



EU-CIRCLE

A pan-European framework
for strengthening Critical
Infrastructure resilience to
climate change

D6.9 Case Study 4 INT: Evaluation report

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Statement

The EU-CIRCLE project proposes a methodological framework for assessing risk and resilience of climate extreme conditions, climate hazards and climate change scenarios to critical infrastructures and support relative adaptation decisions based on consequences and cost-benefit analysis. This report presents the concrete results from the final workshop of the Khulna City case study (CS4). It completes the Evaluation report of the case study.

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Preparation Slip			
	Name	Partner	Date
From	Prof Bingunath Ingirige, Dr. Fuad Ali and Ms Afroze Zainal Abidin	University of Huddersfield, UK	08/05/2018
Reviewer	I. Gkotsis	KEMEA	10/10/2018
Reviewer			
For delivery	A. Sfetsos	NCSR	15/10/2018

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Executive Summary

This document reports on the academic, policy maker and CI stakeholder engagements and demonstration event undertaken as part of the Khulna City Case Study for the EU-CIRCLE project.



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List of acronyms

ACRONYM	EXPLANATION
CIRP	Climate Impact Résilience Platform
KCC	Khulna City Corporation
KUET	Khulna University of Engineering and Technology
KPCL	Khulna Power Company Limited
WZPDCL	West Zone Power Distribution Company Limited
KWASA	Khulna Water and Sanitation Agency
UEXE	University of Exeter
MetNor	Norwegian Meteorological Institute

1 Introduction

The demonstration event took place on Tuesday 24th April 2018 and the City Inn Hotel in Khulna City. Critical infrastructure operators and local academics joined the Huddersfield team for a presentation of results from the Climate Impact Resilience Platform, which had been developed with data they themselves had provided during the September 2017 field visit.

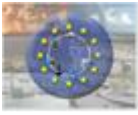
The first part of the event focussed on introductions and study outputs. Results were presented within the Climate Impact Resilience Platform, which ran successfully. Playback videos were also used to present 3D results and flooding impacts and a D3.js application mounted on an external website was used to demonstrate the scope of visualisation. Feedback was gathered in multiple forms, aural and written, individual and collective.

The second part of the event focussed on putting resilience insights to work inside organisations, participants were introduced to the project's Resilience Assessment framework and left with options of engaging further with researches at their own pace and on their own terms.

1.1 Agenda and operators involved

1.1.1 Agenda of Khulna Workshop

Time	Content
1000	Welcome & Scene Setting
1015	EU-CIRCLE and the Khulna Case Study
1030	Khulna City's Resilience Journey so far : Perspectives from KCC and KUET
1100	Coffee Break
1120	Demonstration of Critical Infrastructure Resilience Portal and Visualisation
1230	Lunch and Prayer Break
1330	Charting the Resilience Journeys Ahead: Research and Practice
1430	Thanks and Close



1.1.2 List of participants

EU-Circle Khulna City Demonstration - 25th April 2018 - City Inn Hotel, Khulna City

Participation Register

Name	Organisation	Role	Email
1. MUHAMMED ALAMGIR	K. V. E. T	Professor of Civil Engg & V.C. of KUET	alamgir@ce.kuet.ac.bd
2. ABIR UL JABBAR	Khulna city corporation	Chief Planning officer	abirul_jabbar@yahoo.com
3. MD. ESPAZ-UL-ZANUSAT	Khulna University of Engg & Tech	Assistant Professor	espa@ce.kuet.ac.bd
4. SREENATH ACHARYA	General Manager, Khulna Power Corporation		sreenath.acharya@khulnapower.com
5. SK. Md. Abdus Salauk	Operations Manager, KUET	Khulna Power Company	abk@salauk@khulnapower.com
6. Bhola Mohan Roy	Logistics Manager	Khulna Power Company	biola.moh.roy@khulnapower.com
7. S. M. TARIQUL ISLAM	KUET	Assistant Prof. IDM	tariqul@idm.kuet.ac.bd
8. REZBINA KHANAM	K. C. C.	Architect, K.C.C.	r-bikta@yahoo.com
9. Deboashis Paul	WZPDCL	SDE, System Protection	dkp_eee@yahoo.com
10. Md. Aminur Rahman	WZPDCL	SDE, Planning & Development	eee.aminur@yahoo.com
11. Engr. H.D. SAIFUZZAMAN	WZPDCL	SE, P&D, WZPDCL	azpdd.planning@gmail.com
12. Engr. Md. Ri'suan Noor	Energy PLC	Deputy Manager, Engring	ri'suan.kuet@gmail.com
13. Prof. Dr. Mustafa Sarwar	KUET	Prof. and Head Urban Planning	SARWAR.MUSTAFA@yahoo.com

2 Results from Applying the EU-CIRCLE Approach

The Case Study's deployment of Resilience Assessment Tool (RAT) and Critical Infrastructure Resilience Platform (CIRP) methods are detailed in the subsequent subsections.

2.1 Resilience Assessment Tool (RAT)

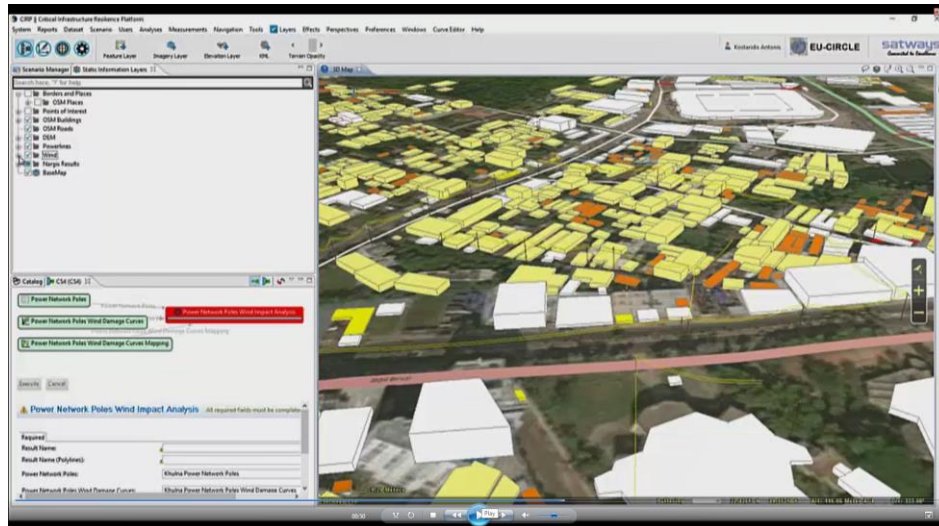
EU CIRCLE's Resilience Assessment Tool was used to structure the afternoon session of the demonstration event. Previous experience at the Torbay case study demonstration had shown how considerable and particular the organizational knowledge requirements were to answer the RAT questionnaire, it was decided to focus on contextualizing the tool's main dissemination point, of five different kinds of resilience capacity and extend support to any operators wishing to engage at a deeper level.

Participants were left with the tool in hard and electronic copies to engage with on their own terms and timescales.



Prof Ingirige outlining the 6 capacities on the EU-CIRCLE Resilience Assessment tool

2.2 Climate Impact Resilience Platform (CIRP)



A screenshot of the 3D CIRP of a section of Khulna City opposite the workshop venue showing grades of building damage, vertical electric poles and a blocked road (in red) in the foreground. Buildings are extruded by a factor proportional to their story data.

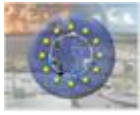
The Satways team provided training, user guide documentation and support for the establishment of a working 2D prototype for the demonstration event as well as a 3D flythrough visualisation.

Climate data: Synthetic Storms

This case study differs from the others in its approach to generating climate data for the CIRP's ingestion. NetCDF files were created by MetNor to characterize the rainfall intensities and wind speed velocities of historical cyclones, then to displace the trajectories of these cyclones to pass through Khulna City.

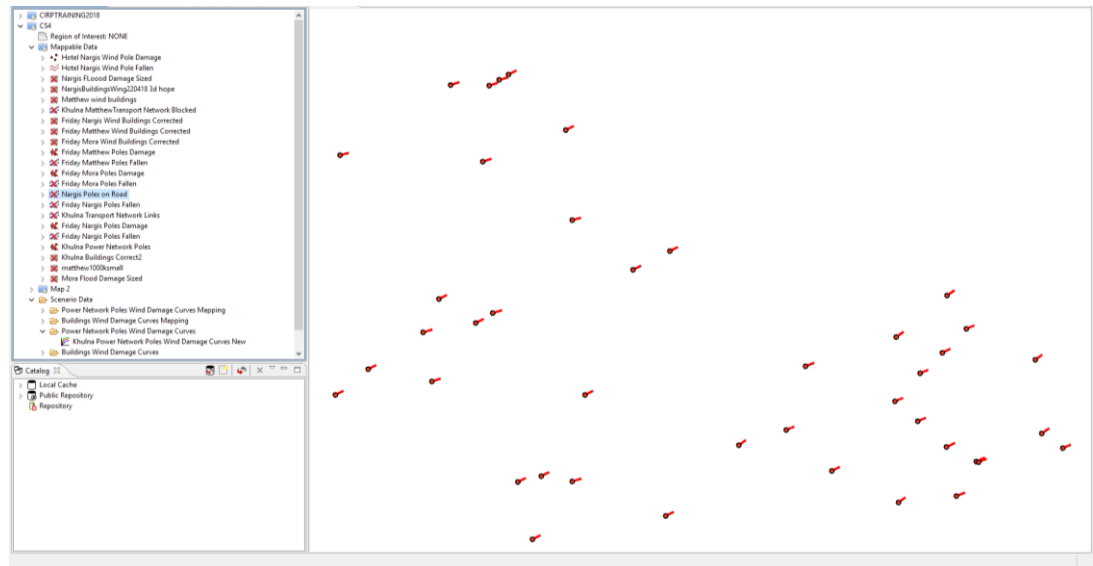
These Synthetic Storms were created for

- i. **Cyclone Nargis 2008,**
- ii. **Cyclone Mora 2017 &**
- iii. **Hurricane Matthew 2016**



Analysis modules

i. Electric Poles Felled by High Winds, and direction of fall (CIRP)



Screenshot of fallen poles and their felling direction. (Case: Cyclone Nargis)

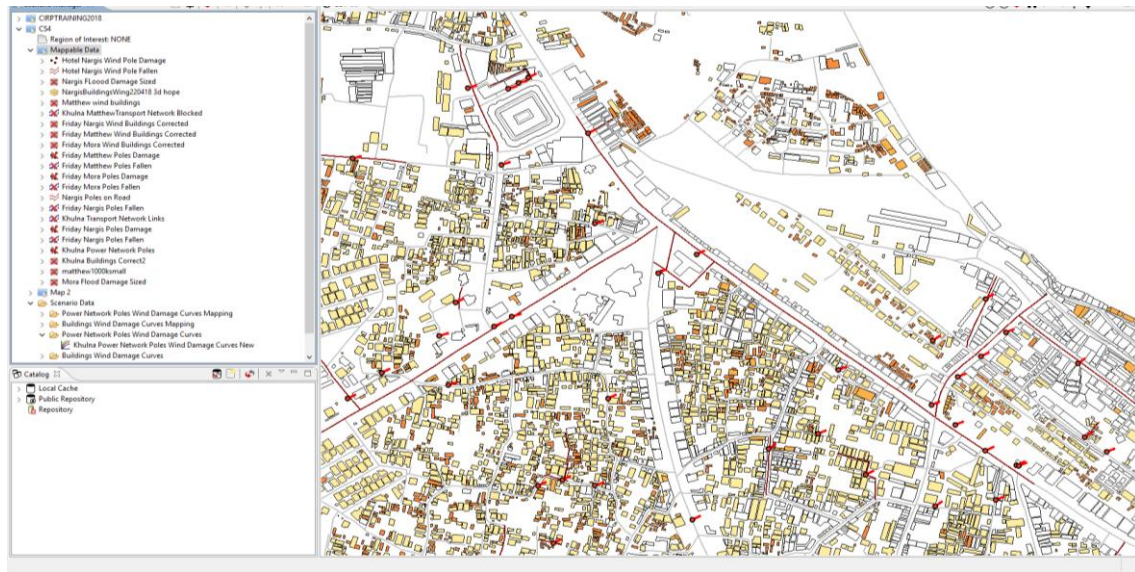
ii. Roads blocked by Electric Poles felled in high winds (CIRP)



Screenshot of fallen poles, their felling direction with surrounding roads. Blocked roads are marked in red (Case: Cyclone Nargis)



iii. Structures Damaged by High winds (CIRP)



Screenshot of wind-damaged buildings, fallen poles, their felling direction with surrounding roads. Blocked roads are marked in red (Case: Cyclone Nargis)

3 Communication and Evaluation

3.1 Engagements and Dissemination

The case study team engaged with International stakeholders, project case studies and EU-CIRCLE researchers over the duration of the project.

3.1.1 CIB Symposium on Resilience to Climate Change and Flooding hosted at University of Huddersfield, April 2017



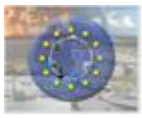
Participant's photo

In association with the Global Disaster Resilience Centre (GDRC) and the CIB, the School of Art, Design and Architecture at the University of Huddersfield organised a one-day symposium on climate change and flooding on the 6th of April 2017, at the Sir George Buckley Theatre, University of Huddersfield.

We invited a team of academics, practitioners, local authority representatives and consultants in the field to showcase some of the local initiatives on flood resilience, community actions on climate change and natural flood management schemes amidst some of the similar initiatives worldwide. Altogether 35 guests attended the event. The event started with welcome messages from **Prof. Bingunath Ingirige**, **Prof. Dilanthi Amaratunga**, Director of the GDRC and **Ms Helena Soimakallio**, the President of the CIB.

The presentations of the event were as follows.

1. **Prof Dilanthi Amaratunga** and **Prof. Richard Haigh**, the Director and Co-Director of the Global Disaster Resilience Centre (GDRC) discussed some of the projects of the GDRC portfolio relating to climate change and disaster risk reduction. They explained some of the examples and key societal outcomes achieved from their recent and ongoing research projects.
2. **Mr. Philip Wilbourn**, a Chartered Environmental Surveyor and Consultant presented the Sheffield Lower Don Valley flood resilience scheme where the funding for the project was raised as a collaborative venture between the local authority and businesses in the area and how the benefits of the scheme was earned by the community as a whole. Mr. Wilbourn served as a member of the steering group for the project.



3. **Mr. Paul Cobbing**, the CEO of the National Flood Forum of UK, presented “communities and flooding”, where he emphasized the importance of community based solutions for flooding. He also highlighted the importance of longer term sustainable solutions for flood resilience, not just developing short term reactive measures.
4. **Dr. Lydia Vamvakieridou-Lyroudia** from University of Exeter and **Dave Stewart** from the Torbay council did a joint presentation titled “Urban coastal flooding in Torbay”, where they discussed one of the case studies where coastal flooding affects the critical infrastructure in the Torbay area of UK and to visualize the problem using ICT visualization and modelling. This presentation was conducted as part of the EU Horizon 2020 funded EU-CIRCLE project.
5. **Prof. Dongping Fang**, is the Professor and Chair of the School of Civil Engineering and The Executive Director of Future Cities and Infrastructures at the Tsinghua University, China. He is also a CIB member. He presented “initiatives towards resilient urbanization” and highlighted some of the collaborative projects conducted by his laboratory at the Tsinghua University on visualization for resilient urbanisation.
6. **Mr. Andy Cameron**, is the team leader for flood and coastal risk management partnerships and strategic overview team at the Environment Agency, UK. He presented the Salford flood storage scheme and local natural flood management. He explained the value of putting together a scheme that provides multiple benefits to the community in the area rather than just one purpose – i.e. as a flood resilience scheme.

The key Messages of the Symposium

Flooding is a global problem and in the UK it is one of the top items in the National Risk Register. The symposium offered the participants the opportunity to discuss some of the global and local issues that affect communities, due to climate change and flooding. The key message that came out from the discussion was that Increasing resilience to flooding and climate change should focus mainly on the people rather than the physical structures for flood mitigation so that people are at the heart of any solutions both in the short as well as in the long term. It is believed that a significant number of people affected by flooding suffer post-traumatic stress. Hence community engagement is imperative during all phases of the flood propagation chain. It is also proven that flooding has direct links to house price behaviour, therefore, people who are affected have to deal with both the immediate impact and then the cascading effects such as lower house prices, livelihood issues and enduring emotional challenges. Another key observation was that the Government funding during the aftermath of a flood event is often targeted at households. Therefore, small business owners are often overlooked despite their importance within the local economies. As the scale of the challenge of recovery after flooding is getting more and more complex, it is important that a more comprehensive and a cohesive solution should emerge and the strategic narrative in flood resilience is taken higher up in the Government agenda.

For more details of the event, please contact **Prof. Bingunath Ingirige** of the Global Disaster Resilience Centre (GDRC) via Email: B.Ingirige@hud.ac.uk.

3.1.2 Presentation at Dubrovnik Meeting, 8-9 May 2017

An initial presentation of the case study was delivered to the wider EU-Circle project team, mainly featuring geographic detail, strategic resilience issues and the learning potential of this international case study. A group picture with EU-CIRCLE partners is included below.



3.1.3 Field work and Data Collection in Dhaka and Khulna Bangladesh, September 2017

Over the course of 2 weeks Fuad Ali visited Bangladesh to develop contacts and initiate data sharing arrangements with stakeholders in Dhaka and Khulna City. Contacts were developed at: Khulna Power Company, The Centre for Environment and Geographic Information Sciences (CEGIS), International Centre for Climate change and Development (ICCCAD), Khulna City Corporation (the then Mayor and head of planning), Khulna University, Khulna University of Engineering and Technology, the Khulna Water and Sewerage Authority, the Khulna Development Authority as well as the West Zone power Distribution Company Limited.



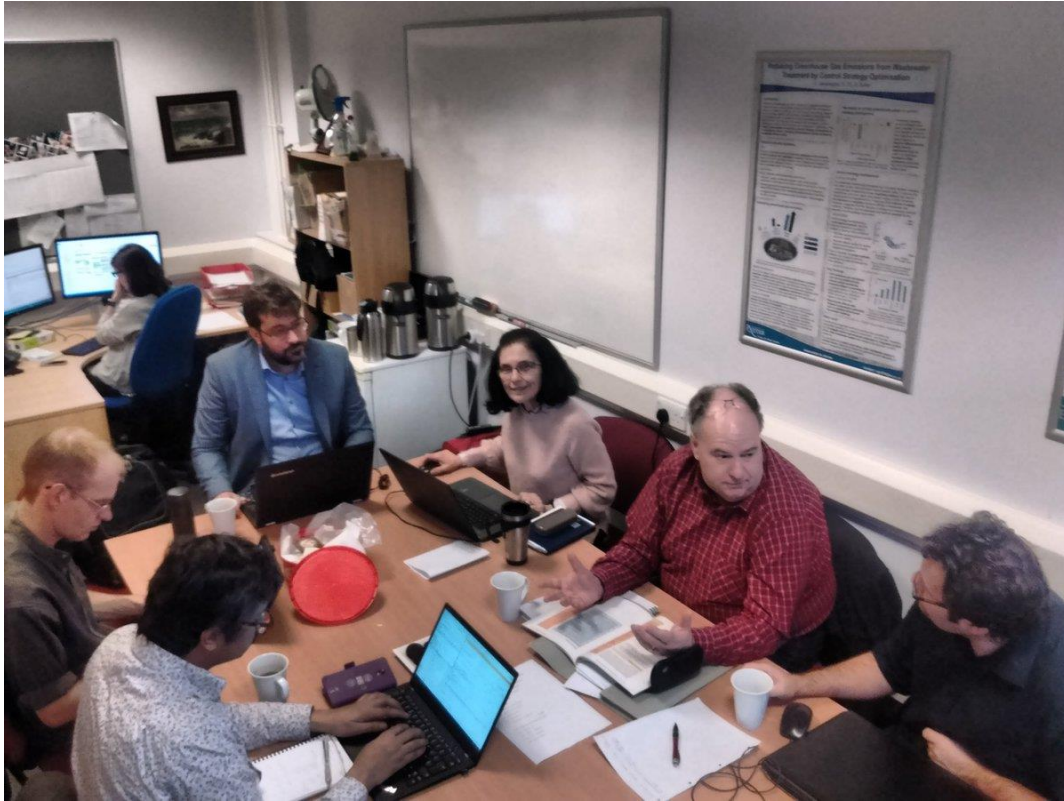
A southward view of the Khulna City Corporation main building (white left) with the Rupsa River in the background.



Pluvial flooding is common in the city center

3.1.4 Presentations at Exeter Meetings, 2nd November 2017 & 2nd February 2018

Following extensive data collection in the case study area and geoprocessing, Fuad Ali participated in 2 meetings with the Exeter, Satways and Torbay Case study teams, to explore how CI asset data could be implemented with the CIRP, CADDIES, D3 and Serious Game approach.



3.1.5 Special Session at 7th International Conference on Building Resilience, 29th November 2017



Prof Bingunath Ingirige presenting the panel discussion section of the special session.

Full conference proceedings: <https://www.sciencedirect.com/journal/procedia-engineering/vol/212>

Fuad Ali Paper: <https://www.sciencedirect.com/science/article/pii/S1877705818301309>

Session description with presented biographies and abstracts presented below.

CLIMATE MODELS, WEATHER RISKS, CRITICAL INFRASTRUCTURE AND CITIES

Special Session Brief

As part of the EU Horizon 2020 funded EU-CIRCLE project titled “A pan-European framework for strengthening Critical Infrastructure resilience to climate change” (www.eu-circle.eu), a group of partners have put together an exciting themed discussion where two of its case studies are showcased. In addition, the project team encouraged other participants of the International Conference on Building Resilience 2017 to join the session whereby fruitful discussions and knowledge exchanges can be facilitated for mutual benefits in the areas of weather and climate modelling, critical infrastructure damage curves, stakeholder engagement and climate risk management in cities. The team encouraged several international players and multidisciplinary experts to present, participate and contribute into the discussions of the session. The special session particularly showcases two of EU-CIRCLE project’s case studies. First in the UK the impact of urban coastal flooding in Torbay is investigated. Then the impact of cyclonic stresses and their effects on critical infrastructure within the Khulna city in Bangladesh is discussed. The EU-CIRCLE team have organised the following presentations within this special themed discussion as follows.

The Presentations in the session are as follows:

1. **Prof. Bingunath Ingirige**, as the special session theme leader, gave the opening address to the session with its aims and objectives and introduced the following speakers in the session.

Prof. Ingirige has the Chair in Project Management & Resilience at the Global Disaster Resilience Centre (GDRC), University of Huddersfield. He was a contributor to the UK Government's Climate Change Risk Assessment 2016 (<https://goo.gl/TaEos8>) report which provided advice on strategic measures to overcome future vulnerability to climate change. He has led international research into post flood recovery and reconstruction in Sri Lanka and Malaysia. He is a key investigator of the EU-CIRCLE project responsible for the delivery of the case study in Khulna city, Bangladesh.

2. **Dr. Athanasios Sfetsos**, the coordinator of the EU-CIRCLE project, made an introduction to project and its current developments.

Dr. Athanasios Sfetsos, received a B.Sc. in Physics from University of Patras in 1995 and a Ph.D. in Electrical Engineering from Imperial College, University of London (1999). He is a Researcher at the Institute of Nuclear and Radiological Sciences, Technology Energy and Safety at NCSR Demokritos and research collaborator with the Centre for Security Studies. His research interests are related to the impacts of climate change and Critical Infrastructure protection. He has co-authored more than 150 papers in refereed journals and conference proceedings. He has participated in more than 20 EU and nationally funded projects and currently is the coordinator of EU-CIRCLE.

3. **Dr. Rasmus Benestad**, presented "The use of information from climate models to get a better picture of future weather-related risks: The context of Bangladesh"

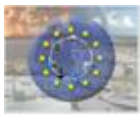
Dr. Benestad is a senior scientist at the Norwegian Meteorological Institute working on climate change and climate analysis. He has published scientific papers on empirical-statistical downscaling, statistical methods, and on weather extremes, and has a D.Phil from Atmospheric, Oceanic, and Planetary Physics at University of Oxford, UK.

4. **Prof. Terrence Fernando**, presented "the role of advanced technologies for supporting multi agency collaboration for resilient communities"

Prof. Terrence Fernando is the Director of the THINKlab, University of Salford, UK. He has several years of experience in developing collaborative platforms for range of application areas such as urban planning, aerospace, space and built environment. He is also the Principal Investigator of the recently funded EPSRC Global Challenge project titled "A Collaborative Multi-agency Platform for Building Resilient Communities" which aims to develop an advanced digital platform that can be used in low-/middle-income countries to strengthen their resilience capacities against natural disasters.

5. **Prof. Slobodan Djordjevic**, presented "3D visualisation tool for improving the resilience to urban and coastal flooding in Torbay, UK"

6. Prof. Slobodan Djordjevic joined the Centre for Water Systems at the University of Exeter, UK in 2002 and was promoted to Professor of Hydraulic Engineering in 2012. He obtained degrees in Civil Engineering from the University of Belgrade. His work focuses on development and application of advanced tools for urban drainage and floods modelling, analysis and impact assessment and other areas of water and infrastructure management. Over the past decade Slobodan has been awarded research grants worth £7.5m, majority of those as the principal investigator. He led EU FP7 CORFU research consortium and in that capacity organised and co-chaired the International Conference of Flood Resilience: Experiences in Asia and Europe, held in Exeter (ICFR2013).



7. **Dr. Fuad Ali**, presented “Assembling and (Re)Assembling Critical Infrastructure Resilience in Khulna City, Bangladesh”

Dr. Fuad Ali is a Research Fellow working at the Global Disaster Resilience Centre, University of Huddersfield, UK. He is currently working on the delivery of the Khulna City, Bangladesh case study as part of the EU-CIRCLE Project. Dr. Ali received his PhD from the Department of Geography at Kings College London in 2014 and both his BSc and MSc from Imperial College, London.

8. **Dr. Barry Evans** presented “Mapping urban infrastructure interdependencies and fuzzy risks”.

Dr. Barry Evans is a research fellow in the Centre for Water Systems at the University of Exeter. His background is varied with a BS (Hons) in Physics with Space Science and Technology, MSc in Geographical Information Systems (GIS), and a PhD in Engineering (specifically in the flood modelling area) from University of Exeter. After working in research for a while Barry went on to work in London in the catastrophe modelling sector for AIR Worldwide Ltd utilising his skills to aid in understanding risks associated with natural disasters and also carrying out risk analyses on a variety of portfolios before returning to academia. His recent works was in the field of Citizen Science as part of the Citizen Observatory Web (COBWEB) project at Aberystwyth University, developing smart phone technology within a novel framework to collect and process data for use in supporting flood risk management.

The abstracts of the presentations are as follows:

1. EU-CIRCLE project outline

Athanasios Sfetsos, Institute of Nuclear and Radiological Sciences, Technology Energy and Safety at NCSR Demokritos, Athens, Greece
Email: ts@ipta.demokritos.gr

Abstract

The main aim of the EU-CIRCLE research project is to provide scientific research, analyses and tools to support the development of an infrastructure network(s) that is resilient to today's natural hazards as well as to future climate change. It addresses existing gaps in the knowledge on climate change impacts and adaptation in Critical Infrastructure (CIs) with the aim of promoting better decision-making by CI stakeholders.

EU-CIRCLE is comprised of nine distinct but linked work packages, which address various themes including climate data; risk modelling; and CI resilience and climate change adaptation. These research themes are directly tied to the development of the Climate Infrastructure Resilience Platform (CIRP), a standalone and comprehensive software toolbox that is able to accommodate different types of datasets (e.g. hazard, assets, interconnections, fragilities), file formats, and risk analysis algorithms. The CIRP is open, modular and extensible in order to support various risk and resilience assessment analysis tools and will provide users with access to diverse simulation, modelling and risk assessment solutions.

EU-CIRCLE will explore the impacts of projected climate change on CI and how various adaption options can influence the resilience of CI networks, taking into account the various interdependencies present in modern CI networks. This will be achieved through implementation of the risk model and the resilience and adaptation frameworks through CIRP in six case studies involving: extreme dryness and forest fires on electricity and transport networks in France; storm and sea surge at a Baltic Sea Port, Gdynia, Poland; coastal flooding across Torbay, UK; cyclonic pressures and flooding, Bangladesh and rapid winter flooding Dresden, Germany.

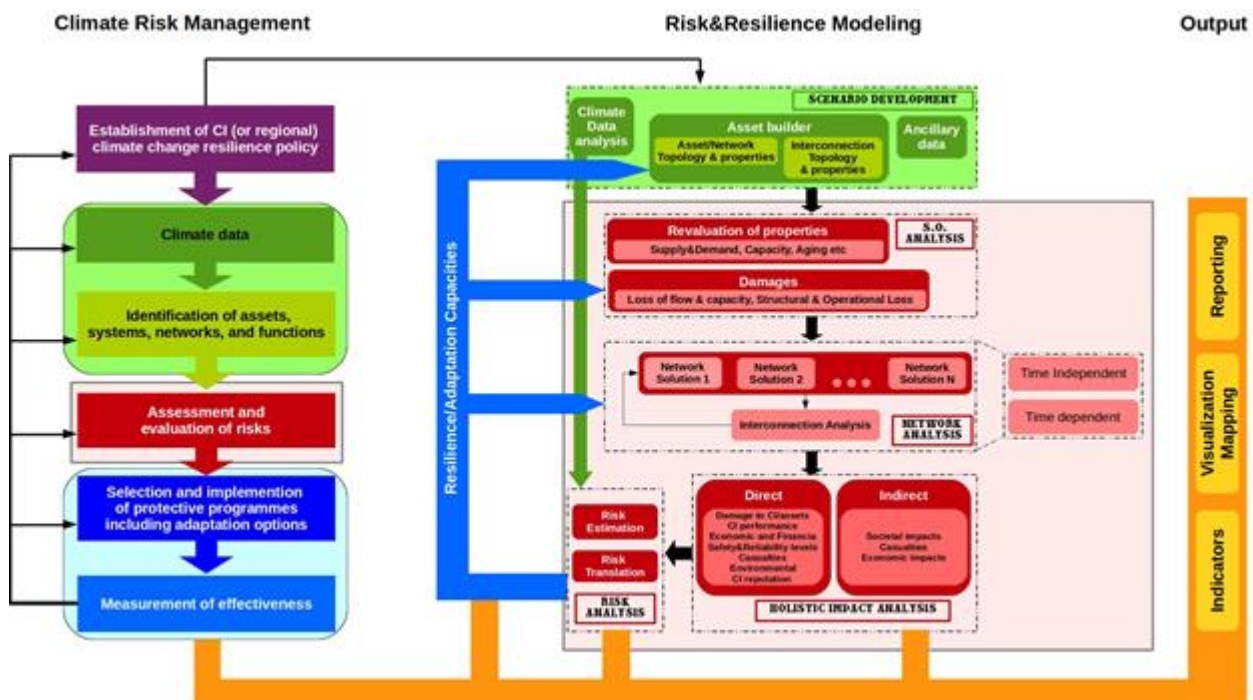
The first step to improving resilience of Critical Infrastructure (CI) to climate change impacts is the identification of the risks of several climate hazards to interconnected and interdependent CIs i.e. risk assessment.

The EU-CIRCLE risk assessment framework includes:

- Assessment of the current risks of a specific climate hazard to a single CI or a CI network or even an area of interest with interconnected and interdependent CI.
- Examination of how climate change may alter risk in the future, or expose new risks. This analysis includes a baseline assessment of the risks to CI assuming no additional adaptation actions under various climate change scenarios, as well as a second assessment which considers how current or future potential adaptation actions will affect the overall scale of risk to CIs in the future under the same climate change scenarios.
- Identification of climate change adaptation or risk mitigation options and definition of priorities. This step examines alternative strategies for mitigating risks to CI and strengthening their resilience such as: enhancing the defences of interconnected infrastructures and implementation of long term adaptation options.

A comparative assessment of these scenarios using well identified criteria (e.g. cost – benefit analysis) will return scientific evidence for supporting informed decision making.

The EU-CIRCLE Risk Modelling Framework is set out in Figure below:



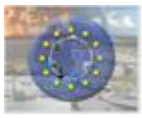
2. The use information from climate models to get a better picture of future weather-related risks: The context of Bangladesh

Rasmus Benestad (MET Norway, Norway)

Email: rasmus.benestad@met.no

Kajsa M. Parding (MET Norway, Norway); Fuad M M Ali (GDRC, University of Huddersfield, UK),
Bingunath Ingirige (GDRC, University of Huddersfield, UK)

Md. Bazlur Rashid (Bangladesh Meterological Department, Bangladesh), Hans Olav Hygen (MET Norway, Norway)

**Abstract**

Planning for the future will benefit from taking likely changes to conditions and risks into account. Simulations with climate models give indications for a range of climate impacts for Bangladesh, which include increasing temperatures, more intense rainfall, and rising local sea levels.

Climate change is also expected to affect tropical cyclones. Global climate models are still too coarse to provide reliable and actionable detailed information that can be used for local planning and adapting to climate change, however, we can make use of information derived from historical observations and sensitivity studies. We present a synthesis of results from a study that uses learning from the past, sensitivity tests based on observations, and downscaled projections of global climate models.

One concern is a changing risk associated with future tropical cyclones, and we present a methodological development, *the Synthetic Storm*, which is an agglomeration of existing and projected hydro meteorological information. Synthetic storms are used as a tool for extreme weather stakeholders to incorporate into modelling, spatial planning, strength-test disaster planning, building codes etc.

The synthetic storm is a realistic scenario which includes several attributes (time, direction and speed of ensemble movement, radial wind velocity profile, storm track, 'friction', climate models (not sure how)) which may be inferred from a combination historical storm tracks analysis and projections. Risks for society also include heavy rainfall and flooding in addition to the damage from high wind and storm surge.

Climate information relevant for building resilience is not limited to extreme weather events and includes temperature, precipitation (frequency and intensity), and sea level/tidal data. Future outlooks will be based on empirical-statistical downscaling of temperature and precipitation statistics.

Projections of future climate are both incomplete and associated with a number of limitations and uncertainties. Nevertheless, there is some information that is useful for future planning. It is important to provide the planners with a realistic picture of what to expect.

We encourage stakeholders to formulate questions regarding e.g. tropical cyclones, for which we will make use of the science and available information to provide the best answers. Some of the answers may be more certain and some questions may not have an exact answer.

It is also important to learn how the climate information is used in decision-making. Is there planning for higher temperatures, and how are the numbers used? E.g. in building practices? More intense rainfall and tropical cyclones are expected to increase the risk of failure for critical infrastructure. What options are there to increase the resilience and how can improved climate information assist deciding which to go for? There may be a range of different viable strategies: insurance for natural disasters, crop failure, and rebuilding; invest in more solid structure that can withstand the forces; shelters and rations; evacuation planning and drilling.

Background on tropical storms over Bangladesh

As a warm ocean with favourable meteorological conditions, Bay of Bengal is the birthplace of Tropical Cyclones. Every year especially during March-May and October-November Tropical Cyclones are formed. Some of these cyclones recurve towards north/northeastwards and make landfall to Bangladesh coast. These cyclones are associated with storm surge, and cyclones in 1970 and 1991 (Cyclones Sidr and Aila) were associated with high damage, devastation over the coastal areas of Bangladesh. In the recent times, due to increment of sea surface temperature, unusual behavior like rapid intensification and dissipation, movement, offseason formation etc. was observed for the cyclones Viyaru, Komen, Roanu and Mora. Warmer conditions may make more intensification of

cyclones formed over the Bay of Bengal. An increased sea level will make the storm surges more invasive and destructive.

The society is also becoming more exposed to risks connected to tropical cyclones, due to a rapid urbanization, changed settlement, increasingly cutting of forests, and the use of fallow land. Due to this cultivable land and natural forest including Sundarban, a mangrove forest area is being decreased day by day. As a result, the main obstacle for tropical cyclones (when they are going to hit Khulna coast) is the Sundarban which provide strong friction to reduce the energy is being decreased. In future the effect of tropical cyclones is expected to be worsening as the coverage area of Sundarban is decreased.

To build resilience, there is a need to prepare for future tropical cyclones and the enhancement of early warning is crucial. There is also a need for estimates of likely maximum intensification in terms of wind speed, storm surge and inundation, heavy rainfall, and their impact on the human settlement and other sectors.

The method of Synthetic Storms can be used to explore the possible likely intensification of tropical cyclones in 2030, 2050, 2070 and 2100 in terms of maximum wind and their impact on Khulna by producing storm surge and inundation, heavy precipitation etc. and calculate the threat on the human settlement for long term planning and preparation and early warning. The result of this study will be shared with government, stakeholders, researchers, planners and disaster managers.

3. 3D visualisation tool for improving the resilience to urban and coastal flooding in Torbay, UK

Albert S. Chen¹, Mehdi Khoury¹, Lydia Vamvakieridou-Lyroudia¹, Dave Stewart², Mike Wood², Dragan A. Savict¹, Slobodan Djordjevic¹

¹ Centre for Water Systems at the University of Exeter, UK

² Torbay Council, UK

Email: A.S.Chen@exeter.ac.uk

Abstract

Torbay, located in South West England, UK, is one of the Case Studies on the EU-funded project EU-CIRCLE, which is aimed at enhancing resilience of Critical Infrastructures (CI) to natural hazards. The region includes three urban centres (Torquay, Paignton and Brixham) and hosts more than 3 million tourists every year that contribute over £450 million to local economy. However, flooding, including coastal, fluvial and pluvial, has been a major threat to the area with more than 15 major incidents occurring since 1999. Rising sea levels, combined with increasing rainfall intensity, linked to climate change, are expected to exacerbate the problem. Better adaptation strategies are needed to safeguard CIs and services while improving resilience to climate hazards. EU-CIRCLE partners are engaged in a review of the existing capacity of flood defenses and the drainage systems in Torbay. To enhance the risk communication with the stakeholders, we adopted a high performance flood model to analyse the flood risk to CIs under a wide range of scenarios. The results are integrated into an innovative 3D visualization tool, showing the progress over time of any flood scenario in the region, via a fully interactive interface allowing stakeholders to better understand flood impacts to CIs.

[Full paper available in conference proceedia]

4. Assembling and (Re)Assembling Critical Infrastructure Resilience in Khulna City, Bangladesh

Fuad Ali, Bingunath Ingirige and Afroze Zainal Abidin
Global Disaster Resilience Centre, University of Huddersfield, UK

Email: F.Ali@hud.ac.uk

Abstract

Extreme Weather Events continue to cause shocking losses of life and long-term damage at scales, depths and complexities that elude robust and accountable calculation, expression and reparation. Cyclones and storm surges can wipe out entire towns, and overwhelm vulnerable built and lived environments. It was storm surges that was integral to the destructive power of Hurricane Katrina in the USA (2005), Typhoon Haiyan in the Philippines (2013), as well as Cyclone Nargis (2008) and the 1970 Bhola Cyclone in the Bay of Bengal. This paper report on work which concerns itself with the question of, given what we know already about such extreme weather events, and their associated critical infrastructure impacts and recovery trajectories, what scenarios, insights and tools might we develop to enable critical infrastructures which are resilient?

With several of the world's most climate vulnerable cities situated in well-peopled and rapidly growing urban areas near coasts, our case study of Khulna City speaks globally into a resilience discourse, through critical infrastructure, disaster risk reduction, through spatial data science and high visualisation. With a current population of 1.4 million estimated to rise to 2.9 million by 2030, dense historical Khulna City may well continue to perform a critical role in regional economic development and as well as a destination for environmental refugees.

Working as part of the EU—CIRCLE consortium¹, we conduct a case study into cyclones and storm surges affecting the critical infrastructure then discuss salient developments of loss modelling. The research aims to contribute towards a practical framework that stimulates adaptive learning across multiple stakeholders and organisational genres.

[Full paper available in conference proceedia]

5. Mapping urban infrastructure interdependencies and fuzzy risks

Barry Evans, Albert S. Chen, Alison Prior, Slobodan Djordjevic, Dragan A. Savic, David Butler, Patrick Goodey, John R. Stevens, Graham Colclough

Centre for Water Systems at the University of Exeter, UK

Email: B.Evans@exeter.ac.uk

Abstract

In this study, we considered the relationships between different types of CI and services to simulate possible cascading effects during extreme hazard conditions brought on by climate change and how to analyse impacts with limited data resources. An area in central Bristol, UK, was used as the case study to investigate the interdependencies among select assets and services. A wide range of plausible scenarios caused by pipe bursts in the area were simulated using the CADDIES 2D modelling framework, to identify the hotspots with high risk. The impact on CI, including water supply, electricity, wastewater, solid waste, transportation, telecommunication, and emergency services were assessed by the HAZUR tool. The analysis demonstrated that with limited data resources the dynamics of the interdependencies between CI networks can be highlighted and a basis of risk quantification can be established. The same procedure can be repeated to evaluate the impact of other types of hazards, or the compound hazard scenarios to provide a holistic assessment. Therefore, urban planners and managers can further explore options of interventions for setting up strategies to strengthen city resilience.

[Full paper available in conference proceedia]

3.1.6 Presentation at Torbay Demonstration, 28th March 2018

At part of the Torbay Case Study's final stakeholder demonstration event the Khulna Case Study was presented by Fuad Ali. This was a valuable opportunity for CIRP and CADDIES testing and to rehearse for the Khulna event the following month.



3.1.7 Demonstration workshop in Khulna, 24th April 2018

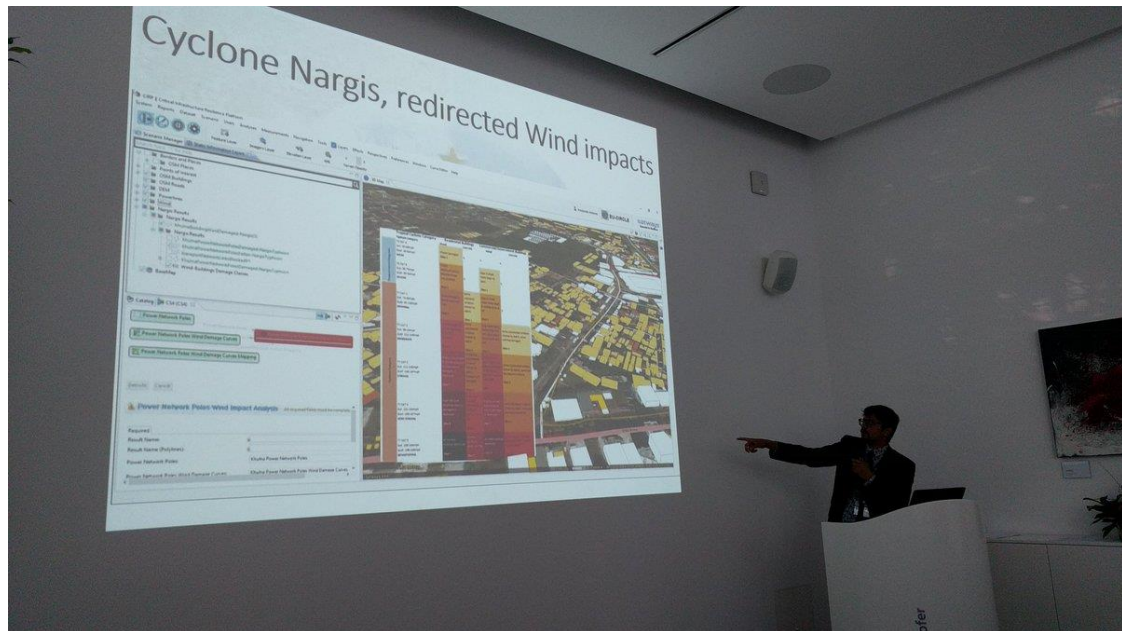
Final Khulna Case Study even described in detail in section 4.

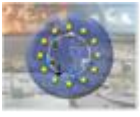


Prof Ingirige with the new Building Engineering and Construction Management Faculty at Khulna University of Engineering Technology.

3.1.8 Presentation at Dresden Demonstration, 29th August 2018

As part of the Dresden Case Study's final stakeholder demonstration event, the Khulna Case Study was presented by Fuad Ali. This presentation related insights from out of Europe institutional data environments to stakeholders present and over the course of preparation engaged with EU-CIRCLE sister projects. In the picture below, a 3-D view of Khulna City is presented through the CIRP with wind damage to buildings and along with road disruption cause by fallen electric poles in the case of a storm modelled on Cyclone Nargis of 2008.





3.2 Evaluation

3.2.1 EU-CIRCLE validation questionnaires

The questionnaires (included in Annexe II and III) were administered during the course of the Khulna City CIRP demonstration to critical infrastructure operators from the Khulna City Corporation (who are responsible for the municipal road network), the Khulna Power Company Ltd and the North West Zone Power Distribution Company Limited. Leadership and relevant research professionals from Khulna University of Engineering and Technology were also amongst the nine participants who filled in questionnaires.

3.2.2 Feedback to the questionnaire on system usability (Q1)

These analyses are presented first quantitatively, then qualitatively.

The ten sub-questions of Question 1 had a high completion rate, with only one out of the nine respondent missing out two sub-questions. Generally, participants expressed a strong desire to use the system frequently (4.1 out of 5), that it was not unnecessarily complex (2.1) and that they would need support from a technical person (4.2) and to learn a lot to be able to use it (4.2). Participants observed that the functions of the CIRP were well integrated (4.1) and were moderately inclined to feel confident about using the system (3.8) and that it was easy to use (3.7).

Participants found the CIRP interesting and engaging, with two thirds expressing that they would like to use it frequently. It was not on the whole regarded as unnecessarily complex, with only one respondent stating so. Opinion on the idea of ease of use varied, with a substantial minority neutral and a narrow majority agreeing with the system's ease of use. Technical support was envisaged as required by all but one participant.

A clear majority of participants judged that the system was well integrated, with two neutral. At the time of presentation CADDIES had not been fully integrated into the CIRP, and in the context of Case Study 4, the CIRP had more integrated features than available data to demonstrate them.

Views on System Inconsistency were mixed, with equal numbers remarking negatively and positively, although the positive view was expressed more strongly. Views on the ease with which most people would quickly learn to use the system tended towards the positive with 3 agreeing and 2 disagreeing. The large neutral voicing, of a third, also speaks to the spectrum of specific technological training present in the organisations participating. Half as many users found the system very cumbersome in comparison to those that did not, with a third neutral.

More than half of users felt very confident using the system, with a third neutral or not very confident. All but one of the participants felt that they needed to learn a lot of things before starting to use the CIRP.



3.2.3 Feedback to the questionnaire on EU-CIRCLE developments and exploitation (Q2)

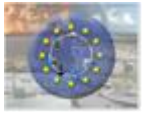
Completion rates on the rest of the form were lower than for the 10 multiple choice questions. This questionnaire was organized along three themes, Intuitiveness, Usability and Marketability

EU Circle Framework Validation: Intuitiveness

- All participants agreed that the EU-CIRCLE platform would help them assess risk more quickly than current methods, with one third agreeing strongly. Regarding assessing and defining resilience this consensus remained.
- One third disagreed that the EU-CIRCLE solution enabled them to assess the consequences of incidents better than their current methods. The other two thirds agreed.
- All but one respondent agreed that the EU-CIRCLE solution was more multi threat capable than their existing methods.
- All responses affirmed the solution would help understand impacts originated from secondary effects (propagated consequences), enable risk management and enable resilience strengthening.
- All responses found the risk and resilience estimations to be very close to their own experience. [Caution is urged here as the questionnaires were completed in the context of the group having previously discussed the need to add layers of sophistication to the wind impact modelling and the Resilience Assessment Tool was only outlined and discussed qualitatively.]
- All responses found that the Risk Assessment and Resilience Framework showcased by the EU Circle Consortium made sense for mid-or-long-term planning.

Produce Assessment: Usability

- Users generally agreed that working with the platform could provide an increased capacity to assess risk and improve resilience of their infrastructure.
- 5 out of 6 responses affirmed that the platform's capabilities made it attractive to use in their OSP.
- Only 2 of 6, a minority, of participants came from organisations holding data suitable for EU-CIRCLE (CIRP) analyses. This speaks to the wider data inequality issue facing many organisations in climate vulnerable contexts faced with a generation of data hungry climate applications and underdeveloped institutional data resources. When prompted for the format of data, GIS format was the only response.
- All of the 7 responses all agreed that the EU-CIRCLE was easy to learn and use.
- All of the 6 responses encountered no problems using the EU-CIRCLE platform. Interpretive caution is again urged as the demonstration was based on showcasing by a single expert user, and it encountered both a power cut and wi-fi failure.
- Regarding forms of support for formal users, none preferred a telephone hotline (perhaps due to time zone and language), 2 selected an internet option and 4 selected e-mail.
- Of 5 responses to the question of whether the information provided by EU-CIRCLE was confusing 4 stated that it was 'Clear enough', with a single observation of 'A bit confusing'.
- There was only one (affirming) response regarding the consistency of EU-CIRCLE terminology.
- There were only five responses regarding the clarity of EU-CIRCLE terminology.
- There was only one response regarding the compliance of EU-CIRCLE terminology to standard terms.
- User interface:
 - 4 out of 5 users found the error/help messages of the CIRP platform to be helpful.
 - 4 users found the UI well designed/ergonomic
 - 2 users found the UI polished.
 - 3 users found the UI simple.
 - No users found the UI intuitive.



- Six users found the platform reasonably fast or very fast.
- Six of 7 users estimated that the EU Circle solution was Robust enough, with an additional user saying it was 'very reliable'.
- All 7 users responding agreed that the EU-Circle solution can cover all levels of end-users (both technically and operationally orientated).

Business Model: Marketability

- Three of the end-user entities were public and three were private.
- Six users were involved in profit making business entities, 1 in a not for profit.
- Users' organisations operated on a range of scales, 1 local, 3 regional and 3 national.
- Six users found the solution quite innovative and interesting, 1 was aware of similar tools but this was the first change they got to use one.
- Two users assessed risk monthly, and 4 annually.
- One user estimated their resilience monthly, 4 6-monthly, and 1 annually.
- Six users were willing to share their data with others entity users of EU circle, 1 was not.
- Three of 6 users were interested in using an EU Circle solution and fine tuning it to their own needs. Of these 3, all were interested in online access to EU-CIRCLE services, 1 in a local installation, 1 in an incorporation of the functionality into their own network or back office system, 2 in technical support (customer model development, client networks data-entry), 2 in software maintenance, 2 in content analysis and 2 in staff training.
- Three of 4 users responding preferred a one off payment over a regular fee.
- There was only one response to the costing question set, and that was for a yearly fee of less than 2000 Euros.
- Five of 6 users responded that they would recommend the EU-Circle solution to others.



3.2.4 EU-CIRCLE Key Evaluation Questions

The conclusions associate to the KEQs that can be drawn based on the questionnaires feedback and the discussions with the energy sector operators during the CS4 pilot in Khulna are the following:

a. Concept

- i. To what extent does EU-CIRCLE addresses an existing challenge in CIP and operational planning in order to address climate change impact?

Feedback from users is positive in this regard.

- ii. How appropriate is the EU-CIRCLE approach to improve preparedness and response capabilities of CIs?

The EU-CIRCLE platform was judged suitable for mid- and long-term assessment of Cyclonic storms and their and their associated wind and flood impacts to the CI.

Which can be main challenges for applying EU-CIRCLE solution?

The limited availability of data at present limits the extent of EU-CIRCLE applications. Technical support is also an issue though an interest in several forms of support was indicated. Funding would also be an issue for the Municipality, though there are several international financing mechanisms for this and tools like EU-CIRCLE will be useful for Loss & Damage streams of activity.

- iii. What is considered innovative in EU-CIRCLE solution?

Multiple risks assessment, cascading damage visualization and quantitative estimation. There was more interest in RAT tool from one of the director level participants.

b. Prototype

- i. To what extent does EU-CIRCLE produce worthwhile results (outputs, outcomes) and/or meeting each of its objectives?

Feedback was positive given the early stage of modelling for wind and data availability. Results did not depart significantly from experts' opinion and expectations.

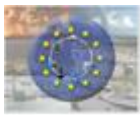
- ii. To what extent is the relationship between inputs and outputs timely, cost-effective and to expected standards?

The system, according to the Khulna operators, performs rather quickly and it is reasonably responsive as expected. Very limited feedback on costs but the economics of the system would be contingent on the new infrastructure that it was attached to. A city like Khulna at present has a lot of CI being installed at present.

- iii. What features of the system and EU-CIRCLE solution make a difference?

Spatio-temporal risk assessment, damage costing support and resilience definition at the mid- and long-term.

- iv. To what extent changes are needed?



The wind damage modules would need development to include the action of trees and the presence of electric lines between distribution pylons. The drainage model would need to incorporate higher dimensionality and the ubiquitous design-performance lag. The electricity distribution company will be installing SCADA systems, so integration with those would be beneficial and extend the applicability to shorter term incidents, like lightning storms which are observed to occur more frequently than high winds.

Changed to institutional data practices would also need to be mainstreamed for the effective operation of EU-CIRCLE system.

c. Operational

- i. Are stakeholders being reached as required?

Operators of city road, power distribution and generation were present for the demonstration event. However, the project contact Sewerage and Water Authority was unable to attend although they provided data to the project.

- ii. How satisfied are EU-CIRCLE stakeholders?

The EU-CIRCLE stakeholders in Khulna were encouraged by the development of EU-CIRCLE.

- iii. How well does EU-CIRCLE align with government and agencies' priorities?

Power companies have KPIs related to disruptions, down time and connections affected. However given the infrequency of large cyclonic events, working memory seldom included direct strong cyclonic hits to the city and lightning storms were of immediate concern.

The municipality acknowledges the severity of the city's climatic and wider environmental vulnerability and was keen to be involved in climate change related research and development during the first data collection visit, though demonstration event occurred during a period of Mayoral transition.

- iv. Are there ethical and data privacy issues not addressed by EU-CIRCLE?

There would be issues of security, public-private data sharing and spatial privacy if this system were to do public. One data provider asked for their data not to be published.

- v. What kind of business model can be considered for using EU-CIRCLE solution?

There was no discussion of this at the event, though it would be reasonable to assume that it could come under international Adaptation or future Loss & Damage financing.

3.3 Event Photography



Chief Planner of the Khulna City Corporation and the delegation from the Khulna University of Engineering and Technology



Participants from the Khulna Power Company Limited



View from the front, morning session.



View from the rear, afternoon session.



End of event picture



4 APPENDIX

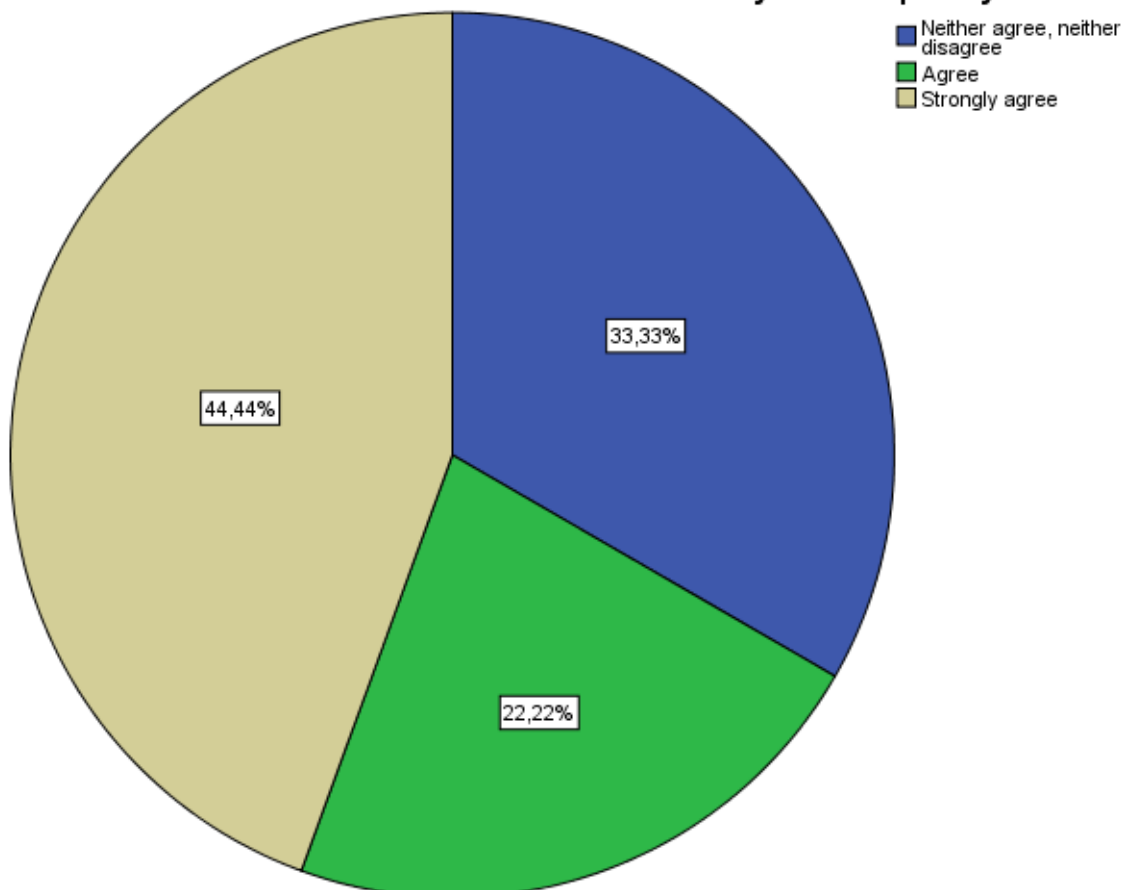
ANNEX I: EU-CIRCLE Evaluation Questionnaire Analysis for CS4

I.1. I think that I would like to use this system frequently

I.1. I think that I would like to use this system frequently

	Frequency	Percent	Valid Percent	Cumulative Percent
Neither agree, neither disagree	3	33,3	33,3	33,3
Agree	2	22,2	22,2	55,6
Strongly agree	4	44,4	44,4	100,0
Total	9	100,0	100,0	

I.1. I think that I would like to use this system frequently

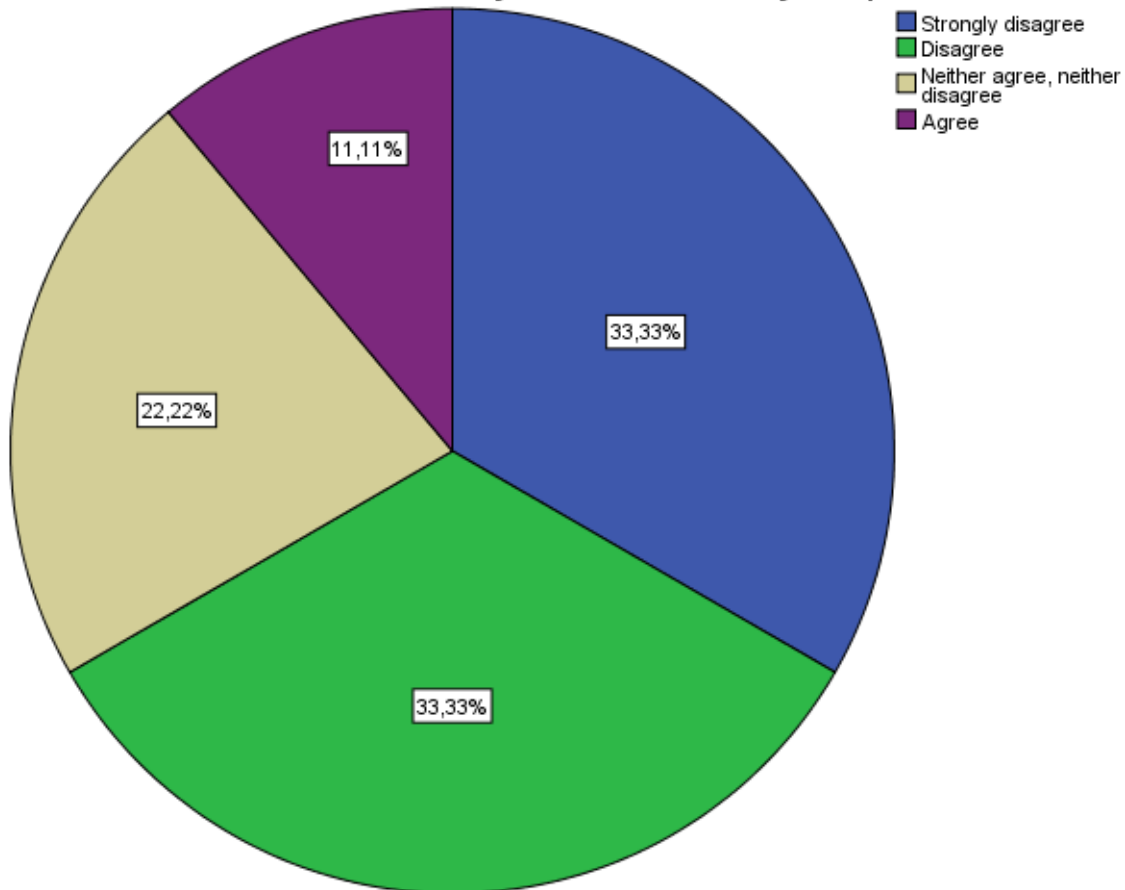


I.2. I found the system unnecessarily complex

I.2. I found the system unnecessarily complex

	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly disagree	3	33,3	33,3	33,3
Disagree	3	33,3	33,3	66,7
Valid Neither agree, neither disagree	2	22,2	22,2	88,9
Agree	1	11,1	11,1	100,0
Total	9	100,0	100,0	

I.2. I found the system unnecessarily complex

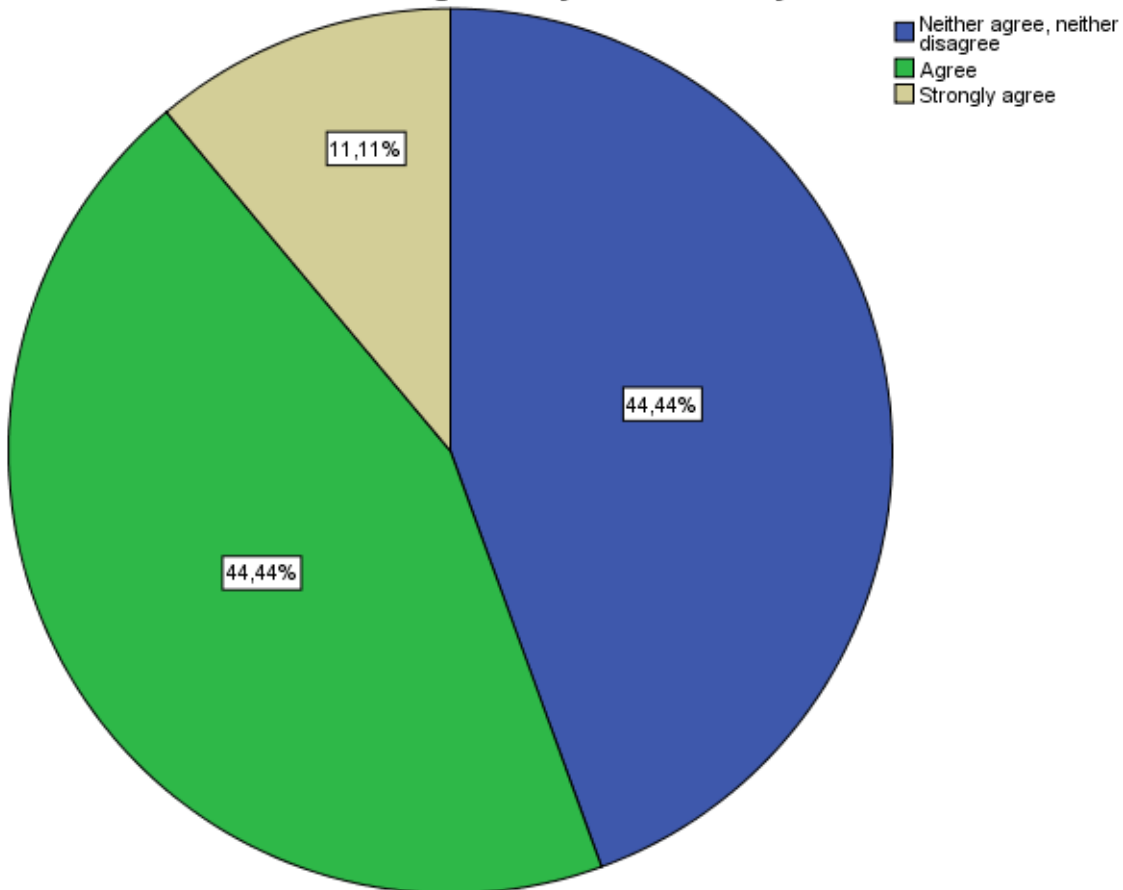


I.3. I thought the system was easy to use

I.3. I thought the system was easy to use

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Neither agree, neither disagree	4	44,4	44,4	44,4
	Agree	4	44,4	44,4	88,9
	Strongly agree	1	11,1	11,1	100,0
	Total	9	100,0	100,0	

I.3. I thought the system was easy to use

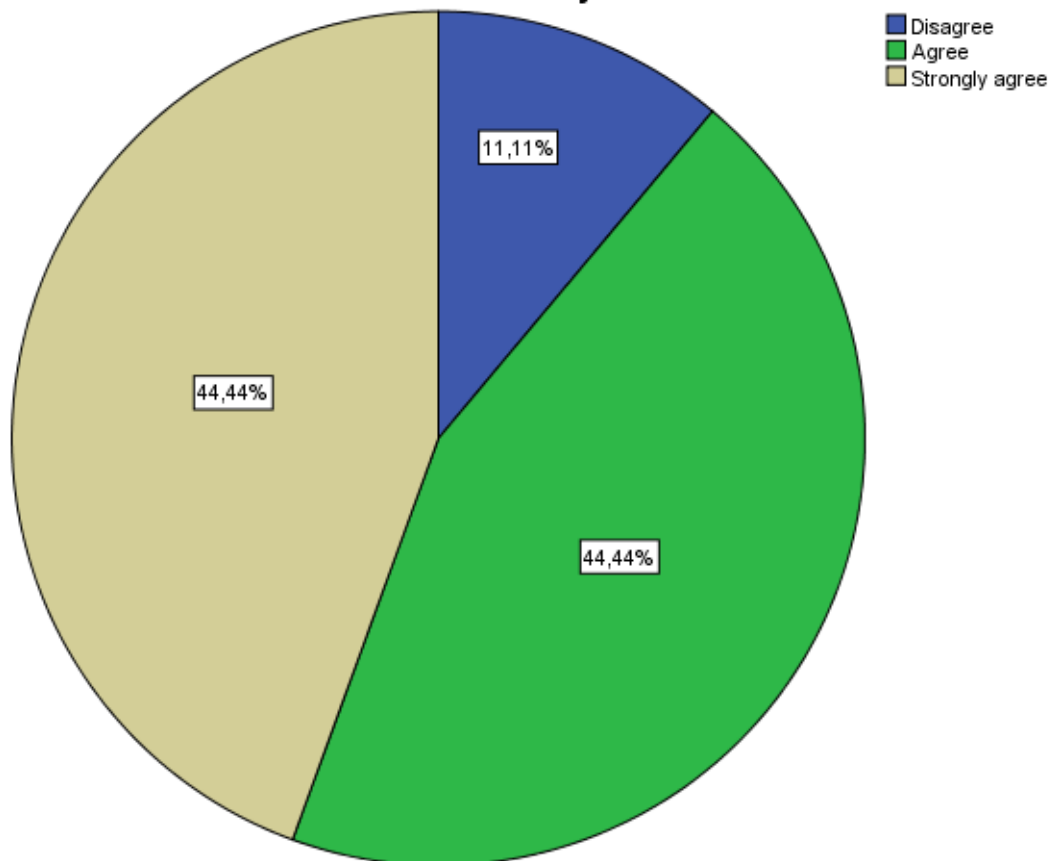


I.4. I think that I would need the support of a technical person to be able to use this system

I.4. I think that I would need the support of a technical person to be able to use this system

	Frequency	Percent	Valid Percent	Cumulative Percent
Disagree	1	11,1	11,1	11,1
Agree	4	44,4	44,4	55,6
Strongly agree	4	44,4	44,4	100,0
Total	9	100,0	100,0	

I.4. I think that I would need the support of a technical person to be able to use this system

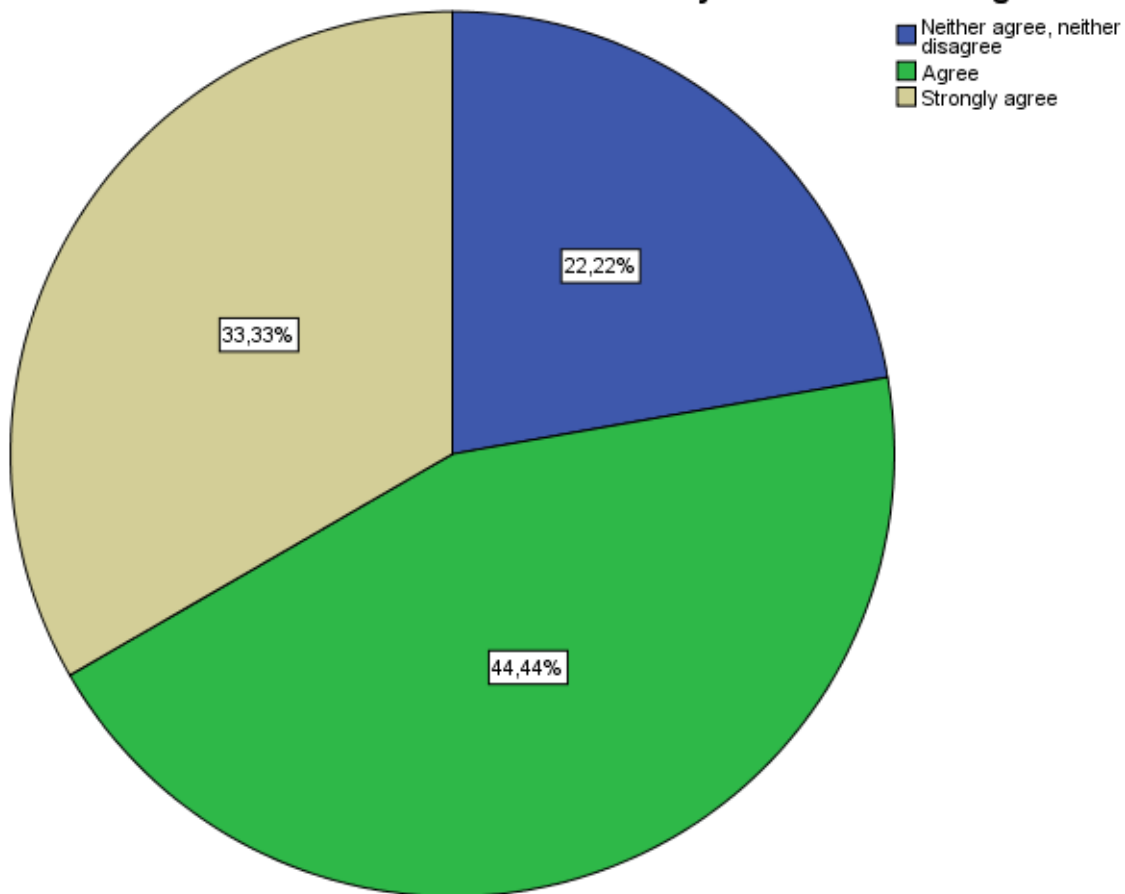


I.5. I found the various functions in this system were well integrated

I.5. I found the various functions in this system were well integrated

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
Neither agree, neither disagree	2	22,2	22,2	22,2
Agree	4	44,4	44,4	66,7
Strongly agree	3	33,3	33,3	100,0
Total	9	100,0	100,0	

I.5. I found the various functions in this system were well integrated

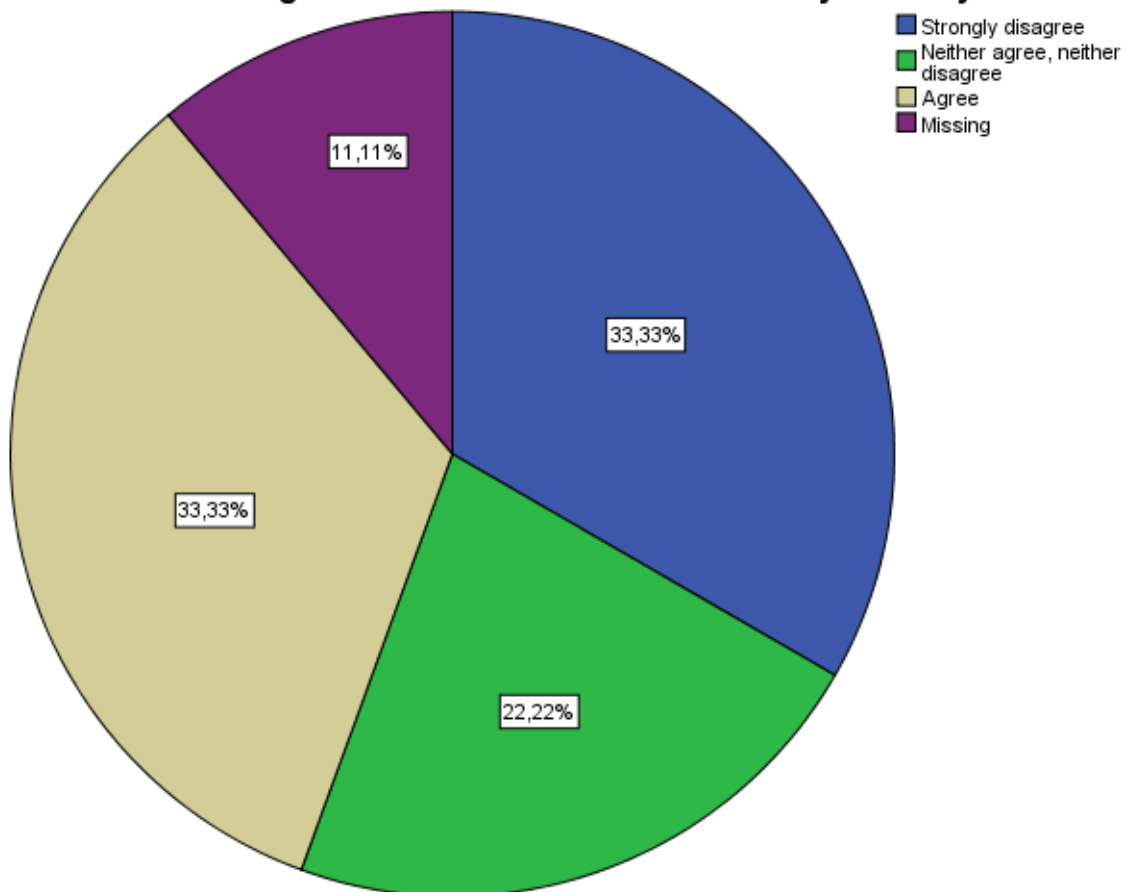


I.6. I thought there was too much inconsistency in this system

I.6. I thought there was too much inconsistency in this system

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	3	33,3	37,5	37,5
	Neither agree, neither disagree	2	22,2	25,0	62,5
	Agree	3	33,3	37,5	100,0
	Total	8	88,9	100,0	
Missing	System	1	11,1		
Total		9	100,0		

I.6. I thought there was too much inconsistency in this system

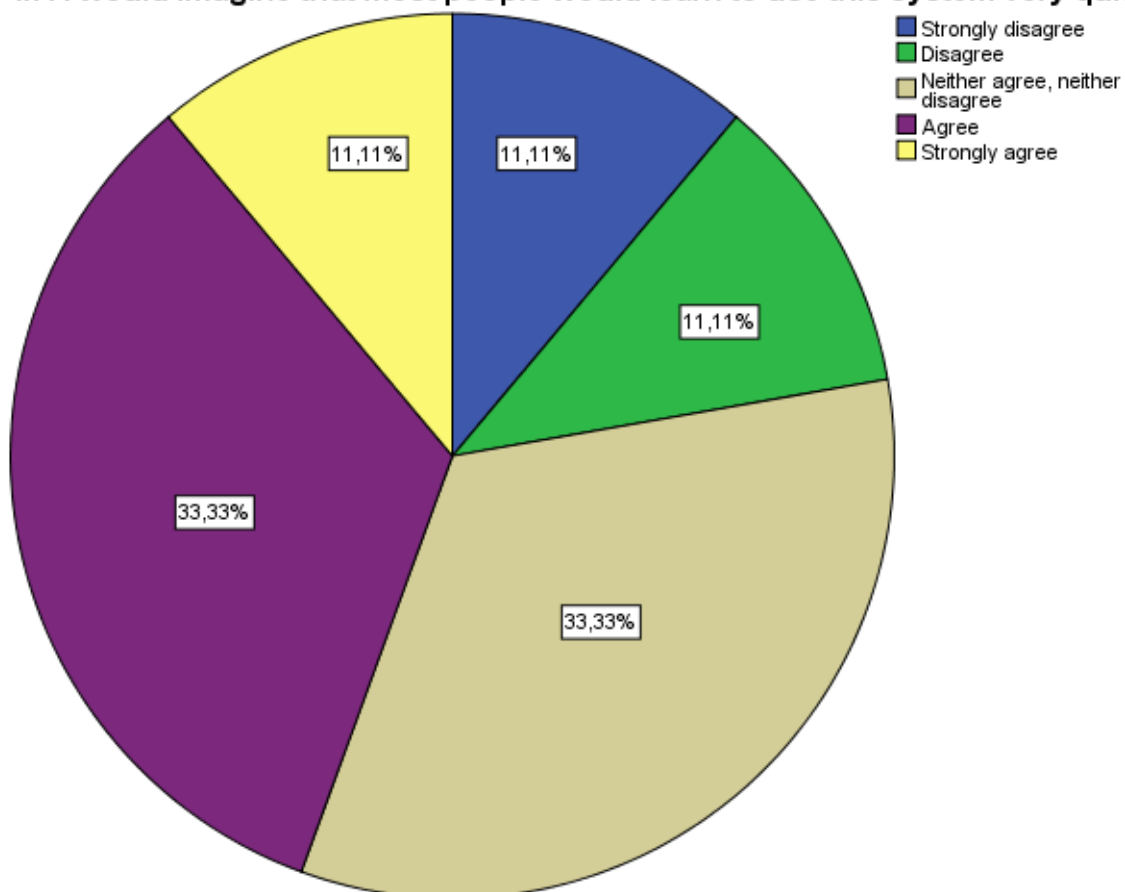


I.7. I would imagine that most people would learn to use this system very quickly

I.7. I would imagine that most people would learn to use this system very quickly

	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly disagree	1	11,1	11,1	11,1
Disagree	1	11,1	11,1	22,2
Neither agree, neither disagree	3	33,3	33,3	55,6
Agree	3	33,3	33,3	88,9
Strongly agree	1	11,1	11,1	100,0
Total	9	100,0	100,0	

I.7. I would imagine that most people would learn to use this system very quickly

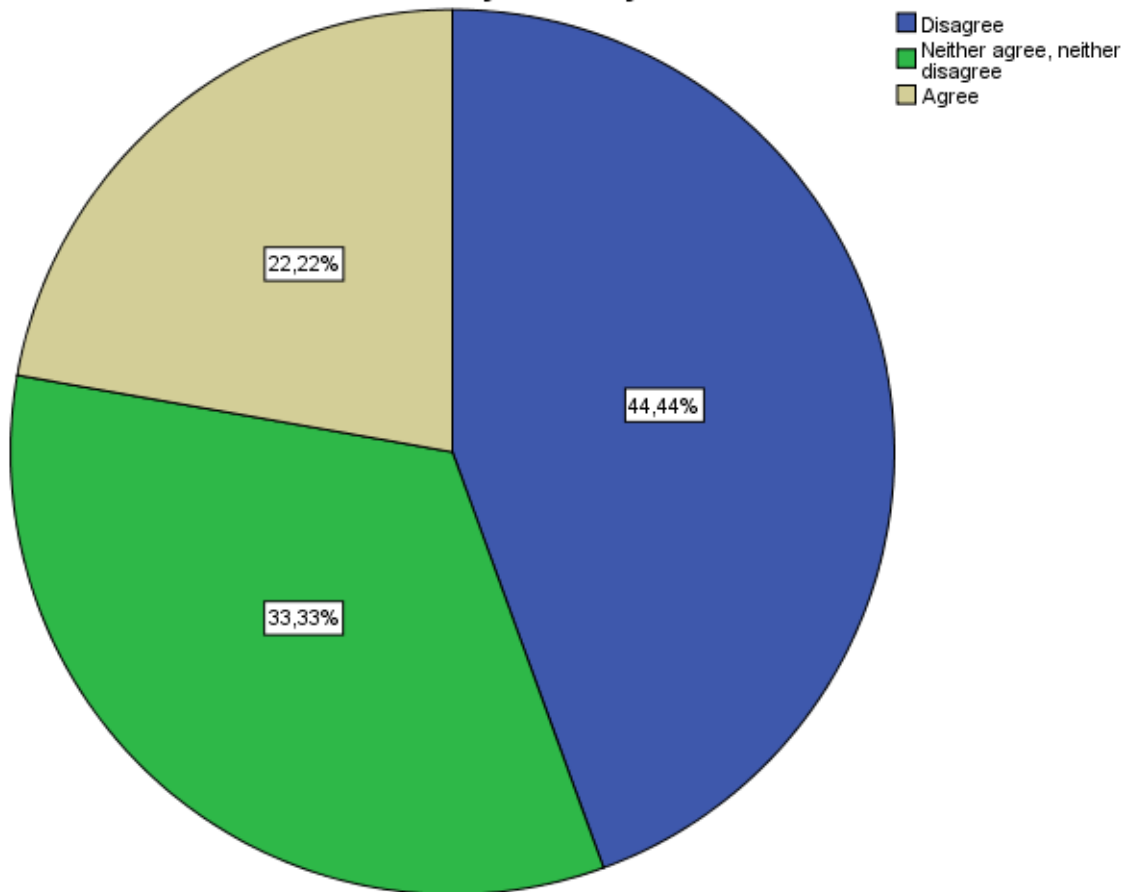


I.8. I found the system very cumbersome to use

I.8. I found the system very cumbersome to use

	Frequency	Percent	Valid Percent	Cumulative Percent
Disagree	4	44,4	44,4	44,4
Neither agree, neither disagree	3	33,3	33,3	77,8
Agree	2	22,2	22,2	100,0
Total	9	100,0	100,0	

I.8. I found the system very cumbersome to use

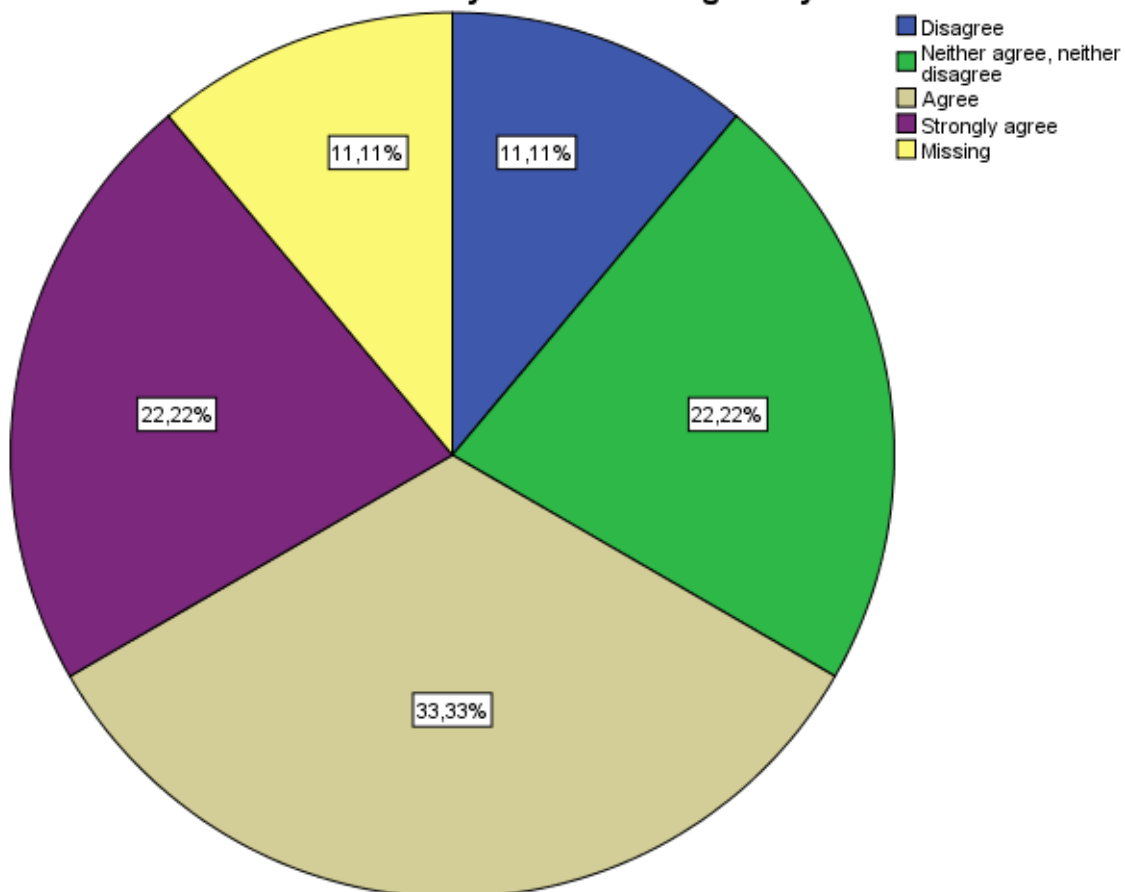


I.9. I felt very confident using the system

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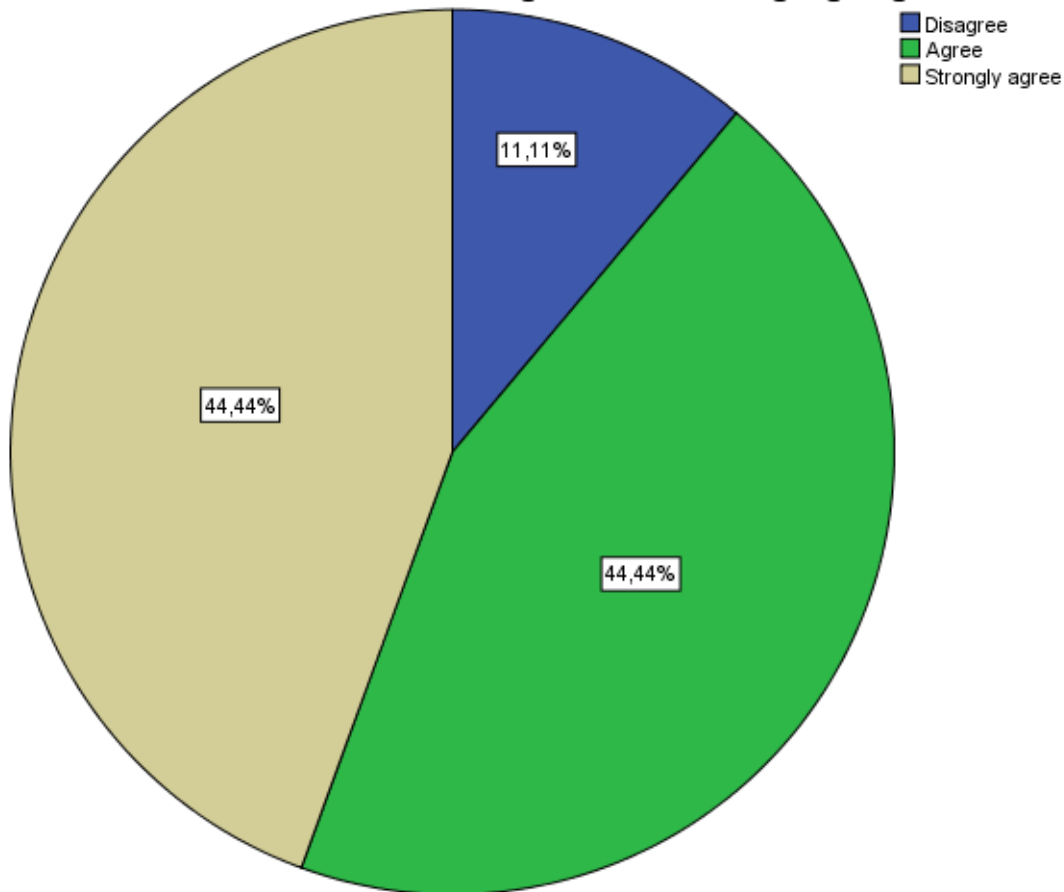
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	1	11,1	12,5	12,5
	Neither agree, neither disagree	2	22,2	25,0	37,5
	Agree	3	33,3	37,5	75,0
	Strongly agree	2	22,2	25,0	100,0
	Total	8	88,9	100,0	
Missing	System	1	11,1		
Total		9	100,0		

I.9. I felt very confident using the system



**I.10. I needed to learn a lot of things before I could get going with this system****I.10. I needed to learn a lot of things before I could get going with this system**

	Frequency	Percent	Valid Percent	Cumulative Percent
Disagree	1	11,1	11,1	11,1
Agree	4	44,4	44,4	55,6
Strongly agree	4	44,4	44,4	100,0
Total	9	100,0	100,0	

I.10. I needed to learn a lot of things before I could get going with this system

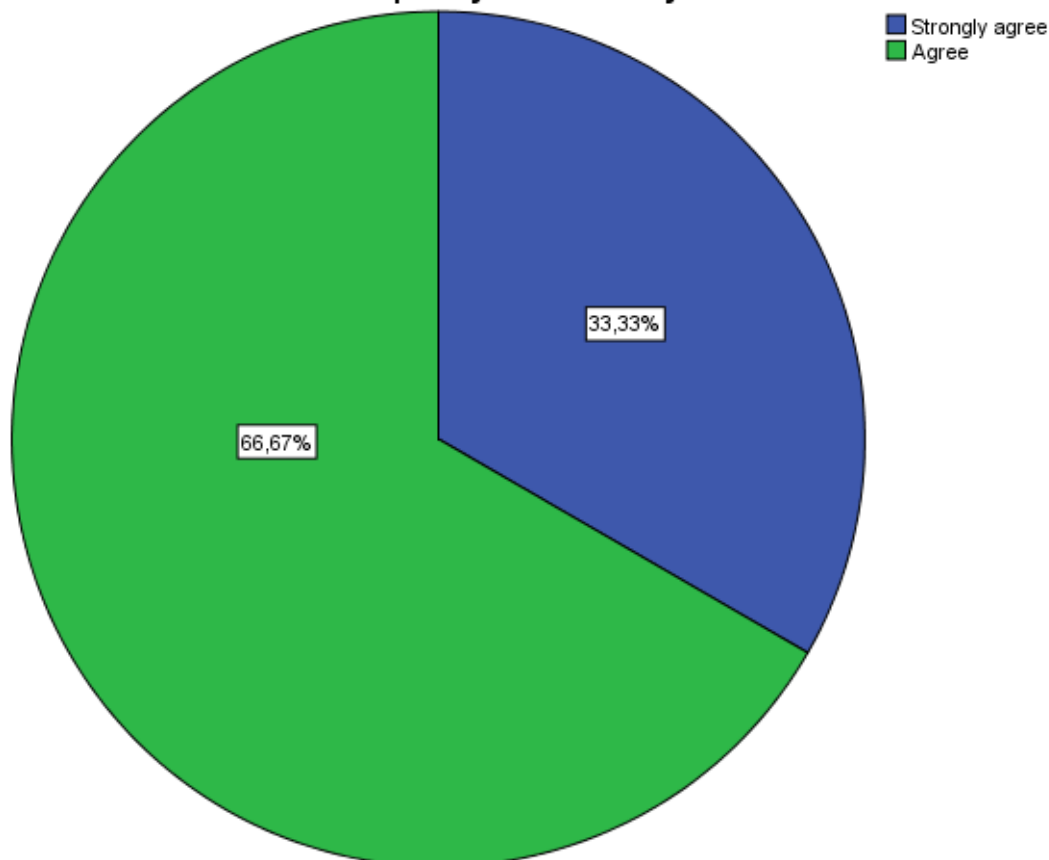


II.5.1. Using the EU-CIRCLE platform would enable me to assess risks and define resilience more quickly than with my current methods.-Risk

II.5.1. Using the EU-CIRCLE platform would enable me to assess risks and define resilience more quickly than with my current methods.-Risk

	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly agree	3	33,3	33,3	33,3
Valid Agree	6	66,7	66,7	100,0
Total	9	100,0	100,0	

II.5.1. Using the EU-CIRCLE platform would enable me to assess risks and define resilience more quickly than with my current methods.-Risk

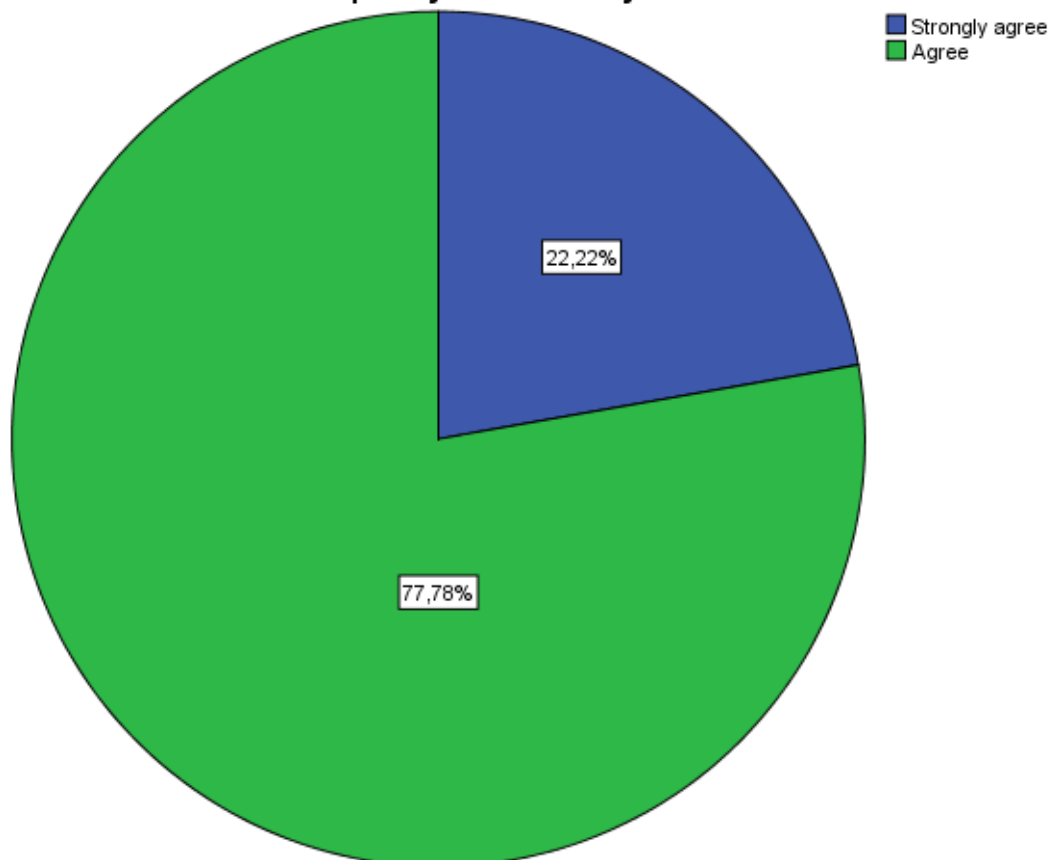


II.5.2. Using the EU-CIRCLE platform would enable me to assess risks and define resilience more quickly than with my current methods.-Resilience

II.5.2. Using the EU-CIRCLE platform would enable me to assess risks and define resilience more quickly than with my current methods.-Resilience

	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly agree	2	22,2	22,2	22,2
Valid Agree	7	77,8	77,8	100,0
Total	9	100,0	100,0	

II.5.2. Using the EU-CIRCLE platform would enable me to assess risks and define resilience more quickly than with my current methods.-Resilience

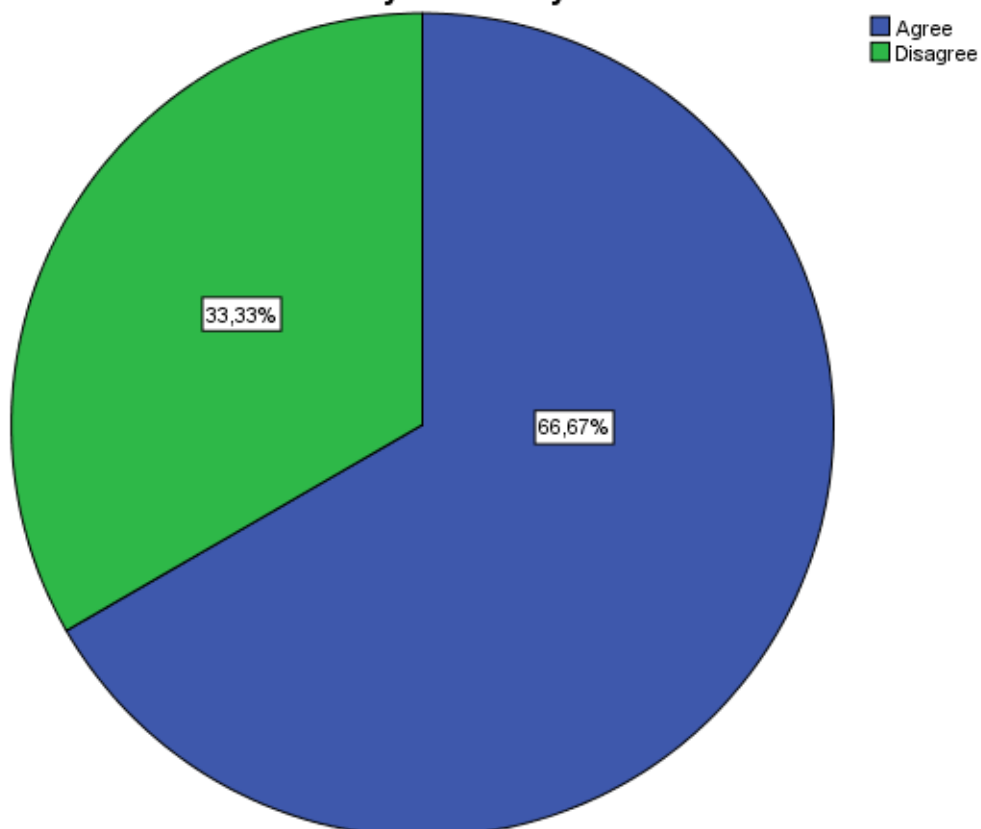


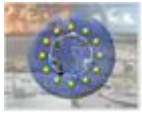
II.7. Using the EU-CIRCLE platform would enable to assess unexpected likelihood/consequences of eventual climate/climate change incidents more accurately than with your current methods?

II.7. Using the EU-CIRCLE platform would enable to assess unexpected likelihood/consequences of eventual climate/climate change incidents more accurately than with your current methods?

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Agree	6	66,7	66,7	66,7
Disagree	3	33,3	33,3	100,0
Total	9	100,0	100,0	

II.7. Using the EU-CIRCLE platform would enable to assess unexpected likelihood/consequences of eventual climate/climate change incidents more accurately than with your current methods?



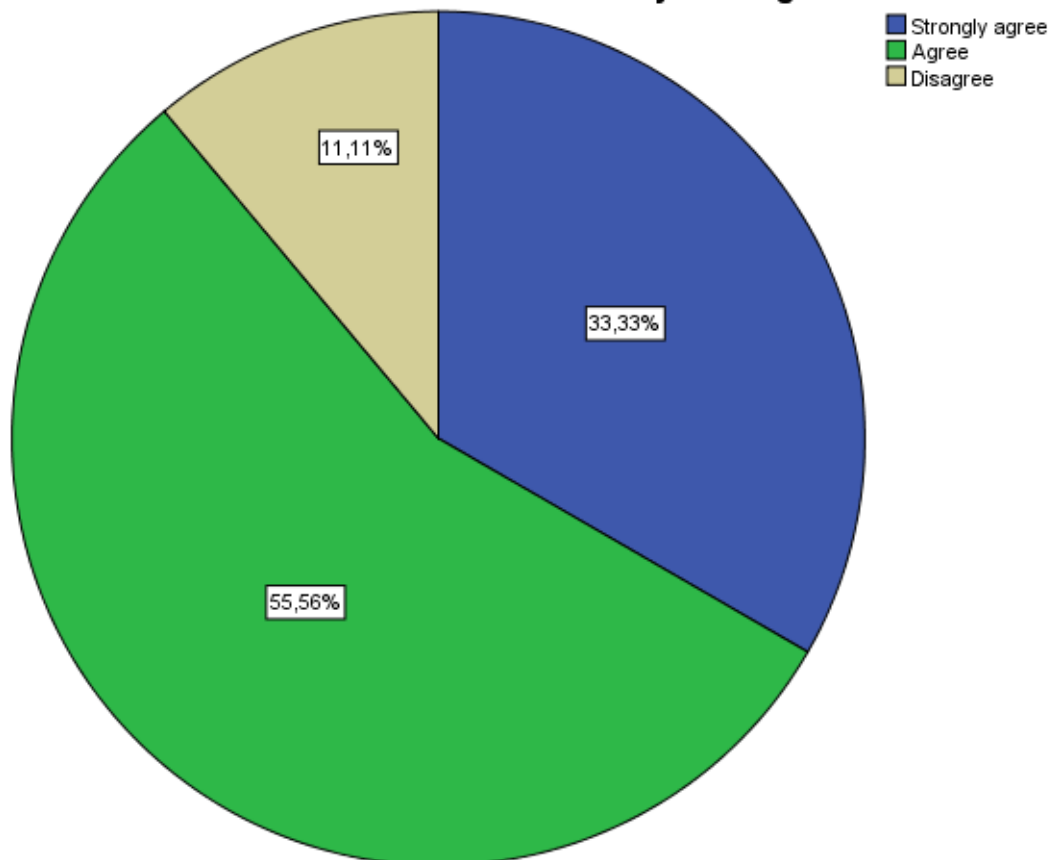


8. Would EU-CIRCLE solution enable you to take into account multiple risk scenarios and more threats than currently existing tools/methods allow.

8. Would EU-CIRCLE solution enable you to take into account multiple risk scenarios and more threats than currently existing tools/methods allow.

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Strongly agree	3	33,3	33,3	33,3
Valid Agree	5	55,6	55,6	88,9
Valid Disagree	1	11,1	11,1	100,0
Total	9	100,0	100,0	

8. Would EU-CIRCLE solution enable you to take into account multiple risk scenarios and more threats than currently existing tools/methods allow.

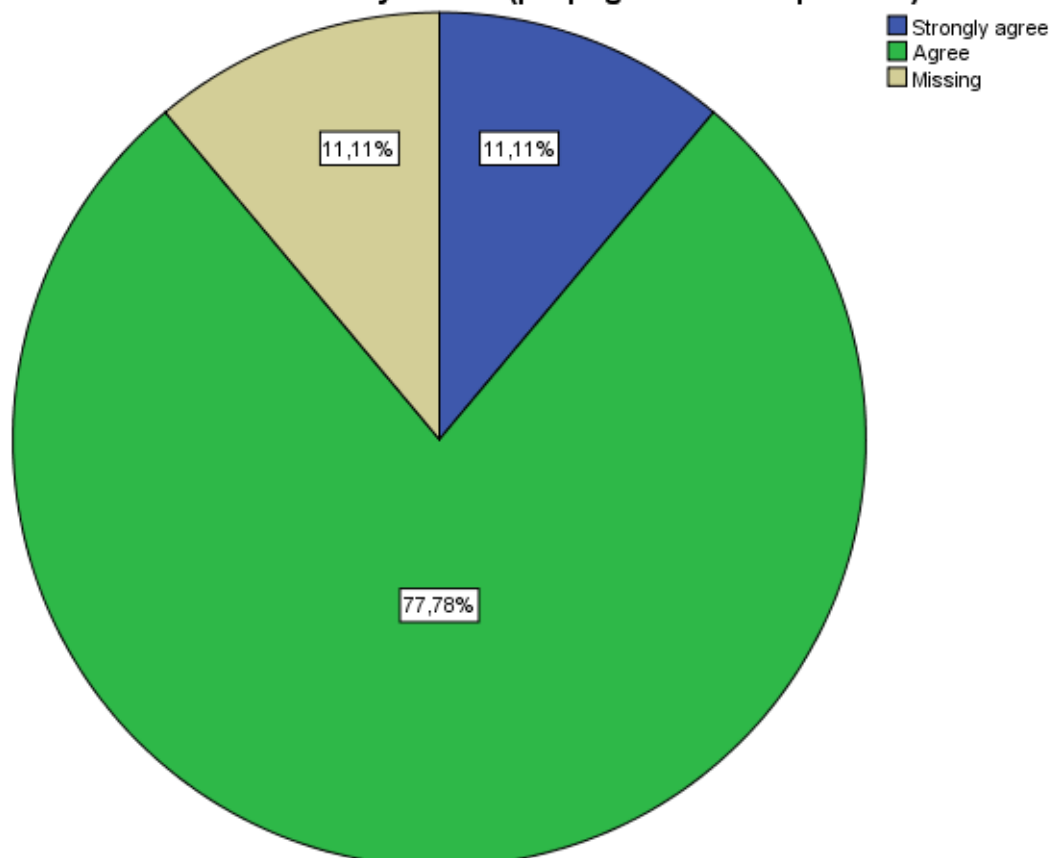


9. Would EU-CIRCLE solution help you to understand impacts originating from secondary effects (propagated consequences).

9. Would EU-CIRCLE solution help you to understand impacts originating from secondary effects (propagated consequences).

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	1	11,1	12,5	12,5
	Agree	7	77,8	87,5	100,0
	Total	8	88,9	100,0	
Missing	System	1	11,1		
Total		9	100,0		

9. Would EU-CIRCLE solution help you to understand impacts originating from secondary effects (propagated consequences).



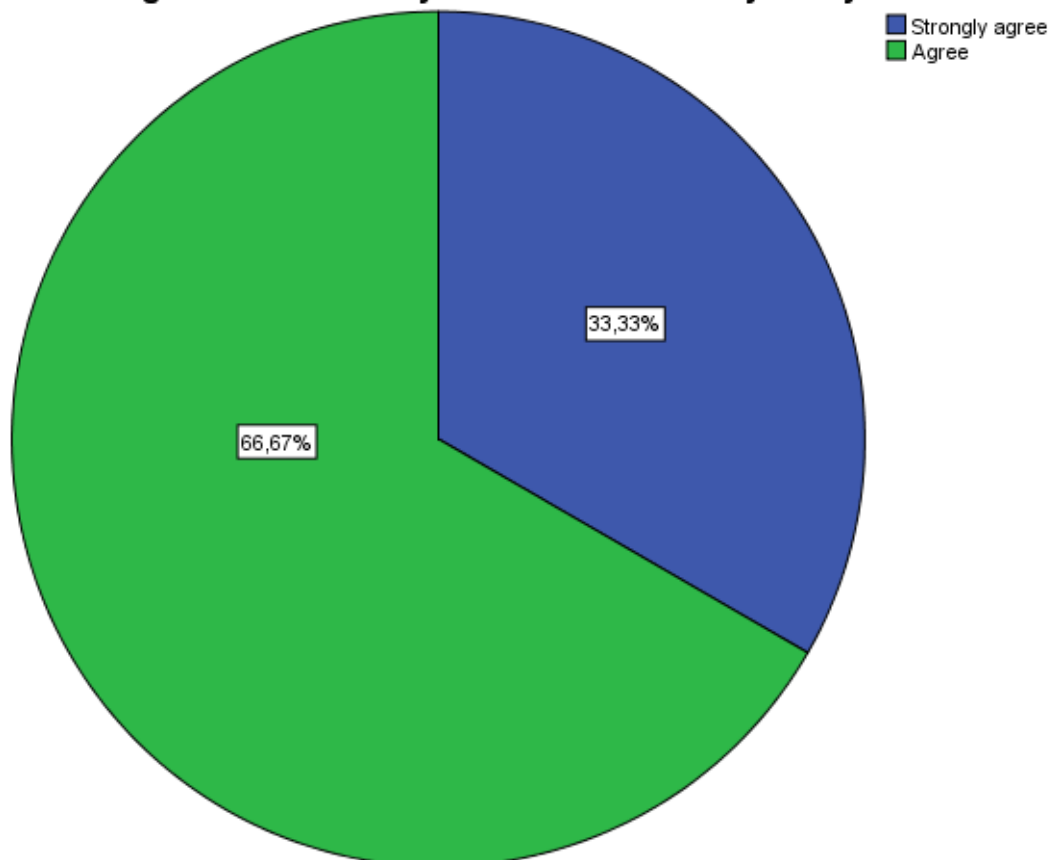


10.1. Would EU-CIRCLE solution enable you to plan risk management (midterm)/strengthen resilience of your CI more effectively than you can now-Risk

10.1. Would EU-CIRCLE solution enable you to plan risk management (midterm)/strengthen resilience of your CI more effectively than you can now-Risk

	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly agree	3	33,3	33,3	33,3
Valid Agree	6	66,7	66,7	100,0
Total	9	100,0	100,0	

10.1. Would EU-CIRCLE solution enable you to plan risk management (midterm) /strengthen resilience of your CI more effectively than you can now-Risk

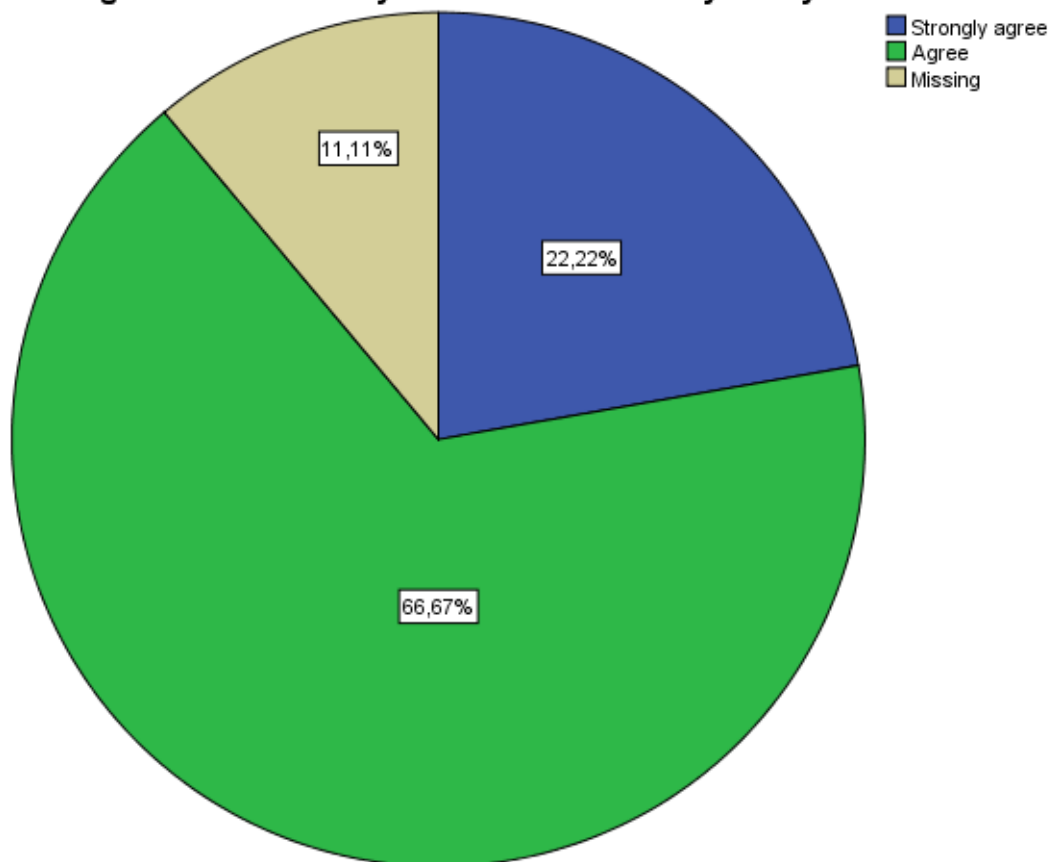


10.2. Would EU-CIRCLE solution enable you to plan risk management (midterm)/strengthen resilience of your CI more effectively than you can now-Resilience

10.2. Would EU-CIRCLE solution enable you to plan risk management (midterm)/strengthen resilience of your CI more effectively than you can now-Resilience

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	2	22,2	25,0	25,0
	Agree	6	66,7	75,0	100,0
	Total	8	88,9	100,0	
Missing	System	1	11,1		
Total		9	100,0		

10.2. Would EU-CIRCLE solution enable you to plan risk management (midterm)/strengthen resilience of your CI more effectively than you can now-Resilience



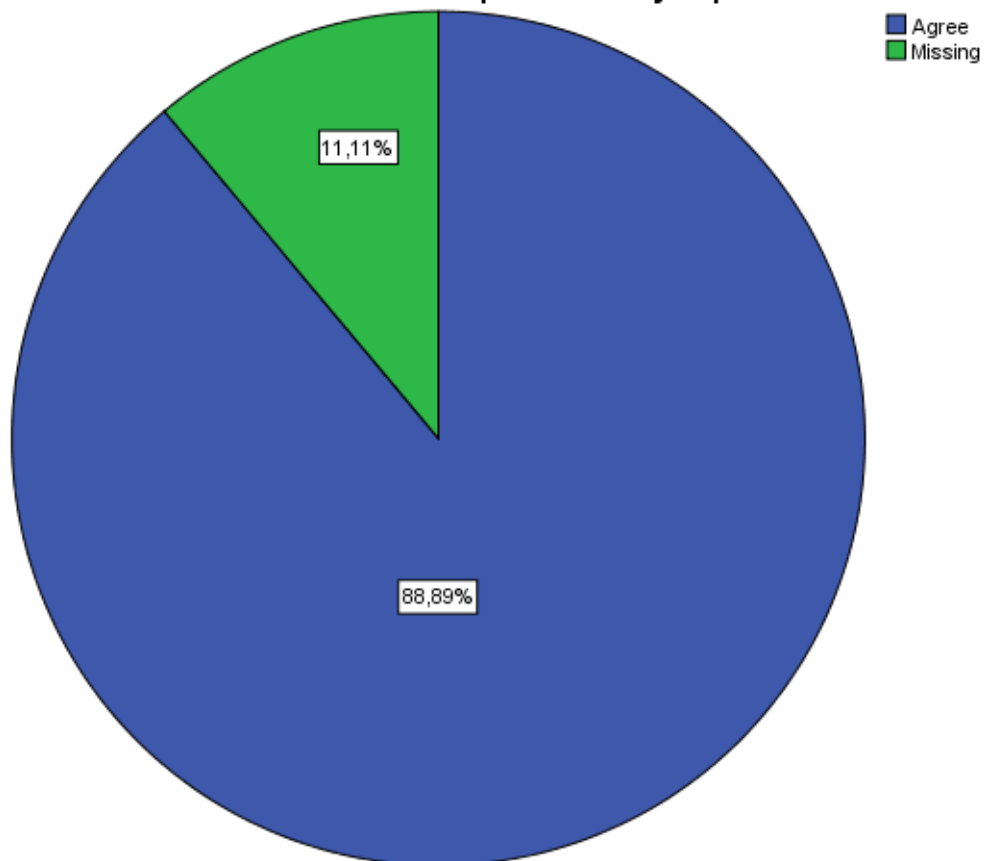


12.1. Do you find the EU-CIRCLE risk/resilience estimations to be very close to what I would expect from my experience-Risk

12.1. Do you find the EU-CIRCLE risk/resilience estimations to be very close to what I would expect from my experience-Risk

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	8	88,9	100,0	100,0
Missing	System	1	11,1		
Total		9	100,0		

12.1. Do you find the EU-CIRCLE risk/resilience estimations to be very close to what I would expect from my experience-Risk

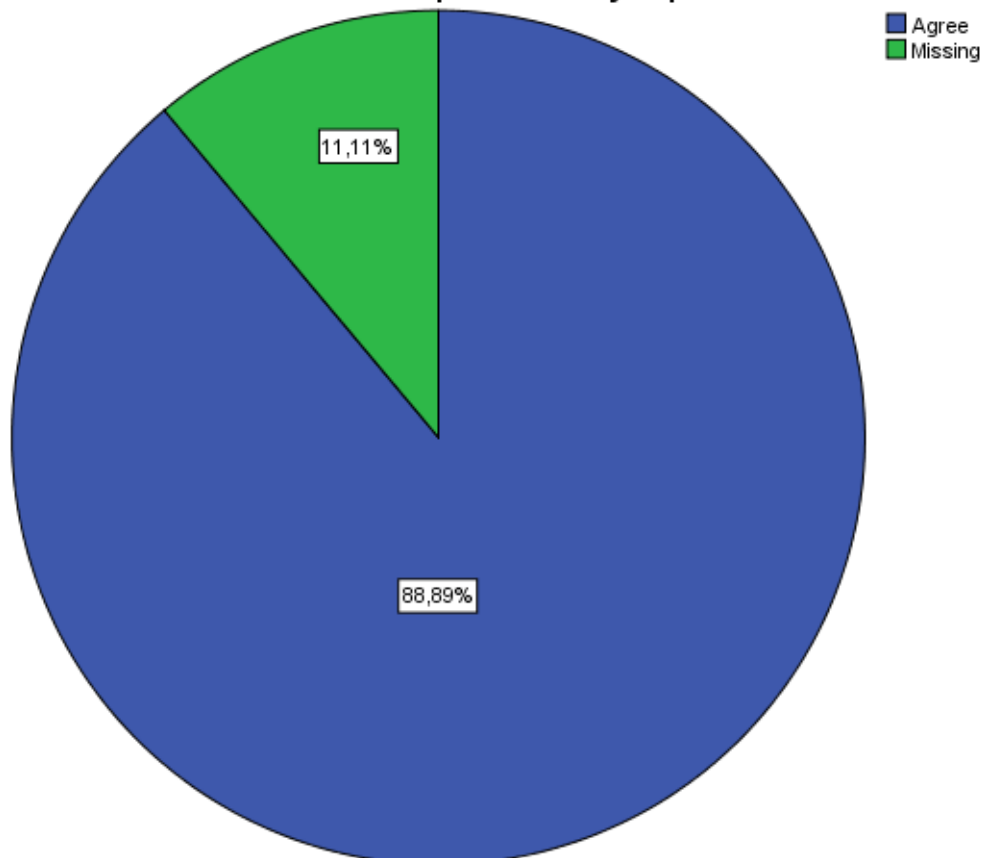


12.2. Do you find the EU-CIRCLE risk/resilience estimations to be very close to what I would expect from my experience-Resilience

12.2. Do you find the EU-CIRCLE risk/resilience estimations to be very close to what I would expect from my experience-Resilience

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	8	88,9	100,0	100,0
Missing	System	1	11,1		
Total		9	100,0		

12.2. Do you find the EU-CIRCLE risk/resilience estimations to be very close to what I would expect from my experience-Resilience

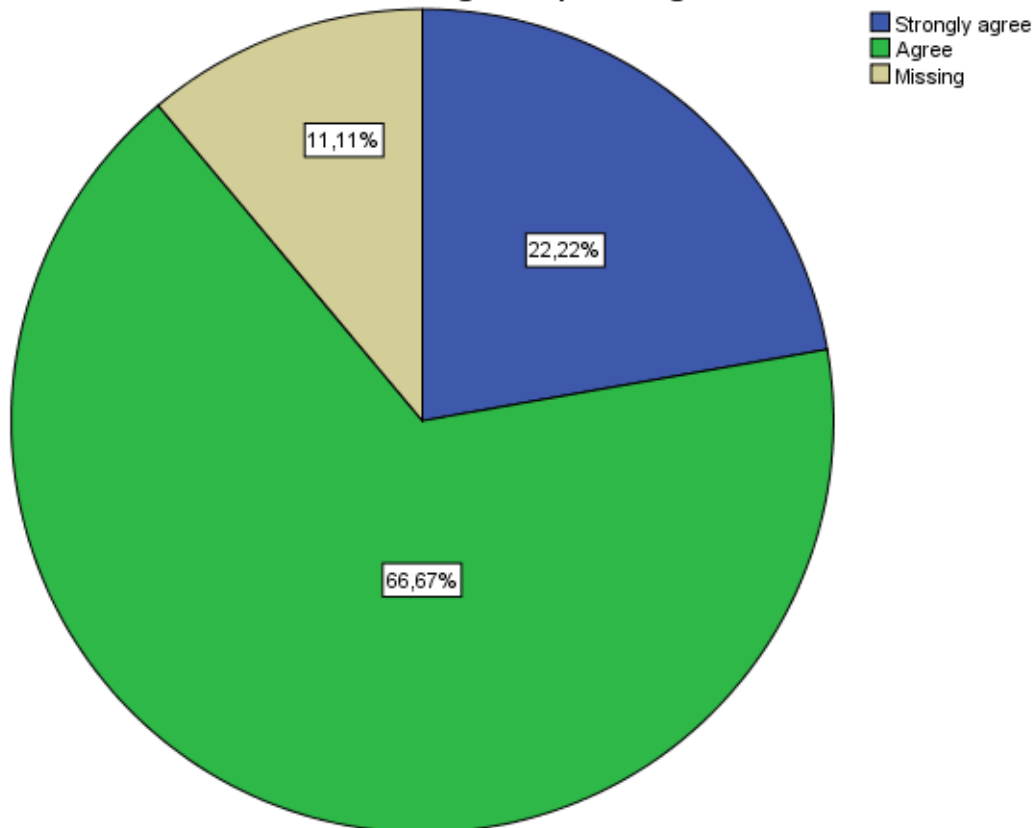


13.1. According to your opinion the overall Risk Assessment/Resilience Framework as showcased by the EU-CIRCLE consortium makes sense for mid- or long-term planning-Risk

13.1. According to your opinion the overall Risk Assessment/Resilience Framework as showcased by the EU-CIRCLE consortium makes sense for mid- or long-term planning-Risk

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	2	22,2	25,0	25,0
	Agree	6	66,7	75,0	100,0
	Total	8	88,9	100,0	
Missing	System	1	11,1		
Total		9	100,0		

13.1. According to your opinion the overall Risk Assessment/Resilience Framework as showcased by the EU-CIRCLE consortium makes sense for mid- or long-term planning-Risk

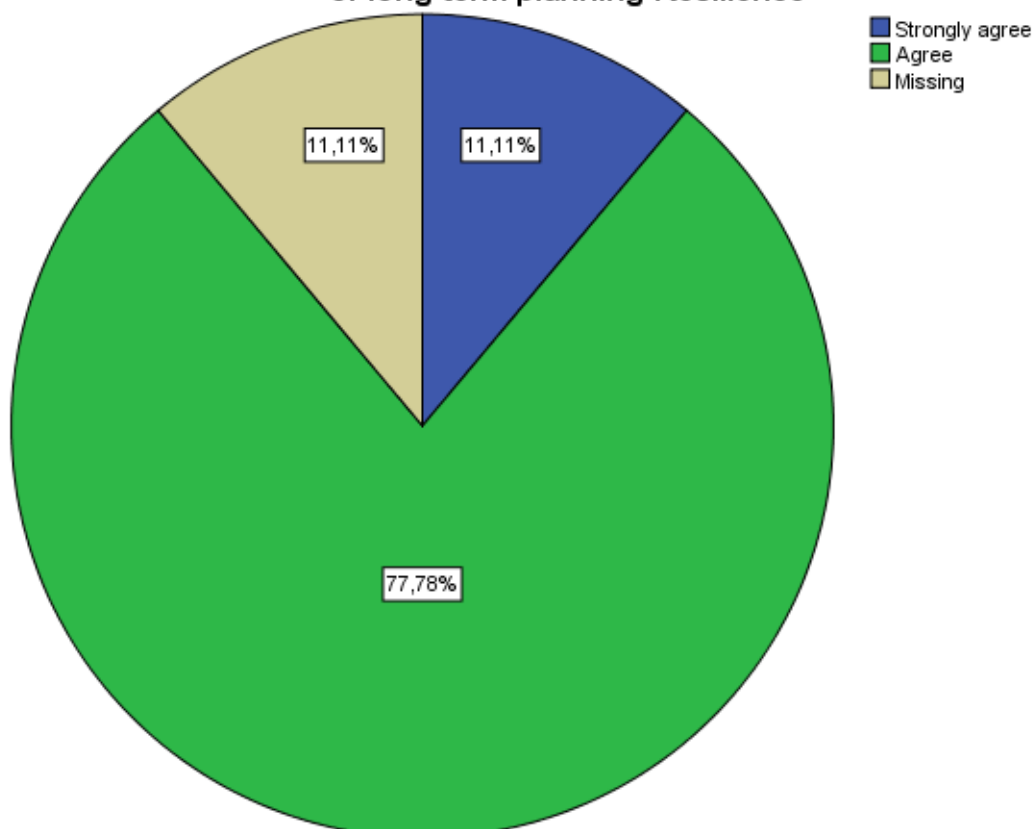


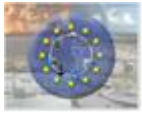
13.2. According to your opinion the overall Risk Assessment/Resilience Framework as showcased by the EU-CIRCLE consortium makes sense for mid- or long-term planning-Resilience

13.2. According to your opinion the overall Risk Assessment/Resilience Framework as showcased by the EU-CIRCLE consortium makes sense for mid- or long-term planning-Resilience

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	1	11,1	12,5	12,5
	Agree	7	77,8	87,5	100,0
	Total	8	88,9	100,0	
Missing	System	1	11,1		
Total		9	100,0		

13.2. According to your opinion the overall Risk Assessment/Resilience Framework as showcased by the EU-CIRCLE consortium makes sense for mid- or long-term planning-Resilience



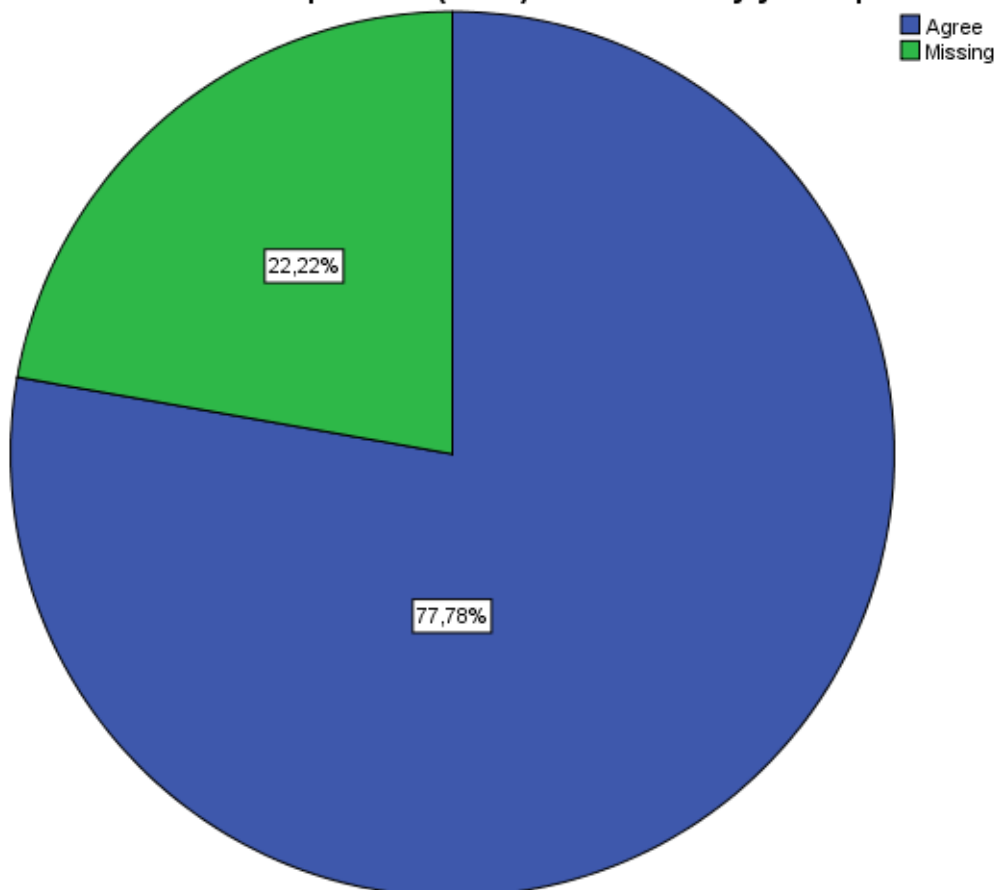


14. The EU-CIRCLE platform (CIRP) works the way you expected it should work.

14. The EU-CIRCLE platform (CIRP) works the way you expected it should work.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	7	77,8	100,0	100,0
Missing	System	2	22,2		
Total		9	100,0		

14. The EU-CIRCLE platform (CIRP) works the way you expected it should work.

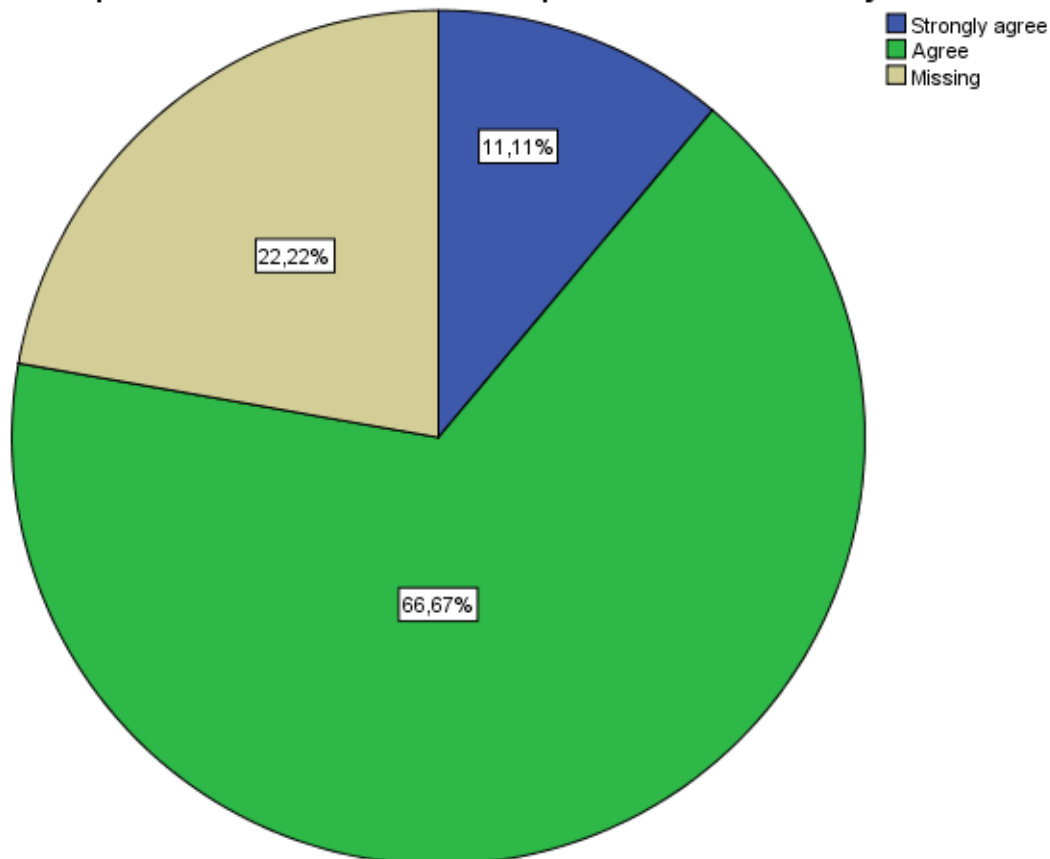


16. Working with the EU-CIRCLE platform can provide you with increased capabilities to assess risk and improve resilience for my infrastructure?

16. Working with the EU-CIRCLE platform can provide you with increased capabilities to assess risk and improve resilience for my infrastructure?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	1	11,1	14,3	14,3
	Agree	6	66,7	85,7	100,0
	Total	7	77,8	100,0	
Missing	System	2	22,2		
Total		9	100,0		

16. Working with the EU-CIRCLE platform can provide you with increased capabilities to assess risk and improve resilience for my infrastructure?

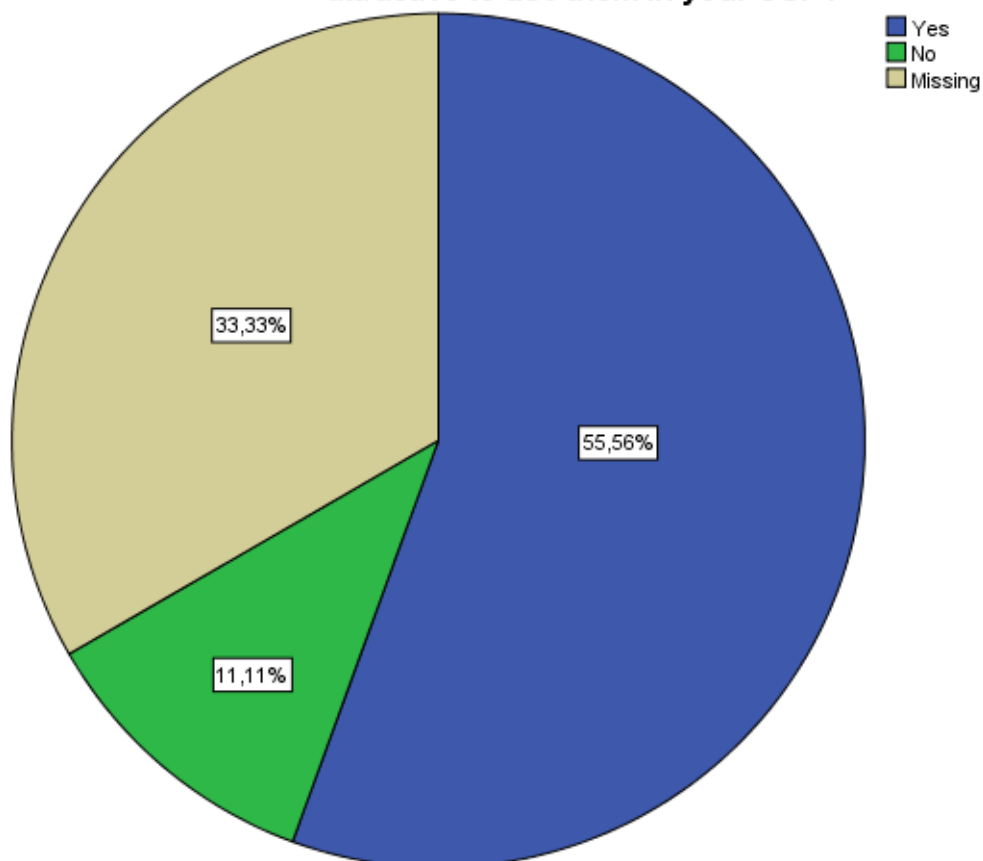


17. Does your organisation find the capabilities of the EU-CIRCLE platform attractive to use them in your OSP?

17. Does your organisation find the capabilities of the EU-CIRCLE platform attractive to use them in your OSP?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	5	55,6	83,3	83,3
	No	1	11,1	16,7	100,0
	Total	6	66,7	100,0	
Missing	System	3	33,3		
Total		9	100,0		

17. Does your organisation find the capabilities of the EU-CIRCLE platform attractive to use them in your OSP?

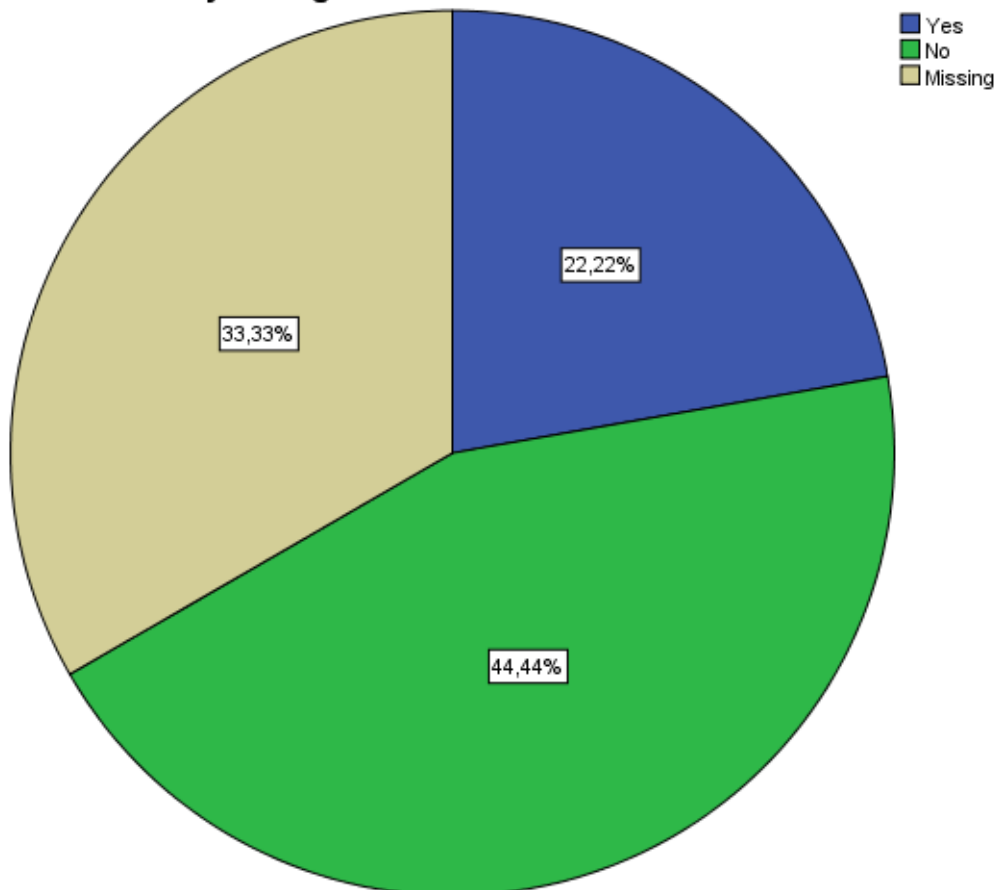


18. Does your organisation have data suitable for EU-CIRCLE analyses?

18. Does your organisation have data suitable for EU-CIRCLE analyses?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	2	22,2	33,3	33,3
	No	4	44,4	66,7	100,0
	Total	6	66,7	100,0	
Missing	System	3	33,3		
Total		9	100,0		

18. Does your organisation have data suitable for EU-CIRCLE analyses?



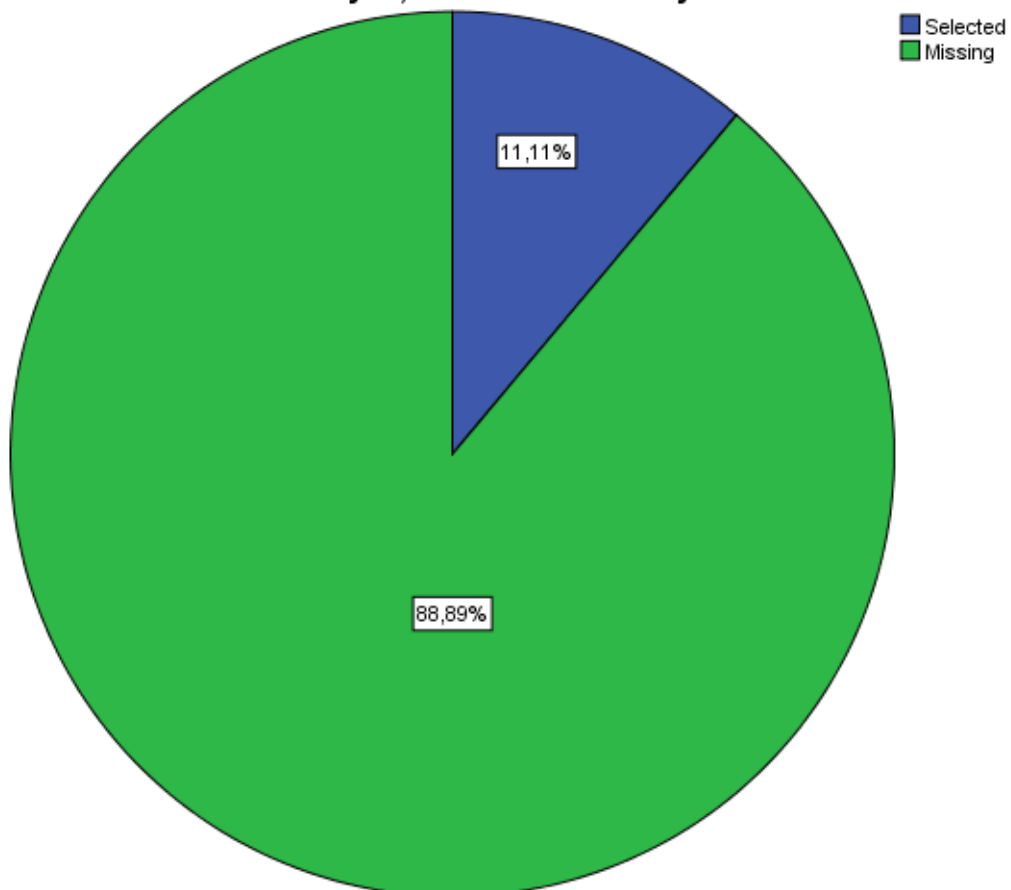


18.1. If yes, in what format they're available?-GIS

18.1. If yes, in what format they're available?-GIS

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Selected	1	11,1	100,0	100,0
Missing	System	8	88,9		
Total		9	100,0		

18.1. If yes, in what format they're available?-GIS





18.2. If yes, in what format they're available?-Google Earth

18.2. If yes, in what format they're available?-Google

Earth

	Frequency	Percent
Missing System	9	100,0

18.3. If yes, in what format they're available?-ASCII

18.3. If yes, in what format they're available?-ASCII

	Frequency	Percent
Missing System	9	100,0

18.4. If yes, in what format they're available?-XML

18.4. If yes, in what format they're available?-XML

	Frequency	Percent
Missing System	9	100,0

18.5. If yes, in what format they're available?-Other

18.5. If yes, in what format they're available?-Other

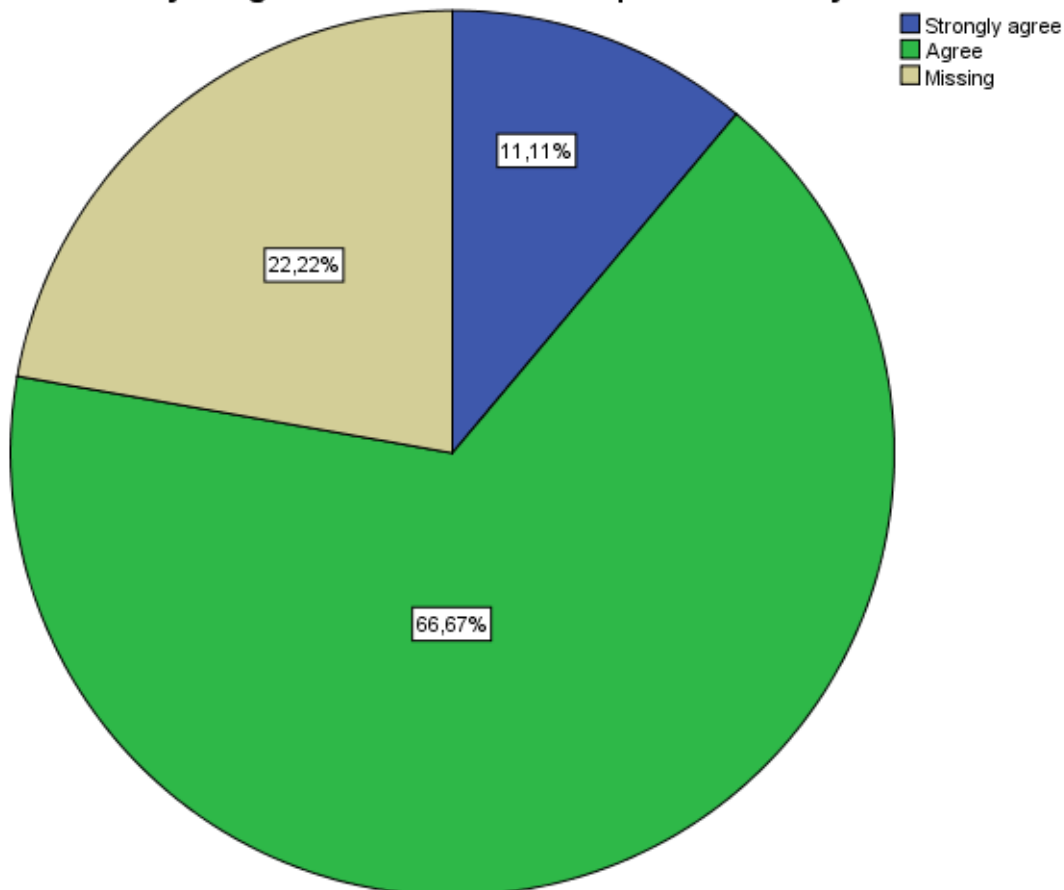
	Frequency	Percent
Missing System	9	100,0

19. Do you agree that the EU-CIRCLE platform is easy to learn and to use

19. Do you agree that the EU-CIRCLE platform is easy to learn and to use

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	1	11,1	14,3	14,3
	Agree	6	66,7	85,7	100,0
	Total	7	77,8	100,0	
Missing	System	2	22,2		
Total		9	100,0		

19. Do you agree that the EU-CIRCLE platform is easy to learn and to use



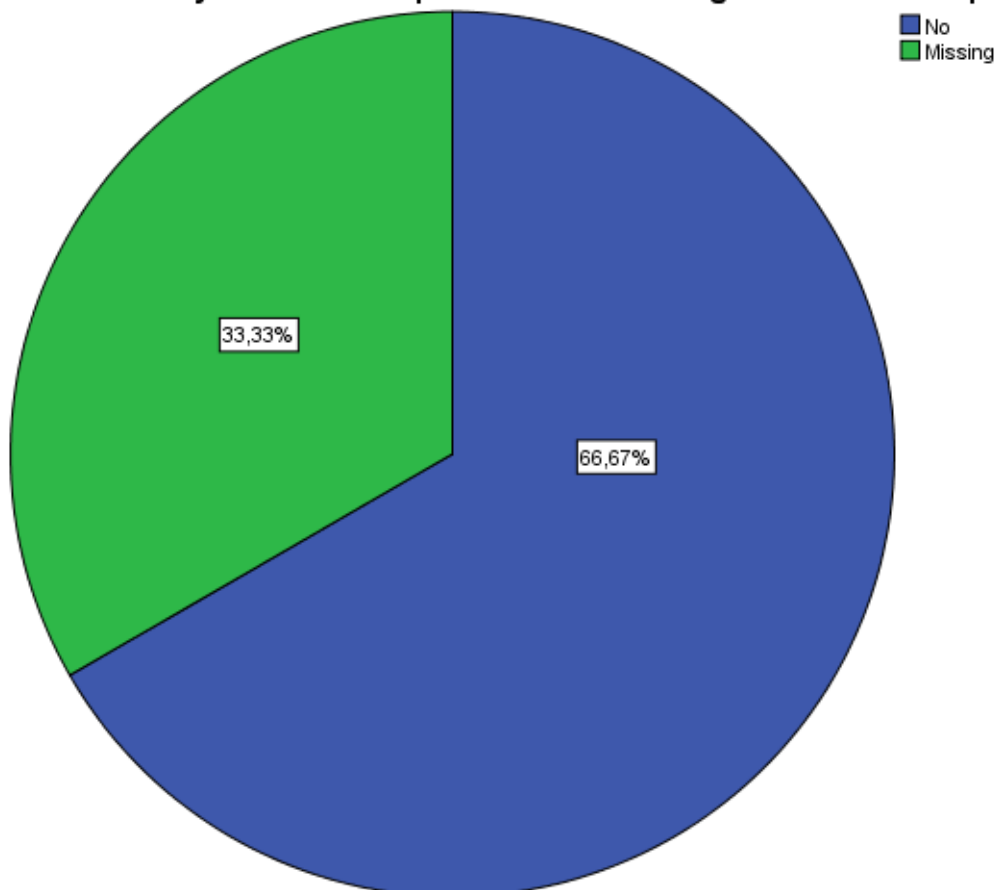


21. Did you encounter problems while using the EU-CIRCLE platform?

21. Did you encounter problems while using the EU-CIRCLE platform?

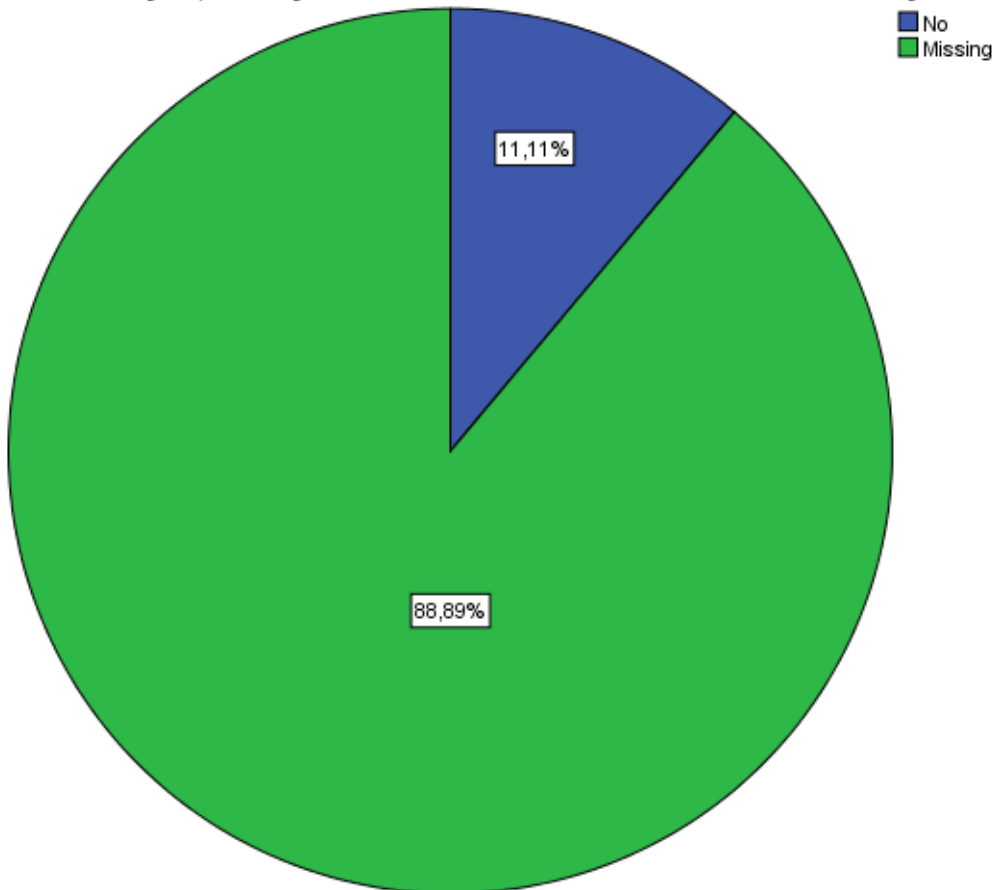
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	6	66,7	100,0	100,0
Missing	System	3	33,3		
Total		9	100,0		

21. Did you encounter problems while using the EU-CIRCLE platform?



**22. If yes, were you able to recover from these errors easily and quickly?****22. If yes, were you able to recover from these errors easily and quickly?**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	1	11,1	100,0	100,0
Missing	System	8	88,9		
Total		9	100,0		

22. If yes, were you able to recover from these errors easily and quickly?



23.1. In case you would be a formal user, which kind of support do you prefer?-FAQ

23.1. In case you would be a formal user, which kind of support do you prefer?-FAQ

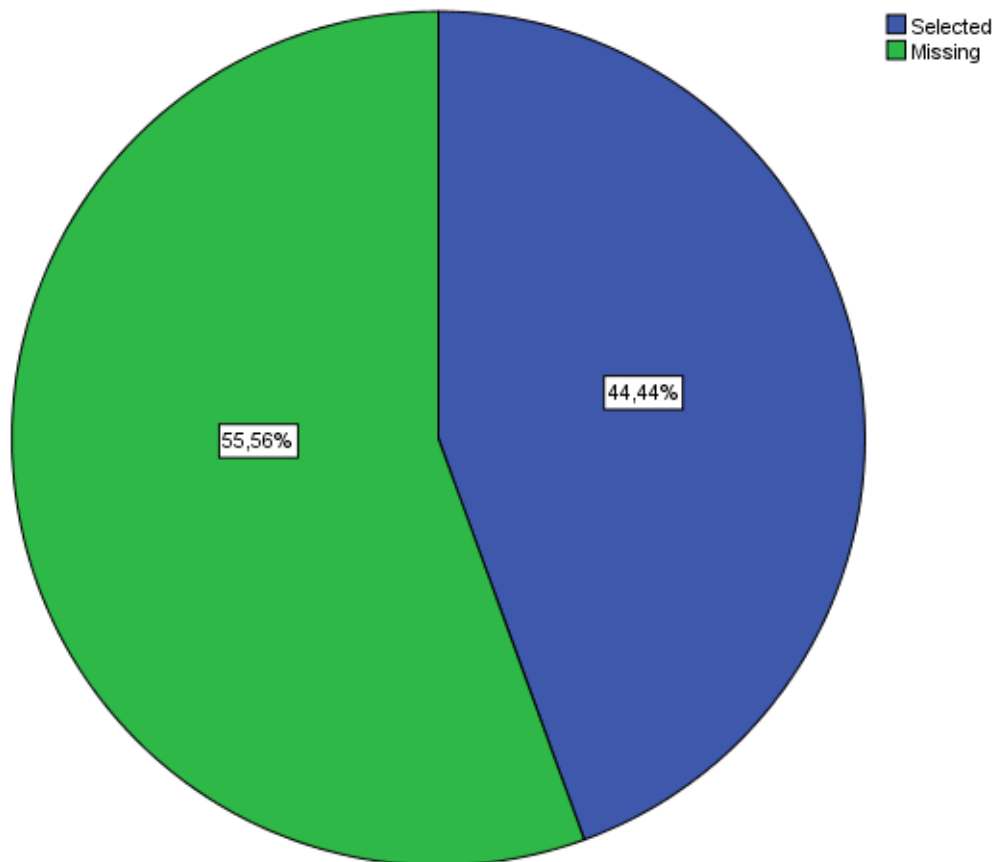
	Frequency	Percent
Missing System	9	100,0

23.2. In case you would be a formal user, which kind of support do you prefer?-E-Mail

23.2. In case you would be a formal user, which kind of support do you prefer?-E-Mail

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Selected	4	44,4	100,0	100,0
Missing System	5	55,6		
Total	9	100,0		

23.2. In case you would be a formal user, which kind of support do you prefer?-E-Mail



23.3. In case you would be a formal user, which kind of support do you prefer?-Telephone-Hotline

23.3. In case you would be a formal user, which kind of support do you prefer?-Telephone-Hotline

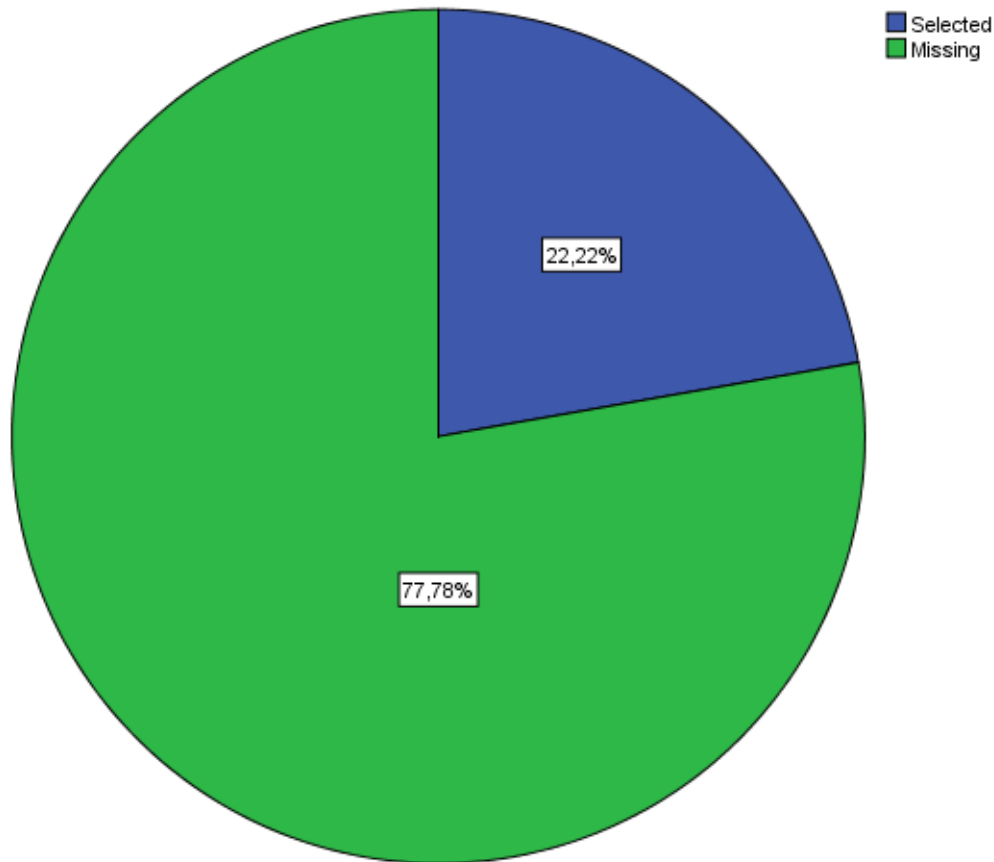
	Frequency	Percent
Missing System	9	100,0

23.4. In case you would be a formal user, which kind of support do you prefer?-Internet

23.4. In case you would be a formal user, which kind of support do you prefer?-Internet

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Selected	2	22,2	100,0	100,0
Missing System	7	77,8		
Total	9	100,0		

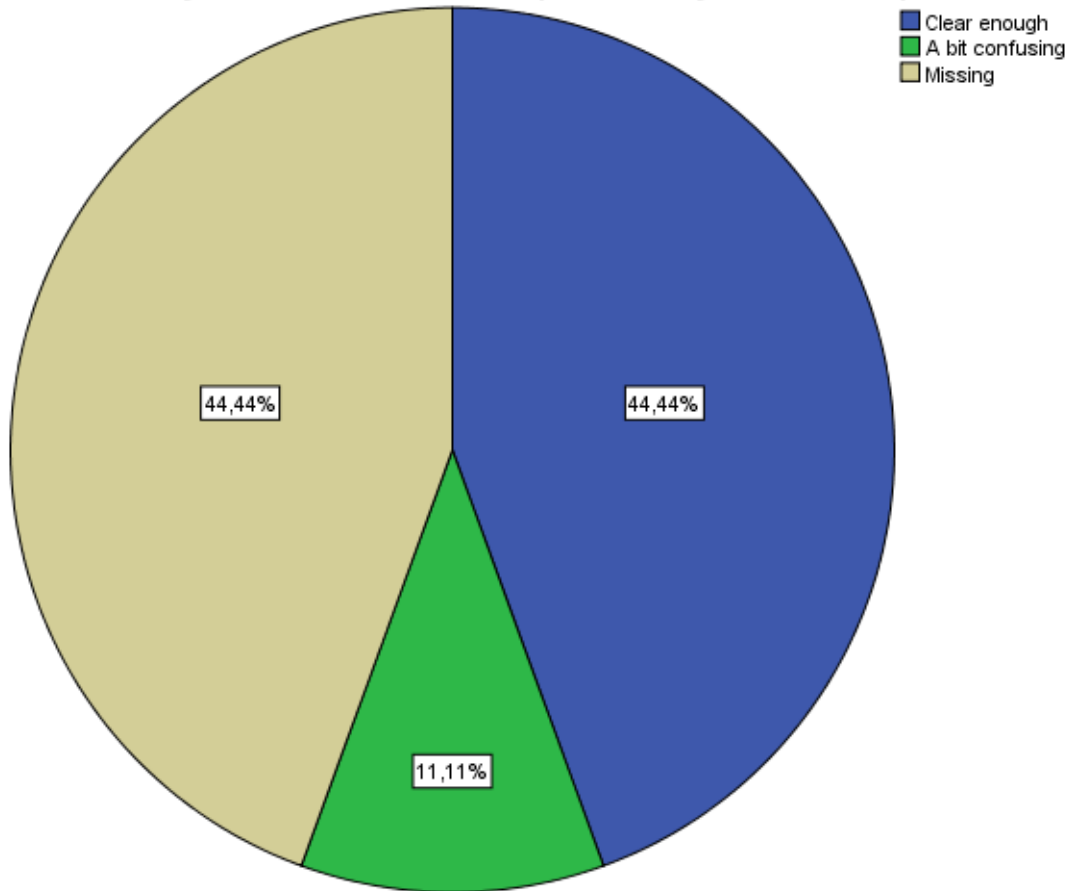
23.4. In case you would be a formal user, which kind of support do you prefer?- Internet



24. Do you find the information provided by EU-CIRCLE platform to be:

24. Do you find the information provided by EU-CIRCLE platform to be:

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Clear enough	4	44,4	80,0	80,0
	A bit confusing	1	11,1	20,0	100,0
	Total	5	55,6	100,0	
Missing	System	4	44,4		
Total		9	100,0		

24. Do you find the information provided by EU-CIRCLE platform to be:

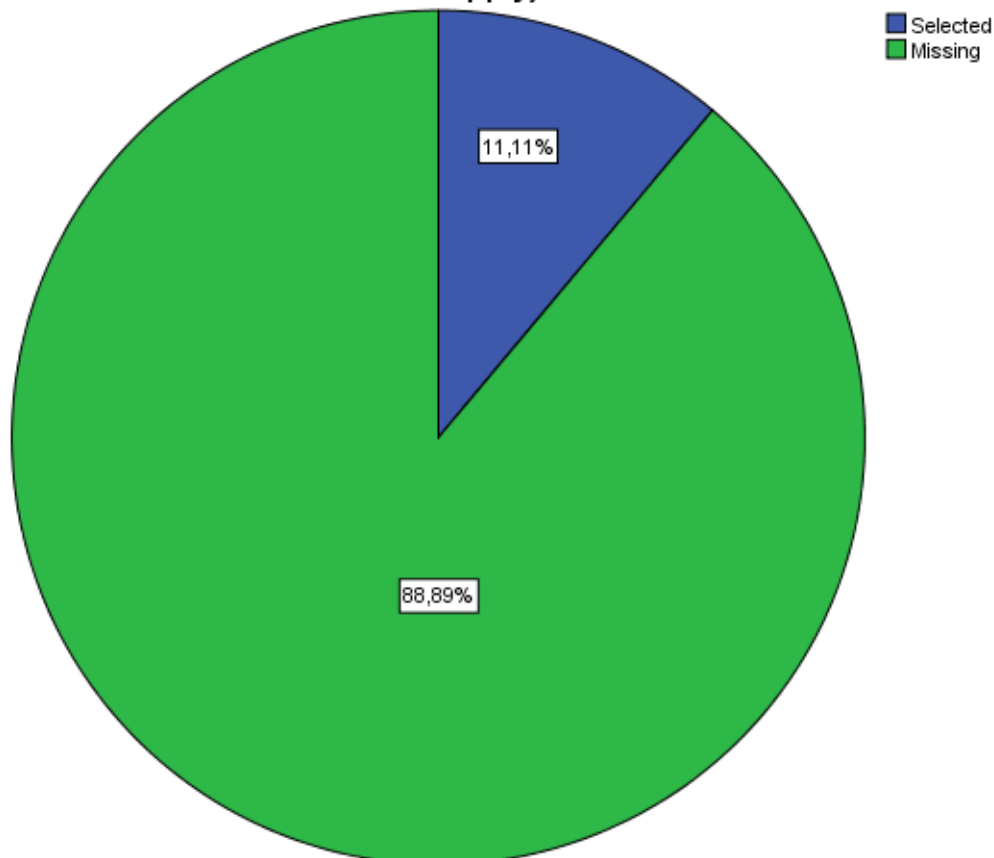
25.1. Do you find the terminology used in EU-CIRCLE to be (please tick all that apply): Consistent

25.1. Do you find the terminology used in EU-CIRCLE to be (please tick all that apply):

Consistent

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Selected	1	11,1	100,0	100,0
Missing System	8	88,9		
Total	9	100,0		

25.1. Do you find the terminology used in EU-CIRCLE to be (please tick all that apply): Consistent



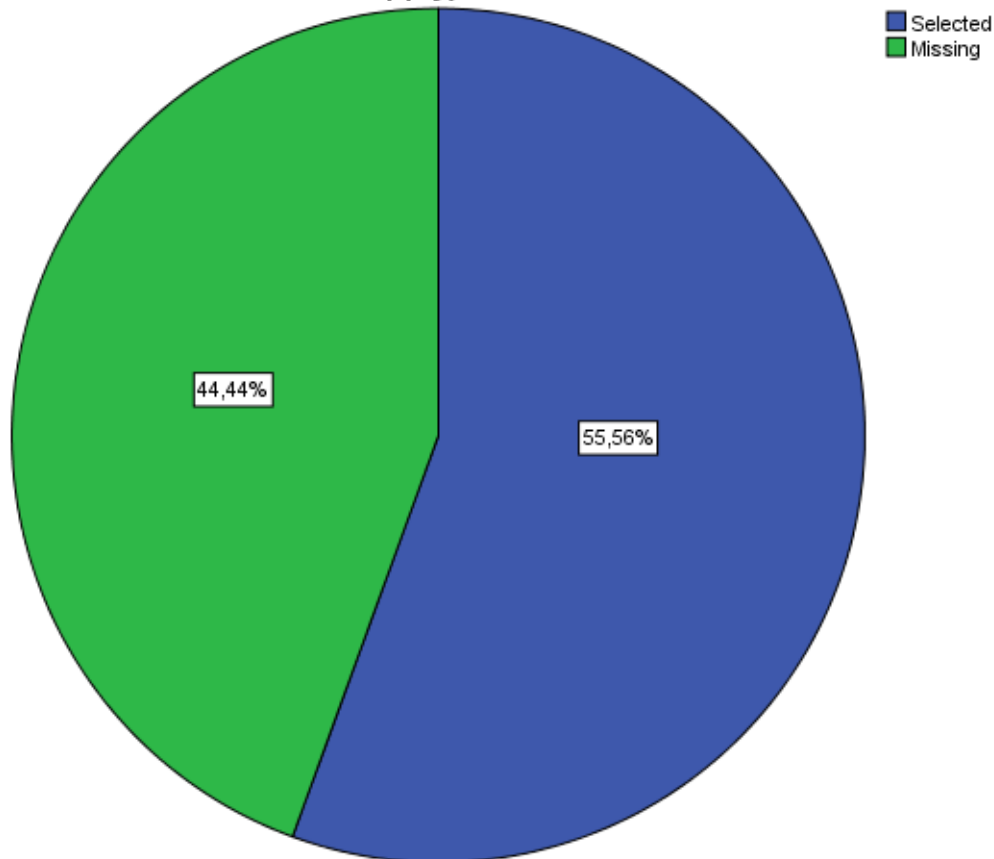
25.2. Do you find the terminology used in EU-CIRCLE to be (please tick all that apply): Understandable/Clear

25.2. Do you find the terminology used in EU-CIRCLE to be (please tick all that apply):

Understandable/Clear

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Selected	5	55,6	100,0	100,0
Missing	System	4	44,4		
Total		9	100,0		

25.2. Do you find the terminology used in EU-CIRCLE to be (please tick all that apply): Understandable/Clear



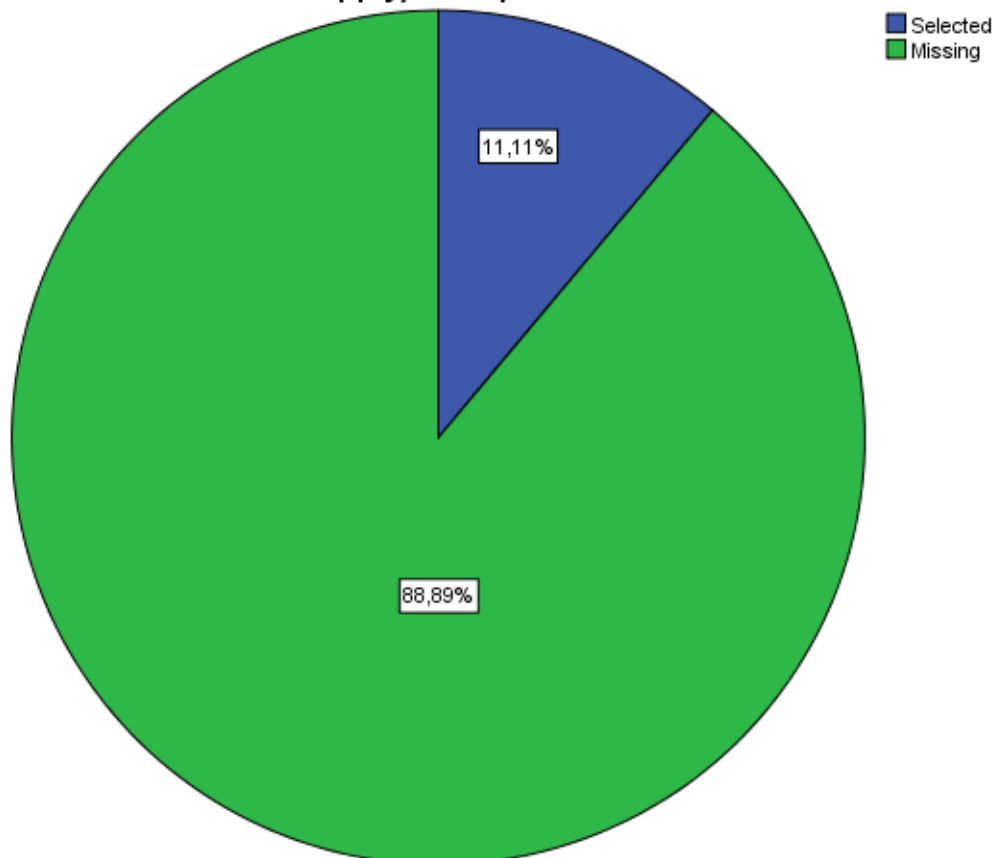
25.3. Do you find the terminology used in EU-CIRCLE to be (please tick all that apply): Compliant to standard terms

25.3. Do you find the terminology used in EU-CIRCLE to be (please tick all that apply):

Compliant to standard terms

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Selected	1	11,1	100,0	100,0
Missing	System	8	88,9		
Total		9	100,0		

25.3. Do you find the terminology used in EU-CIRCLE to be (please tick all that apply): Compliant to standard terms



25.4. Do you find the terminology used in EU-CIRCLE to be (please tick all that apply): Inconsistent

25.4. Do you find the terminology used in EU-CIRCLE

to be (please tick all that apply): Inconsistent

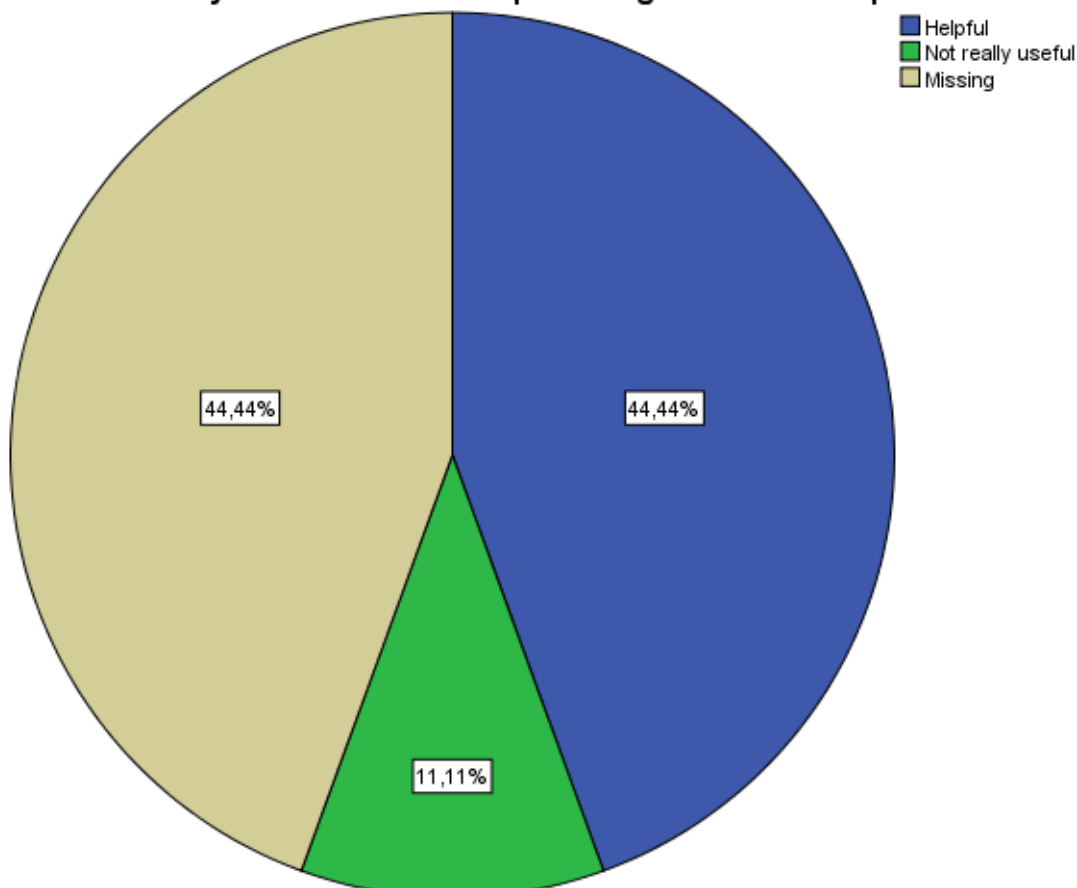
	Frequency	Percent
Missing System	9	100,0

26. Do you find the error/help messages of the CIRP platform to be:

26. Do you find the error/help messages of the CIRP platform to be:

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Helpful	4	44,4	80,0	80,0
Valid Not really useful	1	11,1	20,0	100,0
Total	5	55,6	100,0	
Missing System	4	44,4		
Total	9	100,0		

26. Do you find the error/help messages of the CIRP platform to be:

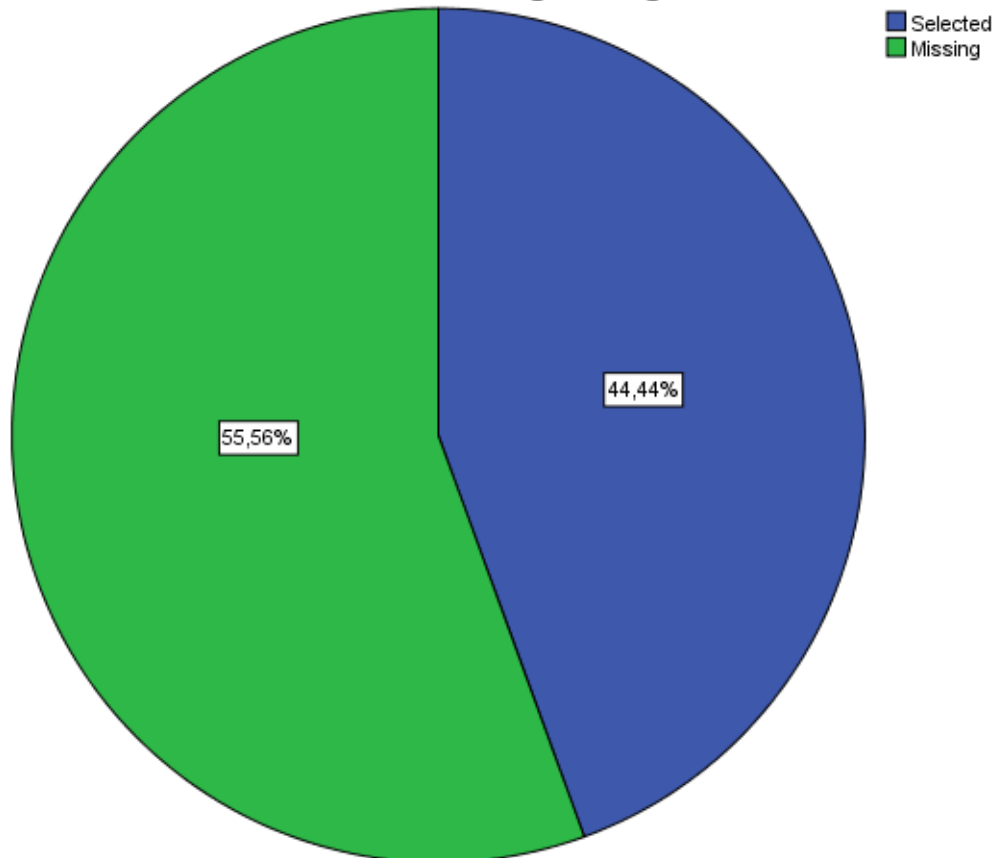


27.1. How do you find the platform's user interface is (please tick all that apply): Well-designed/Ergonomic

27.1. How do you find the platform's user interface is (please tick all that apply): Well-designed/Ergonomic

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Selected	4	44,4	100,0	100,0
Missing	System	5	55,6		
Total		9	100,0		

27.1. How do you find the platform's user interface is (please tick all that apply): Well-designed/Ergonomic

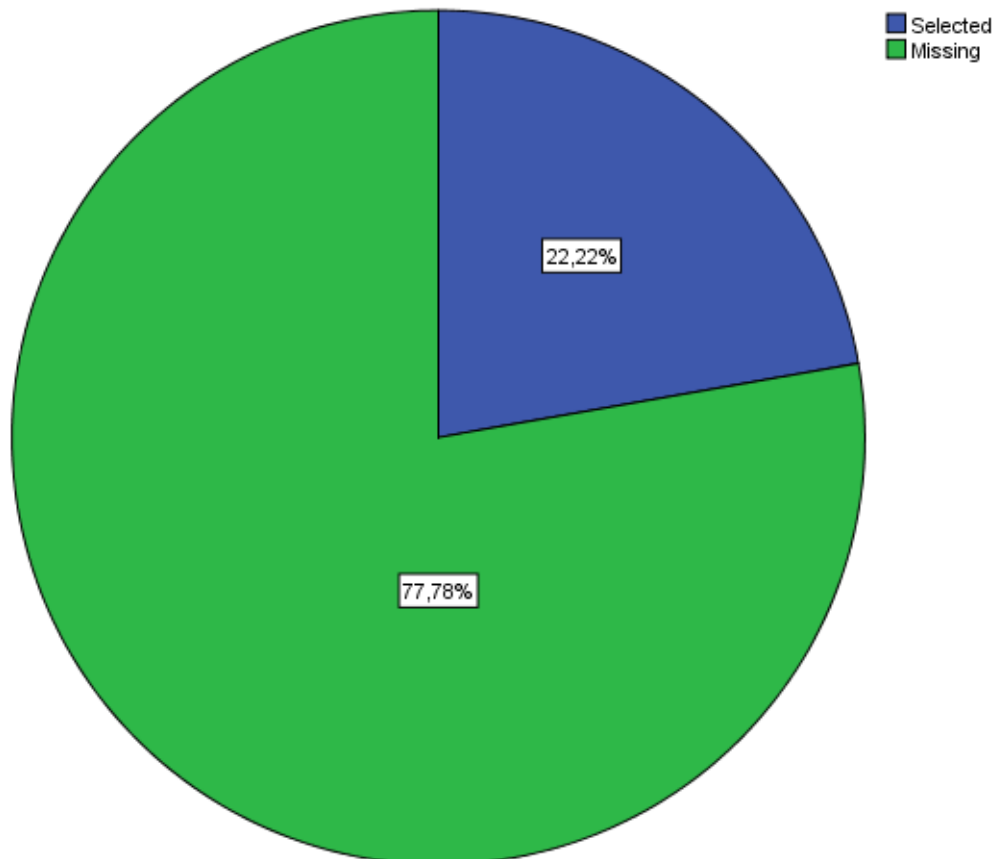


27.2. How do you find the platform's user interface is (please tick all that apply): Polished

27.2. How do you find the platform's user interface is (please tick all that apply): Polished

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Selected	2	22,2	100,0	100,0
Missing	System	7	77,8		
Total		9	100,0		

27.2. How do you find the platform's user interface is (please tick all that apply): Polished

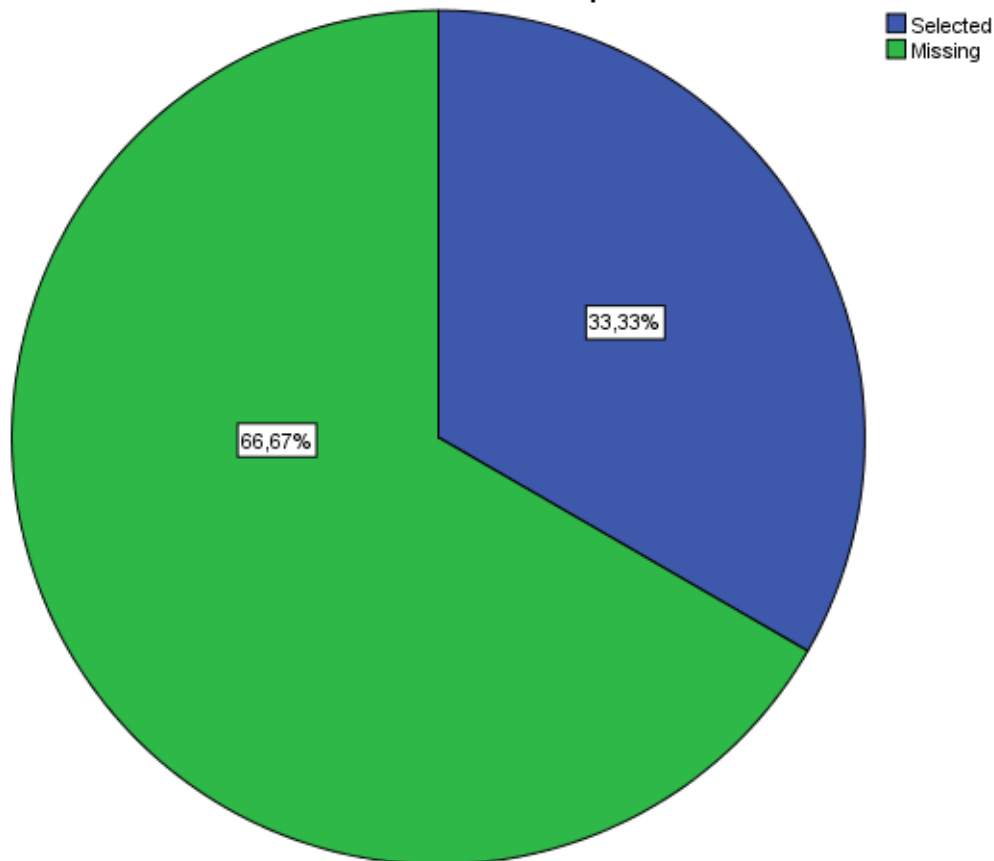


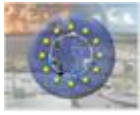
27.3. How do you find the platform's user interface is (please tick all that apply): Simple

27.3. How do you find the platform's user interface is (please tick all that apply): Simple

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Selected	3	33,3	100,0	100,0
Missing	System	6	66,7		
Total		9	100,0		

27.3. How do you find the platform's user interface is (please tick all that apply): Simple



**27.4. How do you find the platform's user interface is (please tick all that apply): Intuitive**

27.4. How do you find the platform's user interface is

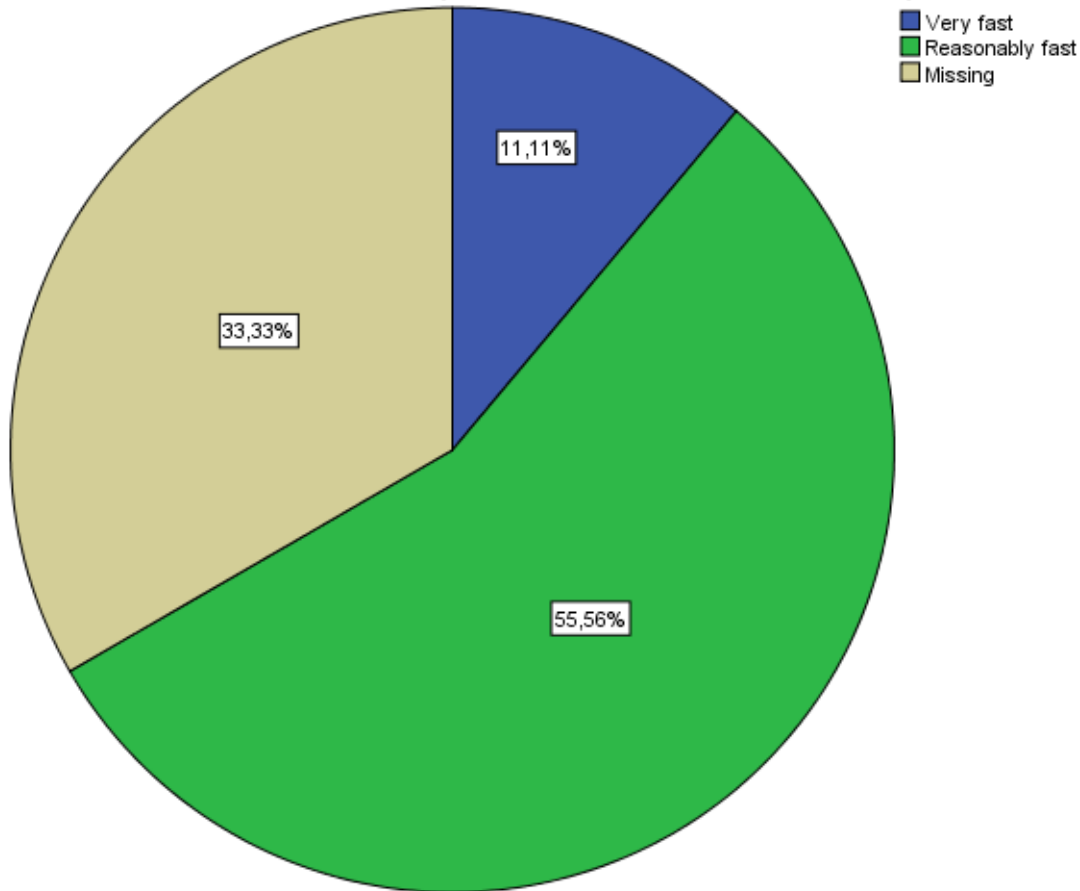
(please tick all that apply): Intuitive

	Frequency	Percent
Missing System	9	100,0

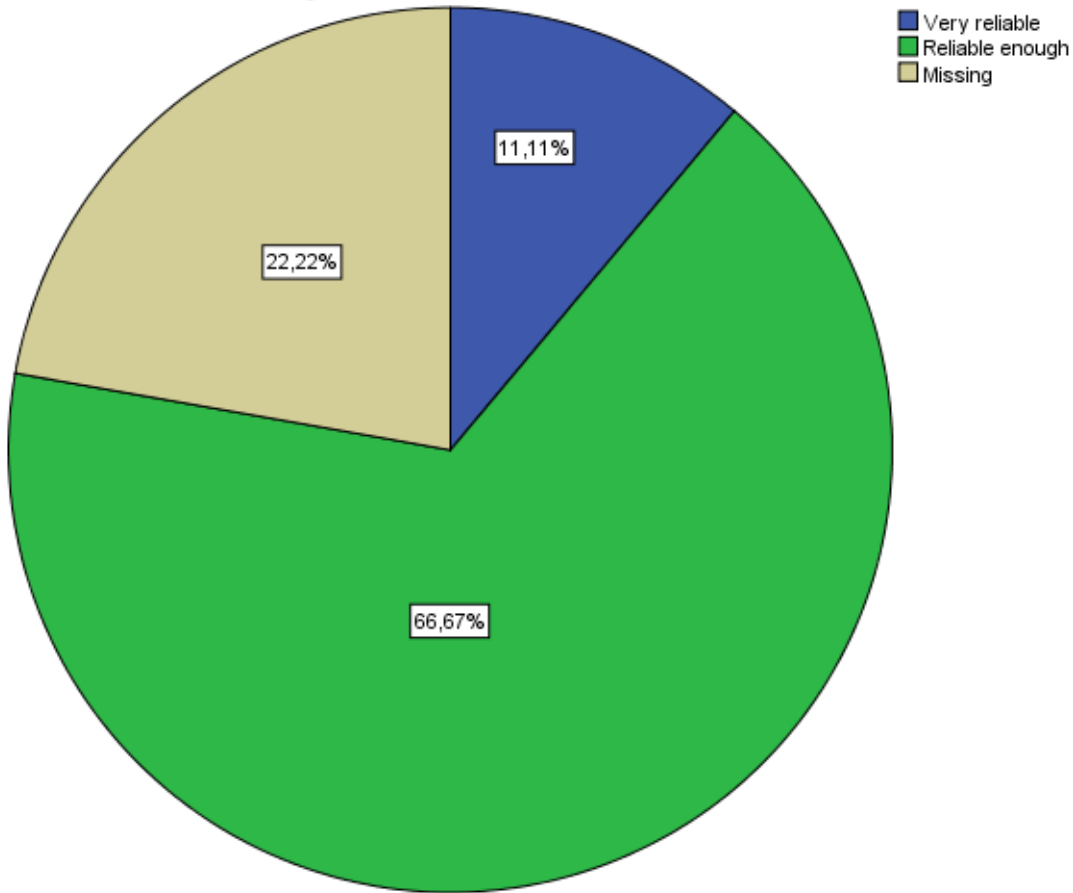
28. Evaluate the responsiveness of the EU-CIRCLE platform:

28. Evaluate the responsiveness of the EU-CIRCLE platform:

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Very fast	1	11,1	16,7	16,7
Valid Reasonably fast	5	55,6	83,3	100,0
Total	6	66,7	100,0	
Missing System	3	33,3		
Total	9	100,0		

28. Evaluate the responsiveness of the EU-CIRCLE platform:

29. Provide your overall estimation for the EU-CIRCLE solution:
29. Provide your overall estimation for the EU-CIRCLE solution:

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very reliable	1	11,1	14,3	14,3
	Reliable enough	6	66,7	85,7	100,0
	Total	7	77,8	100,0	
Missing	System	2	22,2		
Total		9	100,0		

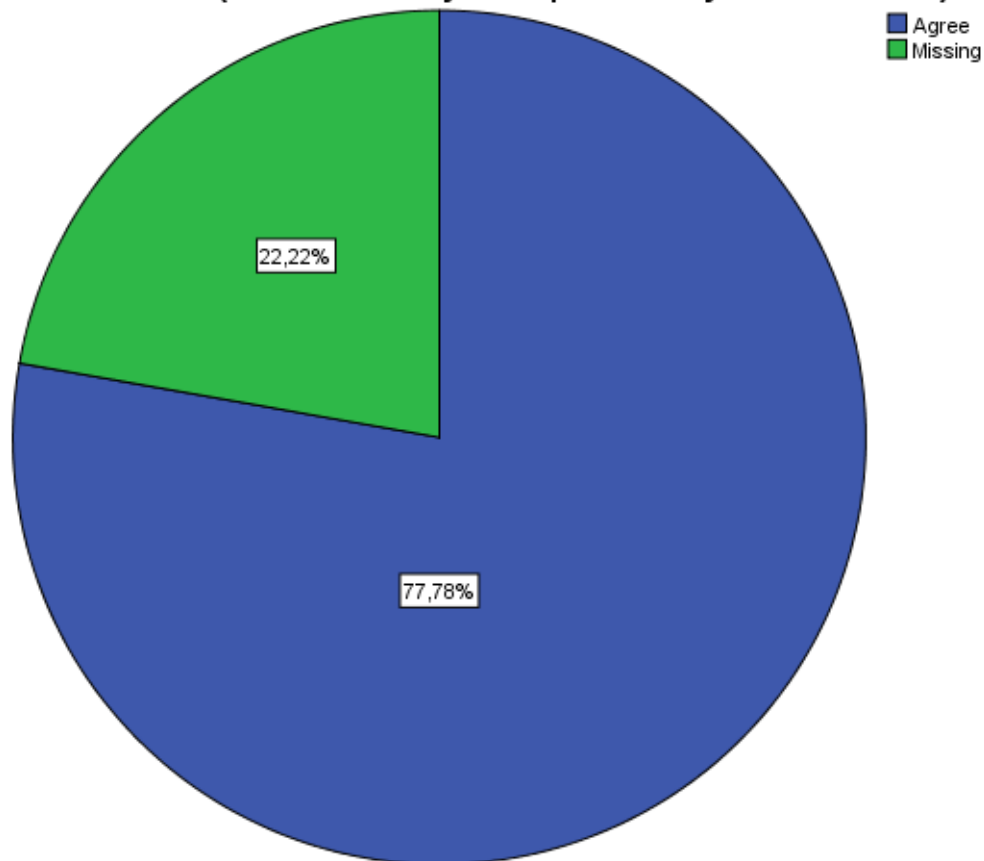
29. Provide your overall estimation for the EU-CIRCLE solution:

30. Do you agree that the EU-CIRCLE solution can cover all levels of end-users (both technically and operationally oriented users)

30. Do you agree that the EU-CIRCLE solution can cover all levels of end-users (both technically and operationally oriented users)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	7	77,8	100,0	100,0
Missing	System	2	22,2		
Total		9	100,0		

30. Do you agree that the EU-CIRCLE solution can cover all levels of end-users (both technically and operationally oriented users)

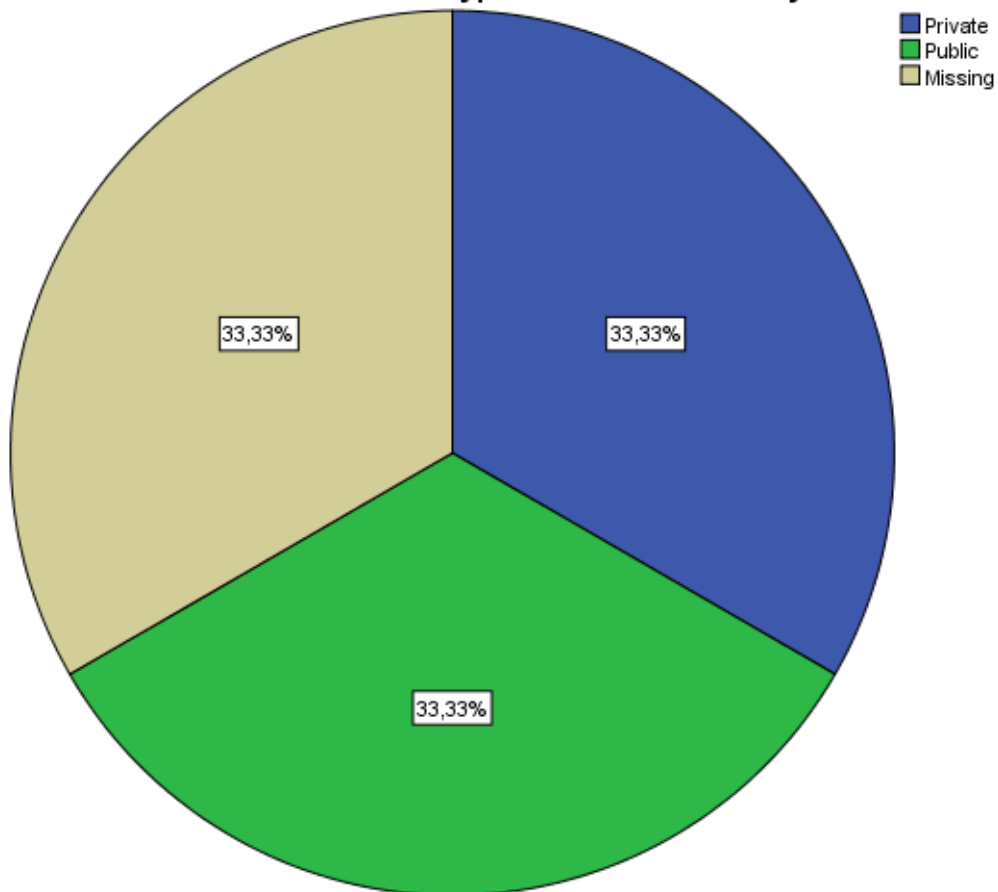


33. Type of end-user's entity

33. Type of end-user's entity

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Private	3	33,3	50,0	50,0
	Public	3	33,3	50,0	100,0
	Total	6	66,7	100,0	
Missing	System	3	33,3		
Total		9	100,0		

33. Type of end-user's entity



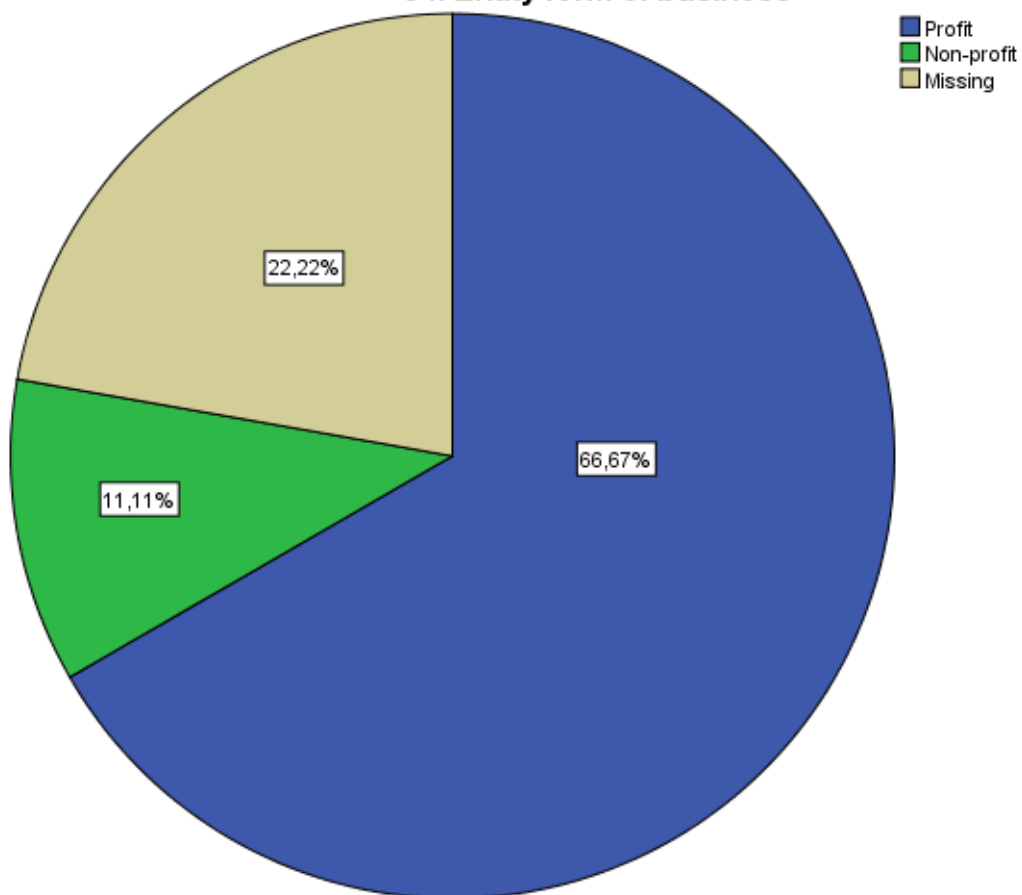


34. Entity form of business

34. Entity form of business

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Profit	6	66,7	85,7	85,7
	Non-profit	1	11,1	14,3	100,0
	Total	7	77,8	100,0	
Missing	System	2	22,2		
Total		9	100,0		

34. Entity form of business

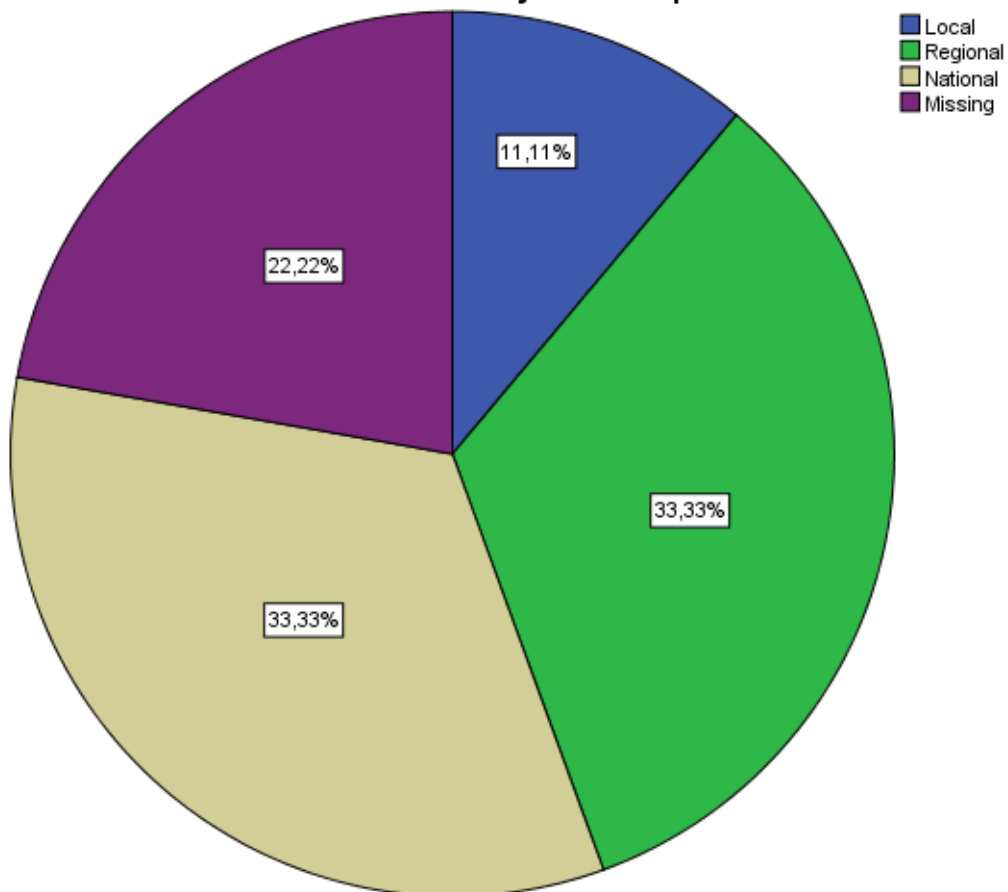


35. Entity level of operation

35. Entity level of operation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Local	1	11,1	14,3	14,3
	Regional	3	33,3	42,9	57,1
	National	3	33,3	42,9	100,0
	Total	7	77,8	100,0	
Missing	System	2	22,2		
Total		9	100,0		

35. Entity level of operation

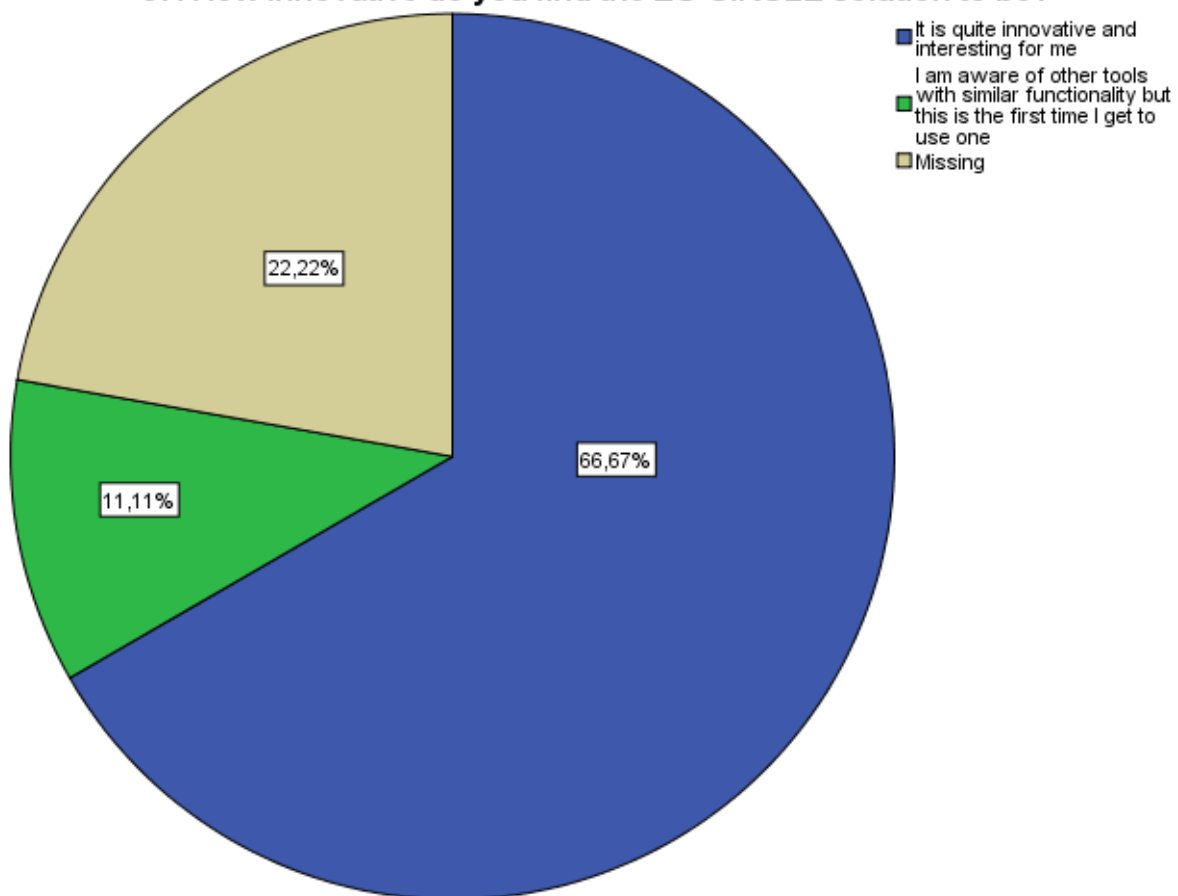


37. How innovative do you find the EU-CIRCLE solution to be?

37. How innovative do you find the EU-CIRCLE solution to be?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	It is quite innovative and interesting for me	6	66,7	85,7	85,7
	I am aware of other tools with similar functionality but this is the first time I get to use one	1	11,1	14,3	100,0
	Total	7	77,8	100,0	
Missing	System	2	22,2		
Total		9	100,0		

37. How innovative do you find the EU-CIRCLE solution to be?

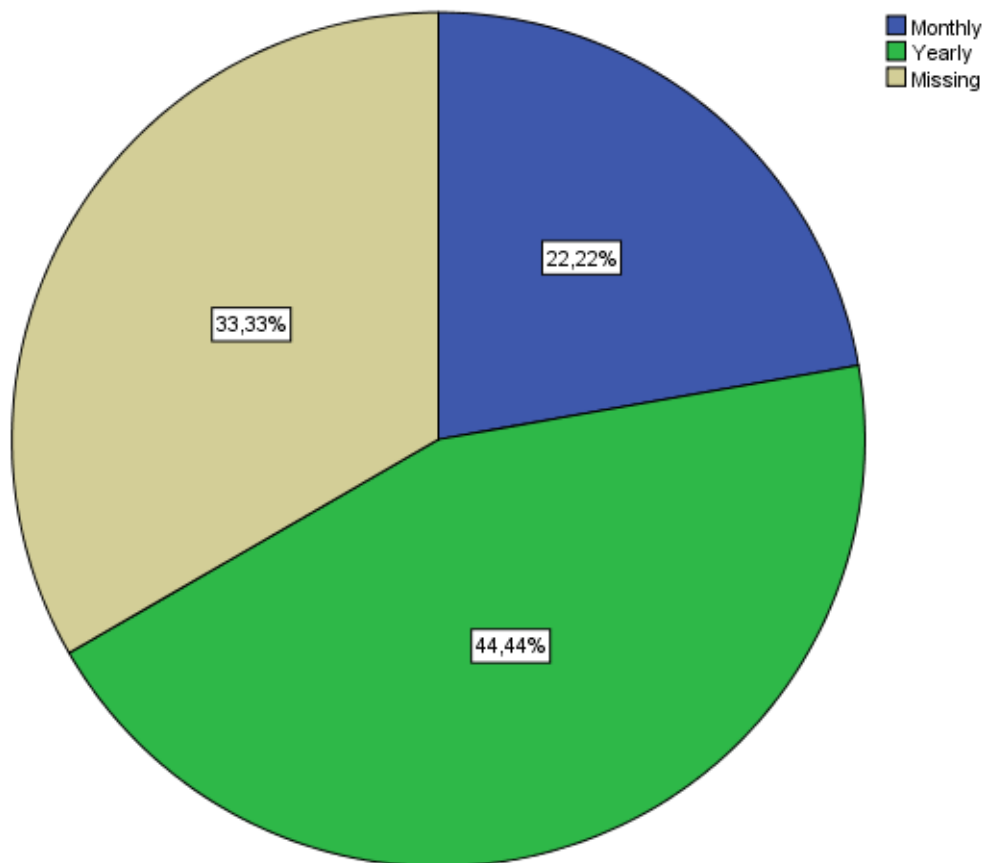


38.1. How often do you “risk-assess” or “estimate resilience” in your infrastructure?-Risk

38.1. How often do you “risk-assess” or “estimate resilience” in your infrastructure?-Risk

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Monthly	2	22,2	33,3	33,3
	Yearly	4	44,4	66,7	100,0
	Total	6	66,7	100,0	
Missing	System	3	33,3		
Total		9	100,0		

38.1. How often do you “risk-assess” or “estimate resilience” in your infrastructure?-Risk

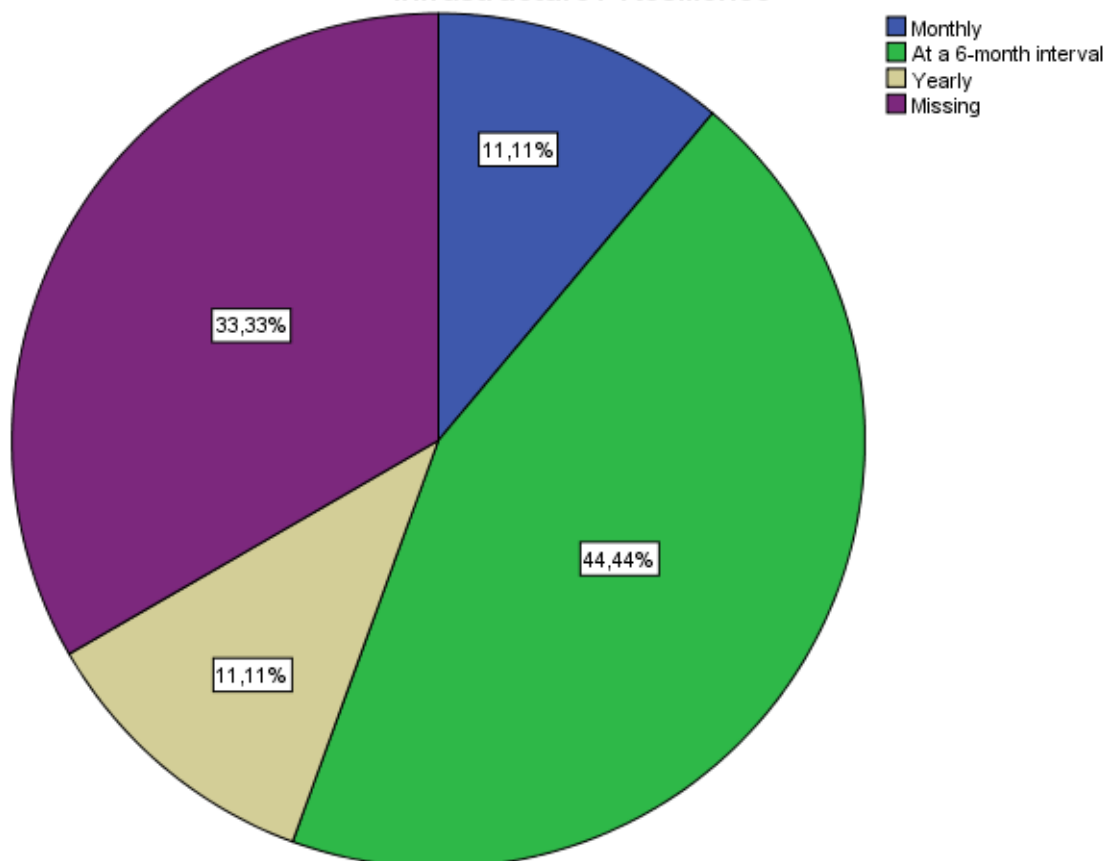


38.2. How often do you “risk-assess” or “estimate resilience” in your infrastructure?-Resilience

38.2. How often do you “risk-assess” or “estimate resilience” in your infrastructure?-Resilience

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Monthly	1	11,1	16,7	16,7
	At a 6-month interval	4	44,4	66,7	83,3
	Yearly	1	11,1	16,7	100,0
	Total	6	66,7	100,0	
Missing	System	3	33,3		
Total		9	100,0		

38.2. How often do you “risk-assess” or “estimate resilience” in your infrastructure?-Resilience



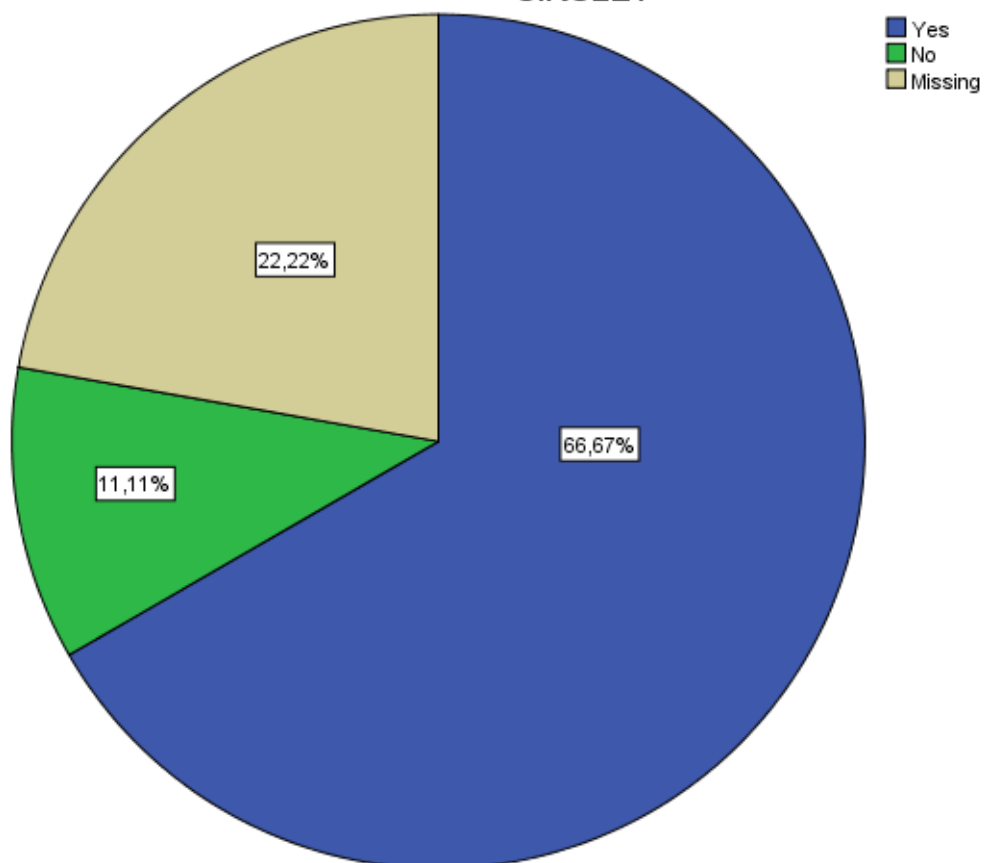


39. Are you willing to share your data with other entities that may use EU-CIRCLE?

39. Are you willing to share your data with other entities that may use EU-CIRCLE?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	6	66,7	85,7	85,7
	No	1	11,1	14,3	100,0
	Total	7	77,8	100,0	
Missing	System	2	22,2		
Total		9	100,0		

39. Are you willing to share your data with other entities that may use EU-CIRCLE?

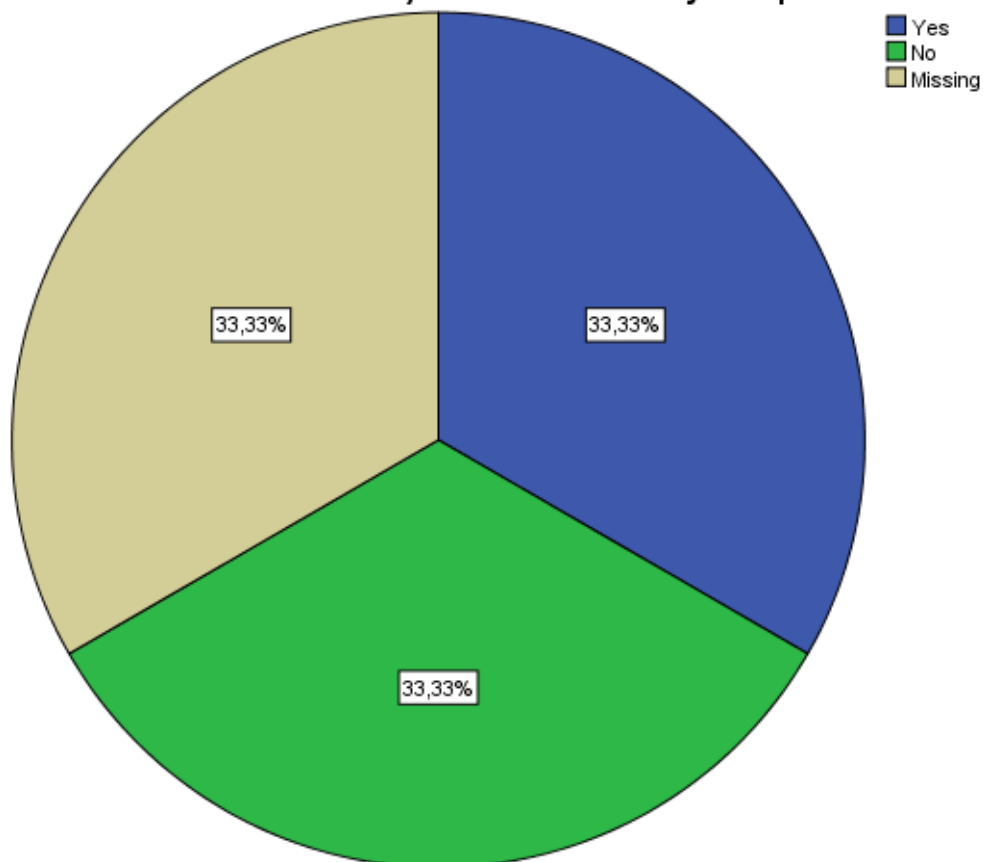


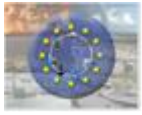
40. Would you be interested to use the EU-CIRCLE solution (once commercialized) and fine-tune it to your specific needs?

40. Would you be interested to use the EU-CIRCLE solution (once commercialized) and fine-tune it to your specific needs?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	3	33,3	50,0	50,0
	No	3	33,3	50,0	100,0
	Total	6	66,7	100,0	
Missing	System	3	33,3		
Total		9	100,0		

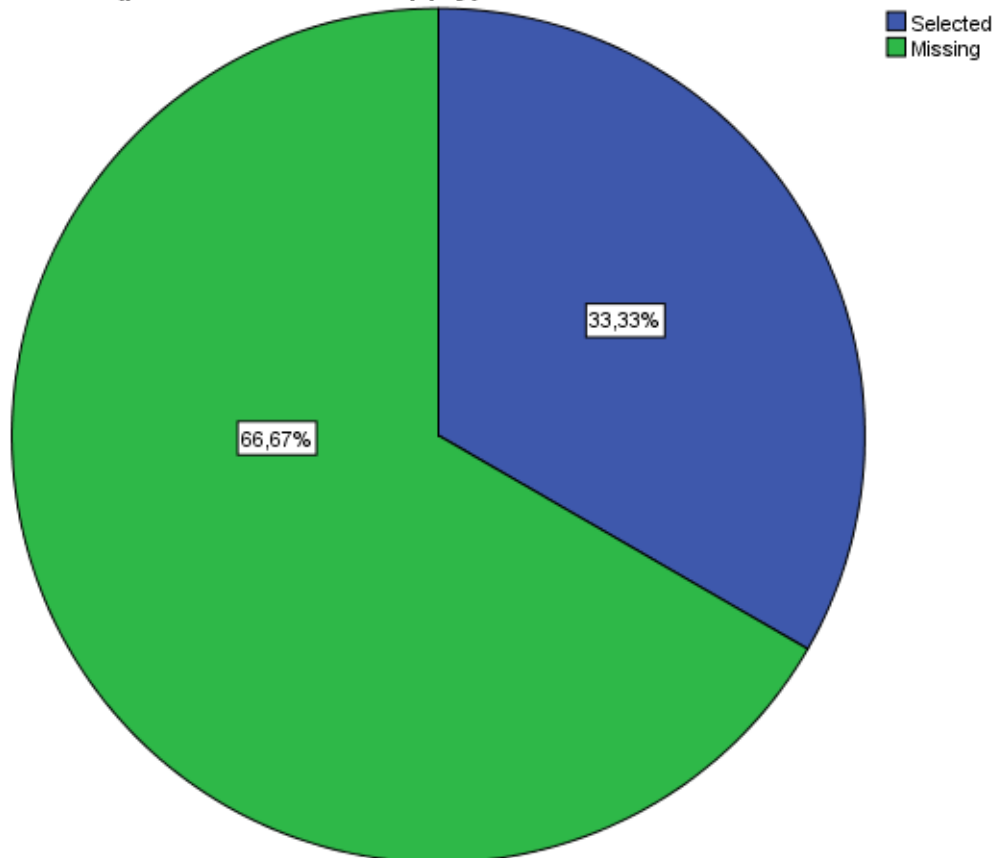
40. Would you be interested to use the EU-CIRCLE solution (once commercialized) and fine-tune it to your specific needs?



**41.1. If yes, which one of the following services would you be interested in (please tick all that apply): Online access to EU-CIRCLE services**

41.1. If yes, which one of the following services would you be interested in (please tick all that apply): Online access to EU-CIRCLE services

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Selected	3	33,3	100,0	100,0
Missing	System	6	66,7		
Total		9	100,0		

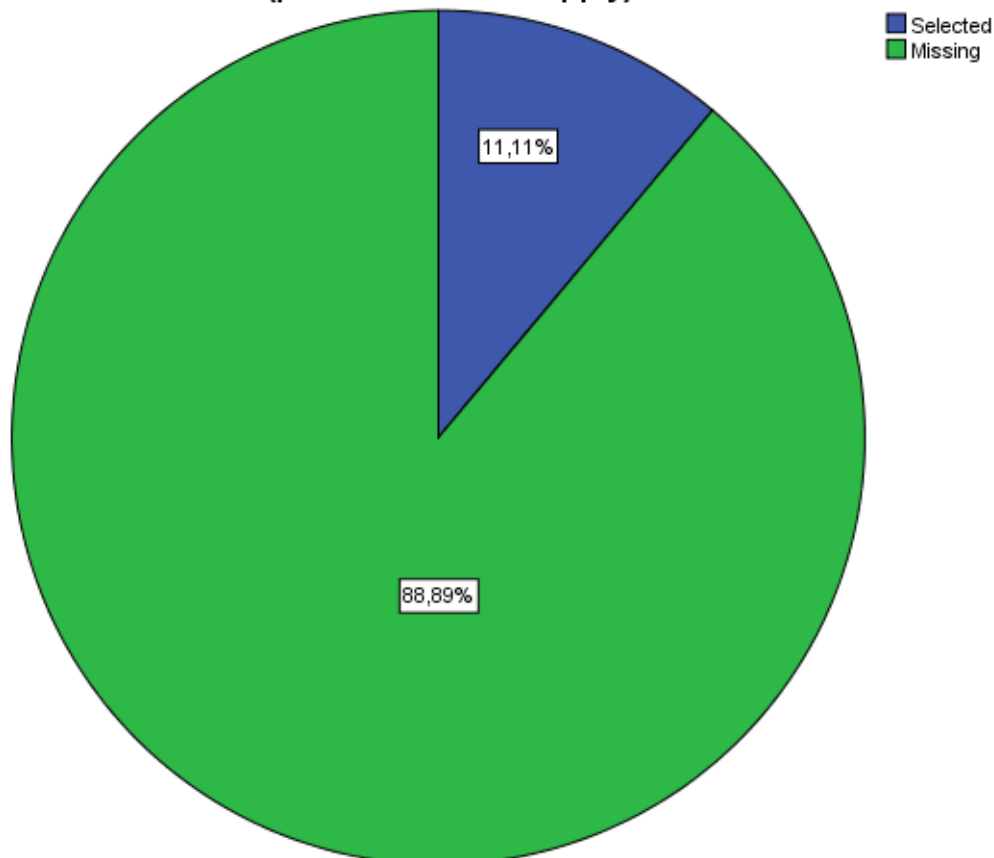
41.1. If yes, which one of the following services would you be interested in (please tick all that apply): Online access to EU-CIRCLE services

41.2. If yes, which one of the following services would you be interested in (please tick all that apply): Local Installation

41.2. If yes, which one of the following services would you be interested in (please tick all that apply): Local Installation

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Selected	1	11,1	100,0	100,0
Missing System	8	88,9		
Total	9	100,0		

41.2. If yes, which one of the following services would you be interested in (please tick all that apply): Local Installation

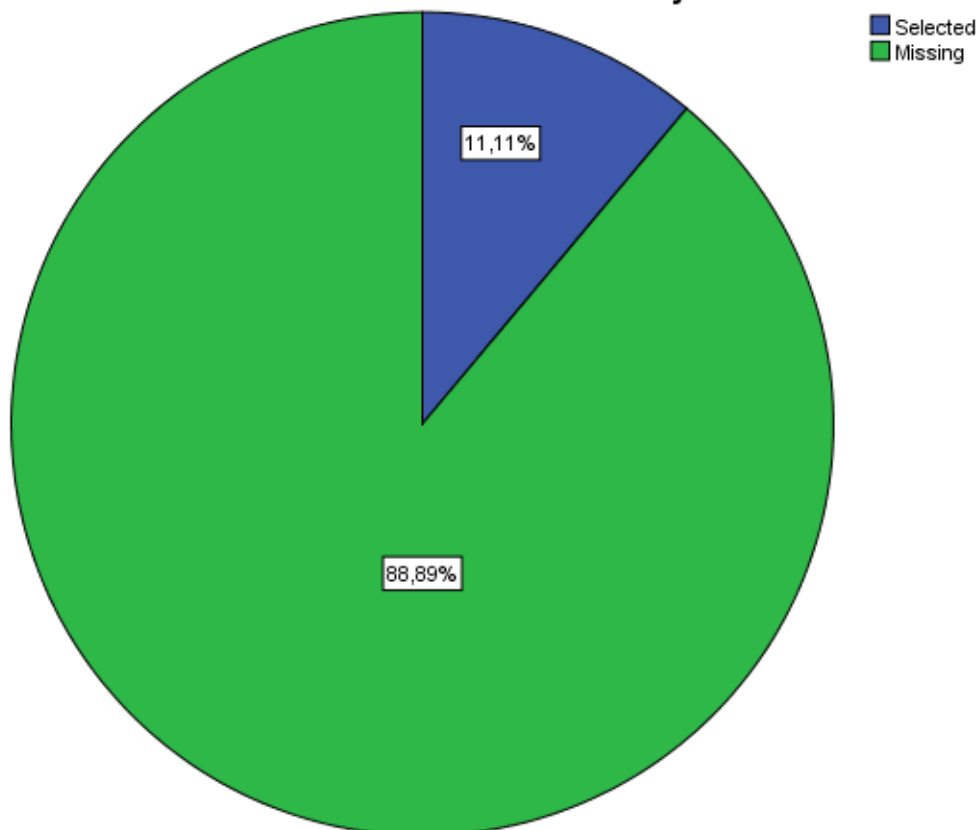


41.3. If yes, which one of the following services would you be interested in (please tick all that apply): Incorporation of the functionality into your network/back-office systems

41.3. If yes, which one of the following services would you be interested in (please tick all that apply): Incorporation of the functionality into your network/back-office systems

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Selected	1	11,1	100,0	100,0
Missing	System	8	88,9		
Total		9	100,0		

41.3. If yes, which one of the following services would you be interested in (please tick all that apply): Incorporation of the functionality into your network/back-office systems

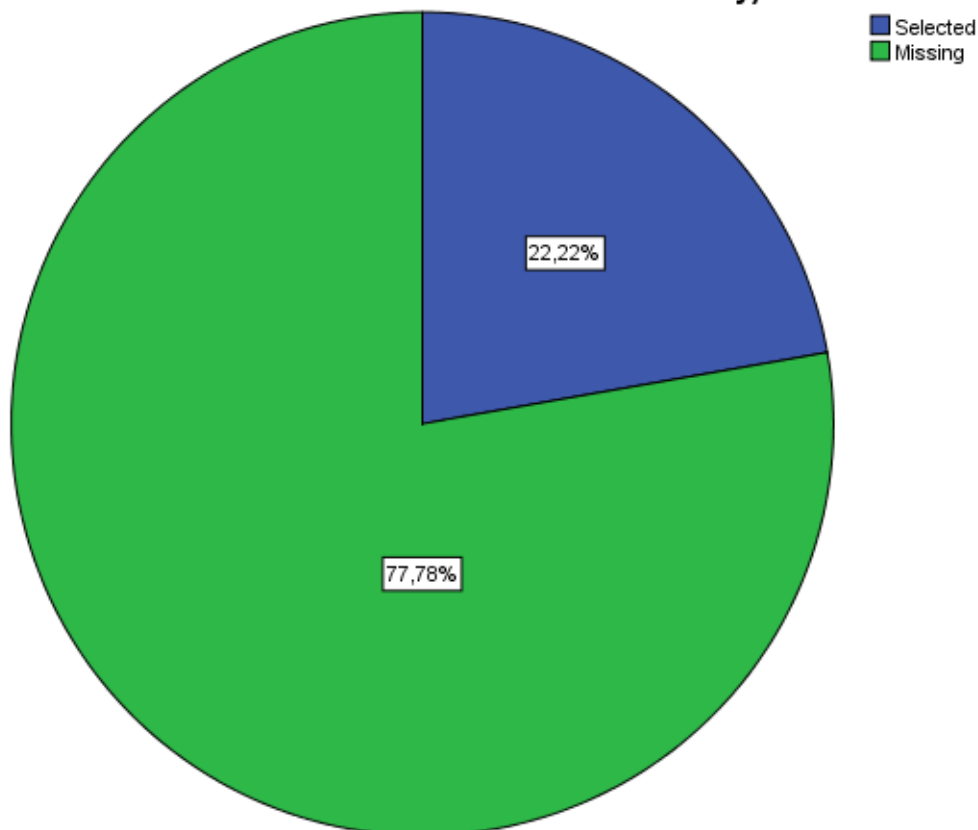


41.4. If yes, which one of the following services would you be interested in (please tick all that apply): Technical support (customer model development, client networks data-entry)

41.4. If yes, which one of the following services would you be interested in (please tick all that apply): Technical support (customer model development, client networks data-entry)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Selected	2	22,2	100,0	100,0
Missing	System	7	77,8		
Total		9	100,0		

41.4. If yes, which one of the following services would you be interested in (please tick all that apply): Technical support (customer model development, client networks data-entry)

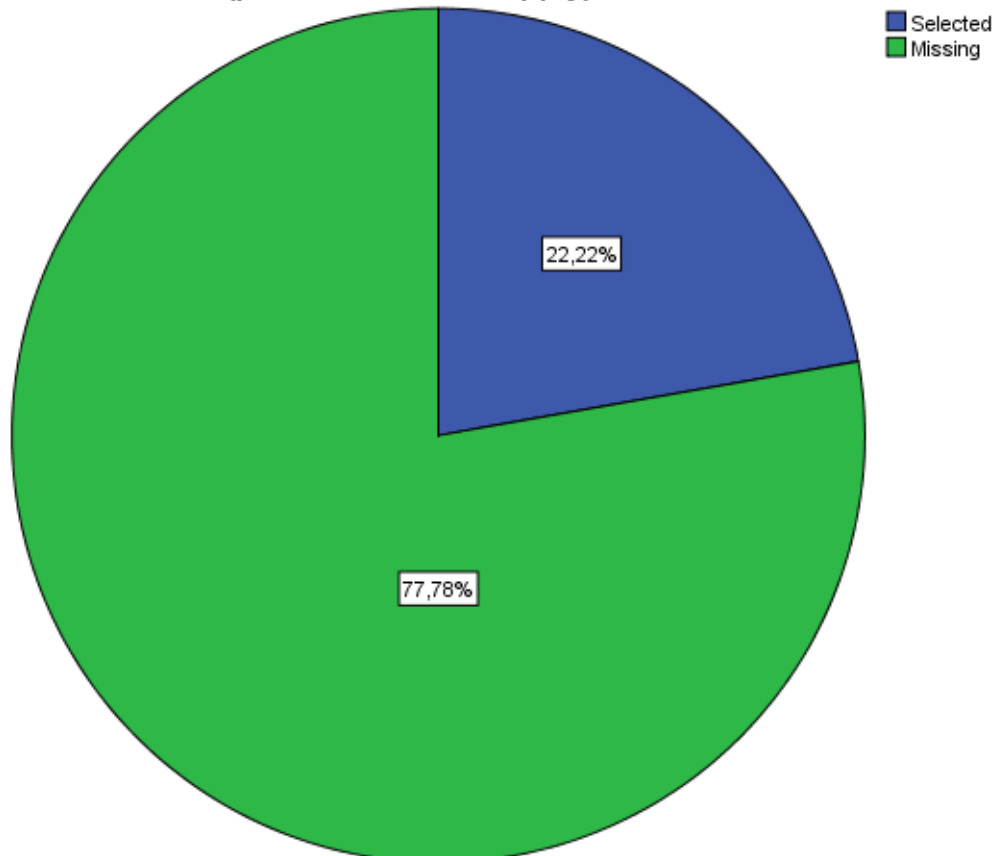


41.5. If yes, which one of the following services would you be interested in (please tick all that apply): Software maintenance

41.5. If yes, which one of the following services would you be interested in (please tick all that apply): Software maintenance

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Selected	2	22,2	100,0	100,0
Missing System	7	77,8		
Total	9	100,0		

41.5. If yes, which one of the following services would you be interested in (please tick all that apply): Software maintenance

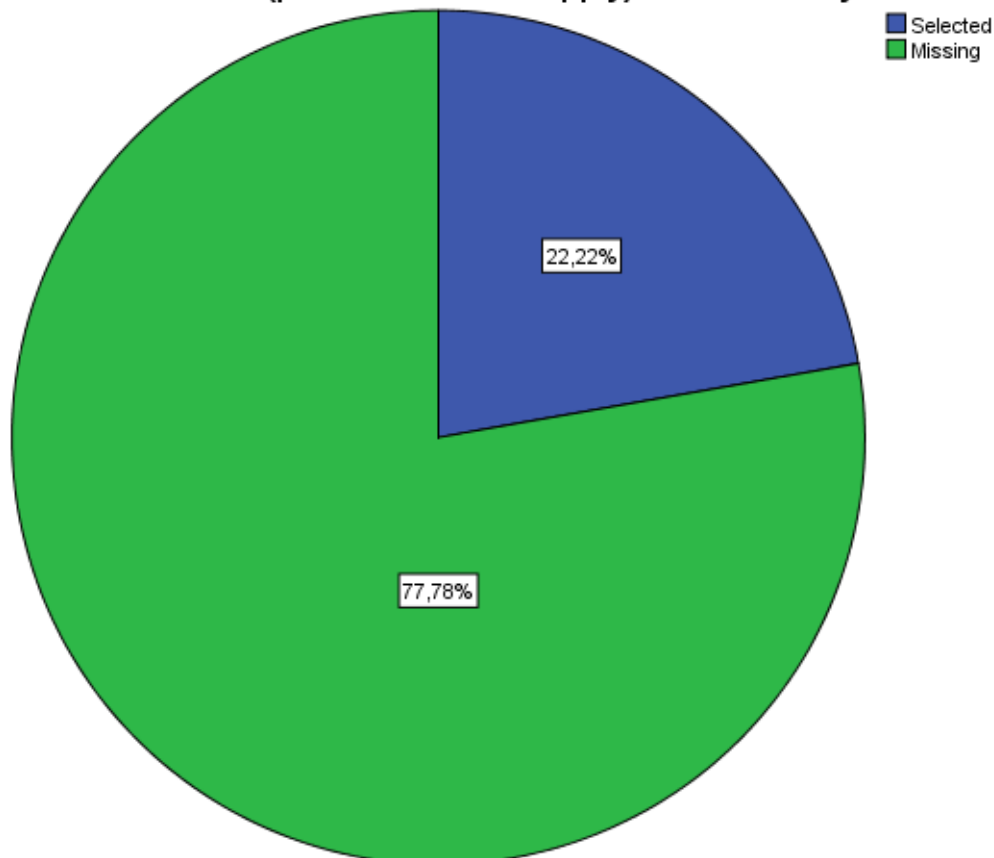


41.6. If yes, which one of the following services would you be interested in (please tick all that apply): Content analysis

41.6. If yes, which one of the following services would you be interested in (please tick all that apply): Content analysis

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Selected	2	22,2	100,0	100,0
Missing System	7	77,8		
Total	9	100,0		

41.6. If yes, which one of the following services would you be interested in (please tick all that apply): Content analysis

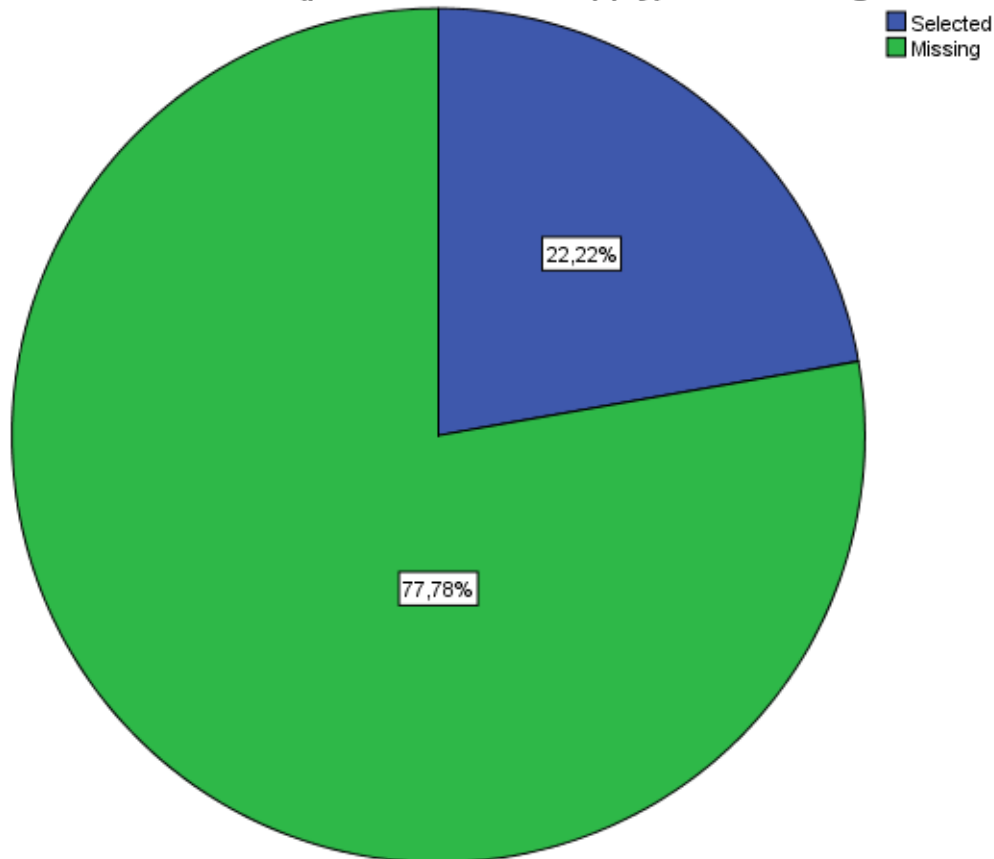


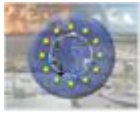
41.7. If yes, which one of the following services would you be interested in (please tick all that apply): Staff training

41.7. If yes, which one of the following services would you be interested in (please tick all that apply): Staff training

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Selected	2	22,2	100,0	100,0
Missing	System	7	77,8		
Total		9	100,0		

41.7. If yes, which one of the following services would you be interested in (please tick all that apply): Staff training



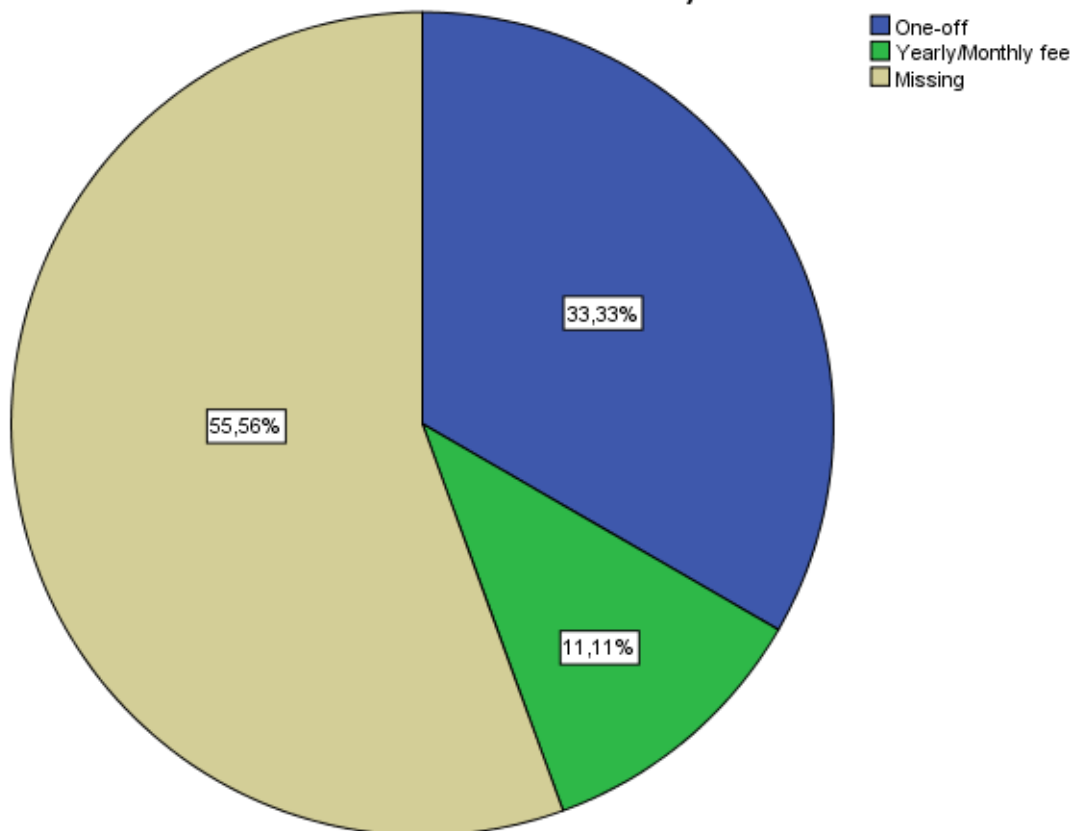


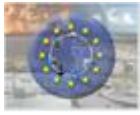
42. Which form of payment would you find convenient for the EU-CIRCLE services (please number in order of convenience – from 1 “most convenient” to 4 “least convenient”)?

42. Which form of payment would you find convenient for the EU-CIRCLE services (please number in order of convenience – from 1 “most convenient” to 4 “least convenient”)?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	One-off	3	33,3	75,0	75,0
	Yearly/Monthly fee	1	11,1	25,0	100,0
	Total	4	44,4	100,0	
Missing	System	5	55,6		
Total		9	100,0		

42. Which form of payment would you find convenient for the EU-CIRCLE services (please number in order of convenience – from 1 “most convenient” to 4 “least convenient”)?





43.1. How much would you be willing to pay to gain access to the EU-CIRCLE functionality?-One-off

43.1. How much would you be willing to pay to gain access to the EU-CIRCLE functionality?-One-off

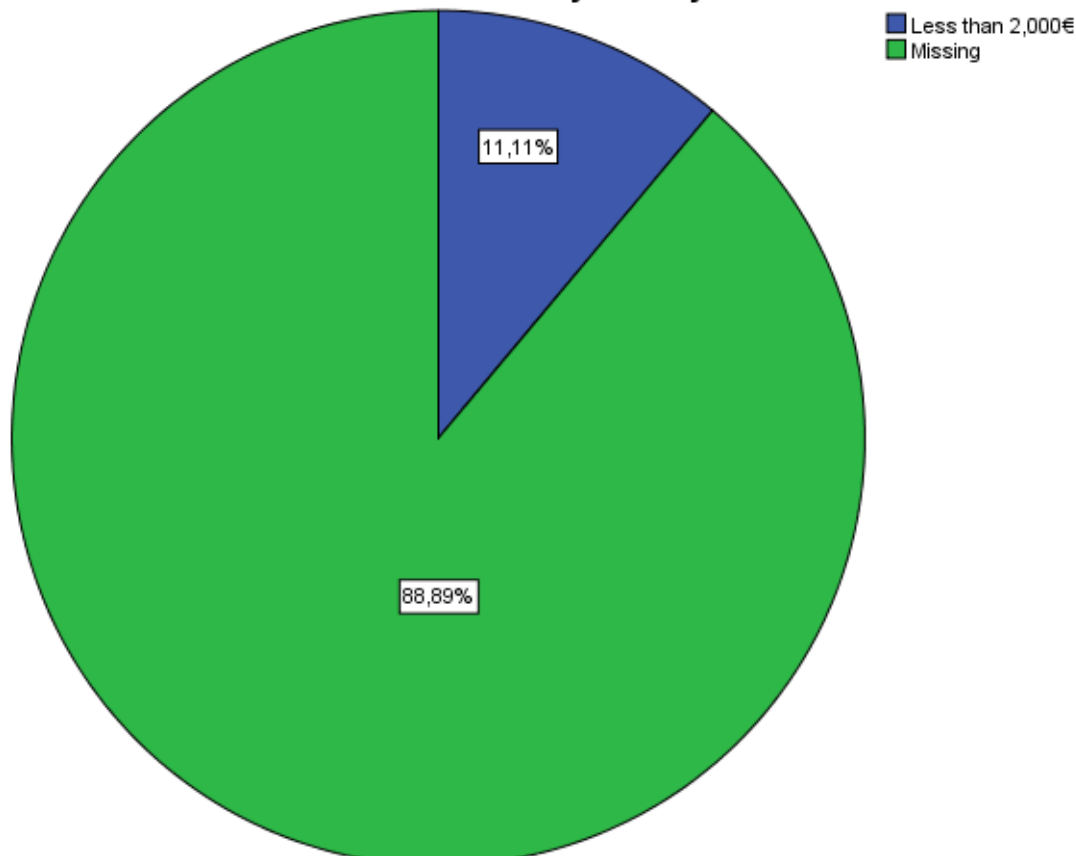
	Frequency	Percent
Missing System	9	100,0

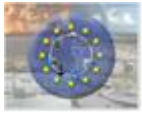
43.2. How much would you be willing to pay to gain access to the EU-CIRCLE functionality?-Yearly fee

43.2. How much would you be willing to pay to gain access to the EU-CIRCLE functionality?-Yearly fee

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Less than 2,000€	1	11,1	100,0	100,0
Missing System	8	88,9		
Total	9	100,0		

43.2. How much would you be willing to pay to gain access to the EU-CIRCLE functionality?-Yearly fee



**43.3. How much would you be willing to pay to gain access to the EU-CIRCLE functionality?-Per use fee**

43.3. How much would you be willing to pay to gain access to the EU-CIRCLE functionality?-Per use fee

	Frequency	Percent
Missing System	9	100,0

43.4. How much would you be willing to pay to gain access to the EU-CIRCLE functionality?-Per license/user fee

43.4. How much would you be willing to pay to gain access to the EU-CIRCLE functionality?-Per license/user fee

	Frequency	Percent
Missing System	9	100,0

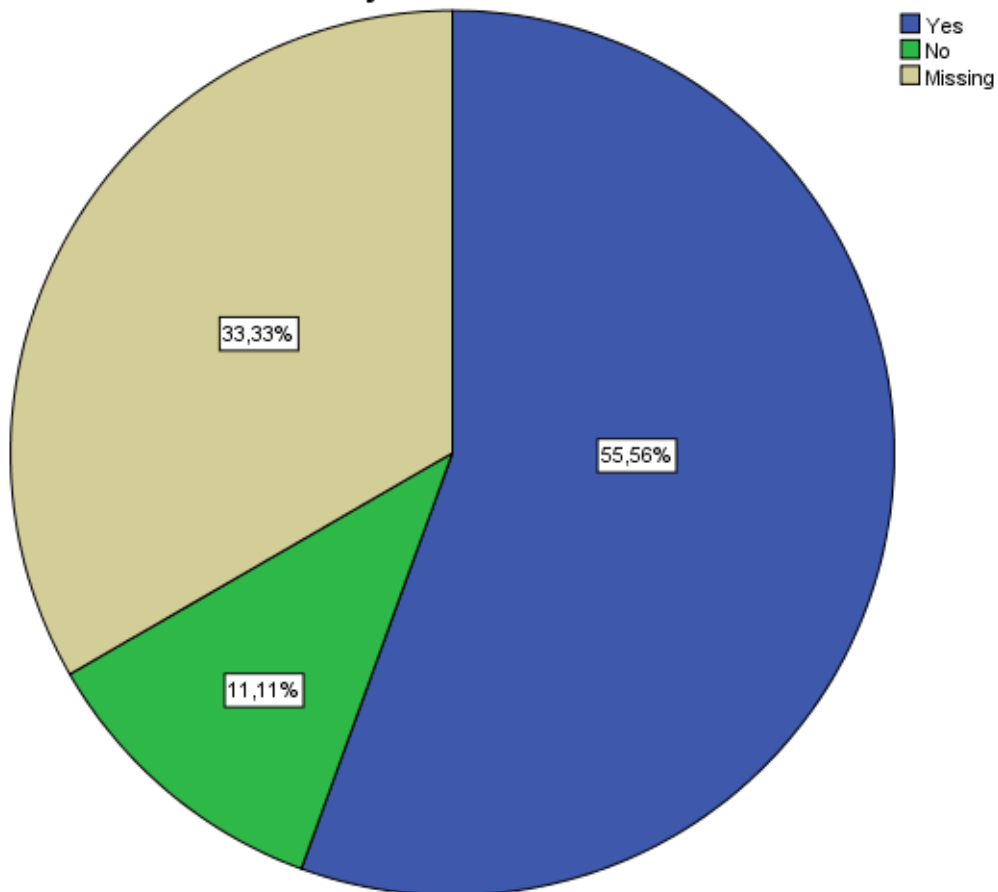


44. Would you recommend the EU-CIRCLE solution?

44. Would you recommend the EU-CIRCLE solution?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	5	55,6	83,3	83,3
	No	1	11,1	16,7	100,0
	Total	6	66,7	100,0	
Missing	System	3	33,3		
Total		9	100,0		

44. Would you recommend the EU-CIRCLE solution?



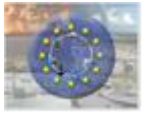
**Questions vs Mean Responses (High values indicate strong agreement, low values indicate strong disagreement)**

I.4. I think that I would need the support of a technical person to be able to use this system	4,22
I.10. I needed to learn a lot of things before I could get going with this system	4,22
I.1. I think that I would like to use this system frequently	4,11
I.5. I found the various functions in this system were well integrated	4,11
I.9. I felt very confident using the system	3,75
I.3. I thought the system was easy to use	3,67
I.7. I would imagine that most people would learn to use this system very quickly	3,22
I.8. I found the system very cumbersome to use	2,78
I.6. I thought there was too much inconsistency in this system	2,63
I.2. I found the system unnecessarily complex	2,11



**Annex II: System Usability Scale Questionnaire (Questionnaire 1) – All participants**

	Strongly disagree				Strongly agree
1. I think that I would like to use this system frequently	1	2	3	4	5
2. I found the system unnecessarily complex	1	2	3	4	5
3. I thought the system was easy to use	1	2	3	4	5
4. I think that I would need the support of a technical person to be able to use this system	1	2	3	4	5
5. I found the various functions in this system were well integrated	1	2	3	4	5
6. I thought there was too much inconsistency in this system	1	2	3	4	5
7. I would imagine that most people would learn to use this system very quickly	1	2	3	4	5
8. I found the system very cumbersome to use	1	2	3	4	5
9. I felt very confident using the system	1	2	3	4	5
10. I needed to learn a lot of things before I could get going with this system	1	2	3	4	5



Annex III: Questionnaire 2 (Focus Groups)

EU-CIRCLE End-User Test Trial Questionnaire

General Information

1. Name

2. Contact details

Address:	
Telephone:	
E-mail:	
Website:	

3. Name of your company/organisation

4. Function/Post within company or organisation

EU-CIRCLE Framework Validation - Intuitiveness

5. Using the EU-CIRCLE platform would enable me to assess risks and define resilience more quickly than with my current methods.

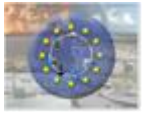
(Risk) ☐ Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree

(Resilience) ☐ Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree

6. If you (strongly) agree, which tasks do you think it would be completed in a better or faster way?

7. Using the EU-CIRCLE platform would enable to assess unexpected likelihood/consequences of eventual climate/climate change incidents more accurately than with your current methods?

☐ Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree



8. Using the EU-CIRCLE solution would enable you to take into account multiple risk scenarios and more threats than currently existing tools/methods allow.

☐ Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree

9. Using the EU-CIRCLE solution would help you to understand impacts originating from secondary effects (propagated consequences).

☐ Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree

10. Using the EU-CIRCLE solution would enable you to manage risks/strengthen resilience more effectively than you can now.

(Risk) ☐ Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree

(Resilience) ☐ Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree

11. Please elaborate (e.g. More accurate time management, better resource planning).
-

12. I find the EU-CIRCLE risk/resilience estimations to be very close to what I would expect from my experience.

(Risk) ☐ Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree

(Resilience) ☐ Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree

13. In my opinion the overall Risk Assessment/Resilience Framework as showcased by the EU-CIRCLE appears to be appropriate and correct.

(Risk) ☐ Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree

(Resilience) ☐ Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree

Product Assessment – Usability

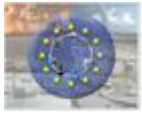
14. The EU-CIRCLE works the way I want it to work.

☐ Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree

15. If you (strongly) disagree which components do you find problematic and why?
-

16. Working with the EU-CIRCLE platform it was a nice experience

☐ Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree



17. Does your organisation have records of the assets and is interested in continuing using EU-CIRCLE?

☐Yes

☐No

18. If yes, in what format is the data available (also consider available conversion tools)?

☐GIS ☐Google Earth ☐ASCII ☐XML ☐Other (specify): _____

19. The EU-CIRCLE platform is generally easy to learn how to use

☐Strongly agree ☐Agree

☐Disagree

☐Strongly disagree

20. If you (strongly) disagree, which component(s) did you find difficult to use and why?

21. Did you encounter problems while using the EU-CIRCLE platform?

☐Yes

☐No

22. If yes, were you able to recover from these errors easily and quickly?

☐Yes

☐No

23. In case you would be a formal user, which kind of support do you prefer?

☐FAQ

☐E-Mail ☐Telephone-Hotline

☐Internet

24. I find the information provided by EU-CIRCLE platform to be:

☐Very Clear

☐Clear enough

☐A bit confusing

☐Incomprehensible

25. I find the terminology used in EU-CIRCLE to be (please tick all that apply):

☐Consistent

☐Understandable/Clear

☐Compliant to standard terms

☐Inconsistent

26. I find the error/help messages of the platform to be:

☐Helpful

☐Quite complex

☐Not really useful

☐Incomprehensible

27. I think the platform's user interface is (please tick all that apply):

☐Well-designed/Ergonomic

☐Polished

☐Simple

☐Intuitive

28. I find the responsiveness of the EU-CIRCLE platform to be:

☐Very fast

☐Reasonably fast

☐Underwhelming

☐Too slow

29. Overall, I find the EU-CIRCLE solution to be:

☐Very reliable

☐Reliable enough

☐Not very reliable

☐Unreliable

30. The EU-CIRCLE solution can cover all levels of end-users (both technically and operationally oriented users)



☐ Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree

31. What other information or functionality would you like to see in the EU-CIRCLE platform?

32. Do you have any further comments about the risk/resilience assessment method or the CIRP?

Risk: _____

Resilience: _____

Business Model - Marketability

33. Type of end-user's entity

☐ Private ☐ Public ☐ Other (Specify: _____)

34. Entity form of business

☐ Profit ☐ Non-profit

35. Entity level of operation

☐ Local ☐ Regional ☐ National ☐ International

36. Entity annual turnover: _____ €

37. How innovative do you find the EU-CIRCLE solution to be?

- ☐ It's something completely new and exciting for me
- ☐ I am aware of other tools with similar functionality but this is the first time I get to use one
- ☐ I think the EU-CIRCLE is better in comparison to similar products
- ☐ I think the EU-CIRCLE is lacking compared to similar products

38. How often do you "risk-assess" or "estimate resilience" in your infrastructure?

Risk

☐ Weekly ☐ Monthly ☐ At a 6-month interval
☐ Yearly ☐ Less than once per year

Resilience

☐ Weekly ☐ Monthly ☐ At a 6-month interval
☐ Yearly ☐ Less than once per year

**39. Are you willing to share your data with other entities that may use EU-CIRCLE?**

☐Yes ☐No ☐Partially

Please elaborate:

40. Would you be interested to use the EU-CIRCLE solution (once commercialized) and fine-tune it to your specific needs?

☐Yes ☐No

41. If yes, which one of the following services would you be interested in (please tick all that apply):

- ☐Online access to EU-CIRCLE services
- ☐Local Installation
- ☐Incorporation of the functionality into your network/back-office systems
- ☐Technical support (customer model development, client networks data-entry)
- ☐Software maintenance
- ☐Content analysis
- ☐Staff training

42. Which form of payment would you find convenient for the EU-CIRCLE services (please number in order of convenience – from 1 “most convenient” to 4 “least convenient”)?

☐One-off ☐Yearly/Monthly fee ☐Per use fee ☐Per license/user fee

43. How much would you be willing to pay to gain access to the EU-CIRCLE functionality?**Price Range**

Service provision	One-off	<input type="checkbox"/> Less than 2,000€	<input type="checkbox"/> 2,000€ - 4,000€	<input type="checkbox"/> More than 4,000€
	Yearly fee	<input type="checkbox"/> Less than 2,000€	<input type="checkbox"/> 2,000€ - 4,000€	<input type="checkbox"/> More than 4,000€
	Per use fee	<input type="checkbox"/> Less than 100€	<input type="checkbox"/> 100€ - 1,000€	<input type="checkbox"/> More than 1,000€
	Per license/user fee	<input type="checkbox"/> Less than 500€	<input type="checkbox"/> 500€ - 2,000€	<input type="checkbox"/> More than 2,000€

44. Would you recommend the EU-CIRCLE solution?

☐Yes ☐No ☐With modifications

Please elaborate:

