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Bachelor Thesis:

**Global Atlas for Renewable Energy**

**Implementation Suggestions for a Training in Pakistan.**

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Abstract English

This thesis deals with the future of the Global Atlas for Renewable Energy. The first part evaluates the Global Atlas platform and then elaborates upon the need for a decision making process analysis in the renewable energy sector of Pakistan for deducing training implementation suggestions of the Global Atlas. In order to establish a clear scope, emphasis was put on large institutional players, including the government sector as well as the largest wind and solar plant developers. Following an outline of the theory behind the decision making process, the semi-structured interviews were conducted with experts from the individual institutions. The results of the interviews were taken into consideration with the analysis of the Global Atlas in order to intricate the implementation suggestions for a training of the tool in Pakistan. The thesis was able to show that a cooperation with donor agencies would be recommendable. Furthermore, the Global Atlas should choose an expert-based approach for the training in order to leverage the usage and user base accordingly. The third implementation suggestion is to keep the materials for the training online.

Abstract German

Diese Bachelorarbeit handelt über die Zukunft des Global Atlas for Renwable Energy. In einem ersten Schritt wurde das Umfeld des Global Atlas einer Analyse unterzogen. Auf dieser Analyse basierend, wurde die Wichtigkeit einer Entscheidungsprozess Analyse erarbeitet. Um konkrete Resultate zu erzielen wurde der Fokus auf grosse Institutionen, namentlich die Regierungsorganisationen sowie die grössten Solar- wie auch Windanlagenanbieter gelegt. Einer genaueren Betrachtung der Theorie über Entscheidungsprozesse folgend, wurden semi-strukturierte Interviews mit Experten der einzelnen Organisationen durchgeführt. Zusammen mit der Umfeldanalyse des Global Atlas wurden Handlungsempfehlungen herausgearbeitet. The Arbeit war in der Lage zu zeigen, dass eine Kooperation mit Gönnerorganisationen vorteilhaft wäre. Zusätzlich sollte ein Experten-basierten Ansatz für das Training gewählt werden, um sicherzustellen, dass das Potenzial des Atlas auch voll ausgeschöpft werden kann. Die dritte Handlungsempfehlung ist der Ratschlag, dass Material für das Training die ganze Zeit online zu haben.

Content

[I. List of Abbreviations 4](#_Toc434241877)

[II. List of Tables 4](#_Toc434241878)

[III. List of Figures 4](#_Toc434241879)

[1. Introduction 6](#_Toc434241880)

[2. Global Atlas for Renewable Energy 8](#_Toc434241881)

[2.1 History & Mission 8](#_Toc434241882)

[2.2 Geographical Information System 9](#_Toc434241883)

[2.3 Users 12](#_Toc434241884)

[2.4 Value for Users 13](#_Toc434241885)

[2.5 Stakeholders 14](#_Toc434241886)

[2.6 Competition 15](#_Toc434241887)

[2.7 Situation Today 18](#_Toc434241888)

[3. ESMAP RE Resource Mapping Program 21](#_Toc434241889)

[3.1 The Initiative 21](#_Toc434241890)

[3.2 Pakistan 23](#_Toc434241891)

[4. Hypothesis 26](#_Toc434241892)

[5. Approach 28](#_Toc434241893)

[5.1 Theoretical Background 28](#_Toc434241894)

[5.1.1 Decision-Making Process 28](#_Toc434241895)

[5.1.2 Study Design 30](#_Toc434241896)

[5.2 Practical Approach 30](#_Toc434241897)

[5.2.1 Problem recognition 30](#_Toc434241898)

[5.2.2 Information Search 31](#_Toc434241899)

[5.2.3 Evaluation of Alternatives 31](#_Toc434241900)

[5.2.4 Decision Making Process 32](#_Toc434241901)

[5.2.5 After-decisional Behavior 32](#_Toc434241902)

[6. Results 33](#_Toc434241903)

[6.1 Stakeholders in Pakistan 33](#_Toc434241904)

[6.2 Problem Recognition 35](#_Toc434241905)

[6.3 Information Search 37](#_Toc434241906)

[6.4 Evaluation of Alternatives 40](#_Toc434241907)

[6.5 Decision Making Process 44](#_Toc434241908)

[7. Interpretations of Results and Implementations Suggestions 49](#_Toc434241909)

[8. Critical Evaluation 53](#_Toc434241910)

[10. Further Research 54](#_Toc434241911)

[11. Conclusion 55](#_Toc434241912)

[Table of Literature 56](#_Toc434241913)

[List of Internet Sources 59](#_Toc434241914)

[Attachments 63](#_Toc434241915)

[A. List of Interview Partner 63](#_Toc434241916)

[B. List of E-mail Partner 63](#_Toc434241917)

[Declaration of Authorship 64](#_Toc434241918)

# List of Abbreviations

AEDB Alternate Energy Development Board, Pakistan

APEC Asia-Pacific Economic Cooperation

CEO Chief Executive Officer

CP-1 Concept of Project – governmental form

CPU Central Processing Unit

EAD Economic Affair Division, Pakistan

EKB Engel-Kollat-Blackwell(-model)

ENERCON National Energy Conservation Center

ESMAP Energy Sector Management Assistance Program

FFC Fauji Fertilizer Company, Pakistan

GDP Gross Domestic Product

GIS Geographical Information System

GIZ Gesellschaft für Internationale Zusammenarbeit

P&D Planning & Development (department of Khyber Pakhtunkhwa)

UNHCR United Nations High Commissioner for Refugees

UNDP United Nations Development Program

KPK Khyber Pakthunkhwa (Province of Pakistan)

RE Renewable Energy

S-O-R Stimulus-Organisation-Reaction(-model)

IEA International Energy Agency

ktoe kilos of oil equivalent

UNEP United Nations Environment Program

OGC Open Geospatial Consortium

NREA New and Renewable Energy Authority, Egypt

IRENA International Renewable Energy Agency

NGO Non-Governmental Organization

# List of Tables

[Table 1: Countries Covered by the ESMAP Initatitve 22](#_Toc433648147)

[Table 2: Interview Scheme I: Problem Recognition 35](#_Toc433648148)

[Table 3: Interview Scheme II: Information Search 37](#_Toc433648149)

[Table 4: List of Donor Agencies 38](#_Toc433648150)

[Table 5: Interview Scheme III: Evaluation of Alternatives 40](#_Toc433648151)

[Table 6: Interview Scheme IV: Decision Making Process 44](#_Toc433648152)

[Table 7: Decision Making Authorities According to Grades on Provincial Level 47](#_Toc433648153)

# List of Figures

[Figure 1: Screenshot of the Global Atlas. 9](#_Toc433648211)

[Figure 2: Embodiment of Different Layer of a GIS System 10](#_Toc433648212)

[Figure 3: Accuracy of Project Cost Estimates by RETScreen 14](#_Toc433648213)

[Figure 4: Competing Environment of the Global Atlas. 17](#_Toc433648214)

[Figure 5: Screenshot of the Global Atlas 17](#_Toc433648215)

[Figure 6: History of CPU Units 19](#_Toc433648216)

[Figure 7: Energy Production in Pakistan according to Sources 24](#_Toc433648217)

[Figure 8: Decision Making Process Steps Applied to this Thesis 30](#_Toc433648218)

[Figure 9: Organizational Flow Chart on Federal Level 45](#_Toc433648219)

[Figure 10: Organizational Flow Chart on Provincial Level 46](#_Toc433648220)

[Figure 11: Organizational Flow Chart for Quaid-e-Azam 47](#_Toc433648221)

[Figure 12: Organizational Flow Chart for FFC Energy Limited 48](#_Toc433648222)

# 1. Introduction

In October of 2014, the President heads of state from the Pacific Rim nations, including China, Australia, Mexico, Russia, and the United States came together in Beijing, China for the Asia-Pacific Economic Cooperation (APEC) Conference. Because of this occasion, the Chinese government shut down several coal plants in and around Beijing (Xinhua, 2014). In the resulting days, the air got cleaner and the color of the sky got to be known as the APEC Blue (China Daily, 2015, p. 1). The cleaner air improved the lives of millions of people.

However, this improvement was just temporary, as China is still dependent on coal production (IEA, 2014, p.1). Nonetheless, this APEC Blue became a spark for a more environmentally-friendly world. Less than half a year after having experienced this APEC Blue, China took measures to regain the same conditions it enjoyed during the conference (Bloomberg, 2015). Having experienced the APEC Blue myself[[1]](#footnote-1), the phenomenon is my motivation to help in the transition towards renewable energy.

Although not motivated by the APEC Blue, the Global Atlas for Renewable Energy shares the exact same goal of enhancing the transition towards a world with increasing renewable energy. Being a tool of the International Renewable Energy Association allows the Global Atlas to have a worldwide impact and therefore, achieve results in a more effective way (Global Atlas, 2015a). The aim of this thesis is to be an academic exercise supporting the Global Atlas for Renewable Energy in achieving this goal faster. The focus of the thesis is to find more insights to enhance the growth and usage of the Global Atlas for Renewable Energy. This will be done by the analysis of the decision-making behavior of the actors in Pakistan's renewable energy field.

This thesis consists of three main parts. In the first part of the thesis, the Global Atlas for Renewable Energy will be analyzed in order to gain insights on today's situation of the tool and its environment. This will be done with literature analysis and interviews so as to elaborate the current situation of the Atlas. On the basis of the analysis, the research question in form of a hypothesis is deducted. In a second step, the hypothesis will be further outlined with a theoretical framework, which will then be used as the foundation of the empirical part. In the third and empirical part of this thesis, interviews will be conducted for gathering more intelligence on the decision-making process of the institutional stakeholders of the renewable energy sector of Pakistan. The fourth and last step implementation suggestions will be carved out on the basis of the intelligence gathered with the decision making-process analysis.

# 2. Global Atlas for Renewable Energy

## 2.1 History & Mission

In this section, a brief historical overview is given of the Global Atlas and how its mission has evolved over time.

Founded in 2009, the Global Atlas for Renewable Energy was an initiative by the national ministries of multiple European countries (the foremost being Germany, Denmark and Spain) with the goal of creating better potential opportunities in wind and solar (N. Fichaux, Webinar, March 23, 2015). The vision was to promote and increase the number of ongoing projects in these sectors. In 2011, the initiative was handed over to the International Renewable Energy Agency (IRENA), an intergovernmental organization with the goal of supporting countries to transition to sustainable, renewable energy (IRENA, 2015a). IRENA expanded the scope of the Atlas to six different renewable energies (solar, wind, geothermal, biomass and hydropower). Moreover, the takeover resulted in the change of the goal of the entire initiative. IRENA took over the initiative with the intention of closing the gap between "nations having access to the necessary datasets, expertise and financial support to evaluate their national renewable energy potential, and those countries lacking such elements." (Global Atlas, 2015a). Closing this gap would lead to more jobs and create a sustainable market to fuel the economies worldwide (N. Fichaux, Webinar, March 23, 2015).

The aim of the initiative is to eventually cover all renewable energy sources globally (Global Atlas, 2015a). Throughout on-going efforts to increase its recognition among policy makers, the initiative has successfully created a community of well-known contributors who are devoted to supporting the initiative. In January 2015, 67 countries and over 50 institutes and partners used Global Atlas initiative (Global Atlas, 2015b). In the same month, a new version of the Atlas, the Global Atlas 2.0, was launched (IISD, 2015). The Global Atlas 2.0 is equipped with a search catalogue for gallery maps (as shown in the figure below) based on multiple search criteria, a universal data viewer for wind and solar energy graphs, as well as the ability to share maps from the Atlas with other programs. In addition to the Atlas, the initiative acts as a supplier of services and database for mapping the potential of renewable energy. (Global Atlas, 2015a)

In 2015, IRENA released with the Global Atlas *Pocket,* a mobile application version of the whole Atlas (IRENA, 2015b). The Global Atlas *Pocket* allows the user to save maps on their mobile and use it on-site. This is extremely helpful in areas where the internet connection is not always stable. These features help make the Global Atlas *Pocket* the most advanced tool of its kind on the market (IRENA, 2015c).

A. O. Ali defines the future value generated by the Global Atlas as the number of people who will use and benefit from the tool as well as the tool’s role in shaping the energy sector moving forward. This is why all the Global Atlas platforms are, and will always be offered for free. (A. O. Ali, interview, July 7, 2015). Furthermore, it must be mentioned that also under the control of IRENA, Global Atlas is classified as a non-profit organization. Notwithstanding, offering the Global Atlas for free is not enough. It is the clear goal of the Global Atlas to grow and therefore enhance the renewable energy sector worldwide (A. O. Ali, interview, July 7, 2015).

It is apparent that since the beginning of the initiative, the Global Atlas has grown steadily according to their mission. However, in the mission to bridge the difference between countries’ access to renewable energy transition support, further growth is desirable, despite offering the Atlas free of charge.

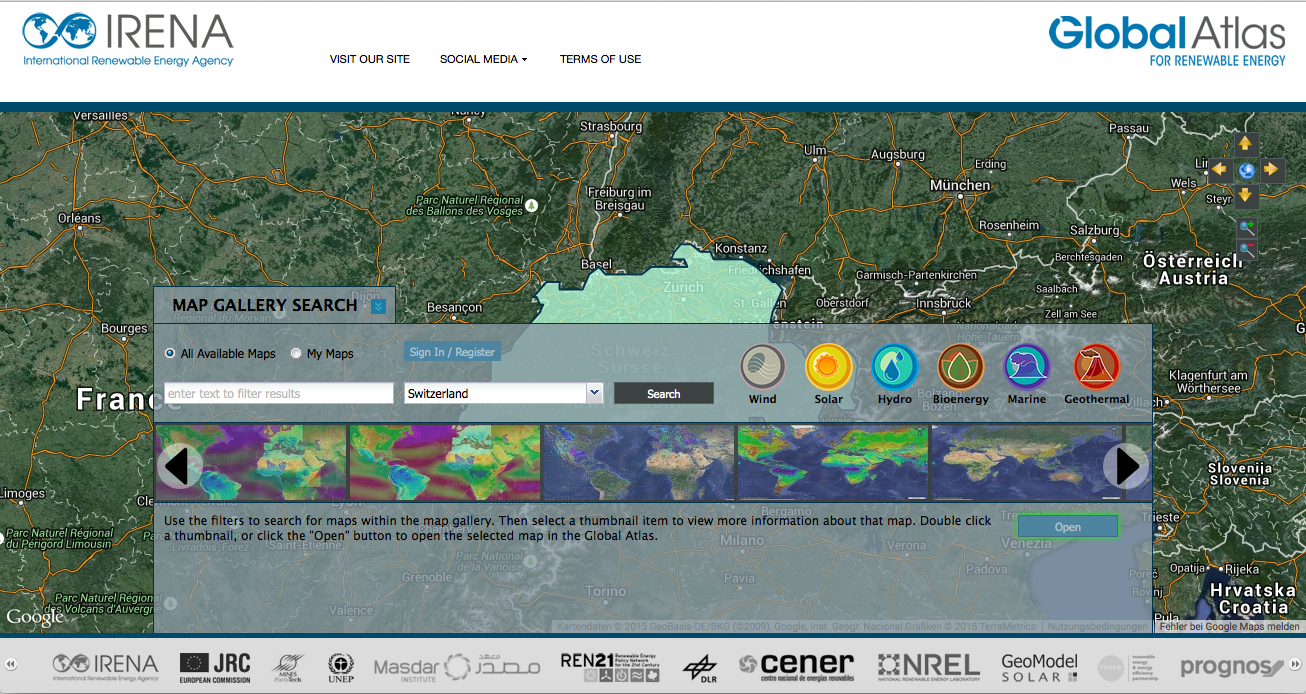


Figure : Screenshot of the Global Atlas (Global Atlas, 2015c).

## 2.2 Geographical Information System

This section includes a description of the Global Atlas’ primary product, an outline of the usage areas, and opportunities and special characteristics of the tool.

The Atlas’s interface utilizes a Geographic Information System (GIS) to display the data. (Huisman & de By, 2009, p. 26). These systems are tools that work with spatial and geographic information (Huisman & de By, 2009, p. 26). GIS dates back to John Snow, who, prior to the age of computers, investigated the spread of cholera with the aid of geographic information. (Koch, T. & Denike. K., 2009, p. 1246ff). Aronoff (1989, p.32) describes the functions of GIS as any system that can capture, prepare, manage, store, maintain, manipulate, analyze or present geographic or spatial data. GIS is used in different fields ranging from engineering to epidemiology to the social and natural sciences (see Naves, L. A., Port, L. B., Correa Rosa, J. W., Casulari, L. A. & Correa Rosa, J. W., 2015, p. 8; Marschalko, M., Bednarik, M. & Yilmaz, I., 2012, p. 1007 or Kwan, M.-P., 2012, p. 245). Nevertheless, GIS is a very broad term.

To get a better understanding of how Global Atlas utilizes this tool, a simple example of a GIS is shown below in Figure 2. The geographic data is split up into different layers with different information all belonging to the same location. In a GIS, this data can be managed, stored, maintained, manipulated or analyzed on each layer. In terms of the Global Atlas, the different data slices can be used to analyze the area. Examples of how the Atlas can be used, include using the Atlas to find an area where there are several accommodations; where solar power is available; where a transmission grid is nearby; whether or not it intersects any illegal boundaries; whether the population is dense enough; whether or not there is a bird protection area; or whether a similar, competing form of an energy plant is nearby. These tools allow the user to deeply analyze the spatial situation when searching for the best location.

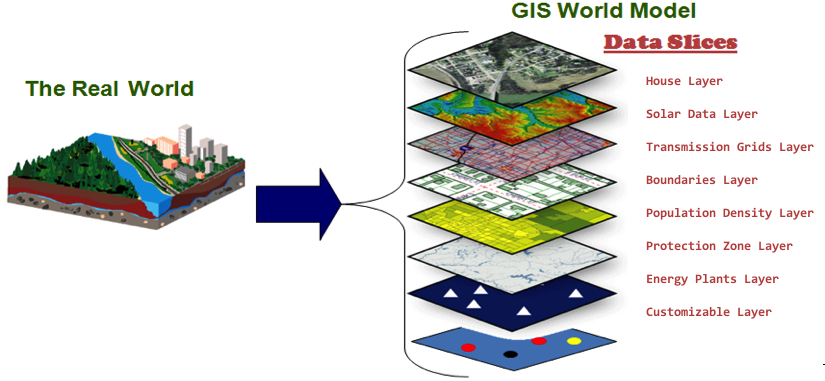


Figure : Embodiment of Different Layer of a GIS System, in dependence on (IN.gov, n.d.)

*Application of the Global Atlas*

The Atlas itself currently consists of more than a thousand datasets that are used in the initial screening of areas, whereupon further assessment of the area can most likely be of significance. (Global Atlas, 2015a) These datasets cover the whole world, so initial screening studies can be conducted across the entire globe. In addition to the GIS tools, the Global Atlas offers prospection tools. In terms of the Global Atlas, this means that once a good location is found, the data (usually covering the energy situation) can be used in conjunction with the fed-in tariffs or other relevant information in order to get an economic feasibility study and preliminary financial outcome. Furthermore, these tools allow the user to compare different spots to each other across multiple criteria, including financial outcome, policy discrepancy, or simply raw solar production. This variety of tools enables the user to find the most suitable areas. The only thing that is missing is the actual ground measuring, which is needed to get the bankable data for projects that are financed by a bank or another financial institution; (P. Kenol, interview, August 6th, 2015). The Global Atlas at the moment only contains non-bankable data. Since data that is used in order to apply for financing or funds is only allowed when there is an on-site measurement available, the Global Atlas is only a first-screening tool.

*Open Geospatial Consortium*

Moreover, the Global Atlas is a member of the Open Geospatial Consortium (OGC, 2014). The Open Geospatial Consortium (OGC) comprises 518 companies, government agencies and universities and is an international industry consortium with the goal of developing a publicly available, standard interface for GIS information (OGC, 2015a). In order to develop an international standard as well as to promote geospatial interoperability, the consortium established the OGC standards. Being a member of the OGC is another step towards the mission of the Global Atlas in that it allows the Global Atlas to provide an open standard, which better integrates new maps into their database as well as furthers the use of their information specialized systems.

This chapter was able to show the system and capabilities of the Global Atlas. Based on a Geographic Information System, the Global Atlas allows the user to find the optimal location for building an energy plant. Additional tools, such as an economic feasibility tool, catalyzes further the use of the data that the Global Atlas provides. Another way that opens up the usage of the Global Atlas is its membership with the Open Geospatial Consortium, which, through open standards, connects the Global Atlas, with the system of renewable energy on a set standard basis.

## 2.3 Users

In this section, the (potential) user of the Global Atlas is described. Following, the needs and demands of the user will be outlined. The analysis is done through examining different end-user surveys published by the Global Atlas as well as information from an interview with the Associate Program Officer of the Global Atlas, Abdulmalik Oricha Ali.

The Atlas was developed to serve policy makers, investors at all scales, people who are interested in renewable energy in any way, as well as educators (A. O. Ali, interview, July 7, 2015). The End User Survey also pointed out opportunities for energy agencies, local communities, consultants, NGOs and academics to use the Global Atlas for their work. A. O. Ali (interview, 2015) further states, that the explicit goal of the Atlas is to make the Atlas useable for everyone, not only for the specialists in the field. The two main user groups, however, consist of policy makers and investors (IRENA, 2012, p. 1). A. O. Ali (interview, July 7, 2015) concludes that, despite their different goals, policy makers and investors share similar interests.

One common interest shared by the two groups is the requirement for maps with information on the potential of renewable energy. The policy maker needs the map in order to plan further actions concerning energy security, economic growth, climate change or new energy diversifying strategies (A. O. Ali, interview, July 7, 2015). The investors need to start looking for a good investment opportunity, which begins with an initial screening across all possible countries necessary for all the investors. They start by looking at which country/region would be the most feasible one. Furthermore, they need this information in order to be trustworthy; because putting more research into a region without any possibilities of building a plant is lost money (A. O. Ali, interview, July 7, 2015).

The second most common detail shared by the two main users of the Global Atlas is the actual user of the specific tools. As A. O. Ali (interview, July 7, 2015) explains, it is the policy maker who uses the data identified out of the Global Atlas. He is then going to decide which areas to put more focus on.

The actual user of the Atlas' tools however, is usually a junior analyst or an associate of the policy maker who needs to know about how the Global Atlas works. The junior analyst/associate will then have to present the data to the policy maker. The same procedure is valid for every large-scale investor as well, where there too, the junior analyst would be the one who interacts with the program, but the investor would be the one who will decide on which steps are taken based on the results created by the Global Atlas. This requires the Global Atlas to not only be understood by the policy maker or the investor, but also by all the people working for her/him.

This section was able to show, that the Global Atlas has a variety of potential users. As the different users varied are, so do their interests. However, it is observed that a policy maker and an investors can share some common interests. Very important to keep in mind is the actual user of the Atlas, which is in most of the cases is a Junior Analyst, as the policy maker or the investor is usually just reviewing the results.

## 2.4 Value for Users

In this chapter, the value created by the Global Atlas will be enumerated. Therefore, general value creation is described, followed by the value creation outlined for the different users. The values created were elaborated in the interview with A. O. Ali (interview, July 7, 2015).

The main advantage for every user of the Global Atlas is the digitization of the information available for a country in one centralized platform. One main positive feature of the centralized information platform is the cross-referencing (A. O. Ali, interview, July 7, 2015). This allows everyone, for example, to analyze a map for Nigeria created by a French institute in combination with a transmission grid layer created by the World Bank, together with the information on the fed-in tariffs for the specific country.

The main value created by the Global Atlas for the policy makers and the investors are the resource maps themselves. Resource maps made available by the Global Atlas allow the users to skip the cost and time to either search the Internet or even measure the data by themselves. Both ways would be very costly for every type of user, in terms of both financial input and time. Hence, the value created for policy makers and investors is a solid information basis for every country they are working in. Another value created for both type of users is the ability to skip the detailed information itself and still be able to get presentable results with just a few mouse clicks (A. O. Ali, interview, July 7, 2015). This also saves time and costs.

For a policy maker, an additional value created is having the ability to generate a solar energy “hotspot” map that focuses on the financial resources in specific spots in the country without having to spend all the money on creating a costly resource map of their own country (A. O. Ali, interview, July 7, 2015).

From an investor’s point of view, Ali (interview, July 7, 2015) sees an additional value as having a portfolio of countries to prospect. This means the investor is equipped to find the best spots in a whole range of countries. For example, the investor can find good spots in the northern part of Nigeria or the western part of Ghana without having to create a resource map for each individual country. Through the GIS tools of the Global Atlas, this can be done with just a few mouse clicks. The value of a first screening can create value for an investor as described in Figure 3. The figure shows the accuracy of the cost for a typical project (RETScreen International, 2008), where the estimate of the accuracy at the beginning or first screening is very low (from 1.5 to 0.5 of the final cost). Better information on a first screen basis, free of charge, will not only help the investor get a better accuracy on the cost assessment, but it will also lead to lower the risks on investment. A lower risk on investment causes lower costs for the investor; hence, the Global Atlas creates a greater value for investors.

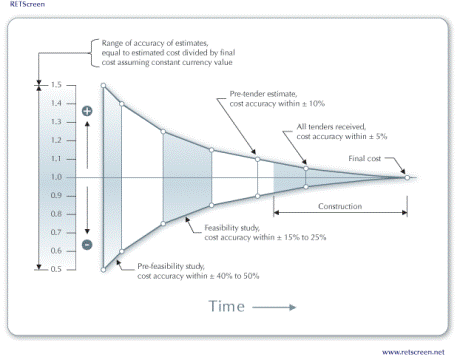


Figure : Accuracy of Project Cost Estimates by RETScreen (RETScreen International, 2008)

This chapter was able to show the value created by the Global Atlas. The centralized platform and the possibility of saving enormous costs and time for every user is a great aspect of the Global Atlas. This value should motivate other potential users to use the program and on this basis, further growth possibilities should ensue.

## 2.5 Stakeholders

In this section, important stakeholders (except the competition) will be addressed to get an overview of the ecosystem of the Global Atlas. The different stakeholders will be named in this chapter and their importance explained.

To better fulfill the needs of the users more effectively, the Global Atlas needs to constantly update its datasets to the highest level available for free. This makes the Global Atlas rely on two very important stakeholders. The first being the data providers (A. O. Ali, interview, July 7, 2015), since the maps on the Global Atlas are not all from IRENA. Henceforward, a vivid partnership needs to be established between the Global Atlas and its data providers. In order to make the partnership work, the Global Atlas must also provide some benefits to the data provider. The Global Atlas can offer the data providers two different kinds of services. First, the Global Atlas can help to fulfill their most important need: “visibility” (A. O. Ali, interview, July 7, 2015). Secondly, the Global Atlas provides assistance to transform the data into format that is easier to present. (A. O. Ali, interview, July 7, 2015). In addtiion to the visibility and aid on transforming the data, Global Atlas also helps the user access its centralized system.

The other vital partners in creating the value offered by the Global Atlas are the software developers who code for the platform (A. O. Ali, interview, July 7, 2015). Here as well, a vivid partnership is desirable. For those partners, the Atlas can offer the same benefits in addition to having a platform to develop the tools necessary. Without the software developers, all the tools offered for the analysis would not be possible. The Global Atlas already has a lot of tools developed on their platform. Having those tools available, however, makes the Global Atlas the best first screening prospection tool on the market.

Furthermore, the situation with the software developers and the data providers could lead to a very interesting, positive situation. The more data a tool has, the more likely it is to attract the best software developers. Once the best software developers are working on a tool, the tool gets better and therefore it is better for data providers to input their new data, where the best tool is. Researchers call this phenomenon positive feedback (Arthur, 1990, p. 92).

This chapter was able to explain the need for the different partners of the Global Atlas in order to continue growing. The data provider and the software developers play a very vital role for the Global Atlas. In being able to provide them with services, the Global Atlas can hope for a positive feedback loop to set in. For this to occur growth is needed.

## 2.6 Competition

In this section, the competitive environment of the Global Atlas will be evaluated. Several possible competing organizations are named and their field of expertise is explained. The competition analysis was conducted in cooperation with Abdumalik Oricha Ali in the interview from July 7, 2015.

Despite the existence of several providers of maps containing information on renewable energy, for example reegle (reegle, n.d.), REN21 (REN21, 2015), REEEP (REEEP, 2015) or SWERA (OpenEI, n.d.-a) exist, there is no direct competitor of the Global Atlas according Ali (interview, July 7th, 2015). The Global Atlas is offering resource mapping information, where as REN21 or REEEP are groups focusing on implementing the best policies on renewable energy to every institution. Hence, their map displays all the results of the policies, including the amount of electricity produced by the country as compared to its fed-in-tariffs. Reegle, on the other hand, focuses on clean energy, i.e. to show where clean energy (renewable energy) is produced as well as to provide information on how the energy is produced and how the policies should be defined (reegle, n.d.). The closest provider of information on the availability of renewable resources and therefore the biggest competing institution is SWERA (Solar and Wind Resource Assessment). SWERA is a program started in 2001 by the United Nation Environment Program, (UNEP) in order to bring together data on renewable energy as well as analysis tool to analyze the data (OpenEI, n.d.-a). Compared to the Global Atlas, SWERA is much older than the Atlas in terms of both the program itself and the data. Additionally, SWERA is as not a worldwide program as the Global Atlas is (A. O. Ali, interview, July 7, 2015). Particularly in providing information about the potential of renewable energy, the stakeholder will always want to have the newest data available to them (P. Kenol, interview, August 6, 2015). Additionally, the data sets published by SWERA is already included and inclusive of other resource maps and analytical tools.

Another program providing information on renewable energy resource mapping is OpenEI (Open Energy Info) (OpenEI, n.d.-b). This platform is constructed as a wiki-page where everyone can upload his or her information on renewable energy. One can even upload new datasets directly onto the platform. Compared to the Global Atlas however, OpenEI, despite having similar information, lacks a proper GIS system, which allows users to combine the different datasets. Additionally, wiki-pages always have the problem regarding data quality (Stvilia, B., Twidale, M., Gasser, L. & Smith L. C., 2005, p. 8). This issue also concerned the Global Atlas, but the Global Atlas was able to launch several initiatives on this topic, where the Global Atlas in collaboration with worldwide experts in order to take preventive measures to enhance the quality of the data available in the Global Atlas (IRENA, 2013, p. 8ff).

An important positive point concerning the Global Atlas competitive environment is the sharing of the same goals by all those organizations, whose goal is to enhance the use of renewable energy. This is what makes them eligible to partner up, what they indeed do (Global Atlas, 2015b). On the example can be seen in the screenshot of Figure 4, where the reegle and REN21 information is used to get better information on a spotted locality.

Figure : Competing Environment of the Global Atlas.

In the private sector there are several providers of resource maps as well. For example SolarGIS or DWS2Power (SolarGIS, 2015). These companies however, are selling the maps instead of providing the information of the map for free. Furthermore, those private map providers are not used as a first screening tool, but are in the section of bankable maps as indicated in chapter 3.4.

It can be said conclusively that in the specific field of first screening, the Global Atlas is the best tool currently available. What makes the Global Atlas unique is the worldwide cover in combination with the GIS tools used to display as well as the usability of the data. Having similar goals as the possible competition allows the Global Atlas to work together with the organizations mentioned in this chapter, allowing further possibilities of growth.

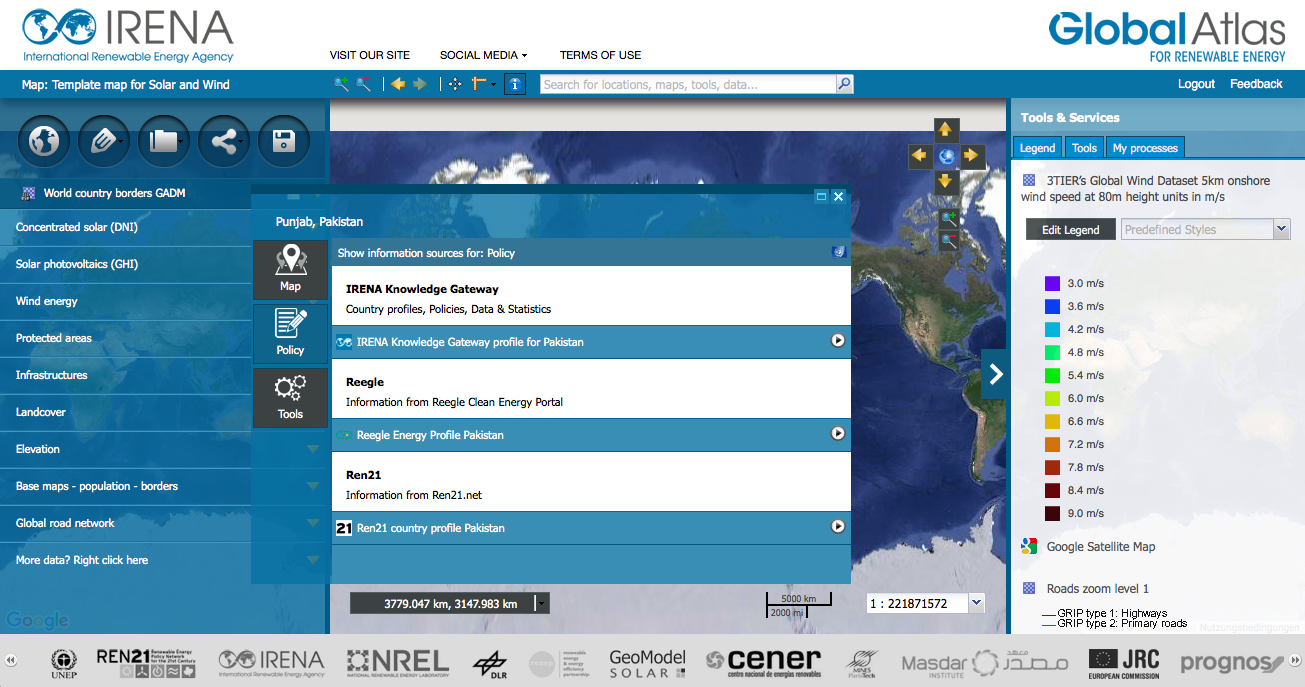


Figure : Screenshot of the Global Atlas (Global Atlas, 2015c)

## 2.7 Situation Today

In this section, the current situation of the Atlas is reviewed in order to work out some possibilities for the future. This is done by literature analysis on the current research on GIS tools as well as the analysis of different end-user surveys and interviews with existing users.

*Outlook*

Not only did Voivontas, Assimacopoulos, Mourelatos & Corominas (1998, p. 333) discover the usefulness of a GIS tool for the modeling of renewable energy worldwide (Sorensen & Meibom, 1999, p. 1262; Yue & Wang, 2004, p. 730; Ramachandra & Shruthi, 2006, p. 1460). In 2014, a study developed by Resch, Sagl, Törnros, Bachmaier, Eggers, Herkel, Narmsara and Gündra (p. 662) outlined the challenges and future research avenues for the GIS-based planning and modeling for renewable energy. The GIS tool is widely used in the field of renewable energy including energy potential assessment, consumption modeling, planning infrastructure projects, site planning for renewable power plants as well as impact assessment (Resch et al., 2014, p. 663). Resch et al (2014, p. 669) on the one hand emphasizes on the need of GIS integration into energy system models due to impossibility to ignore the spatial influences on the energy production.

On the other hand, they also name six limiting factors of GIS-approaches to the renewable energy modeling: complexity, computational requirements, heterogeneity of the data structures, limited data availability, inhomogeneity of the data as well as the change to a dynamic nature of the energy market. (Resch et al., 2014, p. 669f) Nonetheless, the experts clearly agree that, in the long run, GIS will be essential to the energy modeling in the future (Resch et al., 2014, p. 682).

*Challenges*

This subsection will outline that the Global Atlas is on the right track to tackle all the challenges. The first challenge mentioned by Resch et al. (2014, p. 669f) is the complexity of the tool. This challenge can be backed up with other studies done on the Global Atlas. A study conducted by UNEP (United Nations Environmental Program) shows that 80% of all the potential end-users would be interested in attending a training of the Global Atlas (UNEP, 2013, p. 38). Ayman Fayek, the General Manager or Engineering, Environment & Economic Studies at NREA (New and Renewable Energy Authority) in Egypt goes even further and states that without a training, he would not have been able to use the data in the right manner (A. Fayek, interview, August 7, 2015). Also Aminu Haruna Isa from the Energy Commission of Nigeria is in favor of a training (A. Haruna Isa, interview, August 12, 2015). Therefore, in order to make the Global Atlas an even better tool in this area, the Global Atlas has to tackle the complexity of its software. One possibility of reducing the complexity the Global Atlas will upon by the software developers for programming the right tools. On the other hand, the Global Atlas developed a training for the non-experts in their program.

The training to decrease the complexity of the use of tools from the Global Atlas has already been designed. It was conducted as a pilot project for the countries Egypt, Peru and Tanzania. Despite this training, the Global Atlas team still needs to find the perfect way of implementation (A. O. Ali, interview, July 7, 2015). The second challenge, the computational power, despite being dependent on other variables, primarily depends on the Central Processing Unit (CPU). For the CPU progress, there has been a law observable known as Moore’s law (Moore, 1956, p. 114ff), which describes the doubling of the amount of transistors in an integrated circuit every two years. Should this law hold true, exascale (a quintillion calculations per second) computers can be expected in 2023 (Thibodeau, 2014). Having not only the GIS industry for renewable energy rely on computational power, but all the other big industries as well, enables the prediction of progress in this section. (Mulligan, 2014)

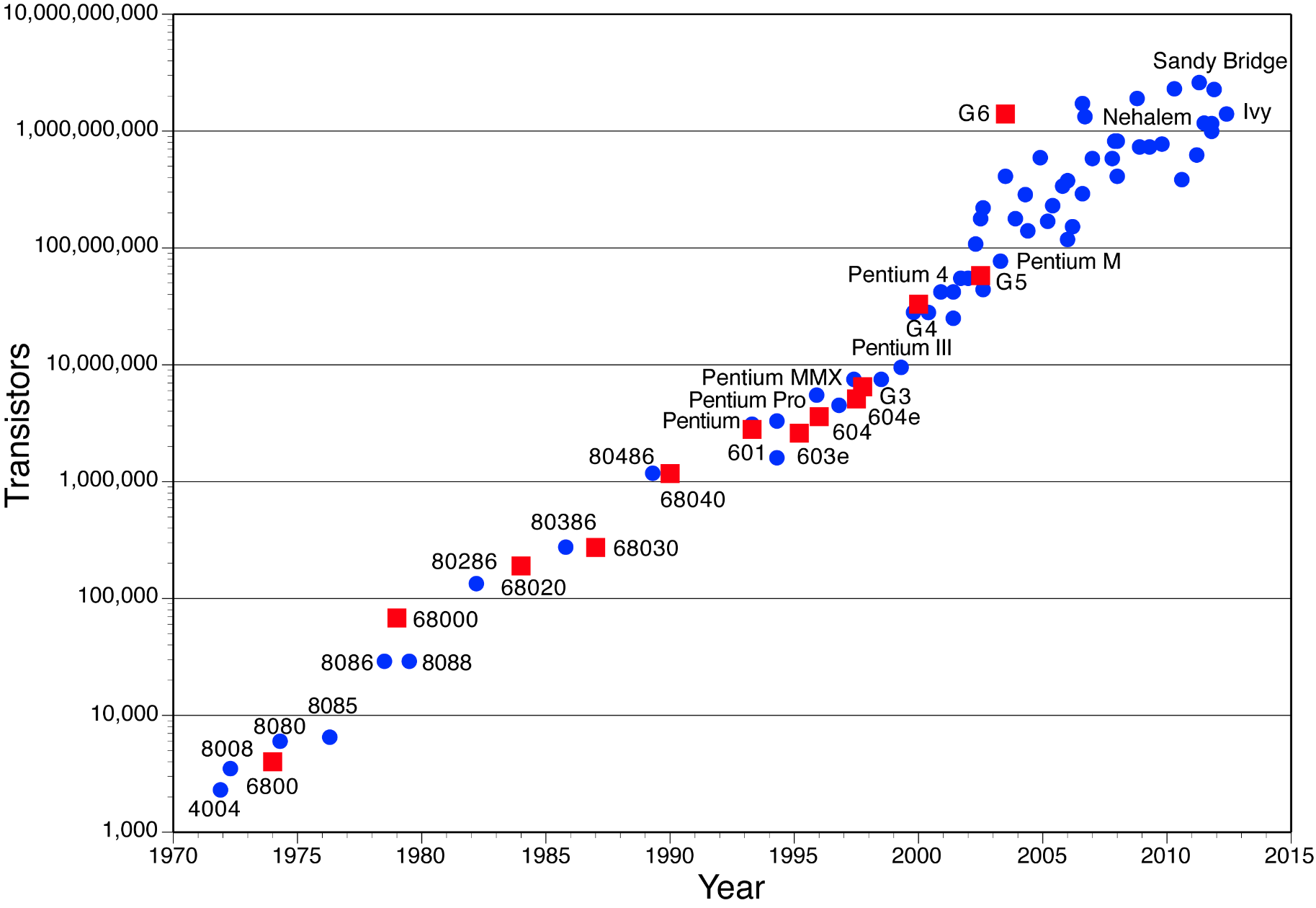


Figure : History of CPU Units (Hanavan, 2015, p. 13)

In order to fight the heterogeneity of the data structures as well as the inhomogeneity of the data, the Global Atlas is a part of the OGC, whose exact mission is to solve those problems in GIS (OGC, 2015b). Having this open standard allows not only the Global Atlas to research better strategies to homogenize the data, but also all the other main players of the industry, which will be able to benefit from the studies and the efforts made together. The dynamic nature of the energy market is a political and economic argument; however, being a free and open platform like the Global Atlas also gives the adapting stakeholder the possibility due to open innovation (Gassmann, Frankenberger & Csik, 2014, p. 236) to adapt to the new environment fast enough. The most essential point, however, will be the data available for the tool. The study conducted by UNEP shows clearly, that all potential end-users are in need of dozens of data describing the renewable energy situation (UNEP, 2013, p. 12). Getting the right data will be the essential to gain new users. In order to guarantee having the right and useful data, the Global Atlas controls every dataset made available through the program. (A. O. Ali, interview, July 7, 2015). Hence, the key to the success and growth of the Global Atlas is contingent upon on trustworthy data providers who can deliver useable data, which is connected to the software programmers as mentioned above.

In conclusion, it can be said that the Global Atlas is on its way to establishing itself as a world player in the field of renewable energy mapping and modeling. With their GIS tools, they have a good base of technology, and have discovered and addressed any shortcomings with this technology. In order to increase the user base, the greatest challenge of the Global Atlas in the future needs to be able to take measures against the complexity of the tools as well as being able to attract the data providers.

# 3. ESMAP RE Resource Mapping Program

The Global Atlas has recently been able to attract a very prominent data provider. In 2012, the Global Atlas partnered with the Energy Sector Management Assistance Program (ESMAP) of the World Bank (WorldBank, 2015a, p. 2). A short overview about the organization behind the partnership is given in the following sections.

## 3.1 The Initiative

ESMAP (Energy Sector Management Assistance Program) is a program administrated by the World Bank with the goal "to increase [low- and middle-income countries] know-how and institutional capacity to achieve environmentally sustainable energy solutions for poverty reduction and economic growth." (ESMAP, 2015a). The service for ESMAP countries can be divided in two different categories. The first service category is Technical Assistance and Policy Advise and the second service category consists of Knowledge Products and Knowledge Exchange. (ESMAP, 2015a). The ESMAP refreshes its business plan every third year; in the fiscal year 2014 a new plan was released with four main focus areas: Clean Energy, Energy Access, Energy Efficient Cities as well as Energy Assessment & Strategies. A major initiative of the Clean Energy focus area is the Renewable Energy Resource Mapping program, which performs thorough geospatial-planning and mapping in order to provide to policy makers with the right information for enhancing investment opportunities into renewable energy. (ESMAP, 2015b) This initiative was launched in 2012 and is expected to finish in 2018 and covers twelve different low- and middle-income countries. The countries were mapped along different kinds of renewable energies, namely Solar, Wind, Small-Hydro and Biomass. A compilation of all the countries with their respective mapped renewable energy can be found in figure 6.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Country | Biomass | Small-Hydro | Solar | Wind |
| Ethiopia, Lesotho, Nepal, Papua New Guinea |  |  |  | √ |
| Indonesia, Madagascar |  | √ |  |  |
| Malawi |  |  | √ |  |
| Maldives, Zambia |  |  | √ | √ |
| Tanzania |  | √ | √ | √ |
| Pakistan | √ |  | √ | √ |
| Vietnam | √ | √ |  | √ |

Table : Countries Covered by the ESMAP Initiative, in dependence of (WorldBank, 2015a, p.2)

The data collected for this initiative has two very significant advantages. First, the data is, through explicit designing of the measurements due to ground-measurements activities, the best data available at the moment (A. O. Ali, interview, July, 7, 2015). Secondly, the data will be openly provided by ESMAP through the Global Atlas for Renewable Energies. This allows everyone to have access to the data. (WorldBank, 2015a, p. 1) The data made available for the Atlas are about 1 Terabyte per country, which is ground breaking (A. O. Ali, interview, July 7, 2015).

With this data, the Global Atlas is able to provide countries with the necessary data and thus solve the problem of limited data available. Though this data needs to be leveraged in order for the Global Atlas to grow even more, the first step towards the increase of the user base is done.

Due to the scope, this thesis is only going to focus on one specific country. In order to try to maximize the possible impact while maintaining scope, two criteria were used to determine which country could be the most effective one: amount of renewable energies involved and the project funding. The first measure was used to increase the leverage of the tools (one tool can be used for several renewable energy industries), whereas the second tool helps to determine, where probably the most data is measured. In accordance with these metrics, Pakistan was chosen. The project in Pakistan not only covers three different renewable energies (including the two big ones, wind and solar), but the nation is also honored to receive the most amount of funding. The Resource Mapping program in Pakistan is funded with 4.35 Million Dollars by the ESMAP initiative[[2]](#footnote-2), the total funding of the project lays at 4.47 Million Dollars. It includes ground-measurements of solar, biogas and wind data. (WorldBank, 2015c)

## 3.2 Pakistan

In short overview over the situation in Pakistan, the current energy situation is explained. In a second step, the initiative by the ESMAP RE Resource Mapping Initiative in Pakistan will be described in the following paragraphs.

The reliance on too much imported oil is the reason for Pakistan’s energy crisis, which started in late 2007. The oil price almost tripled during the previous 18-month period and led to a debt-circle causing financial problems in the energy sector. (Aftab, 2014, p. 1) Pakistan is facing challenges in power generation, as Rauf, Wang, Yue, & Tan (2015, p. 895) state in their paper regarding the energy status in Pakistan. Numbers to confirm the result got Qasim and Katim (2014, p. 162) in their empirical analysis of the energy shortage. In 2011, for example Amer & Quim (2011, p. 420), estimated the shortage of electricity in Pakistan to 6'000MW, which is more than 7.5% of the annual Electricity Consumption in 2011 (IEA, 2015a). According to the World Bank data, (WorldBank, 2015b) 6.4% of the population (trend decreasing) does not have access to electricity in Pakistan. Several studies further indicate that a persistent shortage in power will have a negative influence on the economic development of Pakistan (see for example Siddiqui, 2004, p. 195; Khan and Ahmed, 2009, p. 451).

In contrast, Pakistan is rich in renewable energy resources. In his 2009 paper on the potential for renewable energy in Pakistan, Sheikh (p. 2702) outlined that renewable energy should at least fill 10% of the energy supply mix in Pakistan. This would eliminate the energy shortage of 7.5%. The following graph displays the energy consumption by sources in kilos of oil equivalent (ktoe) from 2012 provided by the International Energy Agency (IEA). The graph shows that Pakistan's biggest energy supply is generated with Biogas/Waste. With the term Biogas/Wood, the IEA speaks about primary solid fuels like wood and charcoal (IEA, 2015c), which is an inefficient way of creating energy and mostly used to heat up homes (Openshaw, 2014, p. 37)

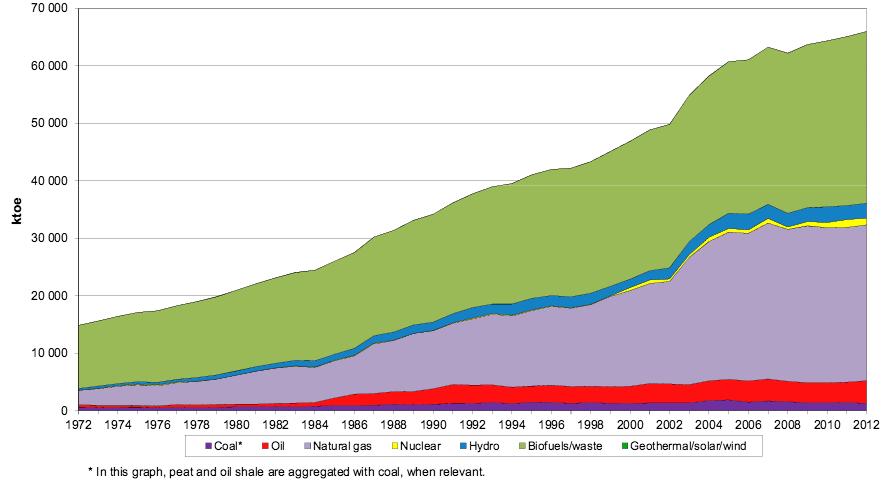


Figure : Energy Production in Pakistan according to Sources (IEA, 2015b)

It can be seen that Geothermal/Solar/Wind is hardly traceable in the energy mix of Pakistan despite, according to Patel & Zhao (2014, p. 7), boasting an average solar insolation rate of 5.3 kWHh/m2, which is comparable to cities like Phoenix, AZ (5.38 kWHh/m2) or Las Vegas, NV (5.3 kWHh/m2) in the United States of America. Furthermore, according to the Triple Bottom Line article, *The Feasibility of Renewable Energy in Pakistan,* (2015) Pakistan has greater absolute wind potential than big neighbor India despite having the smaller surface. Those numbers, of course, cannot be taken for granted, since the data has not been exactly measured yet, but they indicate the possibilities in the country.

Arif Alauddin, the former CEO of Pakistan's Alternate and Renewable Energy Board (AEDB) and now Managing Director of the National Energy Conservation Center (ENERCON) discusses the reasons for the lack of solar, wind and biomass energy in Pakistan; by acknowledging a deficiency in trustworthy resource data in Pakistan (WorldBank, 2013). He adds that the benefits for Pakistan cannot be overelaborated from getting those data. These data can build the ground stone for a renewable energy movement in Pakistan. In conclusion, an improvement in the energy situation is needed in Pakistan. The nation has not yet used all the potential resources available in the field of renewable energy, especially for wind and solar energy. One reason behind the situation is an estimated a lack of information and trustworthy resource data on the potential in Pakistan. This however, will be changed through the ESMAP RE Resource Mapping Initiative.

# 4. Hypothesis

In this chapter, the analysis of the previous chapters is integrated into a comprehensive hypothesis.

As the previous chapters have shown, there are several possibilities for the Global Atlas to increase its usage and user base. First of all, the Global Atlas offers the platform for free, which allows all the users to use the product on a cost-efficient basis from everywhere. Secondly, the GIS, with the various prospection tools is an ideal program for the first screening. Thirdly, the different users gain several benefits from the free platform. This value is the motivation to use the platform in the first place. Creating incentives for the users is the essential step to increase the usage and user base. Increasing the user base aligns with the mission of the Global Atlas to achieve a bigger impact on the situation of renewable energy worldwide. Additionally, the Global Atlas is not facing real competition in the market of a free GIS program for renewable energy. Furthermore, the possibility for the Global Atlas exists to initiate a positive feedback loop.

These characteristics combined make the Global Atlas a product with great potential. However despite all the possibilities, the analysis shows two major hurdles that must be overcome in order to improve, and therefore, increase the user base of the Atlas. The first point can be summarized as the chance to increase the amount and the quality of the datasets, which is required to perform the actions or to set the policies based on the conclusions drawn from the Global Atlas. The Global Atlas took another very important step in overcoming this hurdle with the partnership with the ESMAP initiative. The data of the program is the ideal way for the Global Atlas to grow and maybe achieve the possible growth opportunities mentioned in the previous chapter.

The other hurdle is the complexity of using the programs. An ideal way to reduce the complexity is the creation of a training program, because novice users will be hindered from realizing all of the value generated by the Atlas and thus decreasing the motivation, as already mentioned by Resch et al (2014, p. 669). On this point, the Global Atlas has already developed a training program, as was mentioned in chapter 2.7[[3]](#footnote-3). Though this training includes basic concepts for using the tool, a perfect implementation strategy, as previously mentioned, still needs to be found.

These two hurdles trigger the need to find the best way to implement a training program. Nonetheless, in order to find the best way to implement the training, a market analysis of the preferred market is needed. The analysis shows that more than an ideal market for the Global Atlas is Pakistan because Pakistan is not only a country rich in renewable energy, but it is also a country where the ESMAP is having its biggest project. Furthermore, a rise in renewable energy in Pakistan could be help solve the country’s said energy crisis. The initiative by ESMAP in measuring the Renewable Energy will deliver data, which can be used to guide policies, increase the financing of renewable energy projects as well as aid many more actions by people interested in renewable energy. As the data of the ESMAP initiative will be displayed through the Global Atlas, it will be essential for the renewable energy sector of Pakistan to be able to use the Global Atlas.

In order to gain the insights about the market, this thesis analyzes the decision-making process for applying or attending a training session. The decision-making process analysis allows adjustment throughout the training, according to the needs and processes for the potential attendees of the training. Having information available about the decision-making process enables the Global Atlas to contact and offer them a training is of great importance. In the end, implementation suggestions are drawn from the results. Those implementation suggestions could be used to adjust the training to the decision-making process in order to increase the usability and user base of the training for the participants of the renewable energy sector of Pakistan. This would not only be a step towards the goal of the Global Atlas, it would also increase the usability of the data measured be the World Bank’s RE Resource Mapping initiative as well as help the energy sector of Pakistan. In order to limit the scope of the thesis, the decision-making process analysis is only applied to the big institutions in the field of renewable energy in Pakistan. These institutions include the governmental body of Pakistan, which is responsible for the nation’s policy making; and the biggest companies responsible for financing and developing solar and wind plants. Therefore the major user base of the Global Atlas is covered as well. Among the big institutions only a selected group is chosen. Having the scope on these institutions allows the thesis to have a concrete focus in order to get applicable results without sacrificing the great potential effect on the energy situation in Pakistan.

Therefore the hypothesis of this paper is called: **There is a possible way to implement a working mechanism to provide a training of the Global Atlas according to the needs of selected institutional beneficiaries of the ESMAP RE Resource Mapping Initiative in Pakistan.**

# 5. Approach

## 5.1 Theoretical Background

In order to prove the hypothesis, a theoretical background of the study will be outlined in this section. In a first step, different models for the decision-making process will be evaluated. In the second step, the method, which the data will be gathered for, will be explained further.

### 5.1.1 Decision-Making Process

The decision-making process can be split up into two different schools (Sipp & Carayannis, 2013, p. 18). The first school is the analytical school, whereas the second is called the incremental school of thought. The foundations for the analytical school, commonly known as the Utility model, is described by Neumann and Morgenstern in their book, *Theory of Games and Economic Behavior* (1944, p. 15). In their book, Neumann and Morgenstern simplify the decision process as an exercise in preferences; a person always choses the solution where he or she expects the highest utility. Based on this model, March, Simon & Guetzkow (1993, p. 157) developed the so-called Bounded-Rationality Model. In Bounded-Rationality, human cognition is considered limited, while the reality still remained complex. These conditions lead to a decision-maker who is not able to analyze the situation well enough to derive the optimal solution as suggested in the Neumann-Morgenstern theory. Therefore, the decision-maker in the Bounded-Rationality model strives to find a satisfying solution to his/her problem. Another important figure for the incremental school was Lindblom (1959, p. 79). Lindblom is known for stating that measures and conclusions are interwoven. Therefore, decision-making is not a specific event, but rather a process with incremental changes towards the solution to the problem. Sipp & Carayannis, (2013, p. 18) however, identify three main steps, which are shared by both schools of thought. According to them, the decision-making process can be split up into three different phases: (1) defining the problem, (2) identifying, evaluating and selecting the alternatives and (3) implementing the decision. Additional theories have come up specifying the different steps. For example, Klein (1999, p. 285) claims that the definition of the problem is extremely dependent on the context it is in. Decision-maker therefore rely on their experience in order to create scenarios for evaluating the solutions in the first place.

Hence, taken all those studies into consideration, this thesis is researching a single decision process with a similar context for every interviewee. In addition to this, the goal is to find out about what does a satisfying outcome of the training decision-making process look like. Henceforth, the claim to find the best mechanism is not fully feasible for this study. For the interview a basic, but more specific consumer decision model based on the three main steps is evaluated in the next section. A consumer decision model is taken because those models describe the phases a policy maker would go through in a more specific way similar to the decision-making process when considering a training. And although the institutions interviewed are all organizations with their own organizational decision-making process, they still act as a consumer to the training of the Global Atlas.

The models trying to describe the decision-making process of a customer has, in general, long been a discussion in the field of marketing. Robert Sessions Woodworth described a prevailing model of a consumer decision model in 1929 (p. 226ff). He described the reaction of the consumers to different stimuli and thus, the model later became known as the Stimulus-Organization-Reaction model (S-O-R model). In 1966, Nicosia (p. 21) developed a first dynamic model of the consumer buying process. Engel, Kollat and Blackwell used the insights of Nicosia's model in order to generate their renowned model known as the EKB-model (Engel, Kollat & Blackwell, 1968). The EKB model was tested and applied to various contexts (for example: (Huang & Hsueh, 2010), (O'Brien, 2015) as well as (Bonice, 1985)). The EKB-model consists of five different phases of the consumer buying process: Input, Information Processing, Decision Process, Decisional Variables and External Factors. This thesis is especially interested in the decision process. Engel, Kollat and Blackwell split this process up into six different stages again: problem recognition, search, alternative evaluation, choice, purchase and outcome. Those six stages can define the common ground of the stages applied as the decision-making phases of a consumer buying decision. Usually, the literature coincides with the purchase and outcome together into post-decisional behavior (Kotler, 2002, p. 101; Lancaster & Massingham, 2010, p. 47; Solomon, 2015, p. 47). In 2001 the EKB model got revised by Engel, Blackwell and Miniard (Blackwell, p. 70ff). Nonetheless, the stages remained the same. In this thesis, the five stages as found in Kotler (2002, p. 98ff) and Lancester (2010, p. 47) as well as Solomon, 2015, p. 47) are considered, as the after-decision process can be unified in the situation of the trainings and because the outcome of the training cannot be defined without attending the training. Solomon (2015, p. 47) calls those stages the five steps of Cognitive Decision-Making. This was chosen because the study is an explorative study, where as much information as possible should be gathered to gain first insights into the market, therefore a more open model is hoped to allow more exploration.

Figure : Decision-Making Process Steps Applied to this Thesis, in dependence on Kotler (2002, p. 98ff)

### 5.1.2 Study Design

Due to the missing literature, an explorative way to study the decision-making process of the beneficiaries of the ESMAP RE Resource Mapping Initiative was chosen. Exploratory studies are a part of qualitative research (Ebster & Stalzer, 2013, p. 142). Among the research methods for qualitative research, the method of a semi-structured interview was chosen. Reasons behind this decision are explained in this section.

A semi-structured interview was chosen due to the individuality of the different contexts of the beneficiaries of the initiative. With the interview, the questions adjustable to the specific context of the interviewee opened the door to analyze the situation even further (Fylan in (Miles & Gilbert, 2005, p. 66)). Additionally, the semi-structured interview enables a structure in the process to be able to better summarize the decision-making process. Therefore, the semi-structured interview is the perfect mixture between the adjustability to the individual contexts as well as the necessity of a structure for further analysis. Cramb & Purcell (2001, p. 47) additionally mention that despite the doubts on the formality of the method the semi-structured interview to be very systematic and a well-defined method for data collection.

## 5.2 Practical Approach

In this section the theoretical background will be applied to the context of the hypothesis to structure the different interview schemes for the interview guideline[[4]](#footnote-4). Each scheme will be quickly described in the following subchapters.

### 5.2.1 Problem recognition

Engel, Blackwell and Miniard (Blackwell, 2001, p. 72) point out that no decision can be made without the recognition of a need or a problem. Kotler (2002, p. 98) adds that usually those needs arise through various stimuli. Engel, Blackwell and Miniard (Blackwell, 2001, p. 72) name the two terms environmental influences such as the culture and personal influences as well as the individual differences such as resources or motivation. In this section, it is interesting to find out how the internal and external stimuli work, so that a beneficiary will attend a training. Having more insights about the stimuli creating problems or a need would allow to explicitly address those.

### 5.2.2 Information Search

The search for information begins as soon as the need recognition occurs. Engel, Blackwell and Miniard (Blackwell, 2001, p. 75) differentiate between internal and external search. Whereas one is retrieving information from his or her own memory for internal search, the external search requires gathering knowledge from different stimuli. Stimuli can be divided into marketer dominated or non-marketer dominated sources (Blackwell, 2001, p. 75). Non-marketer dominated sources are sources from the environment, such as colleagues, family or media. In contrast, marketer dominated sources come directly from the marketer itself (Blackwell, 2001, p. 75). Engel, Blackwell & Miniard (Blackwell, 2001, p. 75) furthermore mention the level of arousal of a consumer. This is not considered in this thesis. On top of this Engel, Blackwell & Miniard (Blackwell, 2001, p. 75) note that, also the amount of time spent for looking for information is different for each product. It is extremely hard to figure out the internal search when considering a decision-making process of an individual in an organization. That is why the focus of the questions is on the external search. For the interviews, it would be hard to figure out the internal search since this can be vary from individual to individual. The external search, however, needs to be understood in order to be able to adjust the information to the search process undertaken by the beneficiaries.

### 5.2.3 Evaluation of Alternatives

After having enough information for the decision process, the alternatives are evaluated. This is done by different criteria. The criteria differ for every product (Kotler, 2002, p. 100). Where Kotler (2002, p. 100) is suggesting the consumer weighting the different criteria, Engel, Blackwell and Miniard are differentiating between salient and determinant attributes (Blackwell, 2001, p. 77). However, both rely on the information on the importance of a criterion. Engel, Blackwell and Miniard attribute the salient criteria as high importance, a must-have criterion where the determinant attributes usually determine which exact training is taken. Solomon (2015, p. 55) calls these criteria evaluative criteria for the salient criteria and determinant criteria for the determinant attributes indicated by Engel, Blackwell and Miniard. Those criteria are essential to be worked out during the interview. In this thesis, however, the most important detail is to figure out which criteria exist. On the basis of this, a ranking can be established to further analyze the evaluation of the alternatives. Having more insights allows the creation of a training programming perfectly designed for the audience.

### 5.2.4 Decision-Making Process

Once the evaluation has been made, both Kotler (2001, p. 100) and Blackwell (2001, p. 79) describe factors that can still change the decision process. Kotler (2001, p. 79) summarizes those factors by mentioning the situational factors that were anticipated as well as the attitude towards the decision from others as well as the risk perceived with the decision. In the case for the beneficiaries of the ESMAP initiative, this stage is even more important since it might not be the stakeholder, but a supervisor itself who eventually decides on the training. Here also an organizational decision-making process should be tried to find out during the interview guideline. An organizational decision-making usually include a fixed process which has to be absolved (Robbins & Judge, 2014, p. 257).

### 5.2.5 After-decisional Behavior

For the Post-decisional behavior the satisfaction of the consumer/customers is very important (Blackwell, 2001, p. 80). Kotler as well points out that the after decision process can be very significant (2001, p. 101). Satisfied customers are more likely to use the product again (Blackwell, 2001, p. 81). In the case for training, this can also mean that one will recommend the product to colleagues. Since this part is hard to testify without having the training conducted, it will not play a role in the analysis.

# 6. Results

## 6.1 Stakeholders in Pakistan

In cooperation with N. Khan (Interview, September 7th, 2015), the director for coordination of the RE Resource Mapping Initiative, possible institutional beneficiaries of the ESMAP initiative were discussed. Among the possible institutions a selected group was evaluated for further consideration. The following institutions were elicited of being expert to represent the stakeholder who could benefit from the data measured by the ESMAP RE Resource Mapping Initiative as an institution:

*AEDB - Aqeel Jafri, Director Policy AEDB*

The Alternate Energy Development Board (AEDB) was established in 2003. It is the sole representing agency for the Federal Republic of Pakistan at national level. Its main mission is the facilitation, promotion and Encouragement of development in renewable energies in Pakistan. At the time being, the administrative control is at the ministry of Water and Power. The agency consists of 110 employees (A. Jafri, interview, September 4th, 2015). The agency is especially interesting because it provides the policies on a federal level. Therefore, all policies from AEDB, as a sole representing agency, are very important for the development of renewable energy in the country. (AEDB, 2015) The data of the EMSAP Resource Mapping Initiative is beneficial to AEDB, because it allows them to set up national policies for areas with high potential for renewable energy plants.

*Energy Department of Khyber Pakhtunkhwa - Aimal Pir, Managing Director of Wind Energy in the Energy & Power Department of KPK & Muhammad Ozair, Section Officer Training in the Planning & Development Department of KPK*

Khyber Pakhtunkhwa is the third largest province in Pakistan in terms of population and GIP (Britannica, 2015). Additionally, Khyber Pakhtunkhwa is leading in developing decentralized supply structure in Pakistan (GIZ, 2015). The decentralized structure supports projects for renewable energy in this area even more. Energy policies in the province of Khyber Pakhtunkhwa will therefore be really essential. This is why the data of the ESMAP Resource Mapping Initiative will be very useful in order to set up the right policies to foster development in renewable energies in the region. Of course the other provinces in Pakistan are beneficiaries of the initiative as well, but Khyber Pakhtunkhwa is taken as a representative for the provincial stakeholder.

*Quaid e Azam Solar Power Limited - Jehanzeb Jamshed, Assistant Manager*

Quaid e Azam is the biggest solar energy project developer in Pakistan. It is a public-sector organization by the Government of Punjab and has been established in order to set up general renewable energy projects, especially focused on solar energy. (Quaid e Azam Solar Power Limited, n.d.-a) The project developers are very important for the development of renewable energy projects. The data measured by the ESMAP Resource Mapping Initiative will be very useful to the project developers, because they can use the data on the one hand to compare it with the own measured data as well as to look for new investment opportunities. In the future it is the goal for Quaid-e-Azam to invest in other solar projects within Pakistan (Quaid e Azam Solar Power Limited, n.d.-b).

*FFC Energy Limited - Syed Imran Shah, Project Manager*

FFC Energy Limited is responsible for developing Pakistan's first wind project in the province of Sindh. FFC Energy Limited's wind project was inaugurated by the President of Pakistan, Mr Asif Ali Zardari, and is the leading project developer for its kind. (FFCEnergy, 2013) Juristically, FFC Energy Limited is a subsidiary of the Fauji Fertilizer Group (Fauji Fertilizer Company Limited, 2014, p. 9). The data measured by the ESMAP Resource Mapping Initiative is very useful also for the project developers in wind project as a base information for further projects undertaken. The company is further planning to increase their involvement in the field of alternate energy projects (Fauji Fertilizer Company Limited, 2014, p. 72).

The next four chapters are elaborated with the results from the semi-structured expert interviews with A. Jafri (interview, September 4th, 2015), J. Jamshed (interview, September 22nd, 2015), A. Pir (Interview, September 16th, 2015), M. Ozair (interview, September 16th, 2015), and S. I. Shah (interview, September 29th, 2015). The interview scheme is displayed for every process step.

## 6.2 Problem Recognition

|  |
| --- |
| Interview Scheme I: Problem Recognition |
| * How many times a year do you consider a training? * When do you usually realize a training is necessary? * How is your environment influencing you in terms of considering a training? * What gives you the motivation to be willing to attend a training? |

Table : Interview Scheme I: Problem Recognition

In most cases, the greatest internal stimuli for considering a training is the motivation. This is a characteristic shared by all institutions covered in this analysis. A. Jafri (interview, September 4th, 2015) as a representative for the policy makers at Federal Level explained that on federal level they realize that training on renewable energy, especially on the technical parts, is highly demanded, , because Pakistan still has a lack of knowledge. Therefore, the policy makers on a federal level are very willing to attend trainings concerning specific technologies, software, or procedures concerning renewable energy. For the provincial level, the same situation can be recognized. The motivation for attending trainings is there, but due to restrictions in the final budget, the motivation is tempered. This means that despite the high motivation, the expectations for training turnout is still low. Similar principle count also for the organization of Quaid-e-Azam. J. Jamshed (interview, September 22nd, 2015) mentioned the urge of trainings when holding daily meeting or similar activities. He furthermore emphasized that the lack of knowledge begs for a training that improves the daily operation of the organization. However, for the case of Quaid-e-Azam the budget for training is not sufficiently high, and as a result, a high number of employees without have not attended any training sessions thus far. A different situation can be found at FFC Energy Limited, where the not only is the motivation is very high, but sufficient budget is available. This distinguishes the problem recognition of FFC Energy Limited from the problem recognition by the other stakeholders. The different external stimuli driven problem recognition processes are described in the following paragraph.

In the case of AEDB, the problem recognition can be described as a passive process. This is because most of the training is provided to AEDB are on an invitational basis. The invitations typically sent, directly or indirectly, to any stakeholder in the Pakistani government by other governments or donor agencies. Especially when not directly invited by the before mentioned parties, it is remarkable that training offered to for example the ministry of Water and Power or the embassies of Pakistan gets forwarded to AEDB, so that the right people within the government are able to attend a training offered by the stakeholders. This means that although the general motivation to attend a lot of trainings is there, the policy makers on federal level are waiting to have a training announced by donor agencies or foreign ministries. As already hinted in the previous paragraph, the situation on the provincial level is very similar. However, compared to the federal level, the problem recognition process is even more engraved into the culture, since on provincial level, the case of applying for a training, which is not offered by donor agencies or other ministries, is very rare. The passive problem recognition can also be found for Quaid-e-Azam, though it plays only a minor role. The same is also true for FFC Energy Limited, where the need is also established, when a training is offered to them. However, a direct contact from the donor agencies to FFC Energy Limited and to Quaid-e-Azam is not established. Nonetheless, in case a training is offered to the federal or provincial government which could be beneficial to those companies it will also get channeled to the organizations.

The differences can be found in in the external stimuli driven active problem recognition. For AEDB the active process is based in order to continue operating on their projects. In some cases, the policy makers can address the donor agencies on their own, stating their need of a training. With this process they are hoping to obtain funding for their trainings. Project-based active problem recognition is also the case for the provincial level policy making. Every policy maker in the provincial government of Khyber Pakhtunkhwa can fill out a CP-1, the governmental form to apply for funding for a project. However, those trainings can only be applied when it is absolutely essential to a project. Muhammad Ozair from the Planning & Development Department (P&D) of Khyber Pakhtunkhwa (interview, September 16th, 2015) reassured, nonetheless, that this has been hardly ever been achieved. This is why the motivation is lowered for most of the employees. In Quaid-e-Azam is facing a similar financial conditions. Due to this, the employees are actively recognizing the need of a training in the situation. This is done on an individual basis and in most of the situation. Therefore, in those cases the problem recognition depends on the individual employee. A huge difference in the active problem recognition for FFC Limited: despite the similarity in that the active problem recognition can also be described as a project based approach, the problem recognition is much more elaborated than it is in the other cases. In a first step, all possible or imaginable projects are listed. This is done by evaluating the environment of the company, like upcoming trends or technologies, but without further research on training. As soon as there is a business case for one of the possible projects, it will be presented to the board of directors of FFC Energy Limited. If they decide to go for the project, then a team is built, which needs to be trained. The reason that FFC Energy Limited is totally different from process of the previous three stakeholders, because FFC is spending Millions of Pakistan Rubles on training due to the fact, that FFC Energy Limited is a part of the largest industrial conglomerate in Pakistan.

To conclude, it can be said that despite the active and recognizable problem, recognition by external stimuli is driven by different factors for each and every institution, the common way to get involved in the problem recognition process is through a training offered by donor agencies. Offering training in cooperation with those organization will allow to reach and get involved in the problem recognition process of every organization interviewed in this thesis.

## 6.3 Information Search

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| Interview Scheme II: Information Search |
| * How do you get to information about trainings? (memory or external) * Which specific channels do you make us of when searching for a training? * Are you using information from colleagues, family, friends and media? * Does your employer provide you with any guidelines on eligible trainings? * How much time do you spend on searching for information? |

Table : Interview Scheme II: Information Search

The passive problem recognition as described in the previous chapter does not require an information search. Nonetheless, there are still some sources that are involved in this process. Having the process invitation-based, the most important information are the donor agencies, respectively the organizations, which are offering the training to the institution. A. Jafri (interview, date, 2015) mentioned GIZ (Gesellschaft für Internationale Zusammenarbeit), USAID (United States Agency for International Development) or JICA (Japan International Cooperation Agency) as the donor agencies that typically offer trainings to AEDB. Apart from those donor agencies, embassies or governmental agencies from other countries can also offer the training. For the provincial level, the agencies are about the same. M. Ozair (interview, date, 2015) even add some donor agencies, which are offering trainings from time to time. To the list he adds the Asian Development Bank and UNDP (United Nations Development Program), UNHCR (United Nations High Commissioner for Refugees). All the agencies can be found in the list below. Quaid-e-Azam and FFC Energy Limited are due to the fact, that the training is channeled from the federal or provincial government profiting from the same agencies.

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| Donor Agencies |
| Asian Development Bank |
| UNDP (United Nations Development Programm) |
| UNHCR (United Nations High Comissioner for Refugees) |
| GIZ (Gesellschaft für Internationale Zusammenarbeit) |
| USAID (United States Agency for International Development) |
| JICA (Japan International Cooperation Agency) |

Table : List of Donor Agencies

In case the policy makers on a federal level are actively looking for a training they have two possibilities. One is to define their problems on a concrete basis and the approaching the before-mentioned donor agencies with asking them for the specific training on those topics. The same procedure is done when specific software skills are needed. For this procedure, they directly approach the software developers. The second possibility is to conduct a search on different websites looking for a suitable training. The cases are listed according to their probabilities.

Mostly relying on the invitation-based process, the information search for policy makers at provincial level is basically non-existent. Furthermore, the missing budget for trainings funded by their own, do not allow employee to attend training on their own. This is why the only other opportunity left is applying to a training through a CP-1 in combination with a project application. The information in those cases is done through a simple web search without any preferred websites. Nonetheless, since the possibility that a training is applied successfully through a CP-1 is very low, the motivation to get a training through a CP-1, and therefore also the active information search, is diminished.

The information search for the organization of Quaid-e-Azam is due to the active process further elaborated than within the government. Due to the lack of training offered, the employees are required to go through an information search by themselves. This information search can be divided into two different possibilities. The first possibility is to get in touch with the consultants for the plants, the IFL Consulting firm from Germany. With this way, the organization can assure that the training is important and is able to increase the production capacities, as they can rely on the experience of the firm with other relevant customers. This is usually better than any other information search. The other possibility is the search on the worldwide web. This possibility is mostly used. The organization does not use specific websites to look for the training, but rather search for trainings with the relevant keywords. J. Jamshed (interview, September 22nd, 2015). Those keywords, however are hard to define, since they are depended on the problems occurring.

Another more elaborated information search can be found at FFC Energy Limited. Compared to the information search of Quaid-e-Azam, however, the search is not internet-based. Main source of the search are magazines in the related fields. In the field of wind energy, the foremost is Wind Power Monthly, which provides not only information on new and upcoming technologies but there is also an event calendar with upcoming trainings on the field. Those training suggestions provide the organization with all the events from the industry. The employees of FFC Energy Limited have a subscription for those magazines and check them on a regular basis. The magazines ensure the quality of the training and provide an overview of all events, so that no other information search is needed. This is done on an international basis, because in magazines like Wind Power Monthly, there are no trainings in Pakistan in those magazines. Once a training that fits the criteria (see Evaluation of Alternatives) is found, a further information search on the training provider is conducted. This however, is initiated by the organization of FFC Energy Limited and does not require an active process by the training provider. As with the example of Wind Power Monthly, we can see that most of the information search is driven by non-marketer approaches.

## 6.4 Evaluation of Alternatives

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| Interview Scheme III: Evaluation of Alternatives[[5]](#footnote-5) |
| * What are the characteristics that a training needs in order for you to be interested in it? * Which criteria have an influence on your evaluation of a training? * What is your favorite format of training? Please rank: Workshop in home country, Workshop abroad or online course. * What are the maximum costs you, respectively your organization is likely to pay for a training? * How long does the ideal training take? * Is a recognized certification at the end of a training important for you? * What are your options in terms of trainings provider usually? * What time of the year is the best suitable time for you for the training to take place? * How important are the other criteria for you? |

Table : Interview Scheme III: Evaluation of Alternatives

In this chapter, a summary of the description of a training according to the needs of the individual experts is given. The experts were asked to describe the perfect training for their organizations. The answers are organized through subchapters:

*Policy Makers at Federal Level*

For the AEDB, the most important point or evaluation criterion is the content of the training. The content has to fit to the strategy and the projects in AEDB. Furthermore the training needs to build on the expertise already available in the organization. The other very important criterion is the financial side of the training. In most of the cases, trainings of the AEDB is funded by a third party. Concerning the format, the AEDB prefers a training workshop or seminar; an online course is not really demanded by the organization. Rather, a training in Pakistan itself is preferred because it is more expensive to get people out of Pakistan to attend a training. This is only being done when the physical presence of attendances was really necessary (e.g. when visiting a new plant). The maximal cost of a training is varies as it is dependent upon the funds that are available for the training. Most of the trainings attended so far by the AEDB usually last between three to five days. However, the AEDB is adjustable on this topic. A recognized certification is not needed from the organization itself, however, for the individual a certification is a plus. In terms of trainings provider, the AEDB trusts on the expertise of the donor agencies to assist them with professional providers. Trainings can be offered at any time of the year, except for the time of Ramadan. During Ramadan, the policy makers of Pakistan are fasting and therefore also the travel will be limited. Though there have been cases of trainings during Ramadan, it is not recommended.

*Policy Makers at Provincial Level*

The members of the Energy & Power Department of Khyber Pakthunkhwa prefer a more practical than theoretical training. Aimal Pir (Interview, September 16th, 2015) metaphorically speaks about "[one] should always get the hands dirty during a training". He prefers to have hands-on experience to the amount of slides used in a training. This would enable the members to use the learning from training in everyday life better. The interest for theoretical training is therefore very low. The most preferred format of training is the training abroad. A. Pir (Interview, September 16th, 2015) emphasizes the importance of different cultures in a training. A training in Pakistan would be among people with the same culture, which does not give the same benefit to the people taking a training. He furthermore mentions the possibility of the correspondence, which will also be beneficial in daily working life, especially when encountering a new problem. The length of a training appears to be flexible. For A. Pir, (Interview, September 16th, 2015) a training without getting a degree afterwards can take anywhere from three days to even three months. A certification at the end is important, but just to a degree that the training was attended. A test at the end of the training is apparently not very appreciated. On the contrary is a group presentation at the end, which would help the trainee remember what they have learned throughout the training. Of great importance as well is the teacher of the course. It is not that, training provider that needs to have a certain brand, but the teacher needs to be higher skilled person that the attendees. If this is not the case, a training is not even considered.

On provincial level, Pakistan needs to hand in the numbers for GDP and other different plans in the month of May and June. Although it would be still possible to attend a training in this time, it is more unlikely, that the right amount of people would still attend a training. A. Pir (Interview, September 16th, 2015) estimates the chances to about fifty percent.

*Quaid-e-Azam*

Same as on the provincial level, the employees of the organization of Quaid-e-Azam also prefer to have practical trainings. This is also true for the fact that not the slides of the presentation need to be important, but the hands-on experience. In case of Quaid-e-Azam, on-site trainings would also be beneficial. Additionally, an adjusted training to the situation of the plant of an expert would be helpful to the organization. In terms of format for the training, J. Jamshed (interview, September 22nd, 2015) states that the format is not that important. In contrast to the provincial government, online workshops would also be okay. He adds that workshops abroad would not be possible for individuals when there is a lack of funding from the company. J. Jamshed (interview, September 22nd, 2015) estimates the costs for the training to about 200 to 300 US Dollars. The length of the training can be vary. For Quaid-e-Azam the training can be one hour any day of the week, weekends included. What is very important to the employees of Quaid-e-Azam is the recognized certification at the end of the training. "I think I would not leave the training, until I have the certificate." (J. Jamshed, interview, September 22nd). The reason for this necessity is the fact, that the certifications are the base of the evaluation of an employee. Having more certificates implicates the better caliber of a person. In terms of the favorite training provider, the organization of Quaid-e-Azam prefers trainings from ILS, because they already know the plant and the development. Nonetheless as concerning all of the stakeholders so far, the training provider, although important, can vary if the experts are good. The best time for a training according to J. Jamshed (interview, September 22nd, 2015) would be in summer. He claims that due to the season, the day would be longer (6.5h of sunlight in winter and 14h of sunlight in summer) and the less household work needs to be done. This leaves the employees more time for training, which could have a better effect on the outcome of the training as well. A further plus point that a training could offer is a presentation at the end to keep the attendees focused and more motivated throughout the training.

*FFC Energy Limited*

Trainings for FFC Energy Limited can have two different formats. The training should either be a classic classroom training or a mentor training. S. I. Shah (interview, September 29th, 2015), however, prefers to have the mentor training, where the possibility is given to work together with an experienced consultant or similar expert on a specific task and assistance is given during the actual work on one or two specified subjects. Concerning the location of the training, S. I. Shah (interview, September 29th, 2015) prefers to have the training outside Pakistan, because it allows trainees to meet new people, get new experiences and interact with new technologies. He furthermore mentions that a training in Pakistan would be a meeting with all the people that have met already as well as sharing problems or ideas, that have already been shared, which does not allow to learn something significantly new. A certification is of great importance for the training despite the fact that it is not an absolute requirement. Nonetheless, as soon as some time is spent on a training, a certification would be good, which is often missing to the trainings attended by FFC Energy Limited. According to the philosophy of FFC Energy Limited, a training should take about four to five days, since the organization is planning in weekly terms, where a training should take up a week. The most important characteristic of a training is the trainer himself. S. I. Shad (interview, September 29th, 2015) emphasizes on the qualification of the trainer. The trainer needs not only to be qualified in an academic way, he furthermore needs to be experienced in the field she or he is active so that she or he can cite and quote examples to questions asked by the audience of the training.

To summarize, the different evaluation criteria is almost impossible, since the answers of the different experts for the institutions vary a lot. However, it can be said that two important points are favorable to every institution. The first point is the professionalism of the teacher, who needs to be an expert on the topic. This was sometimes even named as a must-have criterion. The second point is the certification at the end to increase the motivation for the individual attendee. Another point that was, apart from the funding situation, appreciated by all institutions was a training abroad. This however, would only be possible if the funding is available.

## 6.5 Decision-Making Process

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| Interview Scheme IV: Decision-Making Process |
| * What does the general decision process on such a prospective training look like? * Who has the final word on whether you will attend a specific training or not? * Do you have an intern deadline for the application to trainings? * How many times a year do you attend a training? |

Table : Interview Scheme IV: Decision-Making Process

Same as for the Evaluation of Alternatives, the answers, respectively the individual organizational decision-making processes are listed in individual sub-chapters to have a better overview of the uniqueness of the processes.

*Policy Makers at Federal Level*

As already mentioned in the previous chapters, in most of the cases, a training gets offered and is later channeled to the federal level. Once this stage has been achieved, the decision-making process involves several steps from different sections of the organization. First of all, the right people in the organizations need to be found. This requires a search, because AEDB covers several divisions with different knowledge in each division. Secondly the Human Resources department or the administration of the section needs to have availabilities in the timetables of the possible training attenders. They have to make sure, that those people are not involved in other very important activities. In the end, the final word on whether those people are able to attend a training will be decided by the CEO of AEDB, Mr. Amjad Awan. In case there is no funding for the training available, the AEDB has to add several steps, which includes the approval of the board by the different ministries as well as following rules provided by the ministries. The fact that this is extremely difficult to achieve is why successfully funded trainings are most likely to be funded the donor agency. A more detailed process on the provincial level can be found in the next section.

In total, AEDB attends 10 to 15 trainings a year, where most of the specialized trainings are attended by officers of the organization. The staff, however, is only attending trainings related to administration.

Figure : Organizational Flow Chart on Federal Level

*Policy Makers at Provincial Level*

Same as the decision-making process for a training that has been funded includes several steps. The decision-making process at provincial level is well structured. There are clear rules for how the decision on a training is made. In this part, the decision-making process is explained for every province in Pakistan. The programs offered from donor agencies are usually coming from foreign ministries or governments over the EAD (Economic Affair Division) in Islamabad, an agency on federal level. From there, trainings get channeled to the Chief Secretary of the Province; in the case of Khyber Pakhtunkhwa through the Chief Secretary of Khyber Pakhtunkhwa. The Chief Secretary will forward the training to the Planning & Development Department. There, the section officer for trainings will evaluate which departments within the provincial government could benefit from the training. Particular invitations are sent to the respective departments. The employees can then apply for the training which is going back to the section officer. The final decision-making process however, differs depending on the grade of the members of the departments. For members with grade lower than 17[[6]](#footnote-6), the authority to have the final word on the application is the administrative secretary of the respective departments, so the file will not be sent back to P&D. These trainings however, are as already mentioned very rare. Trainings from grade 17 onwards, which is already a graduated officer, are reviewed from the P&D. Those trainings are usually the ones taking trainings from the way described above. Those applications to a training have to be sent to the secretary of the department. After checking the availabilities of the applicants from his department, he will forward the documents back to P&D. At P&D another feasibility check and a choice is made between all the departments before the final applications are handed to the additional secretary of P&D. This is the first step of decision.

Figure : Organizational Flow Chart on Provincial Level

The second step depends on the grade. For trainings for grades 17 to 19, the competent authority is Additional Chief Secretary of P&D; for grade 19, the competent authority is the Chief Secretary; and for grade 20, it is the Chief Minister of the province. A. Pir (Interview, September 16th, 2015) adds that usually trainings are only taken by officers. Although there might be a suitable person to the training with a lower grade, the chances that on officer is accepted is higher. This is related to that the P&D only deals with grades from 17 and above.

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| --- | --- |
| Grade | Competent authority |
| until 17 | Administrative Secretary |
| 17-19 | Additional Chief Secretary |
| 19 | Chief Secretary |
| 20 | Chief Minister |

Table : Decision-Making Authorities According to Grades on Provincial Level

*Quaid-e-Azam*

As already mentioned earlier in the previous sections, there are two ways for employees to attend a training. The first way is to attend the training privately, which does not require any other organizational processes. The second way is that the company can fund the training. In order to achieve this, the training description of the needs for the employee needs to be handed to the respective senior. The seniors will pursue the application to his senior. The final verdict on whether the training is attended or not is in the hand of the Chief Operating Officer of Quaid-e-Azam Sajjad Ahmad Sajid. Usually in this case, the seniors are interested in trying to attend the training as well. The requirement that a training needs to claim is to be generating or helping the production to increase. Furthermore, it should also fit into the strategy of Quaid-e-Azam.

Figure : Organizational Flow Chart for Quaid-e-Azam

*FFC Energy Limited*

The decision process of FFC Energy Limited is similar to the one from Quaid-e-Azam. Employees of the organization can apply for trainings through their superior. The superior, who is also eligible to apply for a training, then directs the training to the project officer. The project officers then channel the application to the Human Resource department. The Human Resource department has the final word on the trainings since this department is handling the budget. Within the budget available, the department is allowed to decide on the training. According to the experience of S. I. Shah (interview, September 29th, 2016) the training gets usually accepted. However, it is possible that the budget available is too small for the training or that the training might not be important enough. Then there is the chance to reschedule the training for the next year, because the budget can also be applied accordingly.

Figure : Organizational Flow Chart for FFC Energy Limited

For the decision-making section a summary of all the institutions is difficult as well. Nonetheless, there is an observable difference between the institutions on the government side and the bigger organizations in terms of where the topic of the training is raised. This, however, was already shown earlier in the problem recognition section. Interestingly, there is one common aspect between all institutions: all decision-making processes are all dependent on favor of higher ranking personnel, due to the decision strength of them. This increases the chance of higher ranking officers or managers to attend a training.

# 7. Interpretation of Results and Implementation Suggestions

In this chapter, a summary of what has been found out in this thesis is outlined. Following the summary, implementation suggestions based on the summary is made.

Concerning the problem recognition, the results have shown, that the motivation to attend a training is very high. This is true for all organizations involved in this study. Thus, if a training is there, the chances of members or employees wanting to attend the training is very high. The interviews have also shown, that the next step from general motivation to the motivation of wanting to attend a specific training is in most of the cases passive. This means that the motivation for a specific training is in most of the cases only there, when it is offered to the organization. The organizations get the training offered through different donor agencies. The donor agencies, which sometimes also include foreign governments, are listed in Figure 10. They play a vital role in the training section for the different organizations. To increase the probability of a successful approach, GIZ, USAID and JICA should be approached first, since they were mentioned by both governmental institutions. Furthermore, once a training in the renewable energy sector is offered, the channeling towards the organization, which is in need of the training, is works perfectly in Pakistan. This is the case in the provincial as well as in the federal level. Sometimes, even the big corporate players such as Quaid-e-Azam and FFC Energy Limited are invited.

Hence, the information search in most of the cases is non-existent. There are cases, when the employees or members of the organizations are looking for a specific training in order to find a training suitable to their specific project needs. However, the main platform for the information search is the donor agencies as well. In case of the AEDB, the donor agencies are sometimes explicitly asked for a certain training. For the individual information search, the chances of getting picked as a training is significantly lower since, first of all the members or employees must be able to find the training offered. Secondly, the steps to finance the training are not always simple. For getting the funding of the organization, long-lasting procedures need to be undertaken. The procedure involves the acceptance on several levels and the final decision is always at the top level of the company, which is simply decreasing the chance of the training getting accepted. To increase the chances of getting accepted, the benefits of the training would need to be expressed in money and words as well as being adjusted to each individual case. This would require investments in the marketing of the training, which would be too expensive. In the private field, the training is competing with all the other expenses of the members or employees of this organization, which would require a marketing of a consumer good, which by itself requires huge financial inputs from the side of the Global Atlas as well. Thus, it can be concluded that in order to best comply with the goal of the Global Atlas, the training needs to be created in combination with the donor agencies. This would not only give the Global Atlas access to all the different organizations, but it would also utilize the motivation available of the members and employees to attend the training of the Global Atlas, which would be beneficial to the marketing cost of the training. Additionally, the training can be offered to any stakeholder in the government and it will get channeled to the relevant agency within the government on both provincial and federal levels, and if doable, also to the companies. This channeling can decrease the cost of marketing by a significant amount as well. Furthermore, the budget in the organizations for funding the trainings by themselves is also very restricted, which, in turn, decreases the chances of a training getting accepted. As for the case of Khyber Pakhtunkhwa, as in most of the cases, there is no money even available for trainings.

In terms of the decision-making process by the different organizations, the results have shown another very important aspect. For every stakeholder interviewed for this thesis, the members, respectively the employees of the stakeholders have only selected people attending a training. Those selected people are usually upper-ranked officials. In AEDB, most of the times officers are attending a training, where the rest of the crew is only allowed to administrative trainings. The same is even more explicit on the provincial level, where even the trainings offered by the donor agencies can only be attended by officers from rank 17 or above. A similar principle is also found in the companies, where the application to a training always needs have a senior, who desires to pursue the training as well. Therefore, also when a training is offered, it is more likely that a senior can also attend the training. Based on the fact, that the motivation within the organizations is high and the lack of knowledge in this field is big, increasing the chance that higher-ranking officers would be attending the training of the Global Atlas. Although this is a good sign because the policies and the decisions are also made by the officer, which would be beneficial to the Global Atlas and its goal. Nonetheless, the actual user of the tools of the Global Atlas will not be addressed with this. The actual user of the tools, as mentioned in chapter 2.3, are mostly the Junior Associates, who do not have the rank of an officer or a senior yet. This is why the motivation evaluated in the previous paragraph needs to be used to slightly change the focus of the training.

The slight change in the focus of training is to make a training that is designed to develop the officers and high-ranking managers as experts on the topic. This expert knowledge should then be used to offer courses within their respective organizations. This would not only allow the actual user to be able to participate in the training, it would also enable the organizations to have the knowledge spread within their organizations. In all of the organizations, the facilities to organize an intern training are given. Furthermore, sending just one or two people to attend the training, but having a lot more other people trained on the topic would also be a good idea, financially, for the organizations. This would also be beneficial to the goal of the Global Atlas, because the user base would increase by a significant amount. With this option, the Global Atlas would also decrease the marketing costs per user, since through the cooperation with the donor agencies, the officers or other relevant person would get in contact with the training through the channeling of the organizations. Additionally through the high-ranking official and managers attending the training would ensure that the training will also be offered by a qualified and gifted expert within the organizations.

Nonetheless, the actual training itself needs to be according to the managers and high-ranking officers to increase their motivation of attending the training. This is why a certification is needed, as shown in the interview results, is a great motivation for the individual who attend the training because it would help them further develop. Another motivation rising from this change is the creation of a get-together with important people from all the different industries in the renewable energy sector and therefore benefitting from the broad approach of the Global Atlas. This would allow the managers to network and get to know other important people within the industry. There are two other reasons for the managers to attend the training. Firstly, teaching the training to the Junior Associates will help them use the results from the tool on a better basis, since they are the only managers/high ranking officers with profound insights in the program. Secondly, the created network will open up their ways to look for project on a broader perspective, which could end in Joint Ventures with manager’s/high ranking officer’s institutions.

In order to unburden the managers and high ranking officers, the material, which the training is based on, should be published online as well. As to support both experts and institution-intern attendees, different versions should be published. This would, on the one hand, ensure the quality of the training, when offered within the organizations as well support the experts in teaching the training to their colleagues or employees. Having the material online, would also allow to constantly update the training, which is used since the Global Atlas is constantly evolving.

To summarize the measures, a list of who could lead according to the expert interviews in combination with the previously done analysis on the Global Atlas and its environment to successful implementation for a training in Pakistan the three implementation suggestions is given below.

1. Offer the training in cooperation with a Donor Agency
2. Train high-ranking officials and managers to expert, who will be able to teach the training within their organizations
3. Keeping the material online in an expert as well as student version

# 8. Critical Evaluation

In this chapter a critical evaluation is worked out in order to align the results so that they can be interpreted in a right scientific way. A critique on the method used is therefore described.

Due to the semi-structured interview, there are several biases and improvements behind the method. Firstly, the validity and reliability of the interviews due the fact that each interview was in a different context, in this thesis most of the interviews were conducted by phone, which leaves out the interpretation of gestures. Additionally, not every expert was asked the same set of questions due to the factor of the individuality of the situation the interview needed. Nonetheless, the author of the research tried to adjust the questions so that the situation could be comparable. This however, can be neither controlled nor tested against. Secondly, also due to the individuality it would be impossible to replicate the same interview. This is, on the one hand, a critique point for the objectivity of the study. On the other hand, however, it was necessary to adjust to the different situation and therefore the thesis has to come to terms with this situation.

Due to the exploratory nature of the study, the results could still be used as a basis for further study on the situation. Further research topics can be found in the following chapter. Additionally it can be said that in terms of the decision-making process inside an institution, the experts were more than qualified to give insights that can be trusted fully since there is one process, which is set according to distinct rules. Fourthly, another important bias to consider in this thesis is the reliance on the interviewer itself. This bias is the risk of the interviewer to see what he wants to see. In this case, it might have been bias to gain insights on how the author would have seen his perfect training and therefore the answer were interpreted according to this bias. Fifthly, there is another risk point for the interviewee. Here the interviewer needs to be able to trust on the answer given by the interviewee. According to the impression of the author this was the case during the interviews.

# 10. Further Research

In this chapter different areas of research are displayed. Due to exploratory nature of the thesis, a lot of new research opportunities were left unexplored, which would be especially interesting to pursue. Interesting further research topics are mentioned below.

First and foremost, an important study to conduct would be to research and develop a demand perspective from donor agencies. The study on the donor agencies could also prevail the needs of the donor agencies. Knowing the needs of the donor agencies would be a benefit for a possible cooperation with those agencies.

Secondly, another interesting study would be comparing the different regions of the ESMAP initiative. For example, a comparison between the East-African countries and Pakistan. This would be especially interesting with regards to a possible supra-national training on the Global Atlas.

Thirdly, analyzing of the needs of the current engineering or finance students of Pakistan would be of great significance. These insights would be valuable in determining how to design the training on the organizational level. This information could then be presented at the training to help the managers or high-ranking officers. This would help them better design the training organized within the different organizations.

Additionally, further research and development of a quantitative analysis on the desire and demands of all the other beneficiaries involved for the ESMAP initiative, especially on an individual level, would be beneficial.

Fifthly, a further interesting study idea came up while researching on the Global Atlas. It would be of great importance to find a way to trigger growth through the positive feedback loops. Decisive factors for data provider and software developers would be greatly interested in the results of such research as it could include a possible way to open up the platform for everyone to upload data.

# 11. Conclusion

The analysis of the Global Atlas and its’ environment has shown that the Global Atlas is the best product in the worldwide first screening market for Renewable Energy. Furthermore, there is no competition in this area so far. Based on a Geographical Information System (GIS), the Global Atlas also has great potential in the future. Nonetheless, there is the need to tackle the program’s complexity as well as the Atlas’s data quality. Though the Global Atlas has developed a training to fight the complexity, a perfect mechanism has yet to been found. Secondly, there is the potential of increasing the databases to increase the usage and user base of the Atlas. This is why the World Banks initiative, ESMAP, to map twelve different countries comes in handy and as it significantly increases the data quality. Pakistan, as the biggest project, was chosen as an example for this thesis. With experts interviews of selected stakeholders, the respective beneficiaries of the Resource Mapping Initiative the decision-making process of their institutions were elaborated upon. It was discovered that though the organizations usually send managers or high-ranking officers to trainings, actual user of the Atlas are, in most of the cases, Junior Associates of the organizations. This is why a training for the high-ranking officers and managers should focus on teaching these high-ranking officers and mangers how to teach the training program to their own employees at their respective institutions. Getting the training certified and offered through donor agencies would lead to a great attendance of the training, which would also lead to increasing the user base of the Global Atlas as well. Thus, with these implementation suggestions, the hypothesis could be sustained because a feasible way to implement a working mechanism to provide a training for the Global Atlas in accordance to needs of the institutional beneficiaries of the ESMAP Renewable Energy Resource Mapping Initiative in Pakistan was found.

Table of Literature

Amer, M., & Daim, T. U. (2011). Selection of renewable energy technologies for a developing county: a case of Pakistan. *Energy for Sustainable Development, 15(4)*, 420-435.

Aronoff, S. (1989). Geographic information systems: a management perspective.

Michigan: WDL Publications.

Blackwell, R. D. (2001). *Consumer behavior*. Fort Worth: TX Dryden Press.

Bonnice, J. C. (1985). AN APPLICATION OF THE ENGEL, KOLLAT AND BLACKWELL MODEL TO CONSUMERS OF AUTOMOBILE INSURANCE [Abstract]. *The Journal of Insurance Issues and Practices*, (1). 23.

Ebster, C., & Stalzer, L. (2013). *Wissenschaftliches Arbeiten für Wirtschafts- und Sozialwissenschaftler*. Wien Facultas 2013.

Engel, J. F., Kollat, D. T. & Blackwell, R. D. (1968). *Consumer behavior* [Abstract]. New York: Holt, Rinehart and Winston.

Gassmann, O., Frankenberger, K. G., & Csik, M. (2014). *The business model navigator. 55 models that will revolutionise your business*. Harlow Pearson 2014.

Huang, C. & Hsueh, S. (2010). Customer behavior and decision making in the refurbishment industry - A data mining approach [Abstract]. *Journal Of Civil Engineering And Management*, *16*(1), 75-84. doi:10.3846/jcem.2010.07

Khan, M.A., & Ahmed, U. (2009). Energy demand in Pakistan: a disaggregate analysis. *MPRA Paper, No. 15056*. Munich: University Library of Munich.

Klein, G.A. (1999) *Sources of power: how people make decisions*. Cambridge: MIT-Press.

Koch, T. and Denike, K. (2009). Crediting his critics' concerns: Remaking John Snow's map of Broad Street cholera, 1854. Social Science & Medicine 69, 1246-1251.

Kotler, P. (2002). *Marketing Management, Millenium Edition.* Boston: Pearson Custom Publishing. Retrieved from http://www.perspectiva.md/ro/files/biblioteca/Kotler- Marketing%20Management%20Millenium%20Edition.pdf

Kwan, M.-P. (2012). How GIS can help address the uncertain geographic context problem in social science research. *Annals of GIS, 18(4),* 245-255. doi: 10.1080/19475683.2012.727867

Lancaster, G., & Massingham, L. (2010). *Essentials of marketing management. Electronical Data*. New York: Routledge.

Lindblom, C. E. (1959). The science of 'muddling through'. Public Administration Review, 19, 79–88.

Mann, L. (1989). "Becoming a better decision maker". *Australian Psychologist 24 (2)*, 141–155. doi:10.1080/00050068908259558

March, J. G., Guetzkow, H. & Simon, H. (1993). *Organizations* (2nd edition)*.* New York: John Wiley & Sons.

Marschalko, M., Bednarik, M. & Yilmaz, I. (2012). Evaluation of engineering-geological conditions for conurbation of Ostrava (Czech Republic) within GIS environment. *Environmental Earth Science, 67(4),* 1007-1044. doi: 10.1007/s12665-012-1547- 9

Mayring, P. (2010). *Qualitative Inhaltsanalyse. Elektronische Daten. Grundlagen und Techniken*. Weinheim: Beltz Verlagsgruppe.

Miles, J. & Gilbert, P. (Eds.) (2005). *A Handbook of Research Methods for Clinical and Health Psychology.* Oxford: Oxford University Press.

Moore, G. E. (1965). Cramming more components onto integrated circuits. *Electronics, 38(8),* 114-117. doi: 10.1109/N-SSC.2006.4785860

Naves, L. A., Port, L. B., Correa Rosa, J. W., Casulari, L. A. & Correa Rosa, J. W. (2015). Geographical information system (GIS) as a new tool to evaluate epidemiology based on spatial analysis and clinical outcomes in acromegaly. *Pituitary, 18,* 8-15. doi: 10.1007/s11102-013-0548-3

Nicosia, F. (1966) *Consumer Decision Processes*, Englewood Cliffs: Prentice Hall.

O'Brien, E. J. (2015). An Empirical Exploration of the Alternative Evaluation Stage of the EKB Model Relative to the Political Decision Making Process [Abstract]. *Proceedings Of The 1987 Academy Of Marketing Science (AMS) Annual Conference*, 19. doi:10.1007/978-3-319-17052-7\_5

Openshaw, K. (2014). Energy Values of Unprocessed Biomass, Charcoal and other  
 Biomass Fuels and their role in Greenhouse Gas Mitigation and Energy Use.  
 *Advances in Environmental Science and Energy Planning, 03,* 30-40. Retrieved  
 from:   
 http://www.wseas.us/elibrary/conferences/2015/Tenerife/ENVIR/ENVIR-  
 03.pdf

Qasim, M., & Kotani, K. (2014). An Empirical Analysis of Energy Shortage in Pakistan. *Asia-Pacific Development Journal*, *21*(1), 137-166.

Rauf, O., Wang, S., Yuan, P., & Tan, J. (2015). An overview of energy status and development in Pakistan. *Renewable & Sustainable Energy Reviews*, *48,* 892-931. doi:10.1016/j.rser.2015.04.012

Resch, B., Sagl, G., Törnros, T., Bachmaier, A., Eggers, J.-B., Herkel, S., Narmsara, S. & Gündra, H. (2014). GIS-Based Planning and Modeling for Renewable Energy: Challenges and Future Research Avenues. *ISPRS International Journal of Geo- Information, 3(2),* 662-692. doi: 10.3390/ijgi3020662

Robbins, S. P., & Judge, T. A. (2014). *Essentials of Organizational Behavior.* London:

Pearson Education 2014.

Sheikh, M. A. (2009). Renewable energy resource potential in Pakistan. *Renewable And Sustainable Energy Reviews*, *13,* 2696-2702. doi:10.1016/j.rser.2009.06.029

Siddiqui, R. (2004). Energy and economic growth in Pakistan. *Pakistan Development Review, 43(2),* 175-200.

Sipp, C. M. & Carayannis, E. G. (2013). *Real Options and Strategic Technology Venturing. A New Paradigm in Decision Making.* New York: Springer. doi:10.1007/978-1-4614- 5814-2

Solomon, M. R. (2015). *Consumer behavior. buying, having, and being*. Boston: Pearson.

Sorensen, B. & Meibom, P. (1999). GIS tools for renewable energy modelling. *Renewable Energy, 16(1-4),* 1262-1267. doi:10.1016/S0960-1481(98)00514-X

Verbruggen, A., & Lauber, V. (2009). Basic concepts for designing renewable electricity support aiming at a full-scale transition by 2050. *Energy Policy*, *37,* 5732-5743. doi:10.1016/j.enpol.2009.08.044

Voivontas, D., Assimacopoulos, D., Mourelatos, A. & Corominas, J. (1998). Evaluation of Renewable Energy potential using a GIS decision support system. *Renewable Energy, 13(3),* 333-344. doi:10.1016/S0960-1481(98)00006-8

Von Neumann, J., Morgenstern, O. (1944). *Theory of Games and Economic Behavior.* Princeton: Princeton University Press.

Woodworth, R. S. (1929). *Psychology.* New York: H. Holt & Co.

Xue, J., Zhao, Z., Dai, Y. & Wang, B. (Eds.) (2013). *Green Energy in China.* Springer International Publishing. doi: 10.1007/978-3-319-01153-0\_5

Yue, C.-D. & Wang, S.-S. (2004). GIS-based evaluation of multifarious local renewable energy sources: a case study of the Chigu area of southwestern Taiwan. *Energy Policy, 34,* 730-742. doi:10.1016/S0140-6701(06)82368-4

List of Internet Sources

AEDB. (2015). About AEDB. Retrieved from http://www.aedb.org/index.php/ae- technologies/biomass-waste-to-energy/53-about-aedb

Aftab, S. (2014). Pakistan's energy crisis: causes, consequences and possible remedies. Retrieved from http://www.peacebuilding.no/var/ezflow\_site/storage/original/application/ade 59fba5daf67a11a1c217434abf440.pdf

Amir, I. (2014). Most of Deputy Commissioners are Junior Officers. Retrieved from http://www.dawn.com/news/1078640

Bhutta, F. M. (2013). Renewable Energy Opportunities and Challenges in Pakistan. Retrieved from http://www.altenergymag.com/content.php?post\_type=2159

Bhutta, F. M. (2015). Renewable Energy and Energy Efficiency Expert. Retrieved from http://faizbhutta.wix.com/bhutta

Bloomberg. (2015). China Needs 50% Emissions Cut for “APEC Blue” Sky, Official Said.  
 Retrieved from http://www.bloomberg.com/news/articles/2015-02-13/china-  
 needs-50-emissions-cut-for-apec-blue-sky-official-says

Britannica. (2015). Khyber Pakhtunkhwa. Retrieved at September 14th 2015 from http://www.britannica.com/place/Khyber-Pakhtunkhwa

China Daily. (2015). APEC blue listed as one of the top 10 ecological accomplishments of  
 2014. Retrieved from http://africa.chinadaily.com.cn/china/2015-  
 01/28/content\_19432489.htm

ESMAP. (2015a). About ESMAP. Retrieved from https://www.esmap.org/overview

ESMAP. (2015b). Renewable Energy Resource Mapping Initiative. Retrieved from http://www.esmap.org/RE\_Mapping

Fauji Fertilizer Company Limited. (2014). *Forging AHEAD Annual Report for the year*

*ended December 31, 2014.* Retrieved from: http://www.ffc.com.pk/uploads/docs/ar\_2014.pdf

FFCEnergy. (2013). Company Profile. Retrieved from http://www.qasolar.com/about- 1/

Global Atlas. (2015c). Map Gallery Search. Retrieved from http://irena.masdar.ac.ae/

Global Atlas. (2015a). About The Global Atlas. Retrieved from http://globalatlas.irena.org/

Global Atlas. (2015b). Partnership. Retrieved from http://globalatlas.irena.org/Partnership.aspx

Huisman, O. & de By, R. A., (Eds.). (2009). *Principles of Geographic Information Systems.* Retrieved from http://www.itc.nl/library/papers\_2009/general/PrinciplesGIS.pdf

IISD. (2015). IRENA, Partners Launch New Version of Global Atlas for Renewable Energy. Retrieved from http://energy-l.iisd.org/news/irena-partners-launch- new-version-of-global-atlas-for-renewable-energy/

IEA. (2015a). Pakistan: Indicators in 2011. Retrieved from http://www.iea.org/statistics/statisticssearch/report/?country=PAKISTAN&pro duct=Indicators&year=2011

IEA. (2015b). Energy Production. Available for download from http://www.iea.org/statistics/statisticssearch/report/?year=2012&country=PA KISTAN&product=Indicators

IEA. (2015c). Pakistan: Renewables and Waste for 2012. Retrieved from http://www.iea.org/statistics/statisticssearch/report/?year=2012&country=PA  
 KISTAN&product=RenewablesandWaste

IEA. (2014). Share of total primary energy supply. Available for download from:  
 http://www.iea.org/stats/WebGraphs/CHINA4.pdf

IN.gov. (n.d.). GIS:What is GIS? Retrieved from http://www.in.gov/gis/gis101.htm

IRENA. (2015a). About IRENA.Retrieved from http://www.irena.org/Menu/index.aspx?PriMenuID=13&mnu=Pri

IRENA. (2015b). New IRENA App Delivers Global Renewable Energy Data Straight to Your Pocket [Press Release]. Retrieved from http://www.irena.org/News/Description.aspx?NType=A&mnu=cat&PriMenuID= 16&CatID=84&News\_ID=415

IRENA. (2015c). New IRENA App Turns Mobile Devices Into Renewable Energy Prospectors. Retrieved from http://irenanewsroom.org/2015/06/16/new-irena- app-turns-mobile-devices-into-renewable-energy-prospectors/

IRENA. (2015d). Global Atlas Training on Planning the Renewable Energy Transition  
 Using Solar and Wind Maps. Retrieved from  
 http://www.irena.org/menu/index.aspx?mnu=Subcat&PriMenuID=30&CatID=7 9&SubcatID=546

IRENA. (2012). Global Solar and Wind Atlas. Gathering the End-User Community. Retrieved from https://www.irena.org/DocumentDownloads/events/GlobalAtlasEnd- userworkshop/summary.pdf

Mulligan, C. (2014). ICT transforming all industries. Retrieved from http://www.ericsson.com/news/141105-ict-transforming-all- industries\_244099435\_c

OpenEI. (n.d.-a). About SWERA. Retrieved September 2, 2015, from http://en.openei.org/wiki/SWERA/About

OpenEI. (n.d.-b). About OpenEI. Retrieved September 2, 2015, from http://en.openei.org/wiki/OpenEI:About

OGC. (2015a). About OGC. Retrieved from http://www.opengeospatial.org/ogc

OGC. (2015b). OGC Vision, Mission & Goals. Retrieved from http://www.opengeospatial.org/ogc/vision

OGC. (2014). Global Renewable Energy Atlas implements OGC standards, invites proposals for mobile application. Retrieved from http://www.opengeospatial.org/blog/1997

Quaid e Azam Solar Power Limited. (n.d.-a). About QA Solar. Retrieved from http://www.qasolar.com/about-1/

Quaid e Azam Solar Power Limited. (n.d.-b). OUR VISION. Retrieved from http://www.qasolar.com/our-company/our-vision/

REEEP. (2015). About REEEP. Retrieved from http://www.reeep.org/about-reeep

reegle. (n.d.). Clean Energy Info Portal. Retrieved from http://www.reegle.info/

REN21. (2015). About us. Retrieved from http://www.ren21.net/about-ren21/about- us/

RETScreen International. (2008). ACCURACY OF PROJECT COST ESTIMATES. Retrieved from http://www.retscreen.net/ang/accuracy\_of\_project\_cost\_estimates\_image.php

SolarGIS. (2015). Purchase. Retrieved from https://solargis.info/purchase/#tl=satellite

Stvilia, B., Twidale, M., Gasser, L. & Smith L. C. (2005). Information quality discussions in Wikipedia. University of Illinois at Urbana Campaign. Retrieved from http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.84.3912&rep=rep1& type=pdf

Thibodeau, A. (2014). Coming by 2023, an exascale supercomputer in the U.S. Retrieved from http://www.computerworld.com/article/2849250/coming-by-2023-an- exascale-supercomputer-in-the-us.html

UNEP. (2013). Insights from Interviews, a Survey, and a Workshop with Potential End- Users of the Global Atlas for Solar and Wind Energy. Available from http://globalatlas.irena.org/UserFiles/Publication/IRENA\_UNEP\_Insights\_Global \_Atlas.pdf

WorldBank. (2015c). Renewable Energy Resource Mapping in Pakistan. Retrieved from http://www.esmap.org/re\_mapping\_pakistan

WorldBank. (2015b). Access to Electricity (% of Population). Retrieved from http://data.worldbank.org/indicator/EG.ELC.ACCS.ZS

WorldBank. (2015a). Renewable Energy Resource Mapping: A Crucial Prerequisite for Investments in Renewable Electricity Generation. Available as Fact Sheet from http://www.esmap.org/RE\_Mapping

WorldBank. (2013). Mapping the Renewable Energy Revolution. Retrieved from http://www.worldbank.org/en/news/feature/2013/06/17/mapping-the- energy-revolution

# Attachments

## List of Interview Partner

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Organization | Position | Date | Place |
| Abdumalik Oricha Ali | Global Atlas for Renewable Energy | Associate Program Officer | July 7, 2015 | Abu Dhabi |
| Pierre Kenol | Energy Specialist | Inter-American Development Bank | August 6, 2015 | Port-au-Prince, Haiti |
| Ayman Fayek | NREA Egypt | General Manager of Engineering, Environment & Economic Studies | August 7, 2015 | Cairo, Egypt |
| Aminu Haruna Isa | Energy Commission of Nigeria | Energy Analyst | August 12, 2015 | Abuja, Nigeria |
| Nafees Ahmad Khan | AEDB | Project Coordinator | September 7, 2015 | Islamabad, Pakistan |
| Aqeel Jafri | AEDB | Director Policy | September 4, 2015 | Islamabad, Pakistan |
| Aimal Pir | Energy & Power Department Khyber Pakhtunkhwa | Managing Director of Wind Energy | September 16, 2015 | Peshawar, Pakistan |
| Muhammad Ozair | Planning & Development Department Khyber Pakhtunkhwa | Section Officer Training | September 16, 2015 | Peshawar, Pakistan |
| Jehanzeb Jamshed | Quaid e Azam Solar Power Limited | Assistant Manager | September 22, 2015 | Bahawalpur, Pakistan |
| Syed Imran Shah | FFC Energy Limited | Manager Engineering (Project) | September 29, 2015 | Thatta, Pakistan |

## List of E-mail Partner

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Organization | Position | Date | Place |
| Abdumalik Oricha Ali | Global Atlas for Renewable Energy | Associate Program Officer | August 26, 2015 | Abu Dhabi |

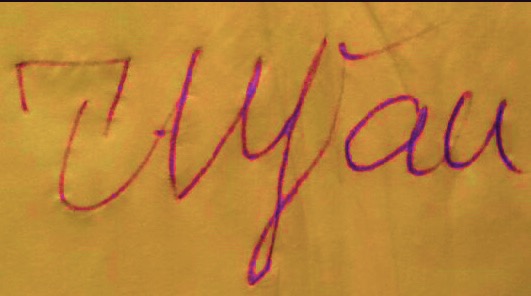
# Declaration of Authorship

I hereby declare

* that I have written this work on my own without other people’s help (copy-editing,

translation, etc.) and without the use of any aids other than those indicated;

* that I have mentioned all the sources used and quoted them correctly in accord-ance with academic quotation rules;
* that the topic or parts of it are not already the object of any work or examination of another course unless this has been explicitly agreed on with the faculty member in advance;
* that my work may be scanned in and electronically checked for plagiarism.



Jan Grau

1. In 2014, I was studying in Beijing, China as a part of the exchange program of the University of St. Gallen in completion of my bachelor’s degree. [↑](#footnote-ref-1)
2. Data for the other countries can be found under: http://www.esmap.org/RE\_Mapping [↑](#footnote-ref-2)
3. The training can be found under http://www.irena.org/menu/index.aspx?mnu=Subcat&PriMenuID=30&CatID=79&SubcatID=546 [↑](#footnote-ref-3)
4. The interview guideline can be found in the attachment. [↑](#footnote-ref-4)
5. The individual criteria were evaluated with A. O. Ali (e-mail, August 28th, 2015). [↑](#footnote-ref-5)
6. The grades are comparable to grades in the army (Amir, 2014). [↑](#footnote-ref-6)