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STAKEHOLDERS ANALYSIS IN THE ENVIRONMENTAL AND MARITIME FIELDS IN CAMBODIA DOCKSIDE REPORT, 2018



ENVIRONMENTAL MARITIME WORKSHOP, ROYAL UNIVERSITY OF AGRICULTURE, PHNOM PENH, CAMBODIA,
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DOCTORAL program in Khmer universities Strengthening the International Development of Environmental and maritime research (DOCKSIDE)



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of the European Union**

DOCKSIDE is a structural project co-funded by the Erasmus+ KA2 cooperation for innovation and the exchange of good practices – Capacity Building in the field of Higher Education. The project aims to improve the quality of higher education and the research capacity of Cambodian universities. This report was written by an international team of European and Cambodian researchers.

For further information check the website of the DOCKSIDE project www.dockside-kh.eu

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Abbreviations

Full name	Abbreviation
Agriculture Technology Services Association	ATSA
Angkor Centre for Conservation of Biodiversity	ACCB
Asian Development Bank	ADB
BirdLife International	BLI
Cambodian Agricultural Research and Development Institute	CARDI
Cambodian Center for Study and Development in Agriculture	CEDAC
Cambodian League for the Promotion and Defense of Human Rights	LICADHO
Caritas Cambodia	CC
Cambodian Scientific Committee for Research and Doctoral Program	CSCRDP
Center for Sustainable Water	CSW
Communities of Fisheries	CF
Conservation International	CI
Council for Agricultural and Rural Development	CARD
Council of Ministers of Cambodia	CMC
DOctoral program in Khmer universities Strengthening the International Development of Environmental and maritime research	DOCKSIDE
DSM – Bright Science. Brighter Living.	DSM
The Education, Audiovisual and Culture Executive Agency	EACEA
Eastern Maritime (Cambodia)	EM-Cam
Eco Agricultural Center	EAC
Engineers Without Borders	EWB
Enrich Institute	EI
Environmental Maritime Research	EMR
Equitable Cambodia	EC
European Chamber of Commerce	EuroCham
European Union Delegation	EUD

Fauna and Flora International	FFI
Gender and Development for Cambodia	GADC
Gesellschaft für Internationale Zusammenarbeit GmbH	GIZ
Global Green Growth Institute	GGGI
Gouvernance et Emergence de la Recherche en Sciences Humaines au Cambodge	GEReSH-CAM
Green Country Development Co. Ltd	GCD
Heinrich Boell Foundation	HBF
The World bank, Higher Education Quality and Capacity Improvement Project	HEQCIP
Impact Hub	IH
Institut de Recherche pour le Developpement	IRD
Institute of Technology of Cambodia	ITC
International Association of Ports and Harbors	IPAH
International Fund for Agricultural Development	IFAD
International Institute of Rural Reconstruction	IIRR
International Union for Conservation of Nature	IUCN
Japan International Cooperation Agency	JICA
Konrad-Adenauer-Stiftung	KAS
Mekong River Commission	MRC
Metfone	MF
Ministry of Agriculture, Forestry and Fisheries	MAFF
Ministry of Commerce	MoC
Ministry of Economy and Finance	MoEF
Ministry of Education Youth and Sport	MoEYS
Ministry of Environment	MoE
Ministry of Health	MoH
Ministry of Interior	Mol
Ministry of Land Management, Urban Planning, and Construction	MoLMUPC
Ministry of Mines and Energy	MoME
Ministry of National Defense	MoND
Ministry of Public Works and Transport	MPWT

Ministry of Planning	MoP
Ministry of Water Resources and Meteorology	MoWRM
Ministry of Women's Affairs	MoWA
Mother Nature	MN
National Council For Sustainable Development	NCSD
National University of Management	NUM
Oxfam Committee for Famine Relief	Oxfam
Principal Component Analysis	PCA
Prek Leap National College of Agriculture	PNCA
Pannasastra University of Cambodia	PUC
Phnom Penh Autonomous Port	PPAP
Rosewood	RW
Royal University of Agriculture	RUA
Royal University of Fine Arts	RUFA
Royal University of Law and Economics	RULE
Royal University of Phnom Penh	RUPP
Rural Economic and Agriculture Development Agency	READA
Sea Protection Project	SPP
Sihanoukville Autonomous Port	SAP
Smart Development Works	SNV
Smart Mobile Operator	SMART
Social Network Analysis	SNA
Society for Community Development in Cambodia	SOFDEC
Southeast Asian Fisheries Development Center	SEAFDEC
Sustainable Green Fuel Enterprise	SGFE
Tancons (Cambodia) Co. Ltd	TAN
Teuk Saart 1001	TS
Transparency International	TI
United Nations	UN

United States Agency for International Development	USAID
University of Battambang	UBB
Voluntary Service Overseas	VSO
Water Aid	WA
Welthungerhilfe	WHH
World Bank Group	WBG
World Conservation Society	WCS
World Fish Center	WFC
World Vision	WV
World Wildlife Fund	WWF
Young Eco Ambassador	YEA

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Executive Summary

Stakeholder analysis has increased in popularity, with a wide range of organizations opting to analyze participants in many different fields. It is used by policy makers, regulators, governmental and non-governmental organizations, businesses and the media to identify key partners, target groups, and address issues of common interest. It aims to facilitate institutional and organizational reform processes, based on the information of stakeholders' interest. Policy makers can decide how to cooperate with stakeholders, thus ensuring that their adopted strategies are realistic and sustainable. The opinions of the most powerful stakeholders can shape a project at an early stage. Thus, stakeholder analysis could be a useful tool for gaining understanding and building consensus, communicating the benefits of the DOCKSIDE project, and building strong and inclusive campaigns which involve the public.

Key objectives of the DOCKSIDE project include the creation of an Environmental Maritime Research Network, the improvement of the quality and attractiveness of PhD programs in Cambodian universities, the development of multidisciplinary research, and the support for the plans of the Ministry of Education Youth and Sport to develop Doctoral Schools. For this purpose, it is necessary to contact key public, private, international and non-governmental organizations based in Cambodia. The main objectives of this report are to analyze the opinions of major organizations involved in environmental and maritime fields, to identify stakeholders with similar views, to determine the most important stakeholders in the network, and to discover how to make their cooperation more efficient. Two complementary methods have been applied. The first one is Q-methodology. This approach allows us to divide the stakeholders and students into different groups based on their opinions about a set of 28 statements. The second method is the Social Network Analysis (SNA). Different centrality measures are estimated in order to define who the most important stakeholders are, and how the organizations involved in maritime and environmental fields are linked.

We conducted two Q-methodology analyses. The first one refers to data collected from 65 students, while the second one refers to data collected from 49 stakeholders' representatives

involved in maritime or environmental fields. We analyzed the data by using Factor Analysis. Among the students, three groups were identified. The first one was named “Social-Democrat Environmentalists”. The students in this group were concerned about the quality of food, government regulations regarding the use of chemicals or agricultural land, the use of plastic, and improvement of labor efficiency through new technologies. The second group was more oriented toward maximizing outputs and for this reason was called “Responsible Productivists”. The main priorities were issues related to the transportation of goods, public transportation, improving food quality, and increasing farmers’ productivity through new technologies. Most people defined as “Responsible Productivists” consider nuclear energy to be an environmentally friendly alternative for Cambodia. The last group was defined by its “Pro-business” views related to government regulations on agricultural land and the automation of farm labor. Students in this group disagree with the ban on chemicals in agriculture, and think that renewable energy is impossible to develop in Cambodia.

We also conducted a Q-methodology study of the data collected from 49 different stakeholders. Four groups were identified. The first group was called “Social Environmentalists” and this group was defined by stakeholders who prioritize the environment over economic growth, have favorable views on government regulations, object to the development of nuclear energy in Cambodia, and support improving the quality of food. It is interesting to note that there were no NGOs associated with this group.

The second group of stakeholders was named “Ecologists”. Representatives of this group strongly agree that dams have a negative impact on fisheries, and that public transportation should be further developed. They also emphasize the need for a reduction in plastic bags, the development of aquaculture, and a more sustainable livestock production system. Moreover, the stakeholders’ representatives from this group believe that more progress must be made in the protection of natural parks in Cambodia, that nuclear energy is not the best option for the country, and that investments in renewable energies are necessary. This group was made up of various types of organizations.

The third group was called “Community Ecologists” because they strongly agree with the statement: “Community Fisheries successfully manage to ensure long term sustainability of the fish stock.” This group believes that the empowerment of community fisheries is an important element in ensuring the long term sustainability of the fish stock, which is a crucial issue for Cambodia. People identified as “Community Ecologists” believe that there is international pressure on the government to implement some environmental policies, that working conditions for fishermen have not improved, and that the government does not efficiently protect the natural parks in Cambodia. Most of the organizations associated with this group are from the public sector.

The fourth group of stakeholders was defined as “Productivists” due to their strong support for the exploitation of offshore petroleum resources, the development of public transportation, the introduction of new technologies and increased productivity of farmers, and the development of renewable energy. It is interesting to highlight that three departments of MoE are associated with this group.

However, it should be emphasized that there are personal and subjective elements that go into the ranking of the 28 statements, thus the results should be interpreted with caution. In addition, during the interviews, many stakeholders’ representatives revealed important qualitative information regarding their contact with academic institutions. Most of the organizations displayed high levels of interest in DOCKSIDE activities, within the framework of the DOCKSIDE project, however they pointed out that the level of higher education in Cambodia is not sufficient to develop high quality research. It is also a challenge for many stakeholders to find qualified and committed workers and interns. There are possible external factors such as family responsibilities, the mindset of Cambodian students, and the lack of confidence among stakeholders in the skills of young Cambodian scholars. These aspects are beyond the reach of the DOCKSIDE project, but should be taken into account for the implementation of future activities.

We also analyzed the network of the stakeholders. In the survey, we placed an open question regarding the organizations that each respondent would like to work with on projects related to environmental and maritime fields. Equal weight was given to each link, and we built a directed positive network with 84 nodes (stakeholders). The network is not very dense, which is normal since each respondent had to select 3-5 organizations. We estimated basic centralities measures such as degree, betweenness, closeness and modularity. Results of the Social Network Analysis (SNA) show that organizations in the public sector such as MoE, MAFF, MoI and RUA have the highest degree and betweenness centralities. These organizations tend to be selected as potential partners by the majority of the survey's respondents. International organizations such as the European Delegation (EUD), UN and GIZ have very high degree betweenness centralities as well. These organizations are important bridging organizations which could have a crucial role in the dissemination of information between different groups of stakeholders. International organizations have the highest closeness centrality which indicates that they should be used for efficient disseminations of information to different groups of stakeholders. Private companies and NGOs have lower degree centralities, however it should be noted that this could be explained by the fact that there is a large number of NGOs and private companies in Cambodia, and not as many international and public institutions.

The results of this study can help to more efficiently implement the activities related to DOCKSIDE. By identifying potential working groups with Q-methodology, and by identifying some communities using modularity centrality, we can facilitate the formation of future events such as workshops and Summer Schools. The outcomes can help to inform the organizations that are willing to implement projects in environmental and maritime fields. It is now clear who the most influential organizations are, and which organizations share similar views.

About DOCKSIDE Project

DOctoral program in **Kh**mer universities **Strengthening the International Development of Environmental and maritime research (DOCKSIDE)** is a structural project co-funded by the Erasmus+ Programme KA2 Cooperation for innovation and exchange of good practices – Capacity Building in the field of Higher Education¹. The project officially began in October 2016. The kick-off meeting took place on 7–8 December, 2016 at the University of Nantes.



Kick off meeting of DOCKSIDE Project, University of Nantes, Nantes, France, 7-8 December 2016

DOCKSIDE project aims to improve the research collaboration in Maritime and Environmental fields between some of the leading public universities in Cambodia: National University of Management (NUM), Royal University of Law and Economics (RULE), University of Battambang (UBB), and Royal University of Agriculture (RUA). Important institutional support is provided by the Ministry of Education Youth and Sport. University of Nantes (France), University of Vigo

¹ Erasmus+- Capacity Building in the field of Higher Education, accessed on 20 November 2017, https://eacea.ec.europa.eu/erasmus-plus/actions/key-action-2-cooperation-for-innovation-and-exchange-good-practices/capacity-building-projects-in-field-higher-education_en

(Spain), and Southern Denmark University (Denmark) support the Cambodian partners by organizing trainings and exchanging good practices in order to strengthen the research capacity and quality of doctoral programs in the Kingdom.

The objectives of DOCKSIDE project are as follows:

- **Create a scientific cooperation between researchers and PhD students.**

In order to improve the cooperation between researchers and PhD students, an EU supported Environmental Maritime Research (EMR) Network will be created. Moreover an open data EMR platform will be launched to facilitate the collaboration and exchange of information between Cambodian and European scholars.

- **Improve the quality and attractiveness of PhD programs in Cambodian universities.**

In Cambodian universities, few teachers or researchers have PhD diplomas. DOCKSIDE addresses this issue by providing access for Cambodian researchers to work with EU counterparts and to improve their skills. The project also aims to increase the quality and relevance of existing PhD and Master Programs. Many experts from European universities will assist Cambodian staff in their teaching practices and e-learning courses. The increased quality will hopefully convince graduates to pursue their studies in PhD programs. Many training sessions and workshops will be scheduled in order to achieve this objective.

- **Develop multidisciplinary research.**

Environment and maritime research requires a multidisciplinary and transversal approach. We believe that by connecting researchers and PhD students from different backgrounds, and having them work together, it will increase the quality of research in the country. The collaboration on joint projects will enable Cambodian universities to work more cooperatively and learn from each other.

- **Strengthen the collaboration between Cambodian and European universities, as well as Cambodian universities themselves.**

In today's globalized world, every university needs to increase their links to international HEIs. The aim of the project is to improve Cambodian research capacity within joint

research projects with EU partners regarding environmental and maritime issues. Cambodian researchers do not publish often enough in international peer-reviewed journals. Moreover, Cambodian universities do not cooperate often enough on research projects. With the institutional support of MoEYS, a set of recommendations and policies could be adopted.

- **Internationalize Cambodian and European universities.**

International mobilities and the activities within the scope of the project are good for the international images of all partners. The project allows universities to further extend their cooperation, once the project has finished, through the creation of joint curricula and PhD/Master programs.

- **Support the reform of the Ministry of Education to create Doctoral Schools.**

The project is in line with the Cambodian Ministry of Education Youth and Sport (MoEYS) policy to improve the quality and relevance of higher education. MoEYS is considering the reform of higher education by creating Doctoral Schools in different subjects, monitoring the quality of doctoral programs, and setting up a Cambodian Scientific Committee for Research and Doctoral Program (CSCRDP). For this purpose, the Prakas² No. 246 on the Creation of Cambodian Scientific Committee for Research and Doctoral Programs was signed in February 2017 by H.E. Dr. Hang Chuon Naron, Minister of Education Youth and Sport.

² “Prakas” refers to a proclamation related to ministerial or inter-ministerial decision signed by the relevant Minister(s).



H.E Hang Chuon Naron, Mr. Nikola Kutin, Ms. Clara Feldmann and Dr. Sam Or Angkearoat, Meeting at Ministry of Education, Youth and Sport, Phnom Penh, Cambodia, 10 August 2017

Raising awareness for the current environmental and maritime issues in Cambodia is among the priorities of the project. For this purpose, a national network on Environmental and Maritime Research (EMR) was created. In the last six months, DOCKSIDE researchers have met representatives from many organizations involved in the maritime and environmental fields. Some of these stakeholders took part in the Environmental Maritime Research (EMR) Workshop on October 18-20, 2017 at RUA³. For each of the three days there was an average of 134 participants. There were 40 stakeholders' representatives such as: the Ministry of Agriculture Forestry and Fisheries (MAFF), GIZ Cambodia, Institut de Recherche pour le Développement (IRD), Institut of Technology of Cambodia, Prek Leap National College of Agriculture (PNCA), Ministry of Water Resource and Meteorology (MOWRAM), Phnom Penh Water Supply Authority (PPWSA), Ministry of Environment (MoE), Open Development Cambodia, Ministry of Planning, Fisheries Action Coalition Team (FACT), The Learning Institute,

³ Environmental Maritime Research (EMR) Workshop, DOCKSIDE project, accessed on 20 November, 2017, <http://www.dockside-kh.eu/category/emr-workshop/>

Sihanoukville Autonomous Port (PAS), Phnom Penh Autonomous Port (PPAP), The NGO Forum on Cambodia, World Fish Center, and others. These stakeholders are crucial to sustaining the network and improving the cooperation between academic and non-academic organizations in Cambodia.



Environmental Maritime Workshop, Royal University of Agriculture, Phnom Penh, Cambodia, 18-20 October 2017

Moreover, an open data platform was created on the DOCKSIDE project's official website. (<http://www.dockside-kh.eu/emr-platform-dockside/>). It gives young researchers, students, scholars, and professionals from Europe and Cambodia the possibility to upload papers or data in any format. This will eventually encourage the creation of links, and the exchange of ideas and information between the academic community, private-sector firms, associations, and government policy makers, hopefully leading to a better understanding of the nature of EMR.

European PhD students, experts and professors will support Cambodian counterparts in improving the quality of education, efficiency of administration, and research capacity. A

number of training sessions, international mobilities and workshops will take place during the lifespan of the project.

So far two training sessions have been organized. The first one was on “European Project Management in the field of Higher Education”. It took place at the Royal University of Fine Arts on April 7, 2017.



Mr. Nikola Kutin, Training Session, Royal University of Fine Arts, Phnom Penh, Cambodia, 7 April 2017

This training session was conducted in collaboration with representatives from another Erasmus+ Key Action 2 structural project, GERESH-CAM⁴. A second training session on “Active Learning and Inverted Classroom Methods” was organized at RULE on October 17, 2017 with facilitator Prof. Murat Yildizoglu from University of Bordeaux.

⁴ Gouvernance et Emergence de la Recherche en Sciences Humaines au Cambodge, Official Website, accessed on 20 November 2017, <https://www.geresh-cam.eu/-en->



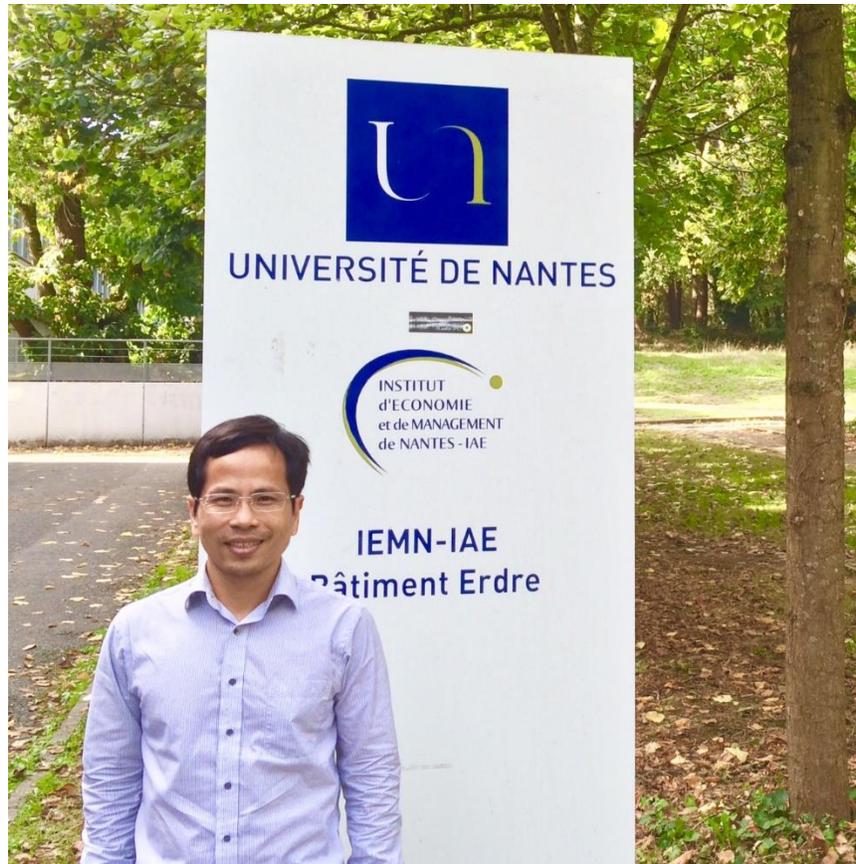
Prof. Murat Yildizoglu, Training Session, Royal University of Law and Economics, Phnom Penh, Cambodia, 17 October 2017

Another important meeting took place on October 17, 2017 at the Ministry of Education Youth and Sport. Representatives from the European partners presented on their PhD programs, and how PhD programs are organized at their respective universities. Prakas No. 246 on the Creation of Cambodian Scientific Committee for Research and Doctoral Programs was also presented. Following a request from HE Dr. Hang Chuon Naron, Minister of Education Youth and Sport, a team of DOCKSIDE researchers proposed a draft of Terms of Reference of Research Director. In the coming months, MoEYS will organize a technical workshop in order to approve and modify this proposal.

Mr. Sopheak SRUN, PhD candidate from RULE, Mr. Chanthol HAY, lecturer in Economics from UBB, and Mr. Sovann NOU, PhD candidate from NUM, traveled to Nantes to improve their research skills.



International Mobility of Mr. SRUN Sopheak, University of Nantes



International Mobility of Mr. HAY Chanthol, University of Nantes



International Mobility of Mr. NOU Sovann, Nantes

Moreover, a team of nine researchers from Cambodia visited all European partner universities in September 2017. During this trip they observed how research and doctoral programs are being organized in the EU, and how best-practices relate to distance learning and innovative teaching.

Empowering faculty members, civil servants, and teachers to develop original research and various teaching methodologies, as well as e-learning and distance education methods, are key elements of the DOCKSIDE project. These activities allow European universities to expand their network and to discover peculiarities of Cambodia. EU partners will meet with MoEYS to discuss policy applications and strategies, in order to support Cambodian universities in the improvement of quality and relevance of PhD and Master programs. The project also addresses the low level of involvement of Cambodian academics in research by increasing collaboration between HEIs and by improving their capability to submit project proposals and to look for alternative sources of funding.



DOCKSIDE Project Management Board Meeting, Royal University of Agriculture, Phnom Penh, Cambodia, 20 October 2017

I. Introduction

Stakeholder analysis has increased in popularity, with a wide range of organizations opting to analyze participants in many different fields, and it is used by policy-makers, regulators, governmental and non-governmental organizations, businesses, and the media to identify key partners, target groups and issues of common interest. Approaches to stakeholder analysis have changed as tools have been adapted from business management for use in policy, development and natural resource management.

Freeman (1984) defined a stakeholder as “any group or individual who is affected by or can affect the achievement of an organization’s objectives”. Eden and Ackermann (1998) considered stakeholders to be “People or small groups with the power to respond to, negotiate with, and change the strategic future of the organization”. Frederick (1998) emphasized the importance of studying the environment of a corporation by analyzing its community, consisting of “collections of political, governmental, societal, ethnic, tribal, religious and cultural institutions, each with a history, a loyal following and a stakeholder status justifying claims to considered treatment by corporate decision makers”. Stakeholders’ analysis could focus on the organizations which have power to influence and/or those which could have the power to impact the organization.

One of the prime objectives of DOCKSIDE is to establish a close cooperation between academic and non-academic communities in environmental and maritime fields in Cambodia, and to develop a strong professional network among Cambodian and EU experts. For this purpose, an Environmental and Maritime Research (EMR) Network was created. The network aims to facilitate more efficient cooperation between academic and non-academic institutions, and to provide potential interesting research topics and data, as well as an exchange of knowledge.

An important initial step in setting up the EMR Network is to conduct a Stakeholders’ Analysis. The concept of stakeholder existed long before management writers took up the cause and adapted the word and concept for organizational purposes. The aims of the study are to compare opinions of students and stakeholders’ representatives, and to detect which

environmental and maritime topics are the most relevant for Cambodia. The research can also detect different groups of views held by students and by stakeholders. In addition, we can observe the network of the identified organizations, and apply Social Network Analysis (SNA) to determine the most influential organizations.

Stakeholder Analysis aims to facilitate institutional and organizational reform processes. Based on information regarding stakeholders' interests, reform advocates can decide how to best provide support in order to ensure that adopted strategies are realistic and sustainable. Stakeholder analysis is capable of identifying the key organizations which must be engaged. The opinions of the most powerful stakeholders can shape a project at an early stage. Others have ideas which can support the project or improve its quality.

Following an extensive literature review and meetings with stakeholders, two methods were decided upon. The first is Q-methodology, which aims to analyze, in a structured way and in a statistically interpretable form, the subjectivity of individuals related to a number of statements. This approach allows us to divide stakeholders and students into different groups based on their opinions about a set of 28 statements. The second method is Social Network Analysis (SNA). It is the process of investigating social structures through the use of networks and graph theory (Otte and Rousseau, 2002). The different centrality measures are estimated in order to define who the most important stakeholders are, and how efficiently the organizations involved in maritime and environmental fields cooperate.

Within the DOCKSIDE project, a research team of European and Cambodian researchers were in charge of the methodology, data collection and data analysis. The team leader was Mr. Nikola Kutin, International Coordinator of DOCKSIDE project at NUM. The study began in April 2017 with the arrival of two interns from the University of Nantes, Mr. Alexis Louis Sidney and Mr. Felix Hinckel, and the hiring of two researchers by NUM, Mr. Bunthoeurn Sen and Ms. Sotheavy RIN.



Mr. Nikola Kutin, Mr. Alexis Louis Sidney, Mr. Felix Hinckel, Mr. Bunthoeurn Sen and Ms. Sotheavy RIN, Research Center, National University of Management, Phnom Penh, Cambodia, April 2017

A framework was established and data was collected from 65 Master and PhD students enrolled at NUM, UBB, RULE and RUA. In July 2017 Ms. Clara Feldmann and Mr. Marco Corapi from SDU came to Cambodia as interns. They worked with Cambodian researchers, and their duties included data collection from stakeholders, writing minutes of meetings, and presenting the project to different organizations. The DOCKSIDE project was presented to more than 50 stakeholders in the environmental and maritime fields in Cambodia. During the implementation of the activities related to data collection, three additional Cambodian researchers supported the activities: Mr. Sovann Nou, PhD candidate from NUM, Mrs. Sokunthy Ly, Researcher from NUM, and Ms. Sreykeo Sun, Researcher from NUM. Two interns from University of VIGO, Ms. Iria Garcia Lorenzo and Irene Dozo, contributed to the revision of the report. Finally, Professor Thomas Vallée, Coordinator of DOCKSIDE project, revised the report and took part in the data analysis.



Mr. Nikola Kutin, Ms. Iria Garcia Lorenzo, Irene Dozo, Ms Sotheavy RIN, Mrs. Sokunthy LY and Mrs. Phearoun POK, Research Center, National University of Management, Phnom Penh, Cambodia, November 2017

The preliminary results of the study were presented at the Environmental Maritime Research (EMR) Workshop⁵ which took place on October 18-20, 2017 at the Royal University of Agriculture, Phnom Penh, Cambodia. For each of the three days, an of 134 participants attended. Forty representatives of key stakeholders in maritime and environmental fields, who had already met the DOCKSIDE researchers, took part in the event. Such stakeholders included the Ministry of Agriculture Forestry and Fisheries (MAFF), GIZ Cambodia, Institut de Recherche pour le Développement (IRD), Institute of Technology of Cambodia, Prek Leap National College of Agriculture (PNCA), Ministry of Water Resource and Meteorology (MOWRAM), Phnom Penh Water Supply Authority (PPWSA), Ministry of Environment (MoE), Open Development Cambodia, Ministry of Planning, Fisheries Action Coalition Team (FACT), The Learning Institute,

⁵ Environmental Maritime Research (EMR) Workshop, DOCKSIDE project, accessed on 20 November, 2017, <http://www.dockside-kh.eu/category/emr-workshop/>

Sihanoukville Autonomous Port (PAS), Phnom Penh Autonomous Port (PPAP), The NGO Forum on Cambodia, World Fish Center and others.

This study is an example of beneficial cooperation between Cambodian and European researchers. Time was limited during the collection of data from more than 50 stakeholders. European and Cambodian researchers showed a great deal of commitment to the implementation of activities related to the DOCKSIDE project.

The report is divided into three parts. The first shows a stakeholders' analysis based on the Q-methodology approach, while the second depicts a study of the Social Network Analysis. Both parts have sub-sections related to the literature review, methodology and results. Lastly, some recommendations regarding the cooperation between the stakeholders, and a summary of the outcomes of the two approaches, are presented.



Catalogue Course Visit, University of Vigo, Spain, September 2017

II. Q-methodology

Q-methodology is used to analyze individual opinions as feelings by requiring respondents to rank a number of items (statements) from the same domain of subjective interest, instead of simply replying to a single question (Brouwer, 1999). Unlike other quantitative methods, Q-methodology also qualitatively analyzes stakeholders, and attempts to reveal their point of view on a given topic (Barry and Proops, 1999). We have decided to conduct two analyses using Q-methodology. The first relates to a sample of 65 students (Master and PhD level) from Cambodian DOCKSIDE partners, and the second investigates the opinions of 49 representatives of stakeholders involved in environmental and maritime fields.

In 2015, a stakeholder analysis was conducted by Kutin et al. (2015) within the framework of HEQCIP⁶, a creation of a research center at the National University of Management specialized in Maritime & Inland Waterways' socioeconomic activities. Two complementary methods were applied. The first one was more qualitative and based on the use of the Mendelow Power Versus Interest Grid. It aimed to identify the capacity (power) of each stakeholder to influence the Observatory's activities, as well as the stakeholder interest in future research outcomes. According to the answers to a set of questions, two indicators were calculated. The first depicted the power of the stakeholder (or its influence), and the second depicted its interest. The second method was more quantitative and based on the Social Network Analysis (SNA). It highlighted relations between stakeholders in selected economic sectors. The current study was largely inspired by the study of Kutin et al. (2015).

The following section of the report is divided into four parts. First, the literature review related to Q-methodology is provided. Second, a detailed explanation of the method and software used, as well as the design of the survey, is depicted. The third and fourth sections present the students and stakeholders' representatives results, respectively. Finally, a discussion regarding major outcomes, and a comparison between the opinions of the two different samples, is presented.

⁶ The World Bank, Higher Education Quality and Capacity Improvement Project, accessed on 20 November 2017, <http://projects.worldbank.org/P106605/higher-education-quality-capacity-improvement-project?lang=en>

1. Review of literature about the Q-methodology

Q-Methodology originated with British-American psychologist and physicist William Stephenson, and is often used for studying opinions or perceptions of a phenomenon (Stephenson (1953); Brouwer (1999)). It combines qualitative research characteristics by identifying and exploring a number of “viewpoints” from people concerning a specific theme (Stephenson (1953); Brown (1996); McKeown and Thomas (2013)). It evolved from factor analytic theory (Brown, 1996). Q-methodology is used in a wide range of fields such as political science, geography, and health economics, and is increasingly being used in stakeholder analyses in the fields of sustainable development (Curry et al., 2013); (Davies and Hodge, 2007)), management of natural resources (Guimaraes, 2010); (Ramseur and Hagerty, 2013), agriculture (Davies and Hodge, 2007), forestry (Bélanger, 2009); (Steelman, 1999), sustainable development of a coastal zone (Guimarães et al., 2012), road infrastructure (Kornev et al., 2016), and others.

Q-methodology is employed to analyze individual opinions or event feelings by requiring respondents to rank a number of items (statements) from the same domain of subjective interest instead of simply replying to a single question (Brouwer, 1999). Unlike other quantitative methods, Q-methodology also qualitatively analyzes stakeholders and attempts to reveal their subjective point of view on a given topic (Barry and Proops, 1999).

Barry and Proops (1999) demonstrated that this method could serve as a decision-making tool for the selection and implementation of environmental policies by identifying and defining precisely how individuals think about environmental issues. It makes it possible to examine the most relevant policy options while eliminating others, and to facilitate policy selection, implementation and evaluation. A set of statements is presented to stakeholders and they must order them from the statement they most agree with to the statement they most disagree with. These sorts are then compared via factor analysis which links stakeholders together according to common points of view. This is a powerful tool to distinguish different groups among the stakeholders based on their opinions on a set of statements. Since the stakeholders, the different members of the system, are quite homogeneous it can easily detect different groups of opinion.

Many different tools can be used for stakeholder analysis. However, while the array of methods can be numerous, some tools are quite common. Reed et al. (2009) made a review of the commonly used methods for stakeholder analysis. Besides citing existing literature, they also recapped broadly used tools that could be helpful, such as the Snowball sampling method to create a network. The snowball sampling starts with the first respondent who is asked to cite his/her partners or organizations/people that they would like to work with. Then researchers contact those people/organizations mentioned by the previous respondent and so on.

2. Q-methodology approach and the survey

Q-methodology analysis can be a useful tool for gaining understanding and building consensus, communicating the benefits of the DOCKSIDE project, and building strong and inclusive campaigns that involve the public.

2.1. Q-methodology survey

Before presenting the methodology used to discover the points of view (Q-method), the definitions of some major terms related to the method are provided in Table 1.

Table 1. *Technical terms related to Q-methodology*

Statement	Statement that the interviewee must rank according to his/her subjective opinion.
Q-sort scaling	Rank order scaling technique wherein the respondents are asked to sort the presented statements into a pyramidal grid where the extreme left and right columns refer to “Strongly agree” and “Strongly disagree”.
Ranking scale	A scale of value ranging in our study from -3 to +3, which refers to “Strongly agree” and “Strongly disagree”.
P-sample	A sample of respondents who filled in the survey.
Q-sample	A list of statements given to each respondent.
Factors	The archetypes identified with the statistical analysis that show different groups according to their responses to the set of statements.

The entire survey was created in both a paper form and an online version. We used a free online application, Q-Software⁷, designed for Q methodology analysis. Q-Software offered an easy-to-use interface, and we utilized the free version of the application. Its creator, Mr. Alessio Pruneddu, has developed a newer version which is compatible with touchscreens and hosts more features. We decided to create the entire survey⁸ with this software, instead of using two different websites (Q-Software and Google Form, for example). The survey was made in two versions: Khmer language and English. Filling in the survey involved a process of sorting a list of statements (Q-sample) written on cards.



Students filling in the survey, University of Battambang, Cambodia.

⁷ Q-Software, Online software for Q-methodology analysis, accessed on 21 November 2017, <http://qsoftware.net/home.html>

⁸ DOCKSIDE online survey on Stakeholders' Analysis, Q-sortware, accessed on 21 November 2017, <https://application.qsoftware.net/user/felixhinckel/>

2.2. Validation of the survey

Initially, a Q-sample of 67 statements (Appendix 1) was prepared after reviewing the strategic plans of public institutions, international organizations and other important stakeholders in environmental and maritime fields. The main topics were the following:

- Agriculture and food safety
- Biodiversity
- Energy and depletion of natural resources
- Fisheries issues
- Ports and infrastructure
- Climate change and environment
- Responsibility, policy and stakeholder cooperation
- Education and research

The Q-sample was "unstructured" since the number of statements was not equitably distributed in these themes. Half of the statements were formulated in positive language, and the other half in a negative way in order to avoid conformity bias. "No opinion" boxes were also provided. We tested the survey with representatives of DOCKSIDE and realized that the number of statements was too high, and that it took too long to fill in the survey. Following an internal meeting between DOCKSIDE researchers, it was decided to limit the number of statements to 46 (Appendix 2).

In June 2017, we organized a workshop to test and validate the statements and the methodology. Representatives from DOCKSIDE partner institutions (MoEYS, RULE, NUM, UBB, and RUA), as well as delegates from Fisheries Administration, Inland Fisheries Research and Development Institute (IFReDI), the French Embassy in Phnom Penh, and Open Development Cambodia took part in the meeting.



Environmental Maritime Workshop, Royal University of Agriculture, Phnom Penh, Cambodia, 18-20 October 2017

During the workshop, we realized that the number of statements was still too high and some were not clear enough. After the workshop we took note of some remarks and came up with a final set of 28 statements (Appendix 3), which was approved by everyone.

2.3. Filling in the Q-Software survey

In order to fill the online survey, the physical presence of a DOCKSIDE researcher was needed to explain the Q-methodology. Then, using Q-Software (online form) allowed the stakeholders to easily fill in the survey. A convenient aspect of the online version was that a group of people could all fill in the survey at the same time. This was convenient because we decided to collect data from both stakeholders' representatives and students. After showing it in a classroom, it was easier than expected for students to fill in the online survey. When we collected data from students, we did a demonstration with a video projector on how to fill in the online survey.

First step: Introduction (Appendix 4)

Every respondent was asked to go to the link provided (<https://application.qsortware.net/user/felixhinckel/>) and choose a language for the survey, as well as the type of survey to be filled in (for the organization representatives, we included questions related to their network).

Second step: First Sort (Appendix 5)

Every individual statement is displayed on the screen and the respondent must drag the statement to one of the following boxes: “Agree”, “Disagree” or “No opinion”.

Third step: Second Sort (Appendix 6)

At this stage, the respondent sees three prefilled columns on the top of the screen reflecting the answers that he/she gave in the previous step. Below these columns, there are seven new columns which correspond to different degrees of agreement (left hand side) and disagreement (right hand side). The respondent must rank each statement by prioritizing it according to a relative level of agreement or disagreement, on a board where a pyramidal and symmetrical grid are represented. The software automatically attributes values of +3 and -3 to the statements situated on the far right and far left corners, respectively (

Figure 1). At the center, there are two columns where the statements that the respondent slightly agreed or disagreed with are placed, as well as a column for the statements that received no opinion. For the final analysis, we have combined these two columns of 5 statements into a unique column of 10 statements. For the statements placed in these two columns the value of 0 was attributed, which corresponds to the answer “No opinion” (see

Figure 1).

Figure 1. Pyramidal shape grid of the Q-methodology used for the current study and the attributed values

Factor 1						
Agree			No	Disagree		
3	2	1	0	-1	-2	-3

The software does not show a pyramid-shaped grid on the interface. It only shows a number of columns. However, it does indicate how many statements are yet to be placed, how many are missing, or how many are in surplus via a written message in red font. In order to prevent confusion, before each selection we presented a hard or soft copy of the pyramid grid. In such a way, we made it clearer to the respondent that the statements must be placed on the grid according to her/his subjective opinion. In addition, the online survey allows the respondent to switch and swap different statements as many times as necessary.

We guided each respondent while filling in the survey and always suggested that they start by placing the most important statements on the boxes at the extreme left and the extreme right of the grid, where the degrees of agreement and disagreement were the highest. There were an equal number of statements as of boxes, and that forced the respondent to choose precisely where he/she would place each statement. The survey required a certain amount of time for reflection because the respondent could modify his/her choices several times, and the reorganization of the cards on the grid was often necessary so that the sorting corresponded to his/her preferences. In the first sort process, it was very rare for the statements to be shared equally so that the respondent agreed with half of the statements and disagreed with the other

half. As a consequence of the symmetrical form of the pyramidal grid, in some cases, it was necessary to require the respondent to place statements with which he agreed on the disagreement side and vice versa.

2.4. Factor Analysis

Factor analysis aims to explain observed relations among numerous variables in terms of simple relations (Cattell, 1965). In the current study, the responses given by stakeholders' representatives were subjected to a factor analysis which consisted of correlating the respondents and grouping them into a limited number of representing factors.

We conducted two Q-methodology analyses. The first relates to data collected from 65 students while the second refers to data collected from 49 stakeholders' representatives involved in maritime and environmental fields.

3. Results related to the opinions of students

In July and August 2017, DOCKSIDE researchers collected data from students enrolled in Cambodian partner universities: NUM, RULE, UBB and RUA. The P-sample consists of 65 Master and PhD students who study different disciplines including Law, Business, Economics and Agriculture. Most have had courses in their curriculum related to Environmental and Maritime topics. The P-sample was not randomly chosen, as we decided to include respondents with diverse backgrounds in order to have a wide range of viewpoints. In such a way, the typology of discourse resulting from the factorial analysis is within the scope of the research objectives. It is important to highlight that the Q-methodology does not have the objective of generalizing the results to a particular group.



Students filling in the survey, Royal University of Law and Economics, Phnom Penh, Cambodia.

Table 2 P-sample of students per university and their major or field of study

University and number of respondents	Major or/and field of study
University of Battambang (13 students)	Sustainable Agriculture
	Management
	Business Management
	Agricultural Economics and Rural Development
	Animal Science
Royal University of Law and Economics (20 students)	Economic Management
Royal University of Agriculture (23 students)	Natural Resources Management
National University of Management (9 students)	Management and Business Administration
	Human Resources Management
	Environmental Economics

The size of the P-sample aims to obtain a variety of views, rather than what it represents in proportion to the population. Q-method is generally carried out from a reasoned sampling in a range between 40 to 60 participants (Brown, 1968). Therefore, our sample of 65 respondents should be large enough to have reliable results.

3.1. Statistical analysis and results

Data analysis consists of three steps: Correlation Analysis, Factor Analysis, and Factors Rotation.

3.1.1. The correlation matrix

Appendix 8 includes the results in absolute values between 1 and 7, ranging from "Strongly Disagree" to "Strongly Agree". A score of 4 refers to the answer "No opinion". The absolute values make possible the calculation of the differences between the Q-sorts, which will serve as the basis for the correlation matrix. The first step in the factor analysis is the generation of a correlation matrix between the 65 Q-sorts by the PQMethod software (Appendix 9). Statistically, the probability that a respondent places statements in the same way as another respondent is very low, so correlations in the matrix rarely exceed 0.50.

3.1.2. Extraction and rotation factors

The Q-Software allows for the analysis of the factors either by the method of the centroids or by the analysis in principal components. The Centroid Method allows us to extract only seven factors, as the software has been programmed in such a way that it is rare to obtain more than seven discourses in Q-methodology surveys. The method of Principal Component Analysis allows the extraction of a large quantity of factors, but a maximum of eight can be processed by the software. The Centroid Method appeared to be less precise and therefore, after tests with both methods, the PCA was chosen. The rotation of the factors can be done manually or by the Varimax Method.

The Principal Component Analysis (Appendix 11) maximizes potential correlations by rearranging data to extract a first factor. The correlations that have allowed for the extraction of this first factor are then discarded, and with the residual correlations a second factor is extracted, and this operation is repeated until the residual correlations are not significant (<0.5). Correlations that are not significant represent marginal discourses, which represent a small number of individuals sharing a common points of view.

The eight columns, "A" to "H" in the table in Appendix 11, are derived from the PCA analysis and from the matrix of factors before rotation. The first factor "A" is always statistically prominent. The sum of the squares of the correlation coefficients of each column gives a characteristic root. This characteristic root divided by the 65 variables of the matrix gives the percentage of the variance explained by the factor. Usually, factors with a characteristic root greater than 1 are retained (McKeown and Thomas (2013); Brown (1968)).

As all characteristic roots of extracted factors are greater than 1, we have had to test the rotations with each of them. The final factors were selected by analyzing the explained variances of the factors that must be greater than 10% after rotation. When we keep more factors, the part of the explained variances is small. The Varimax Method automatically seeks to maximize explained variances, so it is more convenient than the manual method. Besides the explained variances, it is necessary to ensure that after rotation the factors are weakly correlated, with a value lower than 0.5 (Table 3). Otherwise the archetypes would risk representing discourses that are too similar.

Table 3. *Factors' correlation matrix*

FACTORS	1	2	3
1	1,0000	0,3583	0,4250
2	0,3583	1,0000	0,4616
3	0,4250	0,4616	1,0000

We then had to find a balance between these two indicators, but also test the different combinations of factors so that we could obtain the largest number of significantly correlated statements with these factors, in order to have enough elements for analysis and interpretation of the discourses.

After repeating several tests and rotations using the Varimax Method, the model which appeared to be the most statistically significant is represented in Appendix 11. It has three factors. The first one explains 16% of the variance while the second and third explain 12% each.

Table 4. *Number of respondents within each of the factors*

	Factor A	Factor B	Factor C
NUM	1	2	2
RUA	8	5	7
UBB	8	0	2
RULE	4	10	3
Total	21	17	14

3.1.3. Statistical interpretation

The table in Appendix 12, indicates the factor with which the Q-sorts are correlated. If a number is in bold followed by an “X” it means the correlation between the statement and the factor is significant. It is important to note that it is impossible to assimilate the discourse of factors to the different categories of students. Indeed, none of them will be able to respond to the survey in a similar way, and bring out a discourse that could be expressed through a single factor. All personal perspectives related to maritime and the environmental fields are in fact a mix between different points of view. Therefore, not a single respondent in the group will have sorted the statements identically to the archetype Q-sort. That is why the three discourses we are going to interpret are general points of view that exist within the sample of students. The general discourses are from intermingled personal points of view, which is why they are more complementary than exclusive.

Table 5 shows the intermediate results of the statistical analysis. It allows us to see which statements are closer or more divergent from the factors, and to discover which statements are the most important in the construction of a given discourse. These correlations are estimated by z-scores which are then converted to the values used in the agreement and disagreement scale, which range between -3 and +3, and thus each factor can be represented in a Q-sorts archetype. The 3 main discourses identified by Facts A, B and C are very different. We can see in Table 5 that the most important statements which define the first discourse are related to the governmental regulation of chemicals and agricultural land, as well as the quality of food. The second discourse stresses the importance of the development of public transportation, and the high transportation costs in Cambodia, as well as the food quality. The last discourse is defined by the regulations on agricultural land, the introduction of more technology, and the exploitation of offshore petroleum resources.

Table 5. Factor scores with corresponding ranks

No	Statements	Fact or A	Ranking A	Fact or B	Ranking B	Fact or C	Ranking
1	State should impose more regulations on the use of agricultural	1.55	3	-0.58	20	2.39	1
2	A good farmer is a farmer that has a high productivity.	0.36	8	1.23	5	-0.28	17
3	Intensive livestock production is a source of ecological problems	-0.08	15	0.17	12	-0.11	15
4	Whenever possible, farm labor should be replaced by more	0.93	4	1.23	4	1.91	2
5	Poor health is related to low quality food.	2.23	2	1.58	3	0.4	9
6	Government should ban the use of chemicals in agriculture.	2.4	1	-0.88	22	-1.36	27
7	Wildlife conservation should only be considered once financial	-0.74	22	-1.65	27	-0.95	23
8	Government protects efficiently the natural parks of Cambodia.	-1.16	26	-1.93	28	-1.09	25
9	Cambodia should intensively exploit offshore petroleum resources	0.05	10	0.28	11	1.23	3
10	Nowadays, it is impossible to develop renewable energy in	-0.95	25	-0.96	24	-1.81	28
11	Nuclear plant could be a good way to produce energy without	-1.38	27	-1.11	26	0.89	6
12	Dams have a negative impact on the fisheries along the Mekong	0.69	7	0.32	9	1.14	4
13	Aquaculture should be further developed in Cambodia.	0.79	6	0.78	6	0.62	7
14	Community Fisheries successfully manage to ensure long term	0.03	11	-0.03	15	0.13	12
15	In the last years, fishermen's working conditions have improved.	-0.79	23	-0.72	21	-0.91	22
16	Port activities have a negative effect on fisheries.	-0.33	18	-0.36	19	-0.63	20
17	The ports infrastructure in Cambodia is well developed.	-0.72	21	-1.03	25	-0.98	24
18	Administrative procedures and security checking should be	-0.93	24	-0.1	16	-0.8	21
19	The price to transport goods in Cambodia is higher than the	-0.36	19	1.66	2	0.99	5
20	Cars and motorbikes emissions are the biggest cause of	-0.05	13	0.29	10	-0.42	18
21	In Cambodia, public transportation is not as developed as it should	-0.04	12	2.25	1	0.33	11
22	Most of the future environmental problems will be solved by the	-0.38	20	0.43	7	0.38	10
23	Multinational companies are the main threat to the environment	-0.18	17	-0.92	23	0.13	13
24	Cambodian economic growth and living standards are more	-1.94	28	0.11	14	-1.14	26
25	No one puts pressure on government in term of environmental	-0.09	16	0.12	13	-0.14	16
26	People would agree on paying a tax to get environmental	-0.06	14	-0.18	17	-0.56	19
27	Cambodia people are aware of consequences of climate change.	0.26	9	-0.34	18	0.11	14
28	We must ban plastic bags.	0.88	5	0.34	8	0.54	8

Regarding the consensus statements, most of the students do not have opinions regarding the ecological impacts of livestock production methods, pressure on the government to protect the environment, or Community Fisheries fish stock management. Most of the students believe that the port infrastructure in Cambodia is not well developed and that fishermen’s conditions have not improved in the last few years.

Table 6. *Consensus statements*

N	CONSENSUS STATEMENTS	Factor 1	Factor 2	Factor 3
3	Intensive livestock production is a source of ecological problems	0	0	0
1	Aquaculture should be further developed in Cambodia.	1	1	1
1	Community Fisheries successfully manage to ensure long term	0	0	0
1	In the last years, fishermen’s working conditions have improved	-1	-1	-1
1	Port activities have a negative effect on fisheries.	0	0	-1
1	The ports infrastructure in Cambodia is well developed.	-1	-2	-2
2	No one puts pressure on government in term of environmental	0	0	0

A Q-sort with a correlation coefficient of 1 would have classified the statements exactly like one of the retained factors. This is shown in Appendix 12, which is the masterpiece of the statistical analysis. The 30 numbers in bold are those which have significantly determined a factor with a probability of $P < 0.01$.

3.2. Factors interpretation

The aim of this section is to clarify the meaning of the archetypal factors constituting the different obtained discourses. There are no specific techniques for this. Nevertheless, it is interesting to note that our own subjectivity will serve to interpret those of the respondents who have brought to light the three discourses that have emerged from the factor analysis. During the interpretations of the three archetypes, not all statements will be addressed, and instead we will concentrate on statements which have been placed at the extremes of the agreement and disagreement scale since they are not only of fundamental importance in the determination of discourses, but they also have the most explanatory power. However, interpretations will also be made on statements placed at the lowest degrees since they can be

revealing. To facilitate the reading of the discourse, all statements of each archetype Q-sort have been placed on their respective boxes of their respective pyramidal grid (Figure 2, Figure 3 and Figure 4). It is easy to spot the most important statements of agreement and disagreement for each discourse, which have been identified using Factor Analysis. We named each discourse based on the statements placed in its pyramidal grid. It should be noted that the interpretations of each factor are complementary. The identified factors allowed us to distinguish 3 groups of students within the sample, and we named them: Social-Democrat Environmentalists, Responsible Productivists and Pro-business Environmentalists.

3.2.1. Group 1: Social-democrat environmentalists

The first archetype factor explains 16% of the variance between the Q-sorts and represents the first discourse. We named the people in this group Social-Democrat Environmentalists. The students in this group were concerned about the quality of food, government regulations regarding the use of chemicals and agricultural land, the use of plastic, and the improvement of labor efficiency through introducing new technologies.

What sets this discourse apart is that this group of students is in favor of ecology, environmental protection and state regulations. It is the only group to be strongly opposed to the use of chemicals in agriculture (+3) and to disagree that material comfort and economic growth should be more important than the environment (-3). On the other hand, health is intimately linked to the quality of food (+3), which is consistent with this aversion to agricultural chemicals. It is also the only category that does not believe that technology can solve environmental problems in the future (-1), which is also relatively consistent with the very unfavorable opinion of using nuclear as a source of clean energy (-3). Regarding the impossibility of developing renewable energies in Cambodia, this discourse is moderately in disagreement (-2). Finally, it is the discourse that is most favorable to the ban on plastic bags (+2), and one that moderately agrees Cambodians are aware of the consequences of climate change (+1).

Figure 2. Q-sort, discourse 1 (Social-Democrat Environmentalists)

Factor 1						
Agree			No opinion	Disagree		
3	2	1	0	-1	-2	-3
Poor health is related to low quality food.	State should impose more regulations on the use of agricultural land.	A good farmer is a farmer that has a high productivity.	Intensive livestock production is a source of ecological problems and needs to be reformed.	Wildlife conservation should only be considered once financial objectives have been reached.	Government protects efficiently the natural parks of Cambodia.	Nuclear plant could be a good way to produce energy without damaging the environment.
Government should ban the use of chemicals in agriculture.	Whenever possible, farm labor should be replaced by more efficient machines and technologies.	Dams have a negative impact on the fisheries along the Mekong River and its tributaries.	Cambodia should intensively exploit offshore petroleum resources to be more energy-independent	In the last years, fishermen's working conditions have improved.	Nowadays, it is impossible to develop renewable energy in Cambodia.	Cambodian economic growth and living standards are more important than environment.
	We must ban plastic bags.	Aquaculture should be further developed in Cambodia.	Community Fisheries successfully manage to ensure long term sustainability of the fish stock.	The ports infrastructure in Cambodia is well developed.	Administrative procedures and security checking should be reduced to improve the ports' efficiency.	
		Cambodia people are aware of consequences of climate change.	Port activities have a negative effect on fisheries.	Most of the future environmental problems will be solved by the technological progress.		

3.2.2. Group 2: Responsible Productivists

The second group of identified students is named Responsible Productivists. This group explains 12% of the variance. The main priorities are issues related to the transportation of goods, public transportation, increasing farmer productivity through new technologies, and the improvement of food quality. Moreover, people associated with this group strongly believe in the preservation of the environment, and that the government should do more to protect national parks in Cambodia. They also consider nuclear energy to be an environmentally friendly alternative for Cambodia.

The second discourse is in favor of global development with respect to the environment. This discourse is sensitive to the development of port infrastructure (-2), public transport (+3), and freight transport in Cambodia (+3). It is also interesting to observe that the Responsible Productivists find transportation costs in Cambodia to be higher than in neighboring countries, which is related to the undeveloped infrastructure (statement 17). We should emphasize that this group finds that multinationals are not a major threat to the environment (-1).

Regarding agricultural productivity, this is the discourse which finds the productivity of a farmer to be relatively important (+2). Coupled with a favorable opinion for the mechanization of work on the farm (+ 2) and an opinion against the ban of chemicals in agriculture (-1), it shows a desire to have well-functioning, developed and sustainable agriculture which provides food security with respect to the environment.

Figure 3. Q-sort, discourse 2 (Responsible Productivists)

FACTEUR ARCHETYPE 2						
Agree			No opinion	Disagree		
3	2	1	0	-1	-2	-3
The price to transport goods in Cambodia is higher than the neighboring countries.	A good farmer is a farmer that has a high productivity.	Dams have a negative impact on the fisheries along the Mekong River and its tributaries.	Intensive livestock production is a source of ecological problems and needs to be reformed.	State should impose more regulations on the use of agricultural land.	Nowadays, it is impossible to develop renewable energy in Cambodia.	Wildlife conservation should only be considered once financial objectives have been reached.
In Cambodia, public transportation is not as developed as it should be.	Whenever possible, farm labor should be replaced by more efficient machines and technologies.	Aquaculture should be further developed in Cambodia.	Cambodia should intensively exploit offshore petroleum resources to be more energy-independent	Government should ban the use of chemicals in agriculture.	Nuclear plant could be a good way to produce energy without damaging the environment.	Government protects efficiently the natural parks of Cambodia.
	Poor health is related to low quality food.	Most of the future environmental problems will be solved by the technological progress.	Community Fisheries successfully manage to ensure long term sustainability of the fish stock.	In the last years, fishermen's working conditions have improved.	The ports infrastructure in Cambodia is well developed.	
		We must ban plastic bags.	Port activities have a negative effect on fisheries.	Multinational companies are the main threat to the environment in Cambodia.		

3.2.3. Group 3: Pro-business environmentalists

The last archetype factor also accounts for 12% of the variance. People associated with this group have been defined as Pro-business.

Figure 4. Q-sort, discourse 3 (Pro-business)

FACTEUR ARCHETYPE 3						
Agree			No Opinion	Disagree		
3	2	1	0	-1	-2	-3
State should impose more regulations on the use of agricultural land.	Cambodia should intensively exploit offshore petroleum resources to be more energy-independent	Poor health is related to low quality food.	A good farmer is a farmer that has a high productivity.	Wildlife conservation should only be considered once financial objectives have been reached.	Government protects efficiently the natural parks of Cambodia.	Government should ban the use of chemicals in agriculture.
Whenever possible, farm labor should be replaced by more efficient machines and technologies.	Dams have a negative impact on the fisheries along the Mekong River and its tributaries.	Nuclear plant could be a good way to produce energy without damaging the environment.	Intensive livestock production is a source of ecological problems and needs to be reformed.	In the last years, fishermen's working conditions have improved.	The ports infrastructure in Cambodia is well developed.	Nowadays, it is impossible to develop renewable energy in Cambodia.
	The price to transport goods in Cambodia is higher than the neighboring countries.	Aquaculture should be further developed in Cambodia.	Community Fisheries successfully manage to ensure long term sustainability of the fish stock.	Port activities have a negative effect on fisheries.	Cambodian economic growth and living standards are more important than environment.	
		We must ban plastic bags.	Cars and motorbikes emissions are the biggest cause of environmental and health problems in Cambodia	Administrative procedures and security checking should be reduced to improve the ports' efficiency.		

For discourse 3, the most important statements are related to state regulations of agricultural land, and the automation of farm labor. Students in this group disagree with the ban on chemicals in agriculture and disagree that it is an impossibility to develop renewable energy in Cambodia.

Energy occupies an important place in this discourse. It is indeed the only group to give a favorable opinion to the exploitation of offshore oil for the energy independence of Cambodia (+2), and to think that nuclear could be a viable alternative for producing energy without degrading the environment (+1). It is also the only group to be in total disagreement with the idea that the development of renewable energies is impossible (-3). We interpret this discourse as favorable to energy independence and a varied mix of energy sources. For the agriculture theme, this discourse is clearly in favor of intensive agriculture as evidenced by the very unfavorable opinion on the ban of chemicals in this sector (-3), and its position favoring early placement of technologies (+3) as well as increased regulation of agricultural land (+3). It is also the discourse for which the statement on bad health being linked to a bad diet is placed at the lowest level of the agreements scale (+1).

In summary we have identified three groups of students by applying Factor Analysis to how each respondent ranked the statements in the pyramidal grid (from Strongly Agree (+3) to Strongly Disagree (-3)). All three groups feel favorably about the protection of the environment. The first group has been named Social-Democrat Environmentalists. They stress the importance for more state regulations and protection of the environment. This is also the biggest group and explains 16% of the variance. The next two groups are more pro-business and both explain 12% of the variance. The Responsible Productivists believe that the government should focus on the development of infrastructure, the improvement of agricultural output via the introduction of new technologies, the preservation of the environment, and the search for alternative sources of energy. Pro-business Environmentalists, who also believe that Cambodia should develop its economy in a sustainable way, stress that Cambodia should develop its off-shore petroleum resources and introduce more automation into agriculture. The opinions of Cambodian youth are important for the implementation of policies by the Cambodian government, and the funding of projects by international donors. Thus they should be taken into account.

The next section of the report will show the opinions of some of the main stakeholders in the environmental and maritime fields in Cambodia.

4. Results related to the opinions of the stakeholders' representatives

Between July and September 2017, DOCKSIDE researchers collected data from 56 stakeholders and met with more than 60 stakeholders' representatives involved in maritime and environmental fields in Cambodia. They were asked the same questions as the students. Most of the respondents currently have management positions at their organizations. Appendix 13 shows the representatives of stakeholders that filled in the survey. In some cases, we asked a few people managing different departments within the same organization to fill in the survey, i.e. GIZ, RUA and MAFF.



Meeting at Phnom Penh Autonomous Port, Phnom Penh, Cambodia, 10 August 2017



Meeting with at Ministry of Public, Work and Transport, Phnom Penh, Cambodia, 9 August 2017



Meeting at Sihanouk Ville Autonomous Port, Sihanouk Ville, Cambodia, September 2017

Table 7. Number of respondents according type of organization they represent

Type	Number	% of the total
International	14	28.57%
NGO	7	14.29%
Private	7	14.29%
Public	21	42.86%
Total	49	100%

In the final sample, we collected data from 14 international, 7 non-governmental, 7 private and 21 public organizations (Table 7). The sample size of 49 is sufficient enough to conduct the Q-method analysis.

4.1. Data collection and stakeholder identification

Between July and September, DOCKSIDE researchers had to identify and contact a number of organizations involved in maritime and environmental activities in Cambodia. Usually, the appointments were made 1–2 weeks in advance and the interviews were scheduled at a time and place most convenient for the respondents. In order to meet stakeholders outside Phnom Penh, two field trips were organized. The first was to Sihanoukville and the second was to Siem Reap. The trips were planned well in advance to ensure the availability of the stakeholders. In a couple of instances, Skype interviews were conducted.



Meeting at Ministry of Mine and Energy, Phnom Penh, Cambodia, 3 August 2017



Meeting at Phnom Penh Water Supply, Phnom Penh, Cambodia, 1 August 2017

Usually, two people conducted an interview. Each interview began with a short presentation on the DOCKSIDE interviewers followed by a project presentation, detailed project description, and Q-sortware survey. Regarding the DOCKSIDE survey, the interviewers attempted to clarify the survey's statements. For instance, when a stakeholder did not understand a question, the interviewer rephrased the question slightly in order to make it more understandable. Immediately following the interview, the two-person interview team wrote down the representative's answers, data information and the minutes of the meeting. This information was recorded as precisely and literally as possible, without summarizing what a stakeholder was "trying" to say. The objective of this follow-up process was to record the information accurately for use in the analysis process, and so it could be useful for future projects and activities of DOCKSIDE partners.

As mentioned before, stakeholders can be individuals, groups, or an institution. Stakeholder groups are made up of people who share a common interest, such as NGOs or private companies. However, such groups often contain many subgroups such as agencies,

departments and units. For instance, seeing a hypothetical company with many departments as one stakeholder group can be meaningless because some people may have very different interests from others in the same company.

The information gathered from individuals, groups, subgroups, or from meetings themselves are not included in the survey. To easily analyse this information, stakeholders have been divided into four different areas: Public Institutions, Regional and Local Authorities, Private Companies, and NGOs and Foundations.

4.1.1. Feedback from Public institutions

From the area of Government and Ministries, a wide range of stakeholders were interviewed: the Ministry of Planning, Ministry of Economy and Finance, Ministry of Mines and Energy, Ministry of Public Works and Transport, Ministry of Health, and Ministry of Agriculture Forestry and Fisheries. All public officials were pleased to hear about projects focusing on increasing the quality of education, especially in the areas of higher education and research. During the meetings it was emphasized that there are issues within the Cambodian educational system. Higher education institutions in Cambodia mostly act as private universities, and compete with each other. Furthermore, there are issues with the lack of transparency in selecting lecturers, as well as a lack of student commitment. DOCKSIDE could have a positive impact by improving the quality of research and education in Cambodia.

The vast majority of authorities proposed improvements or new approaches to be considered in the study. In addition, some interviewees found certain statements to be too general or controversial. Moreover, some public institutions refused to fill in the survey because they did not have enough time or human resources, or the statements were not related to their field of work and competency.

4.1.2. Feedback from Regional and Local Authorities

Among the identified regional and local authorities, there are Cambodian organizations responsible for archaeological protection, water supply, ports' management and state regulations. Their activities include World Heritage conservation, community development, water management, forest and landscape development, environmental management, and tourism. Generally, all interviewees were very interested in the DOCKSIDE project. Most of them emphasized the potential benefits for DOCKSIDE if their organizations could receive some of the student research proposals and give feedback on the relevance of the topics. Furthermore, they were also open to a collaboration with students, and most showed willingness to play an active role in the implementation of the DOCKSIDE project.

The lack of human resources, skills, and time needed to cooperate with the project's partners has already been highlighted. For those reasons, some suggested that DOCKSIDE should have proposed the possibility of international mobility for Khmer staff. Nevertheless, generally the stakeholders of this area showed a positive attitude towards DOCKSIDE, and provided useful information and suggested further useful contacts.

4.1.3. Private Companies feedback

International corporations and local companies have different activities and departments. Activities include logistics, agriculture, health, hygiene and nutrition, sustainable energy solutions, urban planning, and regional economic development. These companies are designed to create sustainable businesses and employment opportunities. In fact, almost all of the stakeholders in this area were open to any sort of cooperation with students and researchers from Cambodian universities, which is useful for the DOCKSIDE goals. The collaboration could be direct between companies and researchers/students, or where organizations act as a bridge and promote student cooperation with other organizations.

However, some organizations encountered different problems with Cambodian students. Some companies believe that the DOCKSIDE mission is relevant but difficult to achieve due to the

mentality of Cambodian students. It was put forth that students lack the interest to get involved for longer periods of time on activities, which is relevant to the scope of projects like DOCKSIDE. Nevertheless, private companies were really excited to work with students who had traveled to Europe and could contribute some best practices. Some organizations preferred to collaborate only with international interns because they believe that the quality of Cambodia's education system is very low. It was reported that having a sustainable framework for collaboration with students and universities is important because in the past, due to lack of engagement by the universities themselves, many collaborations failed. A framework should describe in detail the student positions, organizations involved, regulations, payment, and assigned tasks in order to promote efficient cooperation. From their point of view, universities must become more proactive. The DOCKSIDE project plays a large role in changing the academic landscape in terms of environmental and maritime research in Cambodia.

A few organizations highlighted that the Cambodian higher education system does not provide a sufficient number of programs in constructive topics that would assist Cambodian researchers in focusing on important issues for the country, such as food and nutrition security. Other companies emphasized the importance of an educational cooperation between NGOs, public and private organizations, and students in order to get students involved in real-world projects which could improve the quality of their research skills and their future perspectives. Another important aspect to consider is the educational staff's training which could give all members the necessary knowledge to mobilize and motivate students to get involved.

All private companies' representatives showed an interest in participating in the EMR workshop which was held in October 2017. Some organizations thought it would be interesting to present their projects at the event. They also offered advice on how to add value and enlarge the DOCKSIDE network by giving additional contacts.

4.1.4. Feedback from NGOs and Foundations

Overall, NGOs and foundations based in Cambodia have expressed a significant interest in the DOCKSIDE project, and especially the EMR workshop. Their main areas of focus include waste management, biodiversity conservation, education, business consulting, sustainable development, and health issues. Most of them reported that there is a disconnect between research and policies in Cambodia.

Most of the stakeholders in this area showed interest in cooperating with PhD candidates, and offering scholarships or potential topics for Master students. However, the lack of funds for some NGOs is a major issue. From their point of view, the mission of the DOCKSIDE project is quite relevant but difficult to achieve because of the mentality of Cambodian students. It was reported that, overall, students lack commitment and skills. It is a challenge for them to find qualified personnel (interns and employees). The necessity of changing the behavior through the educational system has been underlined by these organizations. The media, particularly social media, could be very important to environmental awareness among younger generations, and could help to generate more commitment in the environmental sector.

In summary, most of the organizations that the DOCKSIDE researchers met with showed a high level of interest in the activities of the DOCKSIDE project. However, they pointed out that the level of higher education in Cambodia is not sufficient to develop high quality research. It is also a challenge for many stakeholders to find qualified and committed workers and interns. There are other factors such as family bonds, the mindset of Cambodian students, and the lack of confidence among stakeholders in the skills of the young Cambodian scholars. These aspects are beyond the reach of the DOCKSIDE project, but should be taken into account for the implementation of future activities.

4.2. Statistical analysis and results

Similar to previous sections, the data analysis consists of 3 parts: Correlation Analysis, Factor Analysis and Factors Rotation. More details regarding these steps can be found in a previous section of the report.

4.2.1. The correlation matrix

First, we analyzed the correlation between different sorts (responses of the survey). As shown in Appendix 14, most of the time the correlation is lower than 0.5. It is normal since each respondent had to place in the grid a set of 28 statements. It also shows that the respondents placed statements in the grid differently and have heterogeneous opinions.

4.2.2. Extraction and rotation factor

Similar to the student data analysis, we have used the PCA method to identify the different factors. The eight columns, "A" to "H" on the table in Appendix 15, are derived from the PCA approach and form the matrix of factors before rotation. The first factor (A) explains 29% of the variance (Appendix 15). The other factors explain less than 10%. Therefore, we have decided to use the Varimax Method which seeks to maximize the explained variance by limiting the number of factors. In addition, we made sure that the correlation between the different factors is less than 0.5.

Table 8. *Factors' correlation matrix*

	Factor 1	Factor 2	Factor 3	Factor 4
Factor 1	1	0.4896	0.5337	0.1468
Factor 2	0.4896	1	0.5536	0.2437
Factor 3	0.5337	0.5536	1	0.1891
Factor 4	0.1468	0.2437	0.1891	1

Normally, factors explaining more than 10% are retained. However, we have decided to keep factor D (Appendix 16) even though it explains less than 10% because it might reveal some interesting information.

4.2.3. Statistical interpretation

The table in Appendix 16 shows the correlation between each Q-sort and each factor. As it was stated in a previous section, it is almost impossible for the responses of a single individual to be perfectly correlated with the statements which are related to given factors. Each of the identified factors consists of a given number of organizations which have relatively high correlation between their responses (Appendix 16).

Table 9 shows the intermediate results of the Q-methodology. It allows us to see which statements are the most important in the creation of the different discourses (factors). For instance, for Factor A the statement “State should impose more regulations on the use of agricultural land” is the most important, followed by the statements “Government should ban the use of chemicals in agriculture” and “Poor health is related to low quality food”. Additionally, for the respondents who are identified in Factor B, the statement “Dams have a negative impact on the fisheries along the Mekong River and its tributaries” is the most important, followed by the statements “In Cambodia, public transportation is not as developed as it should be” and “Aquaculture should be further developed in Cambodia”.

Table 9. Factor scores with corresponding ranks

No	Statement	Factor A	Ranking A	Factor B	Ranking B	Factor C	Ranking C	Factor D	Ranking D
1	State should impose more regulations on the use of	2.05	1	0.17	11	0.2	14	1.32	4
2	A good farmer is a farmer that has a high productivity.	0.25	11	-1.42	25	0.14	15	1.2	5
3	Intensive livestock production is a source of ecological	0.79	6	1.32	5	0.37	12	-1.93	27
4	Whenever possible, farm labor should be replaced by	0.45	8	0.63	7	0.41	11	1.32	3
5	Poor health is related to low quality food.	1.42	3	0.58	8	2.27	1	0.28	13
6	Government should ban the use of chemicals in	2.04	2	-0.66	22	0.76	5	-2.09	28
7	Wildlife conservation should only be considered once	-1.97	28	-1.55	26	-0.61	21	-0.41	20
8	Government protects efficiently the natural parks of	-0.91	23	-1.64	27	-1.28	26	-1.68	26
9	Cambodia should intensively exploit offshore petroleum	0.15	13	-0.13	15	-1.1	23	1.84	1
10	Nowadays, it is impossible to develop renewable energy	-1.01	25	-1.05	24	-1.99	28	-1.44	25
11	Nuclear plant could be a good way to produce energy	-1.27	26	-1.84	28	-1.22	24	0.53	9
12	Dams have a negative impact on the fisheries along the	0.21	12	1.97	1	1.04	4	0.6	7
13	Aquaculture should be further developed in Cambodia.	0.1	15	1.41	3	0.66	7	0.68	6
14	Community Fisheries successfully manage to ensure	-0.07	18	-0.15	16	1.53	2	-0.14	16
15	In the last years, fishermen's working conditions have	-0.82	21	-0.2	17	-1.44	27	-0.27	17
16	Port activities have a negative effect on fisheries.	-0.88	22	0.46	9	-0.39	18	-0.41	21
17	The ports infrastructure in Cambodia is well developed.	-0.54	19	0.01	13	-0.76	22	-0.43	22
18	Administrative procedures and security checking should	-0.58	20	0.44	10	-0.49	19	-0.12	15
19	The price to transport goods in Cambodia is higher than	0.74	7	1	6	0.52	9	0.45	10
20	Cars and motorbikes emissions are the biggest cause of	0.09	16	-0.26	19	0.52	10	-0.43	23
21	In Cambodia, public transportation is not as developed	0.8	5	1.47	2	0.74	6	1.41	2
22	Most of the future environmental problems will be	0.27	9	-0.01	14	-0.35	17	0.41	12
23	Multinational companies are the main threat to the	-0.04	17	-0.47	21	-0.51	20	-0.12	15
24	Cambodian economic growth and living standards are	-1.74	27	-0.74	23	0.62	8	-0.4	19
25	No one puts pressure on government in term of	0.25	10	-0.25	18	-1.26	25	-0.78	24
26	People would agree on paying a tax to get	0.15	14	-0.43	20	-0.09	16	0.41	11
27	Cambodia people are aware of consequences of climate	-0.92	24	0.02	12	0.36	13	0.54	8
28	We must ban plastic bags.	1.02	4	1.35	4	1.33	3	-0.33	18

Table 10. Consensus statements

No	CONSENSUS STATEMENTS	Factor 1	Factor 2	Factor 3	Factor 4
5	Poor health is related to low quality food.	2	1	3	0
7	Wildlife conservation should only be considered once financial objectives	-3	-2	-1	-1
8	Government protects efficiently the natural parks of Cambodia.	-1	-3	-2	-2
10	Nowadays, it is impossible to develop renewable energy in Cambodia.	-2	-2	-3	-2
12	Dams have a negative impact on the fisheries along the Mekong River and	0	3	2	1
13	Aquaculture should be further developed in Cambodia.	0	2	1	1
19	The price to transport goods in Cambodia is higher than the neighboring	1	1	1	0
20	Cars and motorbikes emissions are the biggest cause of environmental and	0	0	0	-1
21	In Cambodia, public transportation is not as developed as it should be.	2	3	1	3
22	Most of the future environmental problems will be solved by the	1	0	0	0
26	People would agree on paying a tax to get environmental improvements.	0	-1	0	0
28	We must ban plastic bags.	2	2	2	0

We have identified 12 statements where we have a consensus among the different factors (Table 10). The statements where most of the respondents agree are the following: “We must ban plastic bags”; “The price to transport goods in Cambodia is higher than the neighboring countries”; “Aquaculture should be further developed in Cambodia”; “Poor health is related to low quality food”. Statements for which people rather disagree are the following: “Nowadays, it is impossible to develop renewable energy in Cambodia”; “Wildlife conservation should only be considered once financial objectives have been reached”; “Government protects efficiently the natural parks of Cambodia”. This reveals that the representatives of the different organizations have very similar views regarding these topics. It is expected that different initiatives regarding plastic bag reduction, protection of national parks, reduction of transportation costs, and development of renewable energy would gain strong support from most of the stakeholders in environmental and maritime fields in Cambodia.

4.3. Factors interpretation

Recall that different representatives from various organizations involved in maritime and environmental fields in Cambodia have filled in the Q-methodology survey. Four factors have been identified and the fact that their correlations are low (Table 8) reveals that these groups are quite different. Similar to the previous section related to the students, we named each discourse (Factor) and analyzed the most important statements which distinguish the different groups. Moreover, we have proposed different groups of organizations which have similar views on the 28 statements.

4.3.1. Group 1: Social Environmentalists

Figure 5 shows the archetype of the respondents’ opinions associated with Factor A. On the left hand side are the statements which the respondents generally agreed with, and on the right hand side are the statements which the respondents disagreed with. This group has been named the Social Environmentalist because they support more state intervention, i.e. “State

should impose more regulations on the use of agricultural land” and “Government should ban the use of chemicals in agriculture”. This group also prioritizes the environment rather than financial matters, economic growth or living standards. People in this group support the reduction of plastic bags, the development of renewable energy, and the improvement of the quality of food. They are also against the development of nuclear energy in Cambodia. This group is the prevailing one and explains 16% of the variance (Appendix 16).

Figure 5. Q-sort, discourse 1 (Social Environmentalists)

Agree			No Opinion	Disagree		
3	2	1	0	-1	-2	-3
State should impose more regulations on the use of agricultural land.	Poor health is related to low quality food.	Intensive livestock production is a source of ecological problems and needs to be reformed.	A good farmer is a farmer that has a high productivity.	Government protects efficiently the natural parks of Cambodia.	Nowadays, it is impossible to develop renewable energy in Cambodia.	Wildlife conservation should only be considered once financial objectives have been reached.
Government should ban the use of chemicals in agriculture.	We must ban plastic bags.	Whenever possible, farm labor should be replaced by more efficient machines and technologies.	Cambodia should intensively exploit offshore petroleum resources to be more energy-independent	In the last years, fishermen’s working conditions have improved.	Nuclear plant could be a good way to produce energy without damaging the environment.	Cambodian economic growth and living standards are more important than environment.
	In Cambodia, public transportation is not as developed as it should be.	The price to transport goods in Cambodia is higher than the neighboring countries.	Dams have a negative impact on the fisheries along the Mekong River and its tributaries.	Port activities have a negative effect on fisheries.	Cambodia people are aware of consequences of climate change.	
		Most of the future environmental problems will be solved by the technological progress.	Aquaculture should be further developed in Cambodia.	Administrative procedures and security checking should be reduced to improve the ports’ efficiency.		

Table 11 shows the organizations in the identified group. It is interesting to note that there are no NGOs associated with this group. Most of the organizations are public, although the two ports PAS and PPAP are not entirely public as they have private ownership. There are also four international organizations which have similar views on these sets of statements.

Table 11. *Representatives of organizations which constitute the group 1: Social Environmentalists*

Factor A (Social Environmentalists)		
Full name	Name	Type
Ministry of Education Youth and Sport	MoEYS	Public
Ministry of Public Works and Transport	MPWT	Public
GIZ ASEAN sustainable agrifood system (SAS) Department	GIZ-SAS	International
Sihanoukville Autonomous Port	PAS	Public
Institut de Recherche pour le developpement	IRD	International
Royal University of Agriculture	RUA	Public
Institute of Technology of Cambodia	ITC	Public
Eastern Maritime (Cambodia)	EM-Cam	Private
Ministry of Economy and Finance	MEF	Public
Ecoland Research Centre	Ecoland	Public
Phnom Penh Autonomous Port	PPAP	Public
Konrad-Adenauer-Stiftung	KAS	International
GIZ ASEAN sustainable agrifood system (SAS) Department	GIZ-SAS	International
Ministry of Health	MoH	Public

A potential collaboration on a set of crucial issues could be elaborated on in the future. One DOCKSIDE partner, Royal University of Agriculture, is identified as part of this group as is Ecoland, the affiliated research center of RUA. There are also four stakeholders in the sector of transportation and logistics: PPAP, PAS, EM-Cam and MPWT.

4.3.2. Group 2: Ecologists

We have used Factor B to identify a second group of stakeholders named Ecologists. The archetype of statements is represented in Figure 6. Fourteen percent of the variance is explained by this group of stakeholders.

Figure 6. Q-sort, discourse 2 (Ecologists)

Agree			No Opinion	Disagree		
3	2	1	0	-1	-2	-3
Dams have a negative impact on the fisheries along the Mekong River and its tributaries.	Intensive livestock production is a source of ecological problems and needs to be reformed.	Whenever possible, farm labor should be replaced by more efficient machines and technologies.	State should impose more regulations on the use of agricultural land.	Government should ban the use of chemicals in agriculture.	A good farmer is a farmer that has a high productivity.	Government protects efficiently the natural parks of Cambodia.
In Cambodia, public transportation is not as developed as it should be.	Aquaculture should be further developed in Cambodia.	Poor health is related to low quality food.	Cambodia people are aware of consequences of climate change.	Multinational companies are the main threat to the environment in Cambodia.	Wildlife conservation should only be considered once financial objectives have been reached.	Nuclear plant could be a good way to produce energy without damaging the environment.
	We must ban plastic bags.	Port activities have a negative effect on fisheries.	Cambodia should intensively exploit offshore petroleum resources to be more energy-independent	Cambodian economic growth and living standards are more important than environment.	Nowadays, it is impossible to develop renewable energy in Cambodia.	
		The price to transport goods in Cambodia is higher than the neighboring countries.	Community Fisheries successfully manage to ensure long term sustainability of the fish stock.	People would agree on paying a tax to get environmental improvements.		

Representatives of this group strongly agree that dams have a negative impact on the fisheries, and that public transportation should be further developed. They also emphasize the reduction of plastic bags, the development of aquaculture, and a more sustainable livestock production system. Moreover, the stakeholders' representatives in this group believe that more progress must be made in the protection of natural parks in Cambodia. They also consider nuclear energy to not be the best option for the country, and that investments in renewable energies are necessary.

Figure 7 shows the different stakeholders identified as Ecologists. There are four international organizations: GIZ, UNICEFF, EUU and SPP. These organizations support different projects in the maritime and environmental fields, and thus could be important partners for the implementation of future projects. There are two private companies, TANCONS and Sustainable Green Fuel Enterprise, and RUA and RUPP are the only two Cambodian universities in this group. In this group we also have three NGOs specialized in agriculture, fisheries and biodiversity.

Figure 7. Representatives of organizations which constitute the Group 2: Ecologists

Factor 2 (Ecologists)		
Full name	Abbreviation	Type
GIZ Department of Ministry of Education, Youth and Sports (MoEYS)	GIZ-MoEYS	International
EU Delegation	EUD	International
Sustainable Green Fuel Enterprise	SGFE	Private
Sea Protection Project	SPP	International
Royal University of Agriculture	RUA	Public
Niras/Ministry of Agriculture, Forestry and Fisheries	MAFF	Public
Angkor Centre for Conservation of Biodiversity	ACCB	NGO
World Fish Center	WFC	NGO
Royal University of Phnom Penh	RUPP	Public
TANCONS	TAN	Private
Rural Economic & Agriculture Development Agency	Reada	NGO
The United Nations Children's Fund	UNICEF	International

Today, issues related to climate change, environmental protection and biodiversity conservation are hot topics in Cambodia. Every stakeholder should consider the organizations in the table above when writing a project proposal or developing activities in these fields.

4.3.3. Group 3: Community Ecologists

Respondents who constitute the third group explain 13% of the variance and are very similar to the previous group. We have named them Community Ecologists because they strongly agree with the statement “Community Fisheries successfully manage to ensure long term sustainability of the fish stock”. This group believes that the empowerment of community fisheries is an important element in ensuring long term sustainability of the fish stock, which is a crucial issue for Cambodia. People identified as Community Ecologists believe that there is international pressure on the government to implement some environmental policies, that fishermen’s working conditions have not improved, and that the government does not protect efficiently enough the natural parks in Cambodia (Figure 8).

In this group we have organizations specialized in environmental and ecological issues, such as Conservation International and Young Eco Ambassador (Table 12). There are two NGOs specialized in activities which are not directly related to these fields, Heinrich Boell Foundation and Transparency International. Three main public universities, RULE, RUA and UBB, have also been identified as Community Ecologists.

Table 12. *Representatives of organizations which constitute the group 3: Community Ecologists*

Full name	Name	Type
GIZ Department of Ministry of Health, Social Development, Education and Young People	GIZ-HSDEYP	International
Royal University of Law and Economics	RULE	Public
GIZ Department of Ministry of Land Management, Urban Planning, and Construction	GIZ-MoLMUPC	International
Royal University of Agriculture	RUA	Public
Fisheries Administration	FiA	Public
Young Eco Ambassador	YEA	NGO

Full name	Name	Type
Heinrich Boell Foundation	HBF	International
Conservation International	CI	NGO
Transparency International	TI	NGO
University of Battambang	UB	Public

Figure 8. Q-sort, discourse 3 (Community Ecologists)

Agree			No Opinion	Disagree		
3	2	1	0	-1	-2	-3
Poor health is related to low quality food.	Government should ban the use of chemicals in agriculture.	In Cambodia, public transportation is not as developed as it should be.	State should impose more regulations on the use of agricultural land.	Wildlife conservation should only be considered once financial objectives have been reached.	Government protects efficiently the natural parks of Cambodia.	Nowadays, it is impossible to develop renewable energy in Cambodia.
Community Fisheries successfully manage to ensure long term sustainability of the fish stock.	Dams have a negative impact on the fisheries along the Mekong River and its tributaries.	Aquaculture should be further developed in Cambodia.	A good farmer is a farmer that has a high productivity.	Cambodia should intensively exploit offshore petroleum resources to be more energy-independent	Nuclear plant could be a good way to produce energy without damaging the environment.	In the last years, fishermen's working conditions have improved.
	We must ban plastic bags.	The price to transport goods in Cambodia is higher than the neighboring countries.	Intensive livestock production is a source of ecological problems and needs to be reformed.	The ports infrastructure in Cambodia is well developed.	No one puts pressure on government in term of environmental issues in Cambodia.	
		Cambodian economic growth and living standards are more important than environment.	Whenever possible, farm labor should be replaced by more efficient machines and technologies.	Multinational companies are the main threat to the environment in Cambodia.		

Potential projects related to community development, especially in the field of fisheries, should be considered with the Fisheries Administration and GIZ. The latter provides a substantial amount of overseas assistance for the implementation of such activities.

4.3.4. Group 4: Productivists

Finally, we identified a fourth group of stakeholders' representatives named Productivists which explains only 8% of the variance. Their discourse is depicted in Figure 9. This group shows strong support for the exploitation of offshore petroleum resources, the development of public transportation, the increased productivity of farmers, and the introduction of new technologies. Stakeholders in this group do not believe that intensive livestock production is a source of ecological problems, or that the banning of chemicals in agriculture is a good option for farmers. Productivists think that government should better protect the national parks, but also believe that there is not enough pressure currently on the government for it to undertake some action on the environment. They also think the development of renewable energies should be a priority.

It is interesting to note that three departments of the Ministry of Environment are associated with this group. The remaining two organizations are Mefone, a leading mobile operator in Cambodia, and the NGO named Rural Economic and Agriculture Development Agency. Any organizations willing to develop projects related to offshore petroleum resources, mechanization in agriculture, or the increased productivity of farmers should consult and collaborate with the stakeholders in Table 13.

Table 13. *Representatives of organizations which constitute the group 4: Productivists*

Full name	Name	Type
Ministry of Environment (Department of Climate Change)	MoE-DCC	Public
Ministry of Environment (Department of Heritage)	MoE-DH	Public
Metfone	MF	Private
Rural Economic and Agriculture Development Agency	Reada	NGO
Ministry of Environment (Department of Marine and Coastal Zone Conservation)	MoE-DMCC	Public

Figure 9. Q-sort, discourse 4 (Productivists)

Agree			No Opinion	Disagree		
3	2	1	0	-1	-2	-3
Cambodia should intensively exploit offshore petroleum resources to be more energy-independent	State should impose more regulations on the use of agricultural land.	Nuclear plant could be a good way to produce energy without damaging the environment.	Poor health is related to low quality food.	Wildlife conservation should only be considered once financial objectives have been reached.	Government protects efficiently the natural parks of Cambodia.	Intensive livestock production is a source of ecological problems and needs to be reformed.
In Cambodia, public transportation is not as developed as it should be.	A good farmer is a farmer that has a high productivity.	Dams have a negative impact on the fisheries along the Mekong River and its tributaries.	Community Fisheries successfully manage to ensure long term sustainability of the fish stock.	Port activities have a negative effect on fisheries.	Nowadays, it is impossible to develop renewable energy in Cambodia.	Government should ban the use of chemicals in agriculture.
	Whenever possible, farm labor should be replaced by more efficient machines and technologies.	Aquaculture should be further developed in Cambodia.	In the last years, fishermen's working conditions have improved.	The ports infrastructure in Cambodia is well developed.	No one puts pressure on government in term of environmental issues in Cambodia.	
		Cambodia people are aware of consequences of climate change.	Administrative procedures and security checking should be reduced to improve the ports' efficiency.	Cars and motorbikes emissions are the biggest cause of environmental and health problems in Cambodia		

5. Q-methodology results: Stakeholders vs Students

In this section, we will briefly discuss the similarities and differences related to the opinions of stakeholders and students. Table 14 depicts the statements with the highest scores of agreement (most of the stakeholders place these statements on the left hand side of the grid). Both groups have similar priorities but different rankings. Poor health resulting from low food quality is the statement with the highest scores among both students and stakeholders. Reduction of plastic waste is a high priority for stakeholders, while for students the regulations on the use of agricultural land are of particular importance. The first group prioritizes aquaculture while the second emphasizes the negative effects of hydropower dams. Overall, any government policies and projects oriented towards the issues in the table below are expected to gain large support from different stakeholders and youth in Cambodia.

The statements where stakeholders and students both disagree are depicted in Table 15. The issues where both show general disagreement are almost the same. Most of the stakeholders are against the development of nuclear energy, although this is not among the top priorities for students. On the other hand, students believe that the port infrastructure is not well developed. Both groups state that renewable energy should be further developed, that wildlife conservation should be considered regardless of financial perspectives that the government should do more to protect the national parks, that the environment is as important as economic growth, and that the living conditions for fishermen have decreased or remained the same in the last few years.

Controversial statements within the group of students and within the group of stakeholders are represented in Table 16. These statements are quite different for each of the sample groups. Only the statement “Most of the future environmental problems will be solved by the technological progress” is controversial for both groups.

Table 14. Top 6 statements where the majority agrees

Stakeholders	Students
<ol style="list-style-type: none"> 1. Poor health is related to low quality food. 2. We must ban plastic bags. 3. In Cambodia, public transportation is not as developed as it should be. 4. State should impose more regulations on the use of agricultural land. 5. Whenever possible, farm labor should be replaced by more efficient machines and technologies. 6. Aquaculture should be further developed in Cambodia. 	<ol style="list-style-type: none"> 1. Poor health is related to low quality food. 2. State should impose more regulations on the use of agricultural land. 3. Whenever possible, farm labor should be replaced by more efficient machines and technologies. 4. In Cambodia, public transportation is not as developed as it should be. 5. Dams have a negative impact on the fisheries along the Mekong River and its tributaries. 6. We must ban plastic bags.

Table 15. Top 6 statements where the majority disagrees

Stakeholders	Students
<ol style="list-style-type: none"> 1. Nuclear plant could be a good way to produce energy without damaging the environment. 2. Nowadays, it is impossible to develop renewable energy in Cambodia. 3. Wildlife conservation should only be considered once financial objectives have been reached. 4. Government protects efficiently the natural parks of Cambodia. 5. Cambodian economic growth and living standards are more important than environment. 6. In the last years, fishermen's working conditions have improved. 	<ol style="list-style-type: none"> 1. Government protects efficiently the natural parks of Cambodia. 2. Nowadays, it is impossible to develop renewable energy in Cambodia. 3. Cambodian economic growth and living standards are more important than environment. 4. Wildlife conservation should only be considered once financial objectives have been reached. 5. The ports infrastructure in Cambodia is well developed. 6. In the last years, fishermen's working conditions have improved.

Table 16. *Controversial statements among stakeholders and students*

Stakeholders	Students
<ol style="list-style-type: none"> 1. Cambodia should intensively exploit offshore petroleum resources to be more energy-independent. 2. Cars and motorbikes emissions are the biggest cause of environmental and health problems in Cambodia 3. Most of the future environmental problems will be solved by the technological progress. 4. A good farmer is a farmer that has a high productivity. 	<ol style="list-style-type: none"> 1. Cambodia people are aware of consequences of climate change. 2. Most of the future environmental problems will be solved by the technological progress. 3. No one puts pressure on government in term of environmental issues in Cambodia. 4. Intensive livestock production is a source of ecological problems and needs to be reformed.

Many stakeholders evaluated the issue related to offshore petroleum exploitation on either the right or left side of the grid. There were also mixed opinions on whether motor vehicles are the leading cause of environmental and health problems or not, and whether productivity defines a farmer as a good one. Students had split opinions on the climate change awareness of Cambodians, the pressure on the government to tackle environmental issues, and the negative effects of intensive livestock production methods. Obviously, there is a need for more research and information campaigns regarding the issues in the table above.



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III. Social Network Analysis

The second method used to analyze the stakeholders in the maritime and environmental fields was the Social Network Analysis. By applying this method we analyzed how different stakeholders are connected to each other and which are the most important organizations for the development of projects related to EMR.

1. Review of literature on SNA

Among other stakeholder analysis tools, Reed et al. (2009) called attention to the Social Network Analysis (SNA). The key feature of SNA is the concept of centrality. Freeman (1978) recapped the different kinds of centrality and normalized them to get the indicators that are still used today. To identify the most important nodes in a network, there are three main interpretations that can lead to different conclusions. The degree centrality highlights the nodes that have a lot of connections with other nodes. The betweenness centrality focuses on the strength of the position of a node, while observing the flow of information in a graph. The closeness centrality seeks to find the node that has the lowest average distance to every other node. A new measure of centrality based on the eigenvectors of the adjacency matrix has been developed by Bonacich (1987). It estimates the centrality of a node according to the centrality of its neighbors. All of these indicators propose different outputs, corresponding to different features of a graph, and it is important to choose an indicator according to the characteristics of the network you want to highlight.

In a directed graph for example, we can use the in- and out-degree centrality, i.e. counting the ties coming to or from a vertex. This kind of tool can be useful for avoiding a bias coming from a stakeholder who would want to propose too many ties. The weight of each tie can also enter into account in the computation of the metrics. Another kind of graph allows further calculations. A signed network implies two different kinds of ties: positive and negative. In a stakeholder analysis, a positive tie could be a sign of existing cooperation. On the other hand, a negative tie could be a bad relation, and these two stakeholders would have difficulty working

together. A third possibility is the absence of a tie. In this case, the two stakeholders do not work together.

This framework has been studied by Doreian and Mrvar (1996) around its key concept: balanceness. This concept is about the coherence of the different ties with each other. It refers to triads of vertices. A balance triad follows rules like “A friend of a friend is a friend” or “The enemy of a friend is an enemy”. These rules are formalized, and each possible triad is categorized as balanced or unbalanced. The study of the balanceness of a network goes along with the idea of graph partitioning. Cartwright and Harary (1956) established the basic theorem that a balanced network could be partitioned into two antagonistic subgroups each having internal positive balance. A real life network is generally more complicated, and very often unbalanced. Doreian and Mrvar (2009) developed balanceness metrics that can be used during the optimization of a partition.

Along with balanceness, some centrality measures have been developed for signed networks. Basing their work on previous Bonacich centrality, Bonacich and Lloyd (2004) proposed a status score including negative ties. Everett and Borgatti (2014) refined this metric into PN centrality. This metric, which can also be extended to directed graphs, is based on the same logic as the Bonacich centrality. Positive ties with central nodes improve centrality. But negative ties to negative-centrality nodes also improve a node’s centrality. This measure can be seen as a popularity index, where it is good to be disliked by the most disliked node. Smith et al. (2014) proposed another approach with the Political Independence Index. This metric rewards the position of a node in a conflict network, by analyzing its independence from other nodes. This measurement leads to completely different scores than centrality measures. These works are quite recent, and have only been experimented with on test networks. An empiric validation of these metrics is a potential research.

Among the different features provided by the Social Network Analysis, community detection is a prolific topic. Girvan and Newman (2002) proposed one of the most used algorithms, based on edge betweenness. The point of this kind of algorithm is to remove a tie (in this case by computing their betweenness), and to repeat this process until the graph shows two

independent parts. This is repeated on each part, until we end up with a single vertex. The outcome of this algorithm is a dendrogram⁹, which can be cut at a certain height

depending on the number of clusters needed. This general method can be adapted, and other metrics can be used to select the vertex to cut.

An important consideration concerns the selection of groups. Qi et al. (2017) proposed to keep the edge betweenness metrics over the network with only positive ties. Once the graph is split up into two components, a density measure taking into account the ratio of negative ties inside the group determines if the algorithm stops. Again, this research is quite new, and no empiric analysis has ever used them.

Kutin et al. (2015) applied the SNA approach to analyze stakeholders in Maritime and Environmental fields in Cambodia. Each stakeholder representative was asked about their relations with each other stakeholder in the network. Five answers were possible: “None”, “Weak”, “Average”, “Strong” and “I don’t know”. From these answers, a graph was created with weighted links. Some centrality metrics such as closeness, betweenness, and eigenvector were calculated. However, the notions of “Strong”, “Average”, “Weak”, and “None” can be very subjective, and can even change during the survey. But besides the subjectivity of the stakeholder, these options can lead the interviewee to mention ties that are not relevant to the analysis. For example, a weak tie can be simple information sharing, or tax paying, for example. In the first case this is cooperation, while in the other it is irrelevant information. Those facts can lead the stakeholders to state “Average” or “Weak” as default answers. The problem with this can be seen in the representation of the graph which is very dense, and thus not so usable. Among the 135 potential stakeholders, 53 were selected for analysis. The survey can miss important stakeholders, and this can induce a bias in information sharing metrics. They are calculated for each stakeholder, regardless of their answer. We thus get very high centrality measures for stakeholders who answered, and very low ones for those who didn’t fill in the survey. One could remove the stakeholders who didn’t answer from the sample, or use directed metrics, as in degree centrality for example.

⁹ a tree diagram, especially one showing taxonomic relationships

We have taken into account a number of studies which used SNA to analyze the stakeholders in order to adapt this methodology to the needs of the DOCKSIDE consortium.

2. Methodology of SNA

Social Network Analysis (SNA) is the process of investigating social structures through the use of networks and graph theory. It characterizes networked structures in terms of nodes (individual actors, people, or things within the network) and the ties, edges, or links (relationships or interactions) that connect them. In our case, the nodes represent different types of stakeholders and the ties refer to the willingness of each stakeholder to work with others. To avoid useless information, it is not essential to keep every node (stakeholders).

2.1. Design of the SNA survey

We have decided to change the method used by Kutin et al. (2015) and to analyze only the strong positive links between stakeholders. We also allowed each respondent to list a number of organizations. The SNA section of the questionnaire is much shorter than the Q-methodology, and shorter than the previous study's SNA survey. Instead of asking about the relations with each other stakeholder, we asked open-ended questions. This allowed us to continue building the network, in a snowball sampling way, and to open the network to organizations we did not know or think of. Here are the questions in the survey:

- When developing projects in the environmental and maritime fields, which organizations or partners do you work with? (Public institutions, Private companies, Non-governmental organization, Ports, Universities...).
- Guidelines: *Think about your partners in past and ongoing projects. Please propose between 3 and 5 organizations on the next screen:*

Every respondent had to “think about partners in past and ongoing projects” and to propose between 3 to 5 organizations.

- Which organizations would you rather not work with?

Every respondent was allowed to propose between 1 to 3 organizations:

We chose to limit the number of answers so that every stakeholder roughly proposed the same number of answers, but these are only suggestions and we do not force them to answer if they do not want to. The answers to these questions allowed us to build a signed network with (+1, 0, -1) weighted links. Instead of having only the strengths of the relations, we also have their nature. And since the number of answers was limited, we assumed that cited organizations were ones a stakeholder collaborated with the most, or were its worst relations. Thus we found the existing conflicts between groups by looking at the negative ties. Since we emphasized collaboration, we are sure that all the +1 ties mean the same thing. However, very few organizations revealed their negative ties and for this purpose we decided to focus only on positive relations between stakeholders. Thus, the weights of the ties between the nodes are (+1, 0).

2.2. Final sample and aims of the study

The study aims to identify collaboration groups, i.e. groups of stakeholders that already work together. Besides having the working groups, we also have the ties connecting these groups which can be used to improve the global collaboration of the network.

We applied the snowball sampling technique during interviews with stakeholders. In our study, snowball sampling refers to a method which requires each respondent to give names of other organizations that they would like to work with, thus the sample group is said to grow like a rolling snowball. However, although many organizations were mentioned some of them were not relevant for our study and for the objectives of DOCKSIDE project. For this reason, some of the mentioned organizations have been deleted and others have been regrouped. For instance,

FiA belongs to MAFF, so we regrouped the answers of the MAFF and FiA representatives into one node. Some respondents also listed FiA as an organization that they wanted to work with, thus we replaced FiA with MAFF. We have also regrouped all UN agencies into the UN, and several departments of GIZ and MoE were regrouped. Appendix 7 presents all stakeholders that were mentioned by the respondents. Appendix 8 shows all organizations that were included in the sample for SNA.

Once we have our proper sample, we have a list of stakeholders who filled in the survey and a list of stakeholders who did not. SNA gives good results when everyone in the sample has filled in the survey. However, in our sample (Appendix 8) there were stakeholders who did not fill in the survey and yet have still been cited in the SNA section of the survey. These stakeholders seem essential to the network and should be kept. It is important to remember that their centrality score or their group attachment might be biased. We might also have stakeholders who have not been cited, or only cited once or twice. These organizations will have very low scores.

In our signed network, the adjacency matrix contains values of 1 and 0. It is important to note that the adjacency matrix is not symmetric. Relations between A and B can be different, depending on whether you ask A or B. As the rows represent the answer from each stakeholder, the columns represent the different times a stakeholder was cited.

2.3. Directed and undirected network and centrality measures

The graph is positive directed. This is useful, as it carries more information. Some metrics can analyze it properly, and some are unable to do so. It is thus important to keep this directed graph, even if we might need an undirected version.

To get an undirected version of the graph, the adjacency matrix must be symmetric. Out of two different links, we need to make only one. Some situations are trivial. If $a_{ij} = a_{ji} = 1$, then $a_{ij} = 1$. If a stakeholder A mentioned a stakeholder B, but B didn't mention A, we keep the

mentioned tie. Besides the directed and undirected graph, one can also decide to create a directed graph that adds up both weights. If A and B cited each other as collaborators, they get a score of 2. This can be useful to highlight strong bilateral partnerships.

Even if they don't make the core of our analysis, centrality measures are often useful to get the first opinion over a network. Among all the possible metrics, we selected a few that can give precious indication regarding the purpose of our analysis

2.3.1. Betweenness centrality

The betweenness centrality is another common metrics for social network analysis. It measures the strength of a position of a node by counting the number of times it is on the path from a node to another. This centrality is very useful to understand the spreading of information within a network. High betweenness means a strong position, and the node gets power over the use of the information. However, this classical interpretation of the betweenness centrality is hard to extend to other meaning. For instance, our network is a collaboration network. Only strong collaboration ties are mentioned. As (Granovetter, 1973) recalls, these strong ties are not the only way to share the information within a network. In this matter, numerous weak ties are important. Our network does not mention this kind of ties, and thus we cannot use the betweenness centrality to express information sharing.

In our case, a stakeholder with a high betweenness can be at the intersection of two communities. Thus, the computation of this metrics is a good way to find stakeholders that can lead projects gathering two sides of the network.

To find these potential project leaders via the betweenness, we must take care about which network to choose. It is essential to select only the positive networks, as negative links won't express what we want. Secondly, it is not possible to include stakeholders that did not fill in the survey. Adding them would underestimate their score, and bias the other stakeholders' results

when it's about leading gathering projects. We thus recommend to compute the betweenness centrality over the positive graph of stakeholders who answered this survey.

2.3.2. Edge betweenness centrality

Along with the classical betweenness centrality, we can also compute the edge betweenness. This concept is similar, as it measures the strength of the position of an edge by counting the number of times it is on a path from one node to another. While it is used much less frequently than the node betweenness, the edge betweenness is important for the spreading of information.

Figure 10. Edge betweenness centrality



Figure 10 shows two cases. On the left hand side, we observe a high betweenness score for Stakeholder A. On the right hand side, we have a high betweenness score for Stakeholders A, B, and the tie linking them together.

In the first case, a project led by Stakeholder A alone is a good way to improve collaboration, as it links two communities. However, the same logic cannot be followed for the second example. Even if Stakeholder A has a high betweenness score, A needs B in order to reinforce collaboration between both communities.

Node and edge betweenness centralities are two powerful tools which must be used together very carefully. It is easy to use them in an inadequate context, or misinterpret the results and propose ineffective solutions.

2.3.3. In-degree centrality

The degree centrality is a very common centrality metric, but its application can induce a few biases. As the degree centrality counts the number of edges attached to a node, it can represent two things: the ties proposed by Stakeholder A, and the ties proposed by other stakeholders towards Stakeholder A. If the stakeholder is talkative or enthusiastic about a project, he/she might give a lot of names while another stakeholder might give fewer names because he/she does not want to reveal close connections. We tried to avoid this bias by limiting the number of possible answers (between 3 and 5 for the positives), but we cannot fully get rid of this if we want to provide freedom to the person who answers (especially the freedom not to reveal conflicting relations). Regardless, if every stakeholder proposes the same number of answers, degree centrality will not mean so much, as every node would have a minimum of connections.

In a directed graph, the degree centrality can provide two types of information. The in-degree centrality counts the number of edges oriented towards a node, and the out-degree centrality counts the number of edges coming from a node. As we have just shown, the out-degree centrality might not vary so much between the stakeholders, so this is not a good indicator for our purpose. The in-degree centrality, on the other hand, is far more interesting. It gets rid of the bias mentioned earlier, and shows how many times an organization has been cited. This metric can also be calculated for stakeholders who did not answer the survey.

If we introduce this metric into our analysis, we can go even further and compute the positive in-degree centrality for each vertex. These measurements allow us to have an overview of the popularity of the stakeholders in the network. It is also possible to see, at first glance, if the most popular nodes are connected or not, and thus begin to see possible working groups. With

the negative in-degree metrics, we can see the most disliked stakeholders in the network, and observe the imperfections in network collaboration, which unfortunately we did not analyze due to the fact that very few organizations wanted to note the organizations they do not like to collaborate with.

2.3.4. Signed eigenvector centrality and PN centrality

The classical degree centrality is useful since it gives us an easy first glance at the network. In our case, this first glance is better when using only the in-degree centrality, but it is important to remember that this metric is quite simple, if not trivial, and does not give a comprehensive understanding of the dynamics of the network. In an unsigned graph, this wider look is provided by the eigenvector centrality. This allows a higher centrality for a node that is connected to central nodes. As this process is iterative, the calculation is done from matrices. Besides individual centralities, this indicator shows the parts of the graph that are denser and more connected. It is often thought of as an indicator of popularity within a group, where it is more important to be connected to select important persons, rather than many unpopular people.

In signed networks, the matrix calculation gets tricky. This problem has been solved by (Bonacich and Lloyd, 2004). They extended their previous metrics to a network with negative ties. When we think about our network, we might find in this metric the same bias that the classical degree centrality had. If stakeholders can state their collaborators as they want, it is easy to mention an important international organization, for example, and receive a high centrality score while not being very central. As for the degree centrality, taking a look at incoming ties is necessary in order to get more relevant information.

This work has been done by (Everett and Borgatti, 2014). They came up with a new centrality measure named PN (“positive negative”) centrality, and first introduced it to fix an eigenvalue problem inside of Bonacich’s measure. They extended their metrics to propose two indicators: PN-in and PN-out. This differentiation raises a second problem, which is more interesting. What

is it to be central in a signed network? As Borgatti and Everett mentioned, there are many different cases. Is it good for centrality to dislike a person that is disliked by many? Is it better to be liked by a popular person if he likes fewer persons? Is disliking a popular person always a bad thing for centrality? Is it bad to be liked by an unpopular person?

All these cases pull centrality in opposite directions, and it is not possible to make a measurement that gathers them all. For their metrics, Borgatti and Everett kept the underlying mechanisms of the global PN centrality measure. It allows them to explain PN in terms of PN-in and PN-out. But as they mentioned, this choice is arbitrary and some equations can be added to the system to include more mechanisms. They are still producing research about these topics, and it might be interesting to follow the progression.

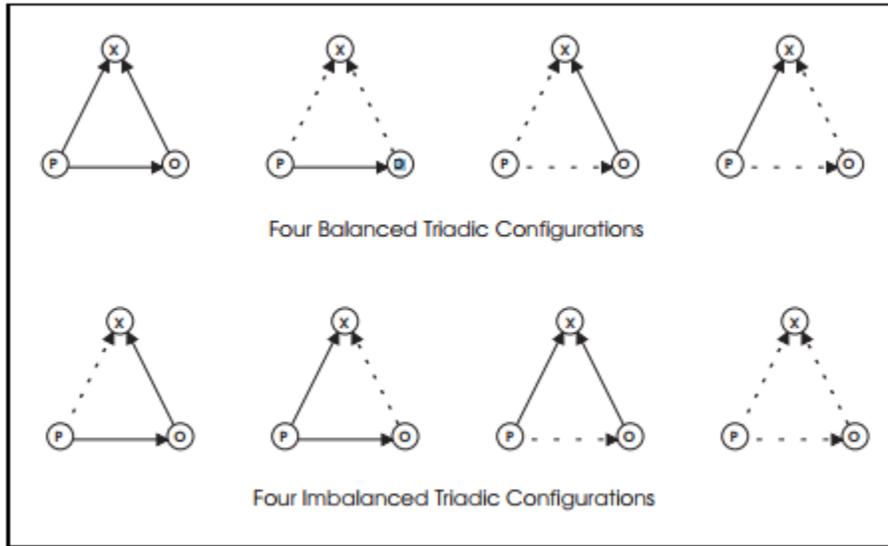
Once again, these different metrics cannot be used on all of our graphs. The Bonacich measure and PN centrality must be used on the graph with stakeholders who answered the survey, but PN-in can be used with other cited stakeholders. These measurements are complex, and often related to popularity in a graph. It is important to remember that this is not exactly the meaning of our ties, and thus we must be careful when interpreting the results.

2.3.5. Clustering Algorithms

(i) Graph balance

The idea of balance in a signed graph is important. Balance ensures the coherence of the ties within the graph, or its sub-graphs. This balance follows rules like “A friend of a friend is a friend” or “The enemy of a friend is an enemy”. These relations have been explained by (Heider, 1946), and then formalized by (Cartwright and Harary, 1956). Figures 11 highlights some of these relations.

Figure 11- Balanced and Imbalanced Configurations



All possible kinds of triads have been analyzed, and the balanceness of a structure can be easily expressed. If a closed cycle contains an even number of negative ties, the cycle is said to be positive. Otherwise, it is negative. A graph is balanced if all of its cycles are positive.

Following Cartwright and Harary's theorem, for a balanced signed network, the set of nodes can be partitioned into two subsets (clusters) so that every positive edge joins nodes of the same subset, and every negative edge joins nodes of different subsets.

The definition of a balanced graph within this theorem implies that we can only observe two antagonist groups. This restriction is due to a specific triad, containing only negative edges (bottom right in the figure).

Davis (1967) proposed another definition of balance called "clusterable graph". It is a graph that does not contain cycles with exactly one negative edge. Thus the theorem for clusterable graph can be extended to allow more than two different groups.

This idea of balance is very strict, though, and very few real networks satisfy these rules. However, this ideal is good to keep in mind if we want to partition the graph. (Doreian and Mrvar, 1996) introduced an algorithm based on this idea. They introduced a criterion, i.e. an

indicator of how close a partitioning is from structural balance, and this criterion increases with negative edges within a group and with positive edges between groups. It sums up these “inconsistencies”, and allows us the possibility to include a weight between positive and negative edges. The partition is then changed by moving nodes from one group to another until the criterion reaches a minimum. However, the optimality of this solution is not always obvious, and it is followed by a matrix block analysis that depends on the number of clusters chosen.

This method does not seem to fit the kind of data we would receive. Such a method is better on denser graphs, and with our limitations our graphs will be quite sparse. Moreover, if people are reluctant to reveal their conflicting relations, the smaller number of negative edges might prevent the algorithm from identifying usable clusters.

(ii) Edge betweenness algorithms

There are a number of classical clustering algorithms. One of the most common is the Girvan-Newman algorithm. The idea is to remove the edges that are most likely to link two communities. To find them, we compute the edge betweenness of all edges and remove the highest score. Here is the procedure:

Step 1: The betweenness of all edges in the network is calculated.

Step 2: The edge with the highest betweenness is removed.

Step 3: The betweenness of all remaining edges is recalculated.

Steps 2 and 3 are repeated until no edges remain.

The outcome of the algorithm is a dendrogram, which keeps track of each time a component was split up into two parts.

(Qi et al., 2017) proposed an adaptation to this algorithm for a signed network. Each time a positive sub-graph is split into two, the internal density of each part is calculated, taking into account the negative links, which lowers the density. If the density is high enough, the component is kept. The algorithm runs until we end up with a set of sufficiently dense components.

This approach seems to be a bit trivial, and the negative edges are not taken into account when removing the edges. If one of these algorithms is to be chosen, it is better to choose the original Girvan-Newman and consult closely the dendrogram. The `cluster_edge_betweenness` function on `igraph` runs this algorithm, and proposes the dendrogram as an outcome.

(iii) Modularity clustering

Another way to measure the quality of a partitioning is the modularity. In unsigned graphs, the modularity is the difference between the observed density of edges, and the density that we could expect from randomness. The modularity is used to analyze sub-graphs in a partition. The global modularity increases with the number of edges within a group, and decreases with the number of edges between groups.

There is a way to maximize this modularity measure, but the algorithm is too time consuming. However, heuristic methods have been found to approach this. Algorithms are getting very complex, but some are now widely used in Social Network Analysis. Some are directly available in `igraph`: `cluster_fast_greedy` (Clauset et al., 2004); `cluster_leading_eigen` (Newman, 2006); `cluster_louvain` (Blondel et al., 2008); `cluster_optimal` (Brandes et al., 2008).

Besides these four algorithms using modularity, another one uses a modularity score to find communities. Proposed by Traag and Bruggeman (2009), this algorithm manages signed networks. The negative version of modularity is added to the classical modularity score. It takes the same concept but reverses it for negative ties. This modularity increases with the number

of negative ties between groups, and decreases with the number of negative ties within a group. The igraph function `cluster_spinglass` returns the created communities.

(iv) Other methods

Besides modularity algorithms and the Girvan-Newman method, three other clustering algorithms are proposed by the igraph package. The `cluster_walktrap` (Pons and Latapy, 2005) assumes that by following a small random walk, one has more chances to stay within a community. By simulating these random walks, it is able to clearly identify the different clusters.

The `cluster_label_prop` (Raghavan et al., 2007) is an algorithm that assigns a label to each vector on the graph. At each step, each vector is relabeled according to its neighbors. It takes the label worn by the majority of its close neighbors. After a few steps, some labels spread out, and in the end the labelling stops. Each community is then defined by the label of the nodes it contains.

To provide beneficial results, in terms of long term capacity building, the DOCKSIDE project needs a strong network to support PhD research. However, this network needs to be organized in order to be able to propose interesting partnerships and interesting topics for students. So far, strategic collaboration and main topics are a bit ambiguous, and the survey is supposed to make things clearer.

The survey given to the stakeholders is based on qualitative data. We want to know which topics they find interesting, which partnerships are strong, and which connections are difficult to make. The strategy behind the questionnaire is to build two comparable groups. The Q-methodology proposes opinion groups, gathering people who think in the same way. Social Network Analysis proposes working groups, formed by stakeholders who are already working together. These methods give us the critical topics, in which the network is divided, as well as the bad relations which weaken the global collaboration.

2. Results of the Social Network Analysis

In this section we will present the outcomes of the Social Network Analysis. The final sample of stakeholders is presented in Appendix 8. We have 84 stakeholders in total. As we have stressed previously, some agencies belonging to larger organizations, such as UN agencies or departments within a ministry, were regrouped. Each respondent had to answer the following question: “When developing projects in the environmental and maritime fields, which organizations or partners do you work with? (Public institutions, Private companies, Non-governmental organization, Ports, Universities...)”. We also provided the following guidelines “Think about your partners in past and ongoing projects. Please propose between 3 and 5 organizations on the next screen”.

2.1. Descriptive statistics

The fact that respondents did not have a list of stakeholders to choose from led to a very large sample of stakeholders and a less dense network. On average, each stakeholder is connected to less than two organizations (Table 17).

Table 17. *Descriptive statistics - Social Network Analysis*

Avg Degree	1.905	Fragmentation	0.8
H-Index	6	Closure	0.162
Centralization	0.196	Avg Distance	3.441
Density	0.023	SD Distance	1.817
Components	70	Diameter	9
Component Ratio	0.831	Breadth	0.92
Connectedness	0.2	Compactness	0.08

Some centrality measures are represented in Appendix 17. The fact that the graph is not dense, and that the answers of some respondents have been regrouped, suggests that we have to be cautious when interpreting results.

2.2. Centrality measures

We have a directed positive network with equal weights (+1) on the links between the nodes shows the top 20 stakeholders with the highest centrality measures. “In” refers to the number of times that a given organization has been pointed out by other respondents, while “out” means the links coming out from a given organization (the organizations selected by the respondent). The results related to the number of times that an organization was selected by other respondents are more useful to this study. Table 18 shows the 20 top ranking stakeholders. We observe that public organizations such as the Ministry of Interior (MoI), Ministry of Environment (MoE), and Ministry of Agriculture Forestry and Fisheries (MAFF), have very high “In” centrality measures. Among NGOs, World Conservation Society (WCS), Fauna and Flora International (FFI), and World Wildlife Fund (WWF), have important roles in the network. Among the international organizations, which support a number of projects in Cambodia, we can distinguish the United Nations agencies (UN), the Asian Development Bank (ADB), and the World Bank Group.

In order to highlight the key stakeholders in the network, we plot different networks where the size of the nodes are given by a particular network measure, and where the colors of the nodes depend on the type of stakeholders (Figures 12-16).

Table 18. *The 20 most important Stakeholders for different network centrality measures*

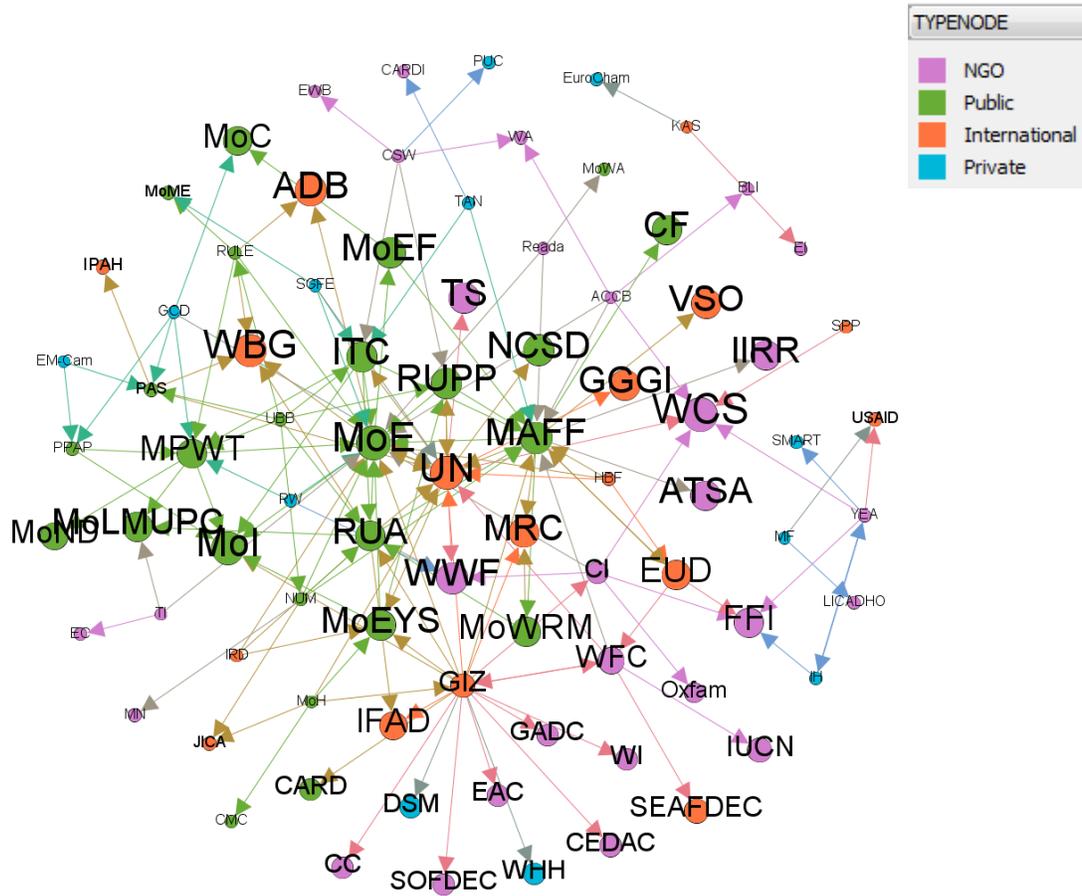
Rank	OutDeg	Indeg	Out2local	In2local	OutBonPw	InBonPwr	OutClose	InClose	Between
1	MAFF	MoI	GIZ	MoE	GIZ	MoE	GIZ	MoE	MAFF
2	UN	MPWT	WFC	UN	UBB	UN	MoH	WCS	EUD
3	RUA	RUA	UBB	MoI	WFC	MoI	UBB	MoI	WFC
4	UBB	ITC	MoH	MAFF	MoH	MAFF	WFC	UN	UN
5	ACCB	WCS	HBF	WBG	HBF	WBG	HBF	WBG	GIZ
6	CI	FFI	ITC	WWF	UN	RUPP	MAFF	MAFF	MoE
7	CSW	MoEYS	RUA	ADB	MAFF	WWF	NUM	ADB	MoEF
8	GCD	RUPP	RUPP	MoEF	ITC	ADB	ACCB	WWF	ITC
9	ITC	WBG	NUM	RUPP	RUA	MoEF	EUD	GGGI	RUA
10	MoE	WWF	MAFF	MRC	RUPP	MoEYS	RUA	ITC	RUPP
11	MoH	MoLMUPC	SGFE	WCS	SGFE	WCS	TAN	MoEF	MPWT
12	NUM	MRC	GCD	MoEYS	EUD	ITC	CSW	NCSD	PAS
13	RULE	PAS	UN	ITC	NUM	GGGI	ITC	RUPP	CI
14	WFC	ADB	IRD	MoLMUPC	TAN	NCSD	Reada	TS	MoWRM
15	YEA	EUD	ACCB	RUA	IRD	TS	RUPP	MoEYS	NUM
16	HBF	GIZ	EUD	EUD	CSW	MRC	SGFE	MRC	PPAP
17	MPWT	IFAD	Reada	MPWT	GCD	EUD	GCD	ATSA	MoEYS
18	SGFE	JICA	TAN	ATSA	ACCB	ATSA	MoEF	CF	YEA
19	EUD	MoC	MoE	CF	Reada	CF	UN	IIRR	RULE
20	IRD	MoME	MoEF	IIRR	MoEYS	IIRR	IRD	MoLMUPC	ACCB

As seen in Figure 13, in terms of betweenness, MAFF is the most central stakeholder. The European Delegation in Cambodia (EUD) is another bridging organization in the network and connects different groups of stakeholders. The World Fish Center (WFC) is one of a few NGOs with high betweenness centrality. To increase the impact of a given project, UN, GIZ and MoE should also be considered since they have high betweenness measures and can control information flow in a network.

2.2.3. Closeness centrality

Closeness centrality measures depict the ability of a stakeholder to reach all the other nodes in the network via the shortest paths (geodetic distances). In other words, it indicates the possibility of accessing the source of information in the social network. As we can see in Figure 14, many NGOs and foundations such as GIZ, WFC, HBF, WWF and CSW have high closeness centralities.

Figure 14. Closeness centrality

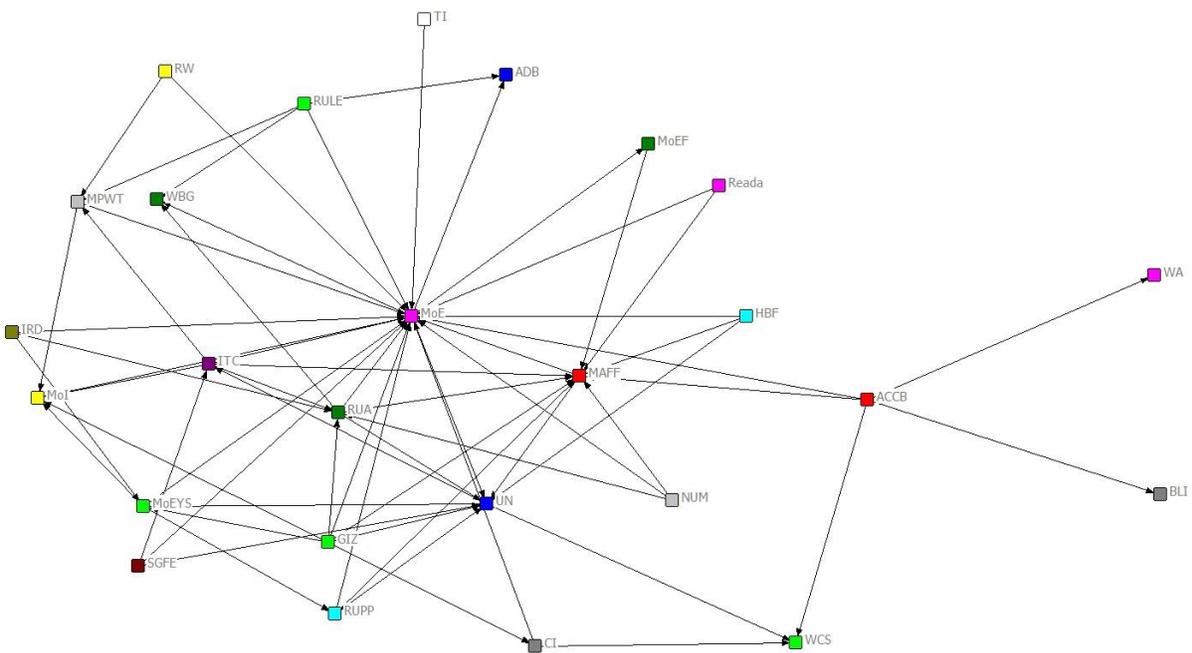


Public stakeholders such as the Ministry of Health, UBB, MoI and MAFF also have very high closeness centralities. These organizations should be considered in the future in order to improve the dissemination strategy of DOCKSIDE project.

2.2.4. Ego-network

Since the MOE appears to be one of the more central stakeholders, we have plotted the ego-network of MOE which highlights the stakeholders who are directly (one-step) or indirectly (two-steps) connected to MOE.

Figure 15. Ego-network of MOE



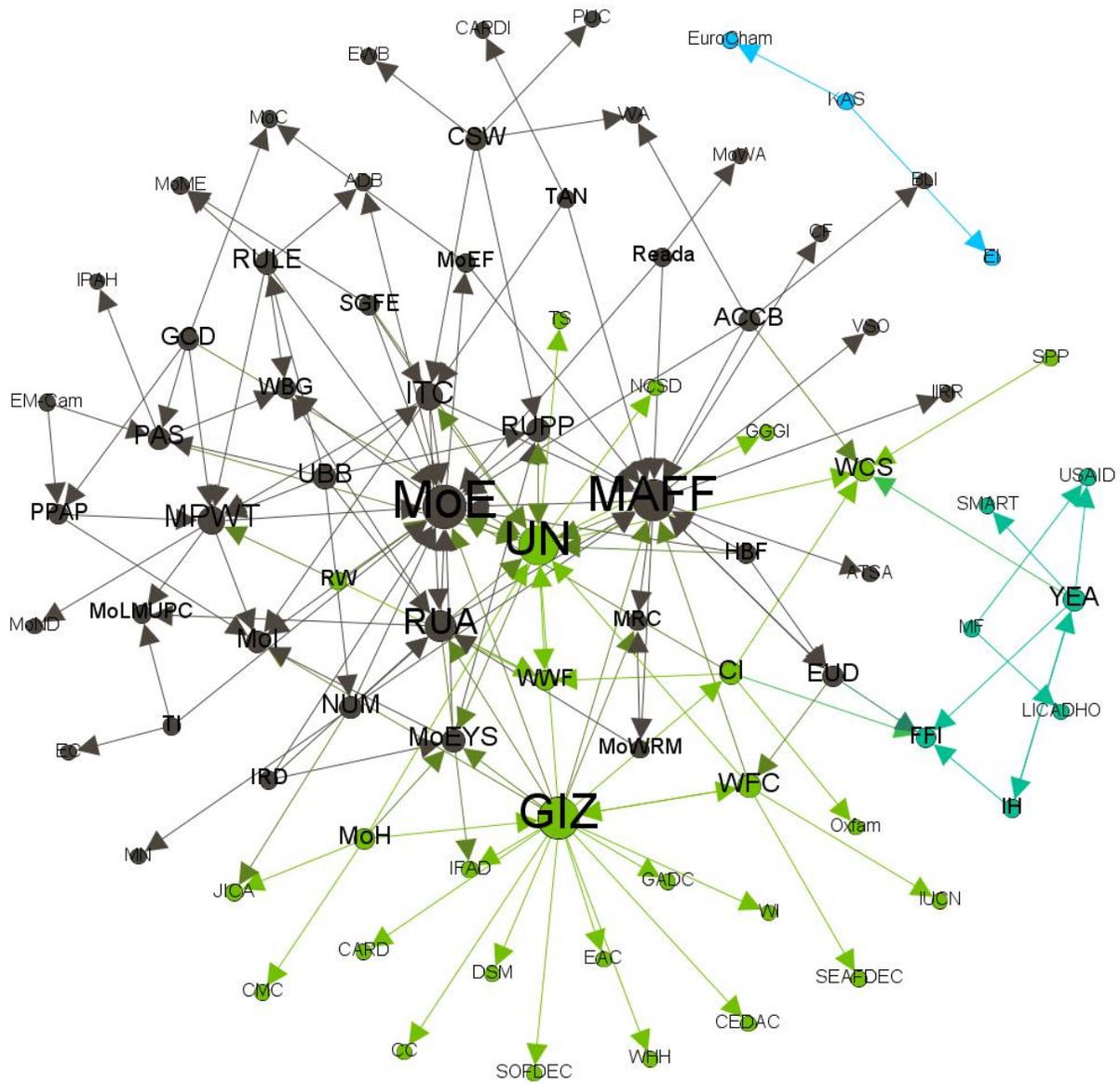
The network of MoE should be considered when developing projects in environmental fields.

2.2.5. Modularity

Although the concept of community within graph theory is not clearly defined, it is possible to detect some communities based on the modularity algorithm of Blondel et al. (2008). As we see

in Figure 16, we can distinguish four communities. The associated members of each community have the same color. We have one big community which is dominated by two ministries, MoE and MAFF, and the central organizations of the second community are UN and GIZ.

Figure 16. Modularity



In summary, when developing projects in environmental and maritime fields, the list of organizations in Appendix 8 should be considered. However, different types of organizations have different centrality measures. As we can see in Table 19, public organizations have the highest Indegree centrality, followed by international, non-governmental, and private stakeholders. Public and international stakeholders are also important bridging organizations and connect different groups of stakeholders.

Table 19. Average centrality measures according to type of organization

	Outdegree	Indegree	Out Closeness	In Closeness	Betweenness
Public	2.68	3.32	657.88	684.60	72.54
International	2.41	2.00	736.94	698.41	67.51
NGO	1.03	1.23	769.70	732.03	14.63
Private	1.75	0.50	709.75	802.83	0.00

In terms of closeness, public organizations have the lowest degree centrality (which indicates that they are efficient in dissemination of information to other stakeholders in the network), followed by the international institutions, NGOs and private companies.

A fundamental stakeholder for the network is the Ministry of Environment. It has been indicated that the organizations in our sample tend to prefer to work with this ministry.

IV. Conclusion and future research

Stakeholder analysis is an important step in ensuring the sustainable outcomes of DOCKSIDE project. By applying Social Network Analysis (SNA), the current study has identified the most important stakeholders in environmental and maritime fields in Cambodia. In addition, based on the opinions of students and stakeholders, we managed to distinguish different groups with similar priorities. A combination of these two approaches has never been used before.

Q-method provides useful results regarding the topics and opinions of students and representatives of stakeholders. Among the interviewed students from NUM, UBB, RULE and RUA, we have distinguished three groups. The first one was named “Social-Democrat Environmentalists” who support environmentally friendly policies, as well as more state intervention and regulations. The second group was named “Responsible Productivists”, and includes students who are interested in increasing the production and efficiency of farmers and companies with a respect to the environment. The last group of students was defined as “Pro-business”, and emphasizes state regulations and policies favoring productivity in maritime and environmental sectors.

Regarding the opinions of stakeholders’ representatives, four groups were identified. The first consists of “Social Environmentalists”, and includes organizations from public and international sectors. These stakeholders support government policies and protection of the environment. The second group mainly consists of NGOs and international organizations. Respondents associated with this group believe in more protection of the environment by the authorities, and that intensive agriculture and farming must be limited. The third group also includes organizations which support environmentally friendly policies. Organizations in this group are from the public, international and non-governmental sectors. The last group consists mainly of public organizations and supports policies related to the increase of productivity.

Overall, stakeholders’ representatives and students have very similar opinions. The main priorities of the two samples relate to the food quality, use of plastic, state regulations on agricultural land, introduction of technology in agriculture, renewable energy development,

wildlife conservation, and improvement of fishermen working conditions. It is clear that these topics require multidisciplinary research. Cambodian universities willing to implement projects in these fields should work with some of the organizations identified by Q-methodology. Cambodian students should also consider the “attractiveness” of different topics for their future studies and careers. In the future, Q-methodology could be applied to only one particular topic which would allow for more precision in defining the priorities of respondents.

The difficulties identified by stakeholders’ respondents should also be highlighted. Many of them mentioned problems with the quality of education in Cambodia, and certain cultural factors that influence the performance of students. Therefore, a potential topic of research could be to clearly identify the factors that make it difficult to create collaborations between academic and non-academic organizations. There is also a need to identify the reasons why students in Cambodia seems to have some difficulties working in private and non-governmental sectors. It would allow us to adapt the university curriculum, and introduce more courses related to the development of soft skills.

We have also analyzed the network of the organizations in the sample by using Social Network Analysis. Not surprisingly, the most connected organizations are in the public sector. The Ministry of Environment and the Ministry of Agriculture Forestry and Fisheries should be considered when developing a project in environmental and maritime fields. Among the international organizations, an important role is being played by UN agencies, GIZ, World Fish Center and World Conservation Society. These results are based on the responses of the interviewees. In order to analyze their network better, a potential topic of research could be to define clearly the financial resources of different organizations as well as the nature of their relations with other organizations. This is challenging research, which could be made possible only through establishing close cooperation with the identified stakeholders.

The Environmental Maritime Research (EMR) Network should be able to provide a useful platform for students and identified stakeholders to exchange and work together. It is important to define priorities and working groups with representatives of different organizations in order to respond to the priorities of different institutions. Thematic events

such as conferences, workshops, summer schools and training sessions must be organized in order to improve the collaboration between DOCKSIDE partners and the identified stakeholders. This collaboration should consist of writing scientific articles, exchanging good practices, developing curricula, establishing internship opportunities for students and other activities. Non-academic organizations have the will to support the universities in the development of research. However, the initiative could also come from Cambodian universities. Crucial efforts in the improvement of education quality and research facilities are necessary in order to create an environment which enables efficient and quick responses to ongoing issues facing Cambodia such as climate change, international trade, regional integration, fisheries management, governmental agricultural regulations, and infrastructure development.



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Appendices

Appendix 1: First selection of statements for the Q-methodology survey

Agriculture and food safety

1. Farmers should have the right to manage their own land however they wish.
2. State should impose more regulations on the use of agricultural land.
3. Environmental damage from agriculture is mostly caused by low income farmers or farmers on poor land.
4. Achieving high crop yields is the sign of a good farmer
5. The effect of the pollution caused by agricultural chemicals is less important than their benefits in production.
6. Nowadays in Cambodia, farmers' main responsibility is to produce food in quantity to feed the nation rather than trying to preserve the rural environment.
7. Intensive livestock production is a source of ecological problems and needs to be reformed.
8. Whenever possible, farm labor should be replaced by more efficient machines and technologies.
9. Poor health is related to low quality food

Biodiversity

10. Wildlife conservation should only be considered once financial objectives have been reached.
11. Rare species can be a problem to look after and farms would be better off without them.
12. The lack of regulations and law enforcement is threatening the marine and inland water biodiversity.
13. Public Authorities protect efficiently the natural parks of Cambodia.
14. Having Special Economic Zone near the coast causes negative effects on maritime wildlife.

15. An agreement with Thailand and Vietnam is needed to protect the Gulf of Thailand

Energy and Depletion of Natural Resources

16. Collective action is needed to prevent natural resources depletion.

17. Cambodia should intensively exploit offshore petroleum resources to be more energy-independent

18. If there is more electricity for rural household, they will use less timber.

19. Hydropower dams are more efficient and less polluting than fossil-fired power plants.

20. Nowadays, it is impossible to develop renewable energy in Cambodia.

21. Nuclear plant could be a good way to produce energy without damaging the environment.

Fisheries Issues

22. Dams have a negative impact on the fisheries along the Mekong River and its tributaries.

23. Aquaculture should be further developed in Cambodia.

24. Overfishing is driving many Cambodian species to extinction.

25. Direct governmental control over the fisheries would be more efficient than Community Fisheries.

26. Community Fisheries successfully manage to ensure long term sustainability of the fish stock.

27. The number of fishermen is decreasing.

28. In the last years, fishermen's working conditions have improved.

29. In Cambodia, the consumption of freshwater (inland) fish is too high.

30. Port activities has a negative effect on fisheries.

Ports and infrastructure

31. It is easy for trucks to transport goods from ports to cities.

32. Train is the most convenient way to transport goods.

33. The ports infrastructure in Cambodia is well developed.

34. Administrative procedures and security checking should be reduced to improve the ports' efficiency.

- 35. Inland transport should be further developed, rather than roads or trains.
- 36. The price to transport goods in Cambodia is higher than the neighboring countries.
- 37. Government can attract port users by decreasing the user fee rather than building more facilities.
- 38. Cars and motorbikes are the biggest cause of environmental and health problems in Cambodia
- 39. In Cambodia, public transportation is not as developed as it should be.
- 40. Among all kind of roads, the port of Sihanouk is the main road for the international trade of Cambodia.

Climate Change and Environment

- 41. Most of future environmental problems will be solved by technology.
- 42. Multinationals are the main threats to the environment in Cambodia.
- 43. Cambodian economic growth and living standards are more important than environment.
- 44. Cambodia is not threatened by climate change
- 45. Humans are not responsible for climate change.
- 46. Cambodia people are aware of consequences of climate change.
- 47. Climate change should be an important topic for politicians.
- 48. The severe drought in 2016 is due to the climate change.
- 49. A lot of jobs could be created in sustainable development.
- 50. Tourism is a threat to Cambodian environment.
- 51. We should be able to pay for reusable bag instead of getting free plastic bag.

Responsibility, Policy and Stakeholder Cooperation

- 52. No one puts pressure on government in term of environmental issue in Cambodia.
- 53. Government should prevent people from using their car by imposing tax.
- 54. Pollution can be reduced by changing the people habit without any government action.
- 55. All private firms whose economic activities harm the environment should pay for the damages,
- 56. The environmental assessment of a projects should be conducted by public institutions.

- 57. It is the responsibility of businesses to provide products that are not damaging the environment.
- 58. People would agree on paying a tax to get environmental improvements
- 59. Cooperation between organizations is not necessary to achieve environmental project.

Education & Research

- 60. We should invest in environmental education for adults.
- 61. Public and private cooperation in environmental and maritime research is essential.
- 62. We should be involved in the research and development of the technology in renewable energy.
- 63. It is necessary to increase communication between the scientific community and the population.
- 64. Universities should provide grants for graduate students in doing research in environmental research.
- 65. To have a good quality of research, only leading universities should focus on the environmental and maritime research.
- 66. The only objective of research is to provide policies implication to the government.
- 67. The best way to promote environmental and maritime research is to propose more promotions to public and private jobs.

Appendix 2: Second selection of statements for the Q-methodology survey

- 1. State should impose more regulations on the use of agricultural land.
- 2. Environmental damage from agriculture is mostly caused by low income farmers.
- 3. A good farmer is a farmer that has a high productivity.
- 4. Farmers' main responsibility is to produce food in quantity to feed the nation rather than trying to preserve the rural environment.

5. Intensive livestock production is a source of ecological problems and needs to be reformed.
6. Whenever possible, farm labor should be replaced by more efficient machines and technologies.
7. Poor health is related to low quality food.
8. Wildlife conservation should only be considered once financial objectives have been reached.
9. Rare species can be a problem to look after and farms would be better off without them.
10. The lack of regulations and law enforcement is threatening the marine and inland water biodiversity.
11. Public Authorities protect efficiently the natural parks of Cambodia.
12. Having Special Economic Zone near the coast causes negative effects on maritime wildlife.
13. Cambodia should intensively exploit offshore petroleum resources to be more energy-independent
14. If there is more electricity for rural household, they will use less timber.
15. Hydropower dams are more efficient and less polluting than fossil-fired power plants.
16. Nowadays, it is impossible to develop renewable energy in Cambodia.
17. Nuclear plant could be a good way to produce energy without damaging the environment.
18. Dams have a negative impact on the fisheries along the Mekong River and its tributaries.
19. Aquaculture should be further developed in Cambodia.
20. Community Fisheries successfully manage to ensure long term sustainability of the fish stock.
21. In the last years, fishermen's working conditions have improved.
22. In Cambodia, the consumption of freshwater (inland) fish is too high.
23. Port activities has a negative effect on fisheries.
24. It is easy for trucks to transport goods from ports to cities.
25. The ports infrastructure in Cambodia is well developed.
26. Administrative procedures and security checking should be reduced to improve the ports' efficiency.

27. Inland transport should be further developed, rather than roads or railways.
28. The price to transport goods in Cambodia is higher than the neighboring countries.
29. Cars and motorbikes are the biggest cause of environmental and health problems in Cambodia
30. In Cambodia, public transportation is not as developed as it should be.
31. Most of the future environmental problems will be solved by the technological progress.
32. Multinational companies are the main threat to the environment in Cambodia.
33. Cambodian economic growth and living standards are more important than environment.
34. Cambodia is not threatened by climate change.
35. Humans are not responsible for climate change.
36. Cambodia people are aware of consequences of climate change.
37. Climate change should be an important political topic.
38. Tourism is a threat to the Cambodian environment.
39. We must ban plastic bags.
40. No one puts pressure on government in term of environmental issues in Cambodia.
41. All private firms whose economic activities harm the environment should pay for the damages.
42. The environmental assessment of a project should be conducted by public institutions.
43. People would agree on paying a tax to get environmental improvements
44. Public and private cooperation in environmental and maritime research is essential.
45. It's necessary to increase communication between the scientific community and citizens.
46. Universities should provide more grants for students doing research on environmental topics.

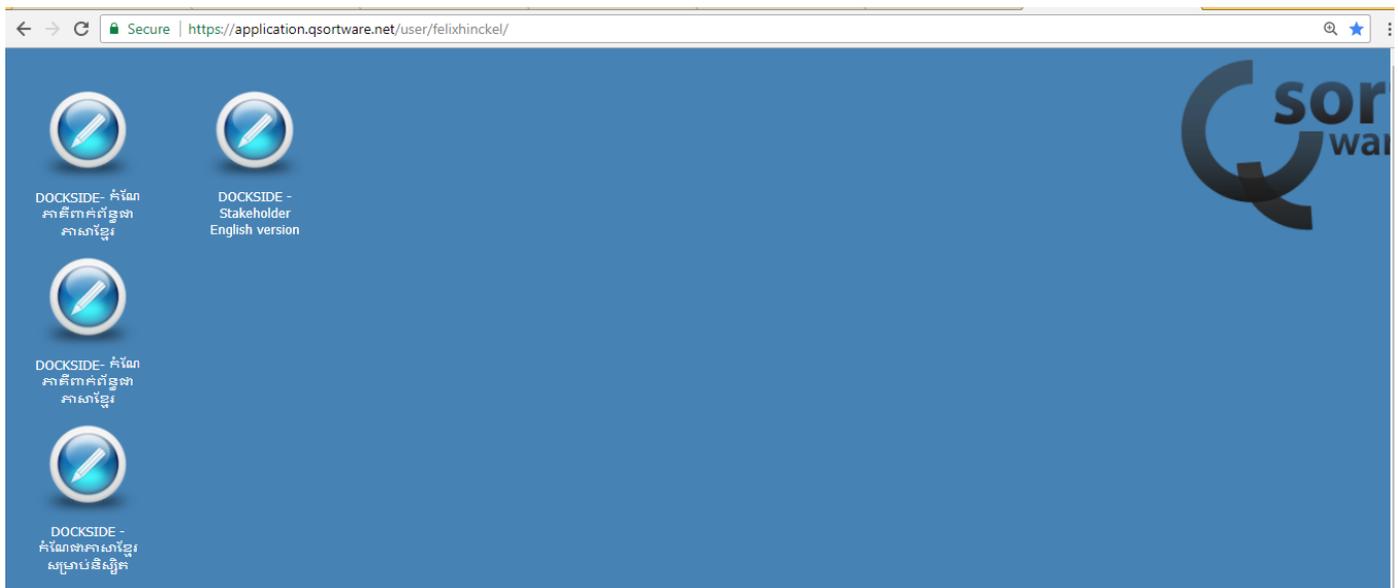
Appendix 3: Last selection of statements for the Q-methodology survey

1. State should impose more regulations on the use of agricultural land.

2. A good farmer is a farmer that has a high productivity.
3. Intensive livestock production is a source of ecological problems and needs to be reformed.
4. Whenever possible, farm labor should be replaced by more efficient machines and technologies.
5. Poor health is related to low quality food.
6. Government should ban the use of chemicals in agriculture.
7. Wildlife conservation should only be considered once financial objectives have been reached.
8. Government protects efficiently the natural parks of Cambodia.
9. Cambodia should intensively exploit offshore petroleum resources to be more energy-independent
10. Nowadays, it is impossible to develop renewable energy in Cambodia.
11. Nuclear plant could be a good way to produce energy without damaging the environment.
12. Dams have a negative impact on the fisheries along the Mekong River and its tributaries.
13. Aquaculture should be further developed in Cambodia.
14. Community Fisheries successfully manage to ensure long term sustainability of the fish stock.
15. In the last years, fishermen's working conditions have improved.
16. Port activities have a negative effect on fisheries.
17. The ports infrastructure in Cambodia is well developed.
18. Administrative procedures and security checking should be reduced to improve the ports' efficiency. AP++
19. The price to transport goods in Cambodia is higher than the neighboring countries.
20. Cars and motorbikes emissions are the biggest cause of environmental and health problems in Cambodia
21. In Cambodia, public transportation is not as developed as it should be.
22. Most of the future environmental problems will be solved by the technological progress.
M++ A--

- 23. Multinational companies are the main threat to the environment in Cambodia. M—A+
- 24. Cambodian economic growth and living standards are more important than environment.
- 25. No one puts pressure on government in term of environmental issues in Cambodia.
- 26. People would agree on paying a tax to get environmental improvements.
- 27. Cambodia people are aware of consequences of climate change.
- 28. We must ban plastic bags.

Appendix 4: Step 1 of filling in the Q-methodology survey (Introduction)



Appendix 5: Step 2 of filling in the Q-methodology survey (First sort)

DOCKSIDE - Stakeholder English version / Step 1 of 1...



Drag the following item into one of the boxes below:

Yes	No opinion	No
1 State should impose more regulations on the use of agricultural land.	1 Nuclear plant could be a good way to produce energy without damaging the environment.	1 Community Fisheries successfully manage to ensure long term sustainability of the fish stock.
2 A good farmer is a farmer that has a high productivity.	2 Dams have a negative impact on the fisheries along the Mekong River and its tributaries.	2 In the last years, fishermen's working conditions have improved.
3 Intensive livestock production is a source of ecological problems and needs to be reformed.	3 Aquaculture should be further developed in Cambodia.	3 Port activities have a negative effect on fisheries.
4 Whenever possible, farm labor should be replaced by more efficient machines and technologies.	4 Administrative procedures and security checking should be reduced to improve the ports' efficiency.	4 The ports infrastructure in Cambodia is well developed.
5 Poor health is related to low quality food.	5 The price to transport goods in Cambodia is higher than the neighboring countries.	5 Most of future environmental problems will be solved by the technological progress.
6 Government should ban the use of chemicals in agriculture.		6 Multinational companies are the main threats to the environment in Cambodia.
7 Wildlife conservation should only be considered once financial objectives have been reached.		7 Cambodian economic growth and living standards are more important than environment.
8 Government protects efficiently the natural parks of Cambodia.		8 No one puts pressure on Cambodian government in terms of environmental issues.
9 Cambodia should intensively exploit offshore petroleum resources to be more energy-independent.		9 People would agree on paying a tax to get environmental improvements
10 Nowadays, it is impossible to develop renewable energy in Cambodia.		
11 Cars and motorbikes emissions are the biggest cause of environmental and health problems in Cambodia		
12 In Cambodia, public transportation is not as developed as it should be.		
13 Cambodian people are aware of consequences of climate change.		
14 We must ban plastic bags.		

Continue



Appendix 6: Step 3 of filling in the Q-methodology survey (Second sort)

DOCKSIDE - Stakeholder English version / Step 1 of 1...

Among the YES section, select the two you agree the most with, and place it in the extreme left box below. From the remaining statements, the one you agree on the most will go in the second box from the left and so on... Do the exact same thing with the NO section, until the pyramidal grid is filled.
The numbers between brackets represent the number of statement to put in each box.

Drag the items to the boxes below:

Yes	No opinion	No
1 State should impose more regulations on the use of agricultural land.	1 Intensive livestock production is a source of ecological problems and needs to be reformed.	1 A good farmer is a farmer that has a high productivity.
2 Nowadays, it is impossible to develop renewable energy in Cambodia.	2 Poor health is related to low quality food.	2 Wildlife conservation should only be considered once financial objectives have been reached.
	3 Government should ban the use of chemicals in agriculture.	3 Government protects efficiently the natural parks of Cambodia.
		4 In the last years, fishermen's working conditions have improved.
		5 We must ban plastic bags.

AGREE (2)	(3)	(4)	(5)	(5)	(4)	(3)	DISAGREE (2)
1 Cambodia should intensively exploit offshore petroleum resources to be more energy-independent.	1 Port activities have a negative effect on fisheries.	1 Administrative procedures and security checking should be reduced to improve the ports' efficiency.	1 Community Fisheries successfully manage to ensure long term sustainability of the fish stock.	1 Multinational companies are the main threats to the environment in Cambodia.	1 No one puts pressure on Cambodian government in terms of environmental issues.	1 Dams have a negative impact on the fisheries along the Mekong River and its tributaries.	
2 Whenever possible, farm labor should be replaced by more efficient machines and technologies.	2 People would agree on paying a tax to get environmental improvements	2 The ports infrastructure in Cambodia is well developed.	2 In Cambodia, public transportation is not as developed as it should be.	2 Aquaculture should be further developed in Cambodia.			
3 Nuclear plant could be a good way to produce energy	3 Cambodian people are aware of consequences of climate change.	3 The price to transport goods in Cambodia is higher than the neighboring	3 Most of future environmental problems will be	3 Cars and motorbikes emissions are the biggest cause of environmental and health problems in			
⚠ Too many items	✅ OK!	⚠ 1 item(s) missing	⚠ 1 item(s) missing	⚠ 2 item(s) missing	⚠ 3 item(s) missing	⚠ 2 item(s) missing	⚠ 2 item(s) missing

Continue



Appendix 7: organizations, including their agencies and departments that were listed by all stakeholders

Organization (full name)	Abbreviation
Angkor Centre for Conservation of Biodiversity	ACCB
Asian Development Bank	ADB
Agriculture Technology Services Association	ATSA
BirdLife International	BLI
Council for Agricultural and Rural Development	CARD
Cambodian Agricultural Research and Development Institute	CARDI
Caritas Cambodia	CC
Communities of Fisheries	CF
Conservation International	CI
Council of Ministers of Cambodia	CMC
Center for sustainable water	CSW
DSM Group (Phnom Penh, Cambodia)	DSM
Eco Agri Center	EAC
Equitable Cambodia	EC
Ecoland Research Centre	Ecoland
Enrich Institute	EI
Eastern Maritime (Cambodia)	EM-Cam
EU Delegation	EUD
European Chamber of Commerce	EuroCham
Engineers Without Borders	EWB
Food and Agriculture Organization	FAO
Fauna & Flora International	FFI
Fisheries Administration	FiA
Gender and Development for Cambodia	GADC
Green Country Development Co. Ltd	GCD
Global Green Growth Institute	GGGI
Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)	GIZ
GIZ Department of Ministry of health, social development, education and young people	GIZ-HSDEYP
GIZ Department of Ministry of Education, Youth and Sports (MoEYS)	GIZ-MoEYS
GIZ Department of Ministry of Land Management, Urban Planning, and Construction	GIZ-MoLMUPC
GIZ Regional Economic Development Programme Department	GIZ-RED
GIZ ASEAN sustainable agrifood system (SAS) Department	GIZ-SAS
Heinrich Boell Foundation	HBF
International Fund for Agricultural Development	IFAD
Impact Hub	IH

Organization (full name)	Abbreviation
International Institute of Rural Reconstruction	IIRR
International Maritime Organization	IMO
National Polytechnic Institute of Toulouse	INP Toulouse
International Ports and Harbour	IPAH
Institut de Recherche pour le développement	IRD
Institute of Technology of Cambodia	ITC
International Union for Conservation of Nature	IUCN
Japan International Cooperation Agency	JICA
Konrad-Adenauer-Stiftung	KAS
Cambodian League for the Promotion and Defense of Human Rights	LICADHO
Niras/Ministry of Agriculture, Forestry and Fisheries	MAFF
Ministry of Economy and Finance	MEF
Metfone	MF
Mother Nature	MN
Muséum National d'Histoire Naturelle	MNHN
Ministry of Commerce	MoC
Ministry of Environment	MoE
Ministry of Environment (Department of Climate Change)	MoE-DCC
Ministry of Environment (Department of Heritage)	MoE-DH
Ministry of Environment (Department of Marine and Coastal Zone Conservation)	MoE-DMCC
Ministry of Economy and Finance	MoEF
Ministry of Education Youth and Sport	MoEYS
Ministry of Health	MoH
Ministry of Interior	MoI
Ministry of Interior	MoINT
Ministry of Land Management, Urban Planning, and Construction	MoLMUPC
Ministry of Mines and Energy	MoME
Ministry of National Defense	MoND
Ministry of Women Affaires	MoWA
Ministry of Water Resources and Meteorology	MoWRM
Ministry of Public Works and Transport	MPWT
Mekong River Commission	MRC
FAO	MWRM
National Council For Sustainable Development	NCSD
National University of Management	NUM
Oxford University	OI
Oxford Committee for Famine Relief	Oxfam
Sihanoukville Autonomous Port	PAS
Phnom Penh Autonomous Port	PPAP

Organization (full name)	Abbreviation
Phnom Penh Municipality	PPM
Pannasastra University of Cambodia	PUC
Rural Economic & Agriculture Development Agency	Reada
Royal University of Agriculture	RUA
Royal University of Law and Economics	RULE
Royal University of Phnom Penh	RUPP
Rosewood	RW
Shipping Companies	SC
Southeast Asian Fisheries Development Center	SEAFDEC
Sustainable Green Fuel Enterprise	SGFE
Smart Mobile Operator	SMART
Smart development works	SNV
Society for Community Development in Cambodia	SOFDEC
Sea Protection Project	SPP
TANCONS	TAN
Transparency International	TI
Teuk Saart 1001	TS
University of Battambang	UBB
United Nations Development Programme	UNDP
United Nations Environment Programme	UNEP
The United Nations Children's Fund	UNICEF
United States Agency for International Development	USAID
Voluntary Service Overseas	VSO
Wildlife Alliance	WA
Water Aid	W-aid
World Bank Group	WBG
World Conservation Society	WCS
World Fish Center	WFC
World Food Program	WFP
Welthungerhilfe	WHH
World Health Organization	WHO
World Vision	WI
World Wildlife Fund	WWF
Young Eco Ambassadors	YEA

Appendix 8: Organizations that were included in the sample for SNA

Full Name	Type	Abbreviation	Filled in the survey
Angkor Centre for Conservation of Biodiversity	NGO	ACCB	YES
Asian Development Bank	International	ADB	
Agriculture Technology Services Association	NGO	ATSA	
BirdLife International	NGO	BLI	
Council for Agricultural and Rural Development	Public	CARD	
Cambodian Agricultural Research and Development Institute	NGO	CARDI	
Caritas Cambodia	NGO	CC	
Cambodian Center for Study and Development in Agriculture	NGO	CEDAC	
Communities of Fisheries	Public	CF	
Conservation International	NGO	CI	YES
Council of Ministers of Cambodia	Public	CMC	
Center for sustainable water	NGO	CSW	YES
DSM – Bright Science. Brighter Living.	Private	DSM	
Eco Agricultural Center	NGO	EAC	
Equitable Cambodia	NGO	EC	
Enrich Institute	NGO	EI	
Eastern Maritime (Cambodia)	Private	EM-Cam	YES
European Union Delegation	International	EUD	YES
European Chamber of Commerce	Private	EuroCham	
Engineers Without Borders	NGO	EWB	
Fauna and Flora International	NGO	FFI	
Gender and Development for Cambodia	NGO	GADC	
Green Country Development Co. Ltd	Private	GCD	YES
Global Green Growth Institute	International	GGGI	
Gesellschaft für Internationale Zusammenarbeit GmbH	International	GIZ	YES
Heinrich Boell Foundation	International	HBF	YES
International Fund for Agricultural Development	International	IFAD	
Impact Hub	Private	IH	YES
International Institute of Rural Reconstruction	NGO	IIRR	
International Association of Ports and Harbours	International	IPAH	
Institut de Recherche pour le developpement	International	IRD	YES
Institute of Technology of Cambodia	Public	ITC	YES
International Union for Conservation of Nature	NGO	IUCN	
Japan International Cooperation Agency	International	JICA	
Konrad-Adenauer-Stiftung	International	KAS	YES
Cambodian League for the Promotion and Defense of Human Rights	NGO	LICADHO	

Full Name	Type	Abbreviation	Filled in the survey
Ministry of Agriculture, Forestry and Fisheries	Public	MAFF	YES
Metfone	Private	MF	YES
Mother Nature	NGO	MN	
Ministry of Commerce	Public	MoC	
Ministry of Environment	Public	MoE	YES
Ministry of Economy and Finance	Public	MoEF	YES
Ministry of Education Youth and Sport	Public	MoEYS	YES
Ministry of Health	Public	MoH	YES
Ministry of Interior	Public	Mol	
Ministry of Land Management, Urban Planning, and Construction	Public	MoLMUPC	
Ministry of Mines and Energy	Public	MoME	
Ministry of National Defense	Public	MoND	
Ministry of Women Affaires	Public	MoWA	
Ministry of Water Resources and Meteorology	Public	MoWRM	YES
Ministry of Public Works and Transport	Public	MPWT	YES
Mekong River Commission	International	MRC	
National Council For Sustainable Development	Public	NCSD	
National University of Management	Public	NUM	YES
Oxfam Committee for Famine Relief	NGO	Oxfam	
Sihanoukville Autonomous Port	Public	PAS	YES
Phnom Penh Autonomous Port	Public	PPAP	YES
Pannasastra University of Cambodia	Private	PUC	
Rural Economic and Agriculture Development Agency	NGO	Reada	YES
Royal University of Agriculture	Public	RUA	YES
Royal University of Law and Economics	Public	RULE	YES
Royal University of Phnom Penh	Public	RUPP	YES
Rosewood	Private	RW	YES
Southeast Asian Fisheries Development Center	International	SEAFDEC	
Sustainable Green Fuel Enterprise	Private	SGFE	YES
Smart Mobile Operator	Private	SMART	
Smart development works	NGO	SNV	
Society for Community Development in Cambodia	NGO	SOFDEC	
Sea Protection Project	International	SPP	YES
Tancons (cambodia) co. ltd	Private	TAN	YES
Transparency International	NGO	TI	YES
Teuk Saart 1001	NGO	TS	
University of Battambang	Public	UBB	YES
United Nations	International	UN	YES

Full Name	Type	Abbreviation	Filled in the survey
United States Agency for International Development	International	USAID	
Voluntary Service Overseas	International	VSO	
Water Aid	NGO	WA	
World Bank Group	International	WBG	
World Conservation Society	NGO	WCS	
World Fish Center	NGO	WFC	YES
Welthungerhilfe	Private	WHH	
World Vision	NGO	WI	
World Wildlife Fund	NGO	WWF	
Young Eco Ambassador	NGO	YEA	YES

Appendix 9: Results and differences between Q-sorts (students' survey)

DIFFERENCES IN ABSOLUTE VALUES STATEMENTS																												
N°	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
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57	6	5	2	4	6	7	2	5	3	1	3	4	5	5	4	4	6	3	4	3	4	4	1	2	7	4	4	4
58	5	3	3	6	7	4	4	5	4	6	1	5	5	4	3	2	4	4	4	2	7	2	4	6	4	3	1	4
59	4	7	1	6	4	5	4	6	2	1	3	6	5	5	4	3	4	4	4	3	5	2	4	4	2	3	4	7
60	4	4	4	4	3	5	5	6	5	1	4	6	3	4	4	2	4	2	3	4	5	4	2	1	7	3	6	7
61	7	4	5	4	4	4	2	1	4	1	4	6	4	5	3	4	2	5	6	2	6	5	3	3	4	4	3	7
62	5	3	4	4	4	5	3	2	4	1	1	7	4	4	4	4	3	4	5	2	6	6	3	2	6	4	5	7
63	4	4	3	6	6	4	1	2	5	4	3	1	5	3	5	2	4	7	3	4	7	4	2	6	5	4	4	4
64	7	4	4	4	3	5	4	4	7	3	1	6	6	4	2	3	2	6	5	4	5	5	4	4	3	2	1	4
65	6	3	6	4	7	7	4	4	4	2	5	4	4	4	3	2	1	1	4	5	3	3	5	2	4	4	5	6

Appendix 11: Factor Matrix, Principal Component Analysis (students' survey)

	FACTOR MATRIX (PCA)							
Sorts	A	B	C	D	E	F	G	H
1	0.361	0.161	0.575	-0.029	0.250	-0.041	-0.050	0.066
2	0.473	0.406	-0.445	0.216	0.110	0.074	0.095	0.050
3	0.718	-0.122	-0.292	0.075	0.251	0.214	0.226	-0.124
4	0.602	0.575	0.367	-0.061	-0.030	-0.166	0.010	0.141
5	0.155	0.639	-0.305	0.237	-0.144	0.072	-0.173	0.061
6	0.188	0.300	0.168	0.255	0.299	0.584	0.172	-0.034
7	0.432	0.322	-0.056	0.295	-0.050	-0.347	0.374	0.109
8	0.534	0.246	-0.124	0.409	0.214	-0.307	0.068	0.168
9	0.488	-0.026	-0.341	0.046	0.059	0.053	-0.287	-0.303
10	0.310	0.424	0.094	-0.272	0.066	-0.069	0.612	-0.033
11	0.619	-0.144	0.012	0.073	-0.111	-0.007	0.407	-0.049
12	0.581	0.075	-0.162	0.259	-0.040	0.175	0.256	-0.169
13	0.586	-0.369	-0.182	-0.095	-0.377	-0.408	0.185	-0.075
14	0.568	0.054	0.327	0.375	0.157	0.285	-0.147	0.178
15	0.570	0.226	-0.042	-0.056	-0.401	-0.090	-0.078	-0.112
16	0.618	0.134	-0.218	0.007	-0.032	0.011	0.165	-0.464
17	0.461	0.451	0.222	-0.197	0.255	0.040	-0.035	-0.297
18	0.161	0.325	-0.555	0.072	0.119	-0.199	-0.040	0.181
19	0.542	-0.315	0.000	0.090	-0.120	-0.061	-0.069	-0.499
20	0.416	0.040	-0.145	0.135	-0.182	-0.078	-0.154	0.511
21	0.417	-0.398	-0.042	0.388	-0.044	-0.121	-0.035	0.075
22	0.329	0.179	0.507	0.304	-0.159	0.050	0.376	-0.017
23	0.646	0.073	-0.024	0.128	0.224	-0.143	-0.095	-0.431
24	0.578	-0.241	-0.254	-0.150	-0.004	-0.158	0.090	0.229
25	0.297	-0.484	-0.126	-0.013	0.022	-0.095	0.031	0.181
26	0.475	-0.234	0.065	-0.382	0.170	-0.246	0.049	0.135
27	0.269	-0.157	-0.337	0.290	-0.408	-0.105	-0.372	0.006
28	0.439	-0.421	-0.005	0.137	0.483	0.118	0.099	0.077
29	0.499	-0.383	0.025	-0.341	0.003	0.390	-0.264	-0.016
30	0.541	-0.148	-0.245	-0.063	0.086	-0.366	-0.257	-0.154
31	0.703	-0.194	-0.120	-0.296	-0.260	0.080	0.020	-0.152
32	0.502	-0.198	0.323	-0.302	-0.106	-0.131	-0.090	0.181
33	0.580	-0.396	0.147	0.246	0.055	0.185	-0.125	0.063
34	0.630	-0.313	-0.178	-0.208	-0.042	0.162	-0.304	0.065
35	0.270	0.431	-0.212	0.196	0.427	-0.300	-0.220	0.382
36	0.312	0.163	-0.001	0.041	-0.389	0.415	0.008	-0.148
37	0.521	0.064	-0.152	0.335	-0.243	0.141	-0.032	0.174
38	0.587	0.006	0.433	0.182	-0.338	-0.211	0.174	0.100
39	0.644	0.114	0.250	-0.029	0.169	-0.007	0.008	0.339
40	0.201	-0.528	-0.193	0.402	0.117	0.095	-0.071	0.106
41	0.586	0.357	-0.014	-0.404	-0.086	-0.062	-0.088	-0.143
42	0.499	-0.073	0.448	0.005	0.015	-0.023	0.098	0.396

43	0.460	-0.316	0.073	-0.008	0.059	0.017	0.187	-0.028
44	0.181	0.555	0.058	0.097	0.415	-0.388	-0.372	0.037
45	0.511	0.159	0.357	0.457	-0.354	0.173	-0.253	0.072
46	0.471	-0.323	0.234	-0.141	-0.350	-0.418	-0.161	0.070
47	0.418	0.095	-0.107	-0.549	0.158	0.172	0.042	0.350
48	0.762	0.030	0.034	-0.180	0.052	0.286	-0.298	-0.097
49	0.549	0.570	-0.133	-0.183	-0.200	-0.183	-0.069	0.025
50	0.400	-0.239	-0.168	-0.227	0.285	-0.308	-0.110	0.100
51	0.407	0.512	0.219	-0.544	0.001	0.079	-0.066	0.105
52	0.451	0.087	-0.281	0.103	-0.458	0.064	0.292	0.012
53	0.477	-0.233	-0.343	0.031	0.145	0.090	0.308	0.222
54	0.508	-0.051	0.050	0.449	0.160	0.351	0.042	-0.025
55	0.427	-0.281	-0.144	-0.206	0.404	-0.025	0.599	0.202
56	0.288	0.044	-0.387	-0.366	-0.161	0.428	-0.248	0.332
57	0.353	-0.067	-0.104	-0.145	0.616	0.417	-0.198	0.033
58	0.266	-0.293	0.257	0.177	0.420	-0.074	-0.034	-0.306
59	0.733	0.267	0.145	-0.119	-0.001	0.039	0.002	-0.259
60	0.660	0.043	-0.018	-0.205	0.053	-0.014	0.159	-0.480
61	0.493	-0.158	0.474	0.156	-0.159	0.089	-0.314	0.187
62	0.348	0.276	-0.156	0.236	0.283	-0.274	-0.366	-0.269
63	0.239	0.241	-0.462	0.046	-0.250	0.231	0.171	0.256
64	0.456	0.033	0.125	-0.218	-0.261	0.368	-0.120	0.028
65	0.524	-0.478	0.178	-0.007	0.031	-0.407	-0.084	-0.019
Eigenvalues	15.50	5.80	4.13	3.83	3.74	3.39	3.07	2.94
Explained Variances	0.24	0.09	0.06	0.06	0.06	0.05	0.05	0.05

Appendix 12: Final mode of Q-sorts, VARIMAX (students' survey)

Sorts	ROTATED FACTORS (VARIMAX)		
	1	2	3
1	0.03522	-0.06489	0.69377
2	0.09825	0.75814	0.03748
3	0.61913	0.46793	0.11516
4	-0.06674	0.43753	0.79577
5	-0.30681	0.65464	0.05298
6	-0.11603	0.17805	0.32908
7	0.06838	0.45132	0.29192
8	0.20319	0.49824	0.26869
9	0.40257	0.43871	-0.01438
10	-0.11149	0.361	0.37705
11	0.51975	0.22073	0.29264
12	0.36386	0.43997	0.20849
13	0.69021	0.18278	0.05033
14	0.29255	0.12511	0.57599
15	0.22887	0.45464	0.34535
16	0.35572	0.52876	0.20309
17	-0.04914	0.37667	0.56581
18	-0.03645	0.61679	-0.24086
19	0.59314	0.0834	0.18656
20	0.27542	0.32415	0.12184
21	0.57462	-0.00585	0.06018
22	0.01196	-0.02862	0.62927
23	0.38726	0.38863	0.35007
24	0.60453	0.30028	0.03117
25	0.56983	-0.06922	-0.09735
26	0.47918	0.05938	0.22814
27	0.34874	0.24474	-0.17034
28	0.60017	-0.03081	0.09331
29	0.60913	0.00493	0.16049
30	0.51143	0.33287	0.04933
31	0.63397	0.31231	0.21784
32	0.42954	-0.05991	0.45543
33	0.65366	-0.03538	0.29489
34	0.67921	0.23697	0.09555
35	-0.09389	0.52996	0.11916
36	0.09363	0.2592	0.21858
37	0.3302	0.39654	0.17969
38	0.32207	0.04156	0.65296
39	0.3129	0.24712	0.57578
40	0.54642	-0.10408	-0.21609
41	0.14054	0.52576	0.41814
42	0.31745	-0.06053	0.59214

43	0.5264	-0.00305	0.19982
44	-0.28669	0.39702	0.32285
45	0.17254	0.14198	0.60318
46	0.51303	-0.09892	0.32814
47	0.23062	0.33559	0.17054
48	0.48798	0.38616	0.44291
49	-0.01838	0.70909	0.37508
50	0.469	0.15934	0.00402
51	-0.12932	0.38882	0.55499
52	0.28711	0.45253	0.04987
53	0.54459	0.30788	-0.08929
54	0.3718	0.19772	0.29311
55	0.51378	0.13224	0.02414
56	0.22453	0.40758	-0.1337
57	0.30316	0.20225	0.08539
58	0.34928	-0.19923	0.24655
59	0.27941	0.44905	0.59139
60	0.41701	0.37364	0.3518
61	0.37047	-0.13228	0.58105
62	0.06098	0.44078	0.15414
63	0.06193	0.54835	-0.15523
64	0.26402	0.17734	0.35193
65	0.66886	-0.13357	0.26272
	10.18	7.71	7.54
	16%	12%	12%

Appendix 13: Respondents of the Q-methodology (stakeholder survey)

Organization (Full name)	Organization (full name)	Abbreviation
Angkor Centre for Conservation of Biodiversity	ACCB	NGO
Conservation International	CI	NGO
Center for sustainable water	CSW	NGO
Ecoland Research Centre	Ecoland	Public
Eastern Maritime (Cambodia)	EM-Cam	Private
EU Delegation	EUD	International
Fisheries Administration	FiA	Public
Green Country Development Co. Ltd	GCD	Private
GIZ Department of Ministry of health, social development, education and young people	GIZ-HSDEYP	International
GIZ Department of Ministry of Education, Youth and Sports (MoEYS)	GIZ-MoEYS	International
GIZ Department of Ministry of Land Management, Urban Planning, and Construction	GIZ-MoLMUPC	International
GIZ Regional Economic Development Programme Department	GIZ-RED	International
GIZ ASEAN sustainable agrifood system (SAS) Department	GIZ-SAS	International
GIZ ASEAN sustainable agrifood system (SAS) Department	GIZ-SAS	International
GIZ ASEAN sustainable agrifood system (SAS) Department	GIZ-SAS	International
Heinrich Boell Foundation	HBF	International
Impact Hub	IH	Private
Institut de Recherche pour le developpement	IRD	International
Institute of Technology of Cambodia	ITC	Public
Konrad-Adenauer-Stiftung	KAS	International
Niras/Ministry of Agriculture, Forestry and Fisheries	MAFF	Public
Ministry of Economy and Finance	MEF	Public
Metfone	MF	Private
Ministry of Environment (Department of Climate Change)	MoE-DCC	Public
Ministry of Environment (Department of Heritage)	MoE-DH	Public
Ministry of Environment (Department of Marine and Coastal Zone Conservation)	MoE-DMCC	Public
Ministry of Education Youth and Sport	MoEYS	Public
Ministry of Health	MoH	Public
Ministry of Water Resources and Meteorology	MoWRM	Public
Ministry of Public Works and Transport	MPWT	Public

Organization (Full name)	Organization (full name)	Abbreviation
National University of Management	NUM	Public
Sihanoukville Autonomous Port	PAS	Public
Phnom Penh Autonomous Port	PPAP	Public
Rural Economic & Agriculture Development Agency	Reada	NGO
Royal University of Agriculture	RUA	Public
Royal University of Agriculture	RUA	Public
Royal University of Agriculture	RUA	Public
Royal University of Law and Economics	RULE	Public
Royal University of Phnom Penh	RUPP	Public
Rosewood	RW	Private
Sustainable Green Fuel Enterprise	SGFE	Private
Sea Protection Project	SPP	International
TANCONS	TAN	Private
Transparency International	TI	NGO
University of Battambang	UB	Public
United Nations Development Programme	UNDP	International
The United Nations Children's Fund	UNICEF	International
World Fish Center	WFC	NGO
Young Eco Ambassador	YEA	NGO

Appendix 14: Correlation Matrix between sorts

Sorts	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49		
1	1	0.4	0.63	0.49	0.53	0.21	0.44	0.47	0.78	0.47	0.51	0.22	0.53	0.34	0.35	-0.07	-0.03	0.03	0.28	0.57	0.4	0.53	0.54	0.43	0.51	0.74	0.31	0.38	0.26	0.19	0.34	0.41	-0.16	0.38	0.51	0.03	0.32	0.25	0.18	0.5	0.16	0.5	0.4	-0.28	0.22	0.15	0.6	0.43	0.22		
2		1	0.22	0.31	0.28	0.18	0.25	0.4	0.54	0.26	0.29	0.24	0.5	0.24	0.35	0.28	0.04	0.03	0.43	0.78	0.38	0.49	0.19	0.53	0.43	0.19	0.41	0.21	0.47	0.43	0.29	0.71	0.22	0.54	0.09	0.34	0.46	0.22	0.43	0.34	0.12	0.21	0.43	0.46	0.38	0.19					
3			1	0.43	0.09	-0.09	0.31	0.18	0.43	0.49	0.43	0.15	0.43	0.38	0.25	0.12	0.28	0.25	0.38	0.46	0.22	0.38	0.59	0.34	0.54	0.46	0.31	0.68	0.19	0.5	0.19	0.04	0.06	0.59	0.06	0.18	0.1	0.28	0.16	0.31	0.25	0.07	0.24	0.16	0.18	0.28	0.24				
4				1	0.53	0.26	0.56	0.37	0.65	0.38	0.35	0.28	0.46	0.44	0.21	0.4	-0.04	0.44	0.07	0.12	0.25	0.41	0.56	0.49	0.31	0.38	0.37	0.04	0.25	0.38	0.12	0.29	0.53	0.37	0.43	0.25	0.51	0.19	-0.06	0.54	0.32	0.12	0.4	0.38	0.24	0.35	0.35				
5					1	0.35	0.4	0.4	0.57	0.15	0.25	0.26	0.18	-0.01	0.43	0.06	0.22	-0.07	0.28	0.41	0.21	0.13	0.34	0.22	0.19	0.31	0.18	0.1	0.12	0.03	0.06	0.44	-0.16	0.51	0.32	0.15	0.35	0.44	0.13	0.34	0.35	0.44	0.12	0.38	0.6	0.19	0.16				
6						1	0.24	0.31	0.29	0.18	0.04	-0.04	0.25	0.01	0.31	0.18	0.06	-0.03	0.28	0.35	0.4	0.24	0.19	0.5	0.24	0.21	-0.21	-0.35	0.25	0.32	0.09	0.31	0.24	0.44	0.24	0.49	0.07	0.38	0.04	0.06	0.07	0.18	0.04	0.15	0.16	0.38	0.37	0.31			
7							1	0.1	0.63	0.59	0.41	0.26	0.24	0.15	0.31	-0.03	0.19	0.15	0.28	0.43	0.44	0.15	0.25	0.56	0.62	0.56	0.49	0.13	0.43	-0.03	0.13	0.4	-0.12	0.5	0.41	0.03	0.28	-0.01	0.38	0.15	-0.06	0.56	0.59	-0.03	0.13	0.51	0.57	0.21	0.47		
8								1	0.53	0.18	0.07	0.24	0.31	0.15	0.35	0.34	0.13	-0.13	0.16	0.31	0.21	0.31	0.09	0.4	0.13	0.16	-0.03	0.03	0.12	0.25	0.06	0.41	0.25	0.49	0.19	0.22	0.26	0.29	0.25	0.22	-0.16	0.43	0.07	0.16	0.4	0.04	0.37	0.34	0.06		
9									1	0.47	0.32	0.31	0.35	0.32	0.31	0.01	0.04	0.03	0.54	0.66	0.37	0.56	0.24	0.53	0.56	0.62	0.32	0.19	0.38	0.25	0.13	0.62	0.06	0.49	0.5	0.15	0.43	0.28	0.37	0.41	-0.1	0.65	0.35	-0.15	0.32	0.26	0.69	0.4	0.25		
10										1	0.21	0.24	0.32	0.22	0.04	0.22	0.28	0.06	0.41	0.35	0.28	0.44	0.5	0.46	0.57	0.46	0.37	0.43	0.22	-0.01	0.06	0.37	0.15	0.03	0.16	0.65	0.13	-0.09	0.43	0.19	0.09	0.13	0.06	0.43	0.16	0.21	0.18	0.28	0.43	0.34	
11											1	0.38	0.68	0.21	0.44	0.06	0.01	-0.04	-0.1	0.37	0.49	0.16	0.47	0.46	0.28	0.58	0.53	0.4	0.5	0.01	0.38	0.25	-0.09	0.34	0.51	-0.18	0.13	0.37	0.43	0.5	0.38	0.57	0.26	0.06	0.41	0.29	0.29	0.56			
12												1	0.47	0.18	0.49	0.19	0.35	-0.04	-0.06	0.13	0.38	0.19	0.29	0.46	0.1	0.35	0.28	0.19	0.41	-0.03	0.04	0.35	0.03	0.13	0.21	0.19	0.29	0.49	0.41	0.19	0.29	0.41	0.1	0.47	0.04	0.21	0.15	0.34	0.31		
13													1	0.21	0.53	0.31	0.19	0	0.5	0.44	0.44	0.49	0.56	0.28	0.54	0.46	0.37	0.41	0.04	0.34	0.44	-0.07	0.31	0.47	0.25	0.47	0.09	0.38	0.38	0.41	0.41	0.37	0.35	0	0.19	0.25	0.54	0.38			
14														1	0.04	0	0.01	0.4	0.07	0.31	0.03	0.21	0.19	0.15	0.1	0.29	0.03	0.37	0.38	-0.13	0.32	0.09	0.24	-0.09	0.22	0.26	0.37	-0.09	-0.12	0.01	-0.15	0.46	0.21	0.13	0.43	-0.06	-0.03	0.35	0.29		
15															1	0.24	0.35	0.01	0.13	0.41	0.41	0.09	0.29	0.37	0.32	0.46	0.25	0.1	0.6	0.28	0.38	-0.24	0.54	0.24	0.04	0.54	0.13	0.68	0.32	0.37	0.32	0.43	0.44	-0.12	0.32	0.28	0.47	0.32			
16																1	0.6	-0.28	0.24	0.25	-0.09	0.21	0.29	0.24	0.18	0.01	0.12	0.32	0.19	-0.04	0.24	0.28	0.31	0.19	0.09	0.57	0.24	0.19	0.4	0.21	0.01	-0.06	0.5	0.32	0.01	-0.12	0.24	0.12			
17																	1	-0.22	0.22	0	-0.12	0.07	0.34	0.19	0.24	0.09	0.21	0.5	0.16	-0.28	0.32	0.13	0.15	0.03	0.16	0.65	0.13	-0.09	0.43	0.19	0.09	0.13	0.06	0.43	0.16	0.21	-0.18	-0.04	0.07		
18																		1	0.15	0.15	0.07	-0.12	-0.04	-0.18	-0.03	0	-0.07	-0.01	0.04	-0.22	0.13	0.01	-0.12	0.07	0.31	-0.22	0.25	-0.13	-0.34	-0.24	-0.12	0.12	0.06	0	0.13	0.09	0.1	0.21	0.26		
19																			1	0.5	0.01	0.38	0.07	0.19	0.6	0.28	0.16	0.15	0.16	0.28	0.15	0.46	0.19	0.31	0.29	0.15	0.32	0.15	0.28	0.22	-0.06	0	-0.12	-0.18	0.28	0.37	0.22	0.15	0.21		
20																				1	0.34	0.53	0.38	0.53	0.54	0.43	0.37	0.15	0.54	0.34	0.21	0.78	0.01	0.54	0.46	0.15	0.57	0.19	0.38	0.49	0.07	0.37	0.54	-0.04	0.03	0.29	0.59	0.47	0.34		
21																					1	0.28	0.41	0.72	0.31	0.38	0.21	-0.15	0.41	0.18	0.07	0.28	0.03	0.46	0.15	-0.16	0.37	0.1	0.34	0.31	0.28	0.41	0.35	0.15	0.09	0.34	0.5	0.28	0.29		
22																						1	0.19	0.44	0.43	0.4	0.12	0.22	0.22	0.25	0.09	0.44	0.12	0.16	0.29	0.25	0.22	0.16	0.12	0.37	0.06	0.1	0	-0.04	0.15	-0.1	0.29	0.43	0.19		
23																							1	0.38	0.25	0.41	0.31	0.47	0.25	-0.1	0.34	0.26	-0.06	0.13	0.34	0.21	0.26	0.16	0.28	0.34	0.31	0.25	0.32	0.01	0.06	0.1	0.26	0.25	0.21		
24																								1	0.54	0.46	0.34	-0.01	0.44	0.25	0.16	0.46	0.35	0.38	0.28	0.21	0.4	0.1	0.5	0.35	0.25	0.51	0.41	0.18	0.18	0.37	0.51	0.31	0.44		
25																									1	0.57	0.34	0.25	0.28	0.21	0.34	0.44	-0.04	0.35	0.41	0.16	0.22	-0.07	0.31	0.31	0.15	0.28	-0.18	0.29	0.35	0.31	0.28	0.37			
26																										1	0.46	0.28	-0.13	0.37	0.37	-0.04	0.31	0.01	0.34	-0.04	0.41	0.29	0.38	0.31	0.4	0.26	0.06	0.46	0.24	0.21	0.22				
27																											1	0.12	-0.31	0.57	0.06	-0.09	-0.1	0.37	0.26	0.12	0.07	0.09	0.34	0.12	0.22	0.16	0.18	0.28	0.1	-0.18	0.22	0.1	-0.18	0.22	0.01
28																												1	0.4	0.25	0.49	-0.01	0.53	0.15	0	0.47	0.06	0.54	0.28	0.12	0.31	0.6	0.26	-0.09	0.38	0.25	0.37	0.38			
29																													1	-0.01	0.25	0.18	0.37	-0.09	-0.35	0.18	0.24	0.26	0.07	0.15	-0.07	0.04	0.32	-0.13	0.13	0.37	0.24	0.04			
30																														1	0.1	0.16	0.21	0.31	0.18	0.22	-0.13	0	0.26	0.44	0.18	0.35	0.24	0.4	0.31	-0.01	0.15	0.19			
31																															1	-0.03	0.65	0.4	0.25	0.35	0.13	0.34	0.32	0.01	0.31	0.41	0.09	0.03							

Appendix 15: Unrotated Factor Matrix (Stakeholders)

SORTS	A	B	C	D	E	F	G	H
1	0.7461	-0.0786	-0.2574	-0.3743	-0.1471	-0.2841	-0.1667	0.0897
2	0.6834	-0.1384	-0.099	0.2041	0.0049	-0.0877	0.3392	-0.0911
3	0.5693	0.3676	-0.203	-0.4283	-0.1101	-0.1221	0.2022	0.1115
4	0.6836	0.2328	-0.2039	0.0708	0.0326	0.2987	-0.2613	0.0148
5	0.5539	-0.2088	-0.0493	0.1128	-0.2661	0.1457	-0.5006	0.1117
6	0.4108	-0.2947	-0.1166	0.4209	0.1851	0.0235	0.0764	-0.0214
7	0.6663	-0.1339	-0.0441	-0.2524	0.0572	0.4976	-0.1692	-0.093
8	0.4605	-0.0582	-0.2948	0.4252	0.0713	-0.1989	-0.2858	0.1507
9	0.7908	-0.1804	-0.4255	-0.0558	-0.0375	0.0071	-0.2138	0.0069
10	0.5496	0.1786	-0.3052	-0.1917	-0.1203	0.0217	0.0704	-0.1476
11	0.6406	0.0506	0.4669	-0.334	0.0394	-0.0742	-0.0069	0.3611
12	0.4795	0.1864	0.3463	0.1657	0.1486	-0.1318	-0.2785	0.1237
13	0.6949	0.1778	0.3058	-0.0303	0.0854	-0.3702	0.0604	-0.0245
14	0.3332	0.3786	-0.283	-0.2016	0.5857	-0.0978	-0.0096	-0.1007
15	0.6351	-0.0756	0.4588	0.2022	0.0552	-0.0394	-0.0963	-0.1723
16	0.2926	0.489	0.0296	0.6163	-0.1772	-0.0701	0.1274	-0.0368
17	0.2856	0.6479	0.1389	0.3507	-0.2993	0.2803	-0.0909	-0.1235
18	0.0422	-0.0159	-0.1737	-0.3972	0.609	0.1464	0.1192	-0.1224
19	0.4376	-0.0227	-0.5057	0.1526	-0.2539	0.247	0.3586	-0.0807
20	0.7854	-0.2125	-0.1857	0.017	-0.0284	-0.0865	0.1968	-0.2161
21	0.5594	-0.3322	0.2243	-0.0409	0.2172	-0.1106	0.0242	0.1581
22	0.4986	0.0142	-0.3555	0.0682	-0.1477	-0.4718	0.2362	-0.0331
23	0.5414	0.2701	0.1332	-0.201	-0.207	-0.2099	-0.0555	0.0663
24	0.7353	-0.1027	0.0457	0.1931	0.0951	-0.0096	0.0954	0.1565
25	0.652	0.0318	-0.2613	-0.1444	-0.2286	0.2156	0.3006	-0.0928
26	0.7013	0.0681	0.0863	-0.3444	-0.0556	-0.1439	-0.0735	-0.1282
27	0.5436	0.1636	0.3264	-0.2338	-0.185	0.1817	0.1169	-0.0861
28	0.3664	0.7247	0.0006	-0.3232	-0.2641	-0.0909	0.0103	-0.0216
29	0.6239	-0.1346	0.3047	0.0953	0.2227	0.0533	0.163	-0.2481
30	0.2188	-0.6017	-0.0976	0.2612	-0.0824	-0.2224	0.3859	0.0697
31	0.4088	0.4412	0.1239	-0.1884	0.0247	0.0826	0.3706	0.0956
32	0.6872	-0.1929	-0.1099	0.2082	-0.0884	0.0982	0.0925	-0.1969
33	0.0447	0.2047	-0.2819	0.4773	0.2383	0.1031	0.2904	0.5121
34	0.6239	-0.4319	0.0919	0.2091	-0.0003	0.2642	0.051	-0.0493

35	0.5826	0.1796	-0.1921	-0.2493	0.0658	0.0761	-0.073	0.2738
36	0.2051	0.6023	-0.2347	0.4437	-0.0612	0.0765	-0.1682	-0.2444
37	0.6117	-0.0335	0.0228	0.2246	0.2804	-0.1594	-0.0171	-0.4151
38	0.2577	-0.16	-0.0285	0.1703	-0.1657	-0.221	-0.25	0.6206
39	0.6027	-0.0871	0.3797	0.4011	-0.1885	0.0613	-0.1201	-0.0473
40	0.519	-0.0149	0.0573	-0.0186	-0.4499	-0.194	-0.0938	-0.0013
41	0.2592	0.0123	0.5989	-0.0947	-0.1388	-0.1705	0.3602	0.3255
42	0.6036	0.0789	-0.1145	-0.0975	0.3141	0.0867	-0.4243	0.0295
43	0.5645	-0.1952	0.3262	-0.2833	0.0376	0.2388	-0.1149	-0.2203
44	0.1792	0.4475	0.5427	0.4371	0.3529	0.017	-0.039	0.0109
45	0.2527	0.3988	-0.5002	0.1567	0.2666	0.1276	0.0018	0.4022
46	0.478	-0.1572	0.2207	-0.0057	-0.0918	0.6505	0.2051	0.1986
47	0.6051	-0.5646	-0.1794	-0.0807	-0.0415	-0.0071	-0.2102	0.1481
48	0.5587	0.0085	-0.0224	0.0504	0.325	-0.4885	0.0013	-0.2326
49	0.498	0.0111	0.1397	-0.0719	0.3517	0.2264	0.2319	0.3335
Eigenvalues	14.1541	4.1228	3.5617	3.3887	2.4065	2.3335	2.1366	2.0714
% expl.Var.	29%	8%	7%	7%	5%	5%	4%	4%

Appendix 16: Final mode of Q-sorts, VARIMAX (stakeholder survey)

Full name	Abbreviati	Type	1	2	3	4
GIZ Department of Ministry of Education, Youth and Sports (MoEYS)	GIZ-MoEYS	International	0.4256	0.6922X	0.2293	-0.2375
Ministry of Education Youth and Sport	MoEYS	Public	0.6275X	0.2619	0.2369	0.1384
EU Delegation	EUD	International	0.0168	0.7984X	0.2148	0.0024
Sustainable Green Fuel Enterprise	SGFE	Private	0.3837	0.5484X	0.1901	0.2897
Ministry of Public Works and Transport	MPWT	Public	0.5331X	0.1803	0.2207	0.0091
GIZ ASEAN sustainable agrifood system (SAS) Department	GIZ-SAS	International	0.6451X	-0.063	0.0375	0.1577
Rosewood	RW	Private	0.4009	0.4597	0.344	-0.193
Sihanoukville Autonomous Port	PAS	Public	0.5908X	0.1547	-0.0731	0.3238
Institut de Recherche pour le developpement	IRD	International	0.6978X	0.5889	0.0579	-0.0702
Sea Protection Project	SPP	International	0.245	0.6298X	0.0724	0.0441
GIZ Department of Ministry of health, social development, education and young people	GIZ-HSDEYP	Public	0.1	0.3289	0.7802X	-0.1252
Royal University of Law and Economics	RULE	Public	0.1698	0.1048	0.5258X	0.3094
GIZ Department of Ministry of Land Management, Urban Planning, and Construction	GIZ-MoLMUPC	International	0.237	0.3396	0.6345X	0.1866
Royal University of Agriculture	RUA	Public	-0.0179	0.5947X	-0.0101	0.1451
Fisheries Administration	FiA	Public	0.4044	0.0006	0.6815X	0.1802
Ministry of Environment (Department of Climate Change)	MoE-DCC	Public	0.16	0.06	0.1108	0.8148X
Ministry of Environment (Department of Heritage)	MoE-DH	Public	-0.0822	0.2114	0.2478	0.7285X
Ministry of Water Resources and Meteorology	MoWRM	Public	-0.088	0.2998	-0.0631	-0.2974
Royal University of Agriculture	RUA	Public	0.4963X	0.396	-0.2177	0.1435
Institute of Technology of Cambodia	ITC	Public	0.6778X	0.4209	0.2426	-0.0365
GIZ ASEAN sustainable agrifood system (SAS) Department	GIZ-SAS	International	0.4654	0.0755	0.4689	-0.1819
Impact Hub	IH	Private	0.4349	0.4185	-0.0452	0.1161
Niras/Ministry of Agriculture, Forestry and Fisheries	MAFF	Public	0.0606	0.4642X	0.441	0.1033

Eastern Maritime (Cambodia)	EM-Cam	Private	0.5945X	0.2443	0.3887	0.1626
Angkor Centre for Conservation of Biodiversity	ACCB	NGO	0.4031	0.5753X	0.1475	-0.0071
United Nations Development Programme	UNDP	International	0.2296	0.5563	0.4965	-0.1182
Young Eco Ambassador	YEA	NGO	0.0558	0.342	0.6027X	0.0103
World Fish Center	WFC	NGO	-0.3295	0.6984X	0.282	0.297
Heinrich Boell Foundation	HBF	International	0.4282	0.0945	0.5599X	0.0593
Ministry of Economy and Finance	MEF	Public	0.6275X	-0.2382	-0.0398	-0.1888
Royal University of Phnom Penh	RUPP	Public	-0.1142	0.4662X	0.371	0.2112
Ecoland Research Centre	Ecoland	Public	0.6663X	0.2423	0.2262	0.105
Metfone	MF	Private	0.195	0.0099	-0.2739	0.4879X
Phnom Penh Autonomous Port	PPAP	Public	0.7092X	0.0021	0.3484	-0.0604
TANCONS	TAN	Private	0.2088	0.6244X	0.1931	0.0082
Rural Economic & Agriculture Development Agency	Reada	NGO	0.0378	0.2754	-0.1234	0.7512X
Konrad-Adenauer-Stiftung	KAS	International	0.4963X	0.2017	0.3037	0.2166
National University of Management	NUM	Public	0.3372	-0.0018	0.0766	0.0478
GIZ ASEAN sustainable agrifood system (SAS) Department	GIZ-SAS	International	0.4989	-0.0861	0.5673	0.3126
Center for sustainable water	CSW	NGO	0.3121	0.2653	0.3222	0.0408
Conservation International	CI	NGO	-0.0515	-0.0851	0.6516X	-0.0216
The United Nations Children's Fund	UNICEF	International	0.3246	0.4765X	0.2402	0.0546
Transparency International	TI	NGO	0.2557	0.2154	0.6014X	-0.2647
Ministry of Environment (Department of Marine and Coastal Zone Conservation)	MoE-DMCC	Public	-0.1081	-0.1742	0.5052	0.6486X
Green Country Development Co. Ltd	GCD	Private	0.1354	0.4802	-0.2876	0.4074
University of Battambang	UB	Public	0.3288	0.0937	0.4274X	-0.0486
Ministry of Health	MoH	Public	0.7242X	0.2062	0.1489	-0.3667
GIZ Regional Economic Development Programme Department	GIZ-RED	International	0.3756	0.3009	0.2672	0.1108
Royal University of Agriculture	RUA	Public	0.2377	0.2534	0.3896X	0.0179
		% expl.Var.	16	14	13	8

Appendix 17: Centrality Measures related to SNA

	OutDeg	Indeg	Out2loca	In2local	OutBonPw	InBonPwr	Out2Step	In2Step	OutARD	InARD	OutClose	InClose	Between	2StepBet
ACCB	6	1	25	2	1087.273	1.36	17	0	18.533	0	517	830	0	0
ADB	1	3	1	27	1.359	1705.415	0	20	0	14.583	830	592	0	0
ATSA	1	2	1	17	1.358	978.485	0	13	0	12.15	830	610	0	0
BLI	1	2	1	5	1.359	3.204	0	1	0	1	830	821	0	0
CARD	1	2	1	7	1.358	57.065	0	3	0	7.017	830	689	0	0
CARDI	1	2	1	5	1.358	3.205	0	1	0	1	830	821	0	0
CC	1	2	1	7	1.358	57.064	0	3	0	7.017	830	689	0	0
CEDAC	1	2	1	7	1.359	57.064	0	3	0	7.017	830	689	0	0
CF	1	2	1	17	1.359	978.484	0	13	0	12.15	830	610	0	0
CI	6	2	16	7	372.705	57.064	10	3	15.002	6.874	576	692	33.333	2.833
CMC	1	2	1	5	1.358	3.204	0	1	0	1	830	821	0	0
CSW	6	1	19	2	1337.644	1.359	11	0	17.493	0	528	830	0	0
DSM	1	2	1	7	1.359	57.064	0	3	0	7.017	830	689	0	0
EAC	1	2	1	7	1.359	57.064	0	3	0	7.017	830	689	0	0
EC	1	2	1	5	1.359	3.204	0	1	0	1	830	821	0	0
EI	1	2	1	5	1.359	3.205	0	1	0	1	830	821	0	0
EM-Cam	3	1	10	2	322.324	1.358	7	0	13.09	0	588	830	0	0
EUD	4	3	21	20	1769.443	980.331	14	12	17.7	12.15	518	617	429.833	4
EuroC ham	1	2	1	5	1.359	3.205	0	1	0	1	830	821	0	0
EWB	1	2	1	5	1.359	3.204	0	1	0	1	830	821	0	0
FFI	1	5	1	19	1.359	381.818	0	7	0	12.367	830	614	0	0
GADC	1	2	1	7	1.359	57.064	0	3	0	7.017	830	689	0	0
GCD	6	1	29	2	1203.443	1.359	19	0	17.787	0	543	830	0	0
GGGI	1	2	1	16	1.359	1410.675	0	12	0	12.75	830	601	0	0
GIZ	20	3	82	10	4061.03	151.562	40	3	30.417	8.219	471	668	355.833	30.167
HBF	5	1	35	2	2462.513	1.359	24	0	19.45	0	509	830	0	0
IFAD	1	3	1	16	1.358	390.225	0	9	0	11.067	830	627	0	0
IH	3	2	10	6	9.392	4.236	5	1	3.5	1	788	821	0	0
IIRR	1	2	1	17	1.359	978.485	0	13	0	12.15	830	610	0	0
IPAH	1	2	1	8	1.359	5.19	0	4	0	2.5	830	797	0	0

IRD	4	1	22	2	1392.705	1.359	13	0	15.693	0	551	830	0	0
ITC	6	6	36	28	1876.932	1418.057	20	15	18.417	14.917	530	601	186.8	14.75
IUCN	1	2	1	7	1.359	149.716	0	3	0	8.052	830	662	0	0
JICA	1	3	1	9	1.359	5.712	0	3	0	2.5	830	804	0	0
KAS	3	1	5	2	5.05	1.359	2	0	2	0	812	830	0	0
LICAD HO	1	2	1	5	1.359	3.204	0	1	0	1	830	821	0	0
MAFF	10	13	38	61	1994.141	2721.212	24	21	21.783	19.333	509	589	667.783	87.5
MF	3	1	5	2	5.05	1.359	2	0	2	0	812	830	0	0
MN	1	2	1	6	1.359	3.866	0	2	0	1.5	830	813	0	0
MoC	1	3	1	9	1.359	615.189	0	3	0	10.95	830	619	0	0
MoE	6	19	22	109	1011.227	4741.475	15	29	16.66	23.833	554	573	353.733	68
MoEF	3	2	14	23	719.618	1702.908	11	19	15.033	13.583	547	601	194	2
MoEYS	4	5	15	27	1023.529	1470.072	8	13	14.176	14.083	568	604	5.25	3.667
MoH	6	1	42	2	2575.912	1.358	29	0	22.5	0	476	830	0	0
Mol	1	7	1	57	1.358	2988.804	0	27	0	17.833	830	580	0	0
MoLM UPC	1	4	1	23	1.359	525.051	0	13	0	13.067	830	609	0	0
MoME	1	3	1	9	1.358	5.712	0	3	0	2.5	830	804	0	0
MoND	1	2	1	11	1.359	190.044	0	7	0	9.917	830	634	0	0
MoWA	1	2	1	5	1.359	3.205	0	1	0	1	830	821	0	0
MoWR M	3	2	12	17	662.214	978.485	9	13	14.11	11.817	564	617	16.367	1
MPWT	5	7	14	28	370.858	522.416	8	11	13.987	14	585	613	86.567	14.667
MRC	1	4	1	26	1.359	1386.413	0	15	0	13.483	830	606	0	0
NCS D	1	2	1	16	1.359	1410.675	0	12	0	12.75	830	601	0	0
NUM	6	2	32	5	1744.437	3.204	20	1	19.2	1	512	821	8.5	2.417
Oxfam	1	2	1	6	1.358	23.179	0	2	0	6.265	830	713	0	0
PAS	4	4	16	11	749.983	6.895	12	3	14.704	3	569	803	44.333	6.667
PPAP	3	3	9	8	137.545	5.05	5	2	11.223	2	618	812	6.5	2.5
PUC	1	2	1	5	1.359	3.204	0	1	0	1	830	821	0	0
Reada	4	1	21	2	1083.582	1.358	15	0	16.867	0	528	830	0	0
RUA	8	7	38	29	1834.051	925.329	24	13	20	14.45	525	610	133.1	24.583
RULE	6	2	20	5	505.199	3.205	10	1	15.487	1	568	821	2.833	2.5
RUPP	4	5	30	29	1826.669	1942.861	21	15	17.333	14.417	534	602	107.767	4.75
RW	4	1	16	2	501.507	1.358	10	0	14.154	0	577	830	0	0
SEAFD EC	1	2	1	7	1.359	149.716	0	3	0	8.052	830	662	0	0

SGFE	5	1	28	2	1786.486	1.359	18	0	17.576	0	535	830	0	0
SMAR T	1	2	1	6	1.358	4.236	0	2	0	1.5	830	813	0	0
SNV	1	1	1	2	1.359	1.359	0	0	0	0	830	830	0	0
SOFDE C	1	2	1	7	1.359	57.064	0	3	0	7.017	830	689	0	0
SPP	2	1	3	2	3.204	1.359	1	0	1	0	821	830	0	0
TAN	4	1	21	2	1394.005	1.358	15	0	17.167	0	524	830	0	0
TI	4	1	12	2	369.013	1.359	8	0	13.937	0	575	830	0	0
TS	1	2	1	16	1.359	1410.675	0	12	0	12.75	830	601	0	0
UBB	8	1	47	2	3205.131	1.359	21	0	21.493	0	488	830	0	0
UN	10	12	35	82	2073.673	3926.499	16	29	19.076	20.333	546	580	361.967	82.5
USAID	1	3	1	9	1.359	6.082	0	3	0	2.5	830	804	0	0
VSO	1	2	1	17	1.359	978.485	0	13	0	12.15	830	610	0	0
WA	1	3	1	8	1.358	5.051	0	2	0	2	830	812	0	0
WBG	1	5	1	42	1.359	2042.407	0	24	0	16.333	830	585	0	0
WCS	1	6	1	30	1.358	1439.065	0	17	0	16.583	830	571	0	0
WFC	6	3	48	12	2923.954	409.949	34	5	22.333	9.9	492	641	402.5	5.5
WHH	1	2	1	7	1.359	57.064	0	3	0	7.017	830	689	0	0
WI	1	2	1	7	1.359	57.064	0	3	0	7.017	830	689	0	0
WWF	1	5	1	32	1.359	1767.503	0	19	0	15.417	830	591	0	0
YEA	6	2	13	6	13.469	4.236	5	1	5	1	785	821	3	3



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