ECORadar-Shakti – an Interactive Knowledge-Base to Support GIS for Greening an Indian Megacity

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Abstract

The paper explores concept, design and future implementation of a knowledge based internet portal – ECORADAR Shakti India – aimed at small and medium sized enterprises of the Indian megacity Hyderabad. The portal sets out to use the simplest and most persuasive means to motivate and enable sustainability management in those enterprises that have so far taken little or no interest in this aspect of management.

Hyderabad, a prime example of an emerging mega city, is a laboratory where the goal of becoming a sustainable mega city faces of difficult challenges. The intention to work towards a sustainable future will be difficult to achieve without adequate data, tools and implementation strategies. The research idea of this approach in Hyderabad was set up in a research programme funded by the German Federal Ministry of Education and Research (BMBF).

1 Introduction: Greening a Megacity?

The trend towards urbanisation and the increasing number and size of metropolitan areas and megacities in all parts of the world but especially in the developing and newly industrialising countries is a striking example of global change. This restructuring and urban condensation of humankind is happening at an enormous speed that challenges innovativeness and strategic agendas of politics, economics and civil societies. Metropolitan regions and megacities are focal points of sustainable development because they give rise to massive problems in all three dimensions of sustainability. At the same time, however, opportunities arise for innovation strategies and for the support of efficient, compact and sustainable economic systems and lifestyles. Viewed from this perspective, such cities are more and more becoming arenas of decision about global sustainable development. Today's megacities are of particular political interest because they offer the chance for precautionary intervention and targeted urban development in order to prevent economic, social and ecological crises and to preserve or create scope for action.

Hyderabad, India's fifth largest city, is one of these "megacities". The SHAKTI-project (Sustainable Holistic Approach & Know-how Tailored to India), funded by the German Federal Ministry of Education and Research aims to develop collaborative learning and planning processes to design and implement sustainable solutions for urban infrastructure (SCHWAIGER, WALL & GOTSCH 2007). Among other SHAKTI-initiatives, which aim directly at the improvement of the urban infrastructure e.g. mobility or housing, the project

"ECORadar-Shakti" is aimed at small and medium sized companies (SME) of the Hyderabad metropolis. It sets out to use the simplest and most persuasive means to motivate and enable sustainability management in those enterprises that have so far taken little or no interest in this aspect of management.

The concept and prototypical implementation of ECORadar was originally developed in Germany. It was especially designed to help SMEs in Germany to enhance their corporate sustainability management systems. The purpose of this article is to describe the process of transferring ECORadar from a highly industrialized country – for whose needs it was originally developed – to an area with very high rates of growth in all terms. The two geographical areas could not be more different from each other: Germany with its very high standards in terms of environmental and social protection and advanced managerial knowledge base on the one side. An Indian megacity counting 6.8 million inhabitants (2008), a population growth rate of more than 3 % per year, environmental and social standards comparatively poorly developed.

In the second chapter the original concept and scope of ECORadar-Shakti as an interactive, internet-based knowledge base to support corporate sustainability management is shown. The third part describes the results of the authors research work on site in Hyderabad and derives design concepts to be applied to an ECORadar prototype which is planned to be implemented in the city of Hyderabad. The last part evaluates the project status and describes further steps of development.

2 The Web-Based ECORadar-Tool

A large variety of research has been published in the field of environmental management during the last 20 years. The problem is the conversion of this knowledge into enterprise practice. Development-target of the ECORadar-portal is to reduce the information costs of those SME enterprises, which are interested in environmental management. In order to achieve this target, a strategic Community concept of the third generation has been developed in order to build a knowledge-community in the SME sector.

The main emphasis of the ECORadar-community is on the knowledge field and the service and project-areas. The community started as a project-community. In the beginning, ECORadar, as a classical research project, is measuring the success by certain criteria focusing on timeframe and milestones (BULLINGER 2002). An additional feature is the use of a virtual project team (scientists, consultants, entrepreneurs). A virtual cooperation has been realized by establishing a specific editorship- and tele-cooperation system. These project-communities represent the preliminary stage on the way to a knowledge-community. ECORadar is a knowledge network stretched beyond the limits of individual universities and enterprises.

WENGER & SNYDER (2000) describe the knowledge-community as a "flexible organizational unit, beyond official organizational resp. informal units. The community is animated by the common interest of the members in the field of knowledge. The participation is voluntary. The motivation to participate is a positive cost/benefit relation." (WENGER & SYNDER 2000). The collective benefit is categorized by Rheingold (RHEINGOLD 1994, 2002) using the following three dimensions:

- Social use, identification by a common goal
- knowledge capital, use of knowledge from various sources
- community feeling , system of real contacts and experience backgrounds

The ECORadar-community understands itself as community of interests, with the following features defined by HAGEL & ARMSTRONG (1997):

- focus and emphasis on a specific interest
- the ability to integrate contents and communication (REISCH, BIETZ & KREEB 2006, 2007)
- the use of information, supplied by the members
- the access to competing providers

The major task of the community-developers is the professional relations management between the individual community-members. The goal of the ECORadar-relation management is to integrate over 100 participants in the community process. This means that anonymous co-worker will be transformed into active community-members. The socio-economic-group-dynamic processes together with technological-organizational processes have absolute priority. It could be summarized as: Who makes what with whom for which purpose?

3 Knowledge Management in the ECORadar-Community

For the joint-project an expert set of 21 different research institutions is involved. The expert set has the function to edit the relevant knowledge of the "community-environment" so that enterprises can transfer this expert knowledge into the practical environment-oriented management. The knowledge management model of ECORadar supports the creation of knowledge within the enterprise on the basis of the external source of knowledge in the sense of the ontological knowledge spiral. The expert knowledge helps to support the acquisition of external knowledge and the development of own knowledge. The actual knowledge distribution is supported, both by a specifically designed tele-cooperation-system as well as by the portal (RIDEL, BÖHMANN, ROSEMANN & KRCMAR 2008) itself. That tele-cooperation model and the portal are regularly updated by the experts and is supporting the knowledge preservation (HAASIS & KRIWALD 2001) in the enterprise. In the later course of the project it has to be assessed by the experts whether an ontology-based knowledge evaluation can be realized. The evaluation research in co-operation with enterprise practice and with the help of empirical methods has to ensure that the quality criteria that are pursued by ECORadar such as environmental discharge, target group orientation and in particular practice fitness are actually respected and realized. The evaluation of enterprise practice will be performed by the practice-community.

The development team of ECORadar confirms the experience of Davenport/Prusak (DAVENPORT & PRUSAK 1998), that knowledge can exclusively be created in the brains of the knowledge carriers. The knowledge carriers of ECORadar are scientific experts and entrepreneurs, who cooperate within the community-process. The primary focus is on the externalization of the expert's knowledge. The know-how is transferred in an external information system (Knowledge Warehouse, CMS). Externalization of knowledge

(NONAKA & TAKEUCHI 1995) is especially suitable for standardisable knowledge (standards, laws, etc.). The recent experience of the ECORadar research project has shown that direct communication in a Knowledge Network is the best way to convey the expert´s knowledge and experience.

Representatives of the joint project's target group, enterprises in Germany, have already given it broad approval in its start-up phase. Some 40 enterprises employing an estimated one million members of staff have made the decision to support production and development of the prototype. The development of so-called 'ECORadar' screens is to be carried out in eighteen workshops, hand in hand with business representatives and numerous experts. The organization of the high-calibre working groups has been taken on by Europe's largest business-led environmental initiative, the German Environmental Management Association (BAUM e.V.), Hamburg. In addition, in summer 2001 a representative written survey was conducted in around 9,000 enterprises. The survey results reflect the state of the art in the field of sustainable management in German enterprises. These results are integrated in the ECORadar development process in order to enable enterprises to identify relevant technical, political and economic risks – but also market opportunities – in the field of sustainability and environment much earlier than their competitors.

The ECORadar system portal consists of eight screens which can be used as an ensemble – or individually if preferred – to scan a company profile (Company Radar – 'micro-level') or the wider economic setting (Macro Radar – 'macro-level'). The Company Radar is a system component that can be accessed from any ECORadar screen, enabling users to systematically record and evaluate their company Environmental Data, Policy and Goals. The Macro Radar, a similar system component that can be accessed from any ECORadar screen, enables users to record and evaluate the 'macro-level' on the basis of the latest research – like global, national and regional Environmental Data and Environmental Goals.

Within the project ECORadar the internet-portal is being created as environmental service. First, it is essential to embed information, references and checklists that have been already part of the ECORadar-framework and former designs. In addition to these functions, the final version will be able to support all interested by providing a virtual community. Further, it will also identify possibilities for cooperation between all participants. Finally, it is created to enable the integration of Environmental Management in business processes. The first step is the creation of a user-friendly layout of the portal's websites. The essentials are a clear graphical structure, easy handling and the direct access to the services that are available within short download times.

Reflecting the development of a micro-macro-link respectively a link between company and its surrounding the following eight screens has been selected each as theme-oriented platform for supporting services and information to business and industry. The micro-macro-link is represented in each screen by the Company and the Macro Radar.

Fig. 1: ECORadar-Portal-Screenshot

4 Designing ECORadar for the City of Hyderabad

This chapter deals with requirements analysis and design of ECORadar for the city of Hyderabad ("ECORadar-Shakti"). First we summarize the results of our preliminary research work in Hyderabad. In the first section we briefly describe our methodical approach. The second section summarizes the results of our research work concerning the requirements of Indian SMEs. The third section presents our design principles for an ECORadar-Shakti Prototype.

Summary of Research Results

On the basis of our research on site in Hyderabad, three areas of special interest were identified:

The Role of Corporate Environmental Management Systems

Benefits of corporate Environmental Management Systems (EMS) like EMAS or ISO 14001 in Germany are commonly seen in several categories. The subsequent table shows a brief summary of areas of interest based on intensive research executed in Germany for the past years (KREEB 2005, BRAUN, RUSS, SCHULZ, KRCMAR & KREEB 2003).

Table 1: Benefits of Corporate Environmental Management Systems

Category	Sub-Category	Description	Importance indicator (empirical)
Internal	Ecological Performance	Improving material- & energy-efficiency of internal processes and products	high
	Financial Performance	Reducing monetary cost of material and energy input	high
	Product Innovation	Creation and marketing of eco-friendly products	low
	General Management Objectives	Enhancement of analysis and control of administrative- and production-processes	medium
External	Supply Chain Communication	Certified Environmental Management Systems like EMAS or ISO 14.001 ff	Medium, depending on branch
	Deregulation of Environmental Legislation	Replacement of legislative restrictions by voluntary implementation of certified EMS	Low, not as effective as expected

Internally German SME benefit from implementing EMS in terms of achieved improvements in ecological as well as financial performance. This is mainly due to short- and long-term enhancement of material- and energy efficiency of production processes. In times of rising prices of globally sourced raw materials, ecological and financial benefits of improved efficiency come hand in hand.

Green product innovations in terms of lowered ecological cost of carry for consumer of "green" products and services are not seen to be much influenced by mainstream EMS. Marketing- and innovation departments of SME in most cases are not linked to EMS in any way. General management issues in terms of analysis and control of business-processes can benefit from EMS in a limited way. But still the material- and quality-oriented views of EMS have some side effects on these issues.

Externally the supply-chain communication is of some importance for EMS, depending on the branches. In automotive and other consumer oriented branches, EMS certificates like EMAS or ISO 14.001 play an important role in establishing business relations. In other branches, more distant to end-consumers, EMS certificates are of lesser importance and not seen as a prerequisite for business relations. The chance for substantial deregulation in the

area of environmental legislation, meaning that legal authorities would replace specific legal restrictions for EMS certificates, are not as profoundly realized as SMEs originally hoped for.

In the Hyderabad area as well as in all of India (1250 EMS), 2004 the diffusion of EMS is not very high, compared to Germany (6400 EMS) or the USA (3890 EMS). But stakeholder interviews showed a clear interest of SMEs in this area. The managers and owners of companies had a very pragmatic view on EMS and showed a special interest in the two areas "environmental and financial performance" and "supply chain communication". Product innovation and deregulation were of no special interest. Technical or organizational know-how in the areas of interest were quite low and help in any form would be more than welcomed by SMEs.

Information- and Knowledge-Demand and -Supply

SMEs as well as all other stakeholders have a substantial demand for specific information in terms of theoretical knowledge as well as hands-on experience. This includes all areas of expertise without exceptions.

Cooperation among Stakeholders

Cooperation among the stakeholders in the area of EMS is not very pronounced. Neither the chambers of industry & commerce nor the city authorities are able to cover today's information demand from SMEs. Local or state authorities are not very much accepted as potentially trusted sources of information.

Interpretation and Evaluation

Looking at the situation in the above mentioned three areas of special interest we conclude that ECORadar-Shakti has some potential to be a valuable tool for SMEs as well as for supporting organisations e.g. relevant NGOs in the Hyderabad area. But the success of ECORadar will strongly depend on some prerequisites:

- **Subject-specific content**: Due to a very pragmatic approach of SMEs to Environmental Management the subject-specific knowledge content offered on the platform is key to its success. It must be aligned closely to effective needs of the individual users and their entrepreneurial contexts.

- **Cooperation among SMEs:** Besides the technical content provided by the platform, the cooperation of users is critical to its success. Due to the fact that Environmental Management for SMEs is not a critical issue in a strategic sense, cooperation is basically helpful and economically sound.

- **Cooperation with NGOs and local state authorities:** As expressed above, currently the cooperation between SMEs and local state authorities is not very much developed or fruitful. It is a difficult question whether this situation can be positively influenced by ECORadar at all. Cooperation with NGOs is much more likely to be beneficial for the stakeholders involved. Some efforts should be made to support this type of cooperation.

- **Cooperation along the supply-chain:** Supply-Chain collaboration is a new topic so far not emphasized in the German ECORadar project. Interviews with SMEs have shown that transnational cooperation along the value chain is of some interest. The potential benefit still has to be evaluated.

Extending the Scope of ECORadar

Proceeding from these findings, the following section will discuss three major areas of development of the ECORadar-Shakti project. The scope extension must take into account the specific situation found on-site. A 1:1 transfer of content and methods applied in the German project is not feasible.

For a successful and beneficial implementation of ECORadar five groups of stakeholders will be relevant as knowledge suppliers and demanders. All of them are potential users and beneficiaries of ECORadar. The subsequent table summarizes purposes and relevant aspects of each role-group. Above the aspects of role-groups are not exhaustively outlined. The German ECORadar-project has shown that knowledge-supply and -demand of stakeholders and thereby individual users cannot be determined beforehand.

Actual information content on ECORadar is partially subject to supplier's and demander's interests and therefore cannot be fully controlled by its operator. The German project had a clear focus on environmental issues aiming to improve the efficiency and effectiveness of corporate EMS in terms of enhancing economical and environmental performance. While social and health issues are strongly regulated and therefore are playing a minor role in mature markets like Germany, in India the situation is seen different. Considering the strive for a sustainable development, the social part within the sustainability triangle (economical, social and ecological criteria in balance) needs to gain more ground. This will have to shift the current knowledge contents focus from environmental to social criteria.

The adequate selection and motivation of suitable participants in the role-group of experts could help to build an appropriate knowledge-base in this area of expertise. Recipients of this specialized content are SMEs as well as NGOs and local administration authorities. Above all, these stakeholders must be motivated to adopt a new field of expertise.

Collaboration among stakeholders, especially among local government authorities and SMEs is much more difficult than in Germany. But besides content, collaborative functionalities will be key to ECORadar-Shakti´s success. Several different scenarios of collaboration are taken into consideration. The subsequent table shows and summarizes three exemplary scenarios of collaboration that are likely to support the portals success.

5 Conclusion

The article outlined the basic concept of ECORadar as a web-based knowledge-base aimed to support and promote SME´s Environmental Management Systems in Germany. An extension of scope was proposed and roughly specified to deploy it as a tool to contribute to the greening of an Indian megacity. It is obvious that prior to an effective implementation of ECORadar-Shakti as an offering for Indian SMEs (as primary addressees) and other stakeholders, major investments in scientific research, but also in (political) marketing and

technology development would be necessary. Since the success of such a platform is strongly depending on the numbers of participants and the market share covered, a deepened cooperation with, and motivation of political stakeholders is essential – all the more because a purely privately run system, depending on monetary contributions of its users, is expected to be difficult if not close to impossible to be realized.

But a commercial implementation was not the author's aspiration. Our objective was to outline the fundamental possibilities of the tool, may it be a system backed politically or by a Public Private Partnership. Once implemented with a sufficient amount of users, the tool could be a valuable building block to push on the sustainability strategy of the Hyderabad area. The proposed content and collaborative functionalities surpass its German role model in some of its key aspects. The goal of the ECOradar Shakti project is to establish an instrument that can integrate socio-economic effects of changes on the economy, society and environment, as well as evaluate such projections, in order to achieve a stakeholder and knowledge-based procedure for Urban Planning. These socio-economic data could be a supplement for GIS to provide a sustainable perspective for Urban Planner.

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