore needs to be dynamic, rather than static, and ongoing adjustments may be required to ensure the relevance and meaningfulness of the incentive.

Applying the DeMax was found to be time consuming by the stakeholders. However, the outcomes of the systematic design process highlight many critical design considerations and constraints at the local level. The DeMax process also helps to

identify potential fatal flaws that could preclude the implementation of an otherwise popular economic instrument. Examples of these fatal flaws include, for example, the lack of a willing buyer for the implementation of a Payment for Ecosystem Services (PES) instrument, or the creation of otherwise unidentified perverse incentives through Environmental Subsidies. Despite the time consuming nature of the DeMax, it also provides an opportunity to establish a platform for stakeholder consultation and interaction that can later be used to implement the economic instruments.

5. Discussion and Conclusions - Embedding Economic Instruments in INRM

The design and potential implementation of 10 economic instruments were investigated across the five AFROMAISON case studies. The outcomes highlight the fact that governance systems, and the capacity of governments in particular, will likely have the strongest influence on almost all instruments and are therefore a critically important consideration in the local design of an EI. Access and sustainability of funding to generate and sustain incentives is a key limiting factor, while socio-economic, cultural and market contexts also have a significant influence on the potential viability and local design of the instruments.

Rights-based, price-based, and legal, voluntary and information based instruments all have implementation potential in developing countries under certain conditions. However, the "context-instrument matching" process is critical to ensure the best instrument is selected to suit local conditions, as the effectiveness of an economic instrument in acting as an incentive for improved environmental management is not determined by the value of the benefit (incentive) alone. There are a range of factors that will influence the effectiveness of an instrument in a specific context, which are highlighted in chapter 2.

It is therefore important that a conscious selection process is undertaken to ensure that the EI is a good fit to the context. Poor "context-instrument matching" could result in the selection of an ineffective instrument that does not result in the desired behavior/management change by the target agents or institutions, or may even act as a perverse incentive and result in a change contrary to the desired response.

The impact and sustainability of the three categories of economic instruments varies across developing countries, however, the following general conclusions can be made:

- Rights-based instruments typically have the greatest impact in areas with weak tenure or open access resources. However, the impact and sustainability of these instruments is a direct function of the governance systems through which they are implemented. Weak institutional capacity means that the sanctions and controls needed to support the rights based instruments are absent or fragile which means they can be ignored or overridden by other forces. Furthermore, careful consideration needs to be paid to respecting and avoiding conflicts between traditional governance systems and the governance systems used to implement the economic instrument. Conflicts between these systems can result in the erosion of social cohesion, which could ultimately undermine efforts to incentivize improved INRM.
- Price-based instruments are relatively versatile and can be effective from less formal and weak economies through to formal and relatively affluent markets. The critical issue affecting impact and sustainability is the price/cost associated with the incentive needs to be meaningful within the local economy. The economic value of the incentive therefore needs to be locally calculated on a case by case basis and cannot be universally determined. In addition, price based

instruments typically required effective governance systems to implement and enforce them effectively and equitably. Capacity and resource constraints of governance systems in developing countries can therefore be a key limiting factor to the impact and sustainability of price based instruments.

- Legal, voluntary and information based instruments are typically more effective in formal economies with the market limitations of less formal markets typically restricting the potential impact of these instruments. Weak governance also limits the impact of these instruments by being unable to support the legitimacy of the regulating systems established to implement the instrument. Nevertheless a strong platform of civic, NGO, or independent third party role-players can compensate for market limitations or weak governance systems, and can provide an enabling environment for meaningful impact and sustainability of these instruments.

Decentralization and devolution of power to local authorities and users are key criteria for effective implementation of many EI. While national/central governments typically hold de jure authority for environmental management, the reality of capacity, financial and logistical constraints of national governments in developing countries typically mean that local resource users effectively have de facto authority. Formally empowering the local authorities at the meso-level can help to provide on-the-ground legitimacy and control, which can then be used as the platform for management interventions and the implementation of local level tools and incentives. Central governments do have an important role to play in INRM, particularly in providing support through monitoring, sanctions and policy, which is typically most effective if implemented at a national level.

Externalities associated with “illegal or non-local users without local use rights” need to be addressed if the impact and sustainability of incentives are to be maintained. Externalities can be defined as third party effects arising from the consumption of goods and services for which no appropriate compensation is paid, or where consumers do not comply with sanctions or incentives established locally. These externalities can undermine the sustainability of the EI as a result of the local legitimate resource users not benefiting from the incentives equitably yet still bearing the costs.

The scarcity of local funding to generate meaningful benefits at the meso-scale in developing countries often results in a dependence on donor-driven processes. Donor-driven processes, however, need to include a plan to transfer capacity and responsibility to local governance systems in the medium to long term to insure the sustainability of the instruments and incentives beyond the life-cycle of the donor funding. This plan should include consideration of the potential roles and responsibilities of local government, communities/private sector and NGO/support agencies.

From these insights, several recommendations for best practice approaches in implementing economic tools and incentives can be issued:

- Local fees, charges and penalties associated with economic instruments need to be calculated to reflect local market conditions and prices, so as to ensure that the incentives are socially equitable and economically meaningful in the local context. It is also important to protect the legitimate interests of local resource users by adequately considering local economic circumstances and avoiding the establishment of pricing schemes that reflect prices in external markets.
- Monitoring and evaluation of the impacts of SLM interventions from an early stage helps to demonstrate the need for, and value of, improved natural resource

management. This evidence from the monitoring can then be used to motivate markets to invest in the implementation of economic instruments that can be used to generate the incentives for local resource users and managers sustain the SLM interventions.

- Economic instruments need to build or maintain social cohesion when introducing incentives for improved natural resource management, particularly within the realm of traditional cultures' resource use and management practices. Emphasis needs to be placed on creating awareness about the potential complementarity of the incentives with local rules and traditions, and on avoiding conflict. Economic instruments also need to take into consideration protecting the rights of traditional resource user groups, and not replacing these with opportunities for new user groups who are able to position themselves well within the incentive system, which might come at the expense of the traditional rights holders.
- The effectiveness of economic instruments varies at different scales within and beyond the meso-level. The absence of local markets may limit the effectiveness of economic instruments to generate meaningful incentives. Broader market opportunities beyond the meso-scale may need to be explored to support the creation of incentives. Economic instruments can harness regional, national or international markets to generate incentives. It is therefore important that the local design of economic instruments takes opportunities beyond the meso-scale into consideration for effective design and implementation.
- Economic instruments need to be incorporated as part of a strategy rather than seen as a strategy on their own. As part of an effective strategy, economic instruments need to function in relation with other tools and interventions, and

there is seldom a simplistic one-on-one relationship between a single intervention and an economic instrument. This is because there are typically multiple drivers collectively resulting in environmental degradation, and also multiple interventions required to address these drivers of degradation. The most effective approach to implementing economic instruments is therefore usually through a clustering and stacking approach:

Clustering a range of restoration and adaptation interventions, usually to be implemented by a similar group of stakeholders, through a single or complementary set of economic instruments to collectively create the meaningful incentive required.

Stacking of a series of economic instruments may be needed to generate incentives that are adequate to bring about a meaningful change in management or use practices of the target resource managers and users. The benefits generated through a single instrument may not be adequate to generate a meaningful incentive. However, a number of instruments each generating relatively small benefits may be stacked to collectively generate meaningful benefits that act as an effective incentive to trigger the change in management.

Instruments may also be stacked over time, for example an economic instrument that may not be sustainable in the long term (e.g. subsidies) and be used in the short term to generate incentives that induce implementation of restoration and rehabilitation. Monitoring and evaluation of the impacts of these interventions may be used to establish instruments (e.g. PES) that are more term sustainable in the long term.

Therefore, an approach of clustering and stacking of economic instruments across interventions and over time provides a mechanism of incorporating economic tools and incentives into an INRM strategy.

- There is no blue-print for applying economic tools and incentives for INRM at a meso-scale. Generic tools such as the DST and DeMax or instruments (e.g. PES or Environmental Subsidies) that have been developed internationally require local context matching and calibration to ensure ecological, socio-cultural and economic suitability.

While tools such as the DST and DeMax have the potential to highlight economic instruments that have the potential to create local meaningful incentives, the process requires the input of local stakeholders and experts who can evaluate and compare the instruments highlighted by the process, to decide which instruments to carry forward. This expert and local knowledge of stakeholders provides an "informed filter" that can refine the list of economic instruments and their local design for implementation.

Acknowledgements

The authors would first like to acknowledge the work done in the AFROMAISON case studies, by the following researchers:

- *Ethiopia Case Study – Mengistu Desalgen, Mulugeta Lemenih.*
- *Mali Case Study - Aida Zaré, Bruno Barbier, Abdoulaye Diarre, Maïmouna Bologo, Mori Diallo Bakary Kone, Frank van Weert.*
- *South Africa Case Study – Kevan Zunckel, Sian Oosthuizen, Dave Cox, Kate Pringle.*
- *Tunisia Case Study - Mongi Sghaier, Karim Bello, Ben Khatra Nabil.*
- *Uganda Case Study – Moses Muhumuza, Clovis Kabaseke, Arseni Semana.*

The authors would further like to acknowledge the European Commission Seventh Framework Program that funded the AFROMAISON project (Grant agreement no 266379).

The views expressed in the paper are those of the authors and do not necessarily reflect the views of the institutions they belong to.

References

- Anderson. R., Morris. G., and Colby. M. 2001. The Nature and Role of Economic Instruments in Environmental Management, *PSU DRAFT Technical Paper for USAID Project No. 263-0255*, implemented by International Resources Group.
- Bernstein, J.D. 1997. Economic Instruments. In: *Water Pollution Control - A Guide to the Use of Water Quality Management Principles* Edited by Richard Helmer and Ivanildo Hespanhol. Published by E. & F. Spon (on behalf of the United Nations Environment Programme, the Water Supply and Sanitation Collaborative Council and the World Health Organization).
- Dessaegn, M. 2013. Identifying instruments that create incentives for natural resource management: A Case Study in Fogera, Ethiopia. *Afromaison Project Working Document*, International Water Management Institute, Ethiopia.
- Gottret, M.V., White, D. 2001. Assessing the Impact of Integrated Natural Resource Management: Challenges and Experiences. *Conservation Ecology* 5(2): 17.
- Hagmann, J., Chuma, E., Murwira, K., Connolly, M. and Ficarely, P. 2002. Success factors in integrated natural resource management R&D: lessons from practice. *Conservation Ecology* 5(2): 29.
- Hamdard. M., Johnston. R., and Lewis. F. 2012. Tools, Strategies, Processes and Good Practices on Integrated Natural Resources Management, AFROMAISON Project Report, Accessed at: <http://www.Afromaison.net/>.

Hiltunen V., Kurttila M., Leskinen P., Pasanen K. and Pykäläinen J. 2009. Mesta: An internet-based decision-support application for participatory strategic-level natural resources planning, *Forest Policy and Economics*, Volume 11, Issue 1, Pages 1-9.

INR/IWMI - Institute of Natural Resources/ International Water Management Institute. 2013. Sustainable Land Management Interventions for the uThukela District Municipality, *AFROMAISON Working Document*, INR, Pietermaritzburg, Unpublished Report.

IRA/OSS. 2013. Elaboration Du Plan Intégré Participatif D'aménagement du Bassin Versant d'Oum Zessar, *AFROMAISON Working Document*, IRA, Medenine, Tunisia. Unpublished Report.

Johnston. R. 2012. Identifying Sustainable Land Management Interventions, *AFROMAISON Working Paper*, IWMI.

Lewis, F. 2013. Application of the Economic Instruments Decision Support Tool: Identifying economic instruments to create meaningful incentives for improved natural resource management in the South African case study in the uThukela District. *Afromaison Project Working Document*, Institute of Natural Resources, South Africa.

Lewis, F., and Zunckel, K. 2013. Selecting and Designing Economic Instruments to Create Incentives for Improved Natural resource Management: A Case Study in the Upper uThukela District, South Africa. *Afromaison Project Working Document*, Institute of Natural Resources, South Africa.

Lewis. F., Johnston. R., and Hamdard. M. 2014. Tools and Approaches for Integrated Natural Resource Management. Project Report. Accessed at: <http://www.AfroMaison.net/>.

- Matthies M., Giupponi C. and Ostendorf B. 2007. Environmental decision support systems: Current issues, methods and tools, *Environmental Modelling & Software*, Volume 22, Issue 2, Pages 123-127.
- McIntosh B.C., J.C. Ascough II, M. Twery, J. Chew, A. Elmahdi, D. Haase, J.J. Harou, et al. 2011. Environmental decision support systems (EDSS) development – Challenges and best practices, *Environmental Modelling & Software*, Volume 26, Issue 12, Pages 1389-1402.
- Ochola, W. O., Sangina, P. C., and Bekalo, I. 2010. *Managing Natural Resources for Devolvement in Africa: A Resource Book*, University of Nairobi Press (UONP), Kenya.
- Panayotou. T. 1998. *Instruments of Change: Motivating and Financing Sustainable Development*, Earthscan, London.
- Ravi S., Subramaniam C. and Matthew L. N. 2011. Open source software licenses: Strong-copyleft, non-copyleft, or somewhere in between?, *Decision Support Systems*, Volume 52, Issue 1, Pages 199-206.
- Scacchi W. and Alspaugh T. A. 2012. Understanding the role of licenses and evolution in open architecture software ecosystems, *Journal of Systems and Software*, Volume 85, Issue 7, Pages 1479-1494.
- Sghaier M., Jebahi R., and Louhichi M. 2012. Analysis of incentives tools and assessment of the suitability of economic Instruments in the case study of Oum Zessar Watershed, Tunisia Afromaison Project Working Document, Observatory of the Sahara and Sahel (OSS), Tunisia.
- Sghaier M., Abdeladhim M., Bechir R. and Ousessar M. 2013. *Economic Instruments Design Matrix: Case study of Oum Zessar Watershed, Tunisia*. Afromaison

Project Working Document, Observatory of the Sahara and Sahel (OSS), Tunisia.

Zaré, A., Barbier, B., Diarre, A., and Bologo, M. 2013. Economic instruments for the sustainable management of natural resources in the Inner Niger Delta: Ouagadougou workshop 8 to 12 July 2013. Afromaison Project Working Document, International Institute for Water and Environment Engineering (2iE), Burkina Faso.

Zeng Y., Cai Y., Jia P. and Jee H. 2012. Development of a web-based decision support system for supporting integrated water resources management in Daegu city, South Korea, Expert Systems with Applications, Volume 39, Issue 11, Pages 10091-10102.

Figures

Figure 1: Overview of approach and tools for selecting economic instruments as incentives for improved natural resource management.

Figure 2: Decision Support Tool in HTML.