EU-CIRCLE

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

D6.7 Case Study 3 (Evaluation report)

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Dissemination Level: Public Deliverable

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 case study (CS3). It completes the Evaluation report of the case study.

EU-CIRCLE is a project that has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 653824. Please see http://www.eu-circle.eu/for more information.

Preparation Slip			
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Document Log			
Issue	Date	Comment	Author / Organization
V01	17/10/2018	Draft	UNEXE
V02	18/10/2018	Draft commented by Torbay Council and updated by UNEXE	Torbay Council, UNEXE
V03	27/10/2018	CIRP analyses and results incorporated	STWS
V04	27/10/2018	Final correction	UNEXE
		List here the changes and their rational for each release	

Executive Summary

The report evaluates the outcomes from the Case Study 3, Torbay, in the EU-CIRCLE project. The methodology and tools developed in EU-CIRCLE were successfully applied in the CS. Close engagement with the key stakeholders helped to shape the research direction and the results were disseminated at the final workshop. The CS considered the future climate scenarios to estimate the possible damage and impact caused by flooding. The benefits of setting a secondary flood defence were also investigated to justify the selection of climate-change adaptation measures.

Contents

List of acronyms

ACRONYM	EXPLANATION
CI	Critical Infrastructure
CIRP	Critical Infrastructure Resilience Platform
DSM	Digital Surface Model
DTM	Digital Terrain Model
EA	Environment Agency
LiDAR	Light Detection and Ranging
MCM	Multi-Coloured Manual
NRD	Nation Receptor Dataset

1 Agenda and operators involved

1.1 Agenda

The Torbay Case Study stakeholders engagement and final dissemination workshops were organized on 31 Oct 2017 and 27 Mar 2018, respectively. The agenda of the workshops are followings:

EU Circle Workshop - Exeter University 31st October 2017

Agenda

09:00-09:15 hrs	**Registration**
09:15 hrs	**Background to the project and case study** • *Introductions* • *Presentation on EU Circle Project and Case Study* • *Currently available data (GIS- Roads, Houses, Coastal Defences, Flood Modelling, Address point)* • *Demonstration of the visualisation tool*
10:15 hrs	**Identification of Critical Infrastructure for use in case study** • *Definition of Critical Infrastructure (CI)* • *Summary List of CI (Workshop handout -Table 1)* • *Discussion on any other CI that is thought relevant* • *What data is available and can this be used in the case study*
11:00 hrs	**Coffee Break**
11:15 hrs	**Discussion on effects of flooding on CI/interaction of CI and resilience** • *Effects– The effect of flooding to each CI (Workshop handout -Table 2). This can be broken down into assets i.e. Sewers – Pumping Stations, pipes etc. Also at what point the CI fails and what is recovery time* • *Interaction – The interaction of the CI with other CI and the cascading effects (Workshop handout -Table 3)* • *Resilience of CI – Relevant and measurable*
12:15 hrs	**Application to case study and dissemination of results** • *Agree questions and approaches that meet requirements of the project and CI owners (Workshop handout -Table 4)* • *Scenarios to be tested (Climate Change, return periods)* • *How should the results be presented?* • *How can the results of the case study be used by CI owners* • *What can be made available to the public on completion of case study*
12:50 hrs	**AOB**
13:00 hrs	**Lunch**

Torbay Case Study Dissemination Workshop
Riviera International Conference Centre, Torquay
Tuesday 27th March 2018
AGENDA

9:00 – 9:30	**Registration & Coffee – International Riviera Centre, Grace Murrell Suite**	
9:30 – 9:45	Welcome	
9:45 – 10:15	Introduction to EU-Circle Project	NCSRD
10:15 – 10:30	Description of Case Studies	NCSRD or CEREN/HUD/IVI (5 mins each)
10:30 – 11:00	Background to Torbay Case Study	TORBAY
11:00 – 11:15	Coffee break	
11:15 – 11:30	Stakeholder Requirements for Torbay Case Study	TORBAY
11:30 – 12:30	Demonstration of CIRP Tool & Visualisation	STWS/UNEXE
12:30 – 13:30	Lunch (interactive use of tools/ flood visualisation)	STWS/UNEXE
13:30 -14:15	Results of Torbay Case Study	STWS/UNEXE/TORBAY
14:15 – 14:45	Discussion & Future Developments	All
14:45 – 15:00	Feedback forms	KEMEA/TORBAY/NCSRD
15:00 – 15:30	**Coffee & Close Workshop**	

1.2 List of participants

There were 14 attendees participated in the Torbay Case Study stakeholders engagement workshop on 31 Oct 2017. Apart from the EU-CIRCLE partners, the participants also include the Departments of Emergency Planning and Highways in Torbay Council, Environment Agency, Network Rail, South West Water, Western Power, and Westcountry Rivers Trust.

EU Circle Workshop – Exeter University 31st October

Attendance List

Name	Organisation
Dr Lydia Vamvakeridou-Lyroudia	Exeter University
Dr Albert Chen	Exeter University
David Stewart	Torbay Council
Mike Wood	Torbay Council
Mehdi Khoury	Exeter University
Martin Davies	Environment Agency
Chris Packer	Torbay Council (Emergency Planning)
Ian Jones	Torbay Council (Highways)
Richard Behan	South West Water
Matthew Griffey	South West Water
Nigel Clements	Network Rail
Tim Seabrook	Western Power
Nurul Afroze Zainal Abidin	Huddersfield University
Nick Paling	Westcountry Rivers Trust
Jerry Burrows	BT
Jeff Smale	Wales & West
To be confirmed	
To be confirmed	Environment Agency
To be confirmed	Environment Agency
Andy Hingston	South West Water
Apologies Received	
Hisham Tariq	Salford University

Through the discussion with the stakeholders, the flooding scenarios to be tested as part of Case Study 3 include:

- Coastal Flooding (1 in 200 year event)
- Pluvial/Fluvial Flooding (1 in 100 year event)
- Joint probability Event (50 year / 50 year – 50 year climate)
- Resilience/Adaptation of Paignton & Preston Sea Defence (1 in 200 year – 50 year climate change)

The stakeholders also proposed the climate change scenarios to be considered, including:

- Now
- 20 years
- 50 years
- 100 years

The stakeholders also defined the following key questions to be addressed as part of the case study:

- What roads are closed due to 0.15m depth of flooding?
- How many residential and commercial properties would be flooded?
- Identify all critical infrastructure (assets) affected directly or indirectly by flooding?
- How many residents are affected by the storm event in question?
- What is the cost of a particular storm event?

EU-CIRCLE Case Study 3 Workshop

There were 52 attendees participated in the Torbay Case Study final dissemination workshop on 27 March 2018. In addition to the stakeholders who joined the previous workshop, the Torbay Council Councillor, Executive Leads and Strategic Planning, Torbay Harbour Authority, South West Coastal Group, Plymouth Coastal Observatory, Teignbridge Council, Local Government Flood Forum, and Innovyze also attended the dissemination workshop. The event was recorded that the video clips can be used for further user training and dissemination.

EU-CIRCLE Case Study 3 Final Dissemination Wokshop

EU Circle Torbay Case Study

Final Dissemination Meeting in Torquay

27th March 2018

Name	Organisation	Signed
Chris Packer	Torbay Council - Emergency Planning	
Ian Jones	Torbay Council - Highway Authority	
Tim Seabrooke	Western Power	
Richard Behan	South West Water Wendy Clegg	
Matthew Griffey	South West Water	
Martin Davies	Environment Agency	
Tom Dauben	Environment Agency	
George Arnison	Environment Agency	
Ian Hooper	Environment Agency	
Darren Condick	Environment Agency	
Emma Dauben	Environment Agency	
Nigel Clements	Network Rail	
Adam Parnell	Torbay Harbour Authority	
Gordon Oliver	Torbay Council Mayor	
Dave Thomas	Torbay Council Cllr	
Vic Ellery	Torbay Council Cllr	
Ray Hill	Torbay Council Cllr	
Robert Excell	Torbay Council Cllr	
Kevin Mowat	Torbay Council Executive Lead	
Martin Phillips	Torbay Council Executive Lead	
Andrew Gunther	Torbay Council Strategic Planning	
John Cocker	South West Coastal Group Chairman	
Dafni Sifnioti	Plymouth Coastal Observatory	
Joshua Webborn	Plymouth Coastal Observatory	
Gianluca Di Pasquale	Ernst & Young	
Graeme Smith	Teignbridge Council	
Richard Rainbow	Teignbridge Council	
Andy Johnstone	Local Government Flood Forum	
Steven Dickinson	Total	
Dan Graham	ISAR3	
Andrew Walker	Innovyze	
Trevor Bishop	OFWAT	
Lottie Mcknight	South West Water (SIN4NEXUS Project)	
Barry Evans	Exeter University	
Senthil Gurusamy	Exeter University	
Jamie Bradshaw	Exeter University	

Name	Organisation	Signed
Dave Stewart	Torbay Council	
Mike Wood	Torbay Council	
Thanasis Sfetsos	NCSR Demokritos	
George Eftychidis	KEMEA	
Ilias Gkotsis	KEMEA	
Chaminda Pathirage	University of Salford (USAL)	
Hisham Tariq	University of Salford (USAL)	
Albert Chen	Exeter University	
Lydia Vamvakeridou-Lyroudia	Exeter University	
Mike Gibson	Exeter University	
Mehdi Khoury	Exeter University	
Slobodan Djordjevic	Exeter University	
Bingu Ingirige	University of Huddersfield	
Fuad Ali	University of Huddersfield	
Erika Hartmann	MRK Management Consultants GmbH	
Peter Hartmann	MRK Management Consultants GmbH	
Frank Anderssohn	MRK Management Consultants GmbH	
Konstantina Mita	HNMS	
Nikolaos Karatarakis	HNMS	
Dr. Ralf Hedel	Fraunhofer IVI	
Francesca Argenti	RINA Consulting S.p.A.	
Elenia Duce	RINA Consulting S.p.A.	
Louisa Marie Shakou	European University Cyprus	
Antonis Kostaridis	Satways	
Dimitris Diagourtas	Satways	
Rachel Jouan Daniel	Artelia	
MAYRA RODRIGUEZ	UNIVERSITY OF EXETER	
ALAN OSINBICH	" "	
ANDREW BARRON	KOVIA FOSTER WP	
WILL INGRAM	University of Exeter	

2 Results from applying the EU-CIRCLE approach

2.1 CADDIES flood modelling

The CADDIES model was applied to analyse the consequences of coastal overtopping flooding along the coastlines in Torquay, Paignton and Brixham in Case Study 3. The overtopping discharge along the sea defences were obtained from the AMAZON model (Hu 2000, Haskoning DHV UK Ltd 2017) and used as the boundary inflow condition for the modelling. The weather conditions under current and the future climate change scenarios, discussed on the stakeholder engagement workshop, were applied to simulate the consequences of flooding.

2.1.1 Terrain data/parameters

The UK Environment Agency's (EA) Light Detection and Ranging (LiDAR) digital terrain model (DTM) data were used as the ground elevations for modelling. The LiDAR DTM was filtered from the digital surface model (DSM) (Priestnall *et al.* 2000) using algorithms that remove surface features to build the so-called bare earth terrain. The process removes superfluous features of the data, which are temporary and therefore should not be modelled, such as vehicles, people, animals or trees. It also removes structures within terrain data which are critical to flow movements, e.g. buildings and curbs, and can even leave large indentation where buildings should be present.

In order to simulate the effects of building blockages on flow paths, while also allowing the flow to penetrate into buildings through doors and windows, the DSMs data are pre-processed, following the EA's approach for surface water mapping (EA 2013), using the buildings and road layouts from the Ordnance Survey's Mastermap. All grid cells covered or touched by the road polygons are lowered by 12.5cm from their existing terrain level to account for the true elevation of roads, while buildings are treated differently in order to produce a level surface for each building polygon. The highest elevation within each building polygon is located and all cells within or touched by the polygon are raised to this level plus a threshold of 15cm. This is designed to simulate the door step level of the building, after which flow will be able to enter the cells that represent buildings. However, without further parameter settings this would neglect the influences of buildings' external and internal walls, and contents on flow propagation. To take into account these effects, flow into and within buildings should be limited. To achieve this the caFloodPro application allows for the roughness, infiltration (water loss to the surface), and rain to be tailored for each cell, or groups of cells. In this case, the desired effect of increased building blockage is achieved by increasing the Manning's roughness from 0.015 to 0.1 to slow down the flow within buildings areas.

The current version of CADDIES can only simulate the flood propagation on the surface. In urban areas, sewer systems are playing a critical role for easing flooding problem. To account for the capacity of the sewer system to remove water from the urban surfaces, and the ability of green areas to absorb water, infiltration in CADDIES modelling was applied to mimic the drainage capacity. The infiltration rates were calibrated with the 1D Infoworks ICM model and set for different surface types and shown in Table 1. Although most of the sewer pipes in Torbay were designed to cope with 1 in 30 year return period pluvial event, the current inlets and gullies along the roads do not provide equivalent capacity such that the road drainage is reduced to 1 in 5 year return period event. Additionally a rainfall reduction of 12mm/hr to green areas (cells with natural surface) is implemented.

Table 1 Infiltration/Water loss rates per surface type

Area type	Infiltration (mm/hr)
Green (any other)	12 + (rainfall reduction of 12 mm/hr for pluvial cases)
Roads Tracks And Paths	19
Buildings	28

Two different sizes of the modelling domain were used in the analysis. Firstly a smaller domain was created, limited to just the coastal flood extent, by retaining the areas lower than 30m, allowing enough buffers for coastal floods to propagate. For the pluvial and combine cases, a larger area is required to simulate the collection of runoff from the local catchment. This was done through terrain analysis to obtain the catchment boundaries.

2.1.2 Overtopping conditions

The overtopping discharge along the sea defences were produced by the AMAZON model (Hu 2000, Haskoning DHV UK Ltd 2017), which simulates the random waves travelling as bores. The discharges for the current and the future climate change scenarios of 1 in 200 year return period event were used as inputs to the CADDIES model as the boundary condition for the cells along the coastal defences. The overtopping rates follow the 12-hour tidal cycle with a total duration of 4 days. The flow rates for the 1 in 200 year storm event, with 2100 projection of climate change are shown in Figure 1.

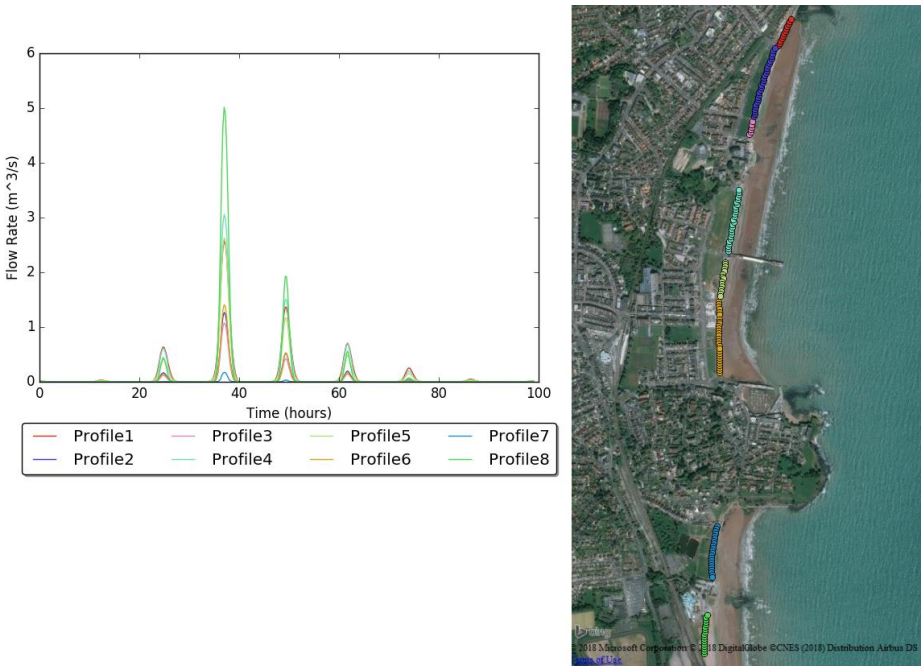

Figure 1 The discharge profiles for 1 in 200 year overtopping event (left) for various coastal sections (right)

2.1.3 Pluvial conditions

The pluvial flooding analysis adopted a design rainfall (spatial-uniformly distributed across the terrain) for the first hour of these simulations, while a further 3 hours of simulation time is used to allow the flow to propagate through the catchment. The rainfall values for events with different return periods were obtained from the Flood Estimation Handbook (CEH 2013) for each location. These rates were scaled up based on the EA's guidance (EA 2016) to account for future climate change scenarios.

2.1.4 Combined pluvial and overtopping conditions

Considering the chance that both extreme pluvial and overtopping conditions occurring at the same time is low, the combination of moderate pluvial and overtopping conditions were modelled as a plausible situation. A 1 hour design rainfall with 1 in 50 year return period was aligned with the largest peak of the inflow for 1 in 50 year overtopping event at the 36th hour of the simulation. The scenario was applied to analyse the climate change impact for a 50 year projection, as well as to investigate the effectiveness of a possible adaption scenario with an extra sea defence being built.

2.2 Flood damage and impact assessment

To assess the cascading effect of flood impact to CIs, we have adopted the EU-CIRCLE framework (Sfetsos *et al.* 2017, Chen *et al.* 2018) in the study. The EU-CIRCLE project considers not only the direct flood damage costs based on flood hazards (e.g. depth), but also the cascaded costs from damage to other types of CI and to properties in the area. For example, if flood damages CI assets such as electrical substations, other properties that are not directly affected by the flooding may still lose power due to the failure of substations. Therefore, CIs such as sewer pumping stations, electricity sub-station, and telecom exchanges will affect a much larger area beyond their locations when they are flooded beyond a certain threshold depth.

The flood information obtained from CADDIES modelling were overlapped with the building layouts, together with the building use information and the depth damage relationships from the Multi-Coloured-Manual (MCM; Penning-Rowsell et al. 2010) to evaluate the direct flood damage of each property. For CIs, the first level of cascading effect was evaluated using the algorithm shown in Figure 2. The interdependencies among CIs and other properties were further analysed such that the cascading effects can be assessed using the EU-CIRCLE framework through a looped analysis (Chen et al. 2018). More details regarding the methodology can be found in D6.6 Case Study 3 (implementation report).

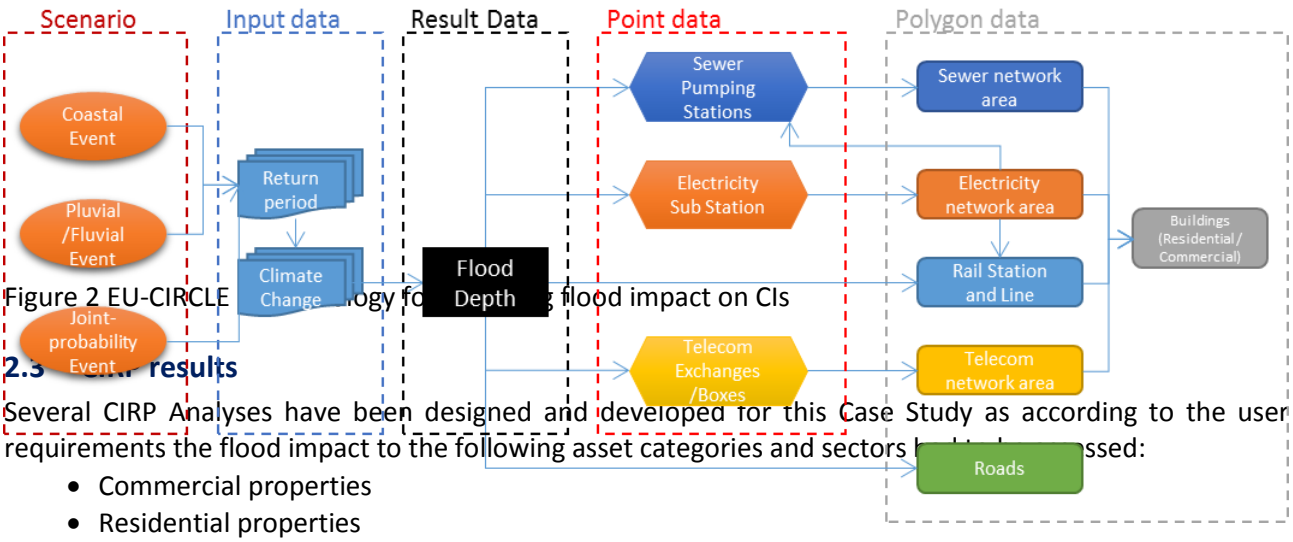

Figure 2 EU-CIRCLE [illegible]ogy fo[illegible] flood impact on CIs

2.3 [illegible] results

Several CIRP Analyses have been designed and developed for this Case Study as according to the user requirements the flood impact to the following asset categories and sectors [illegible]ssed:

- Commercial properties
- Residential properties
- Railways
- Traffic
- Emergency Services costs
- Critical infrastructure
- Tourism

The followed approach was to utilize the Multi-Coloured Handbook manual for deriving cost curves wherever possible and expert knowledge where information was not available.

- Residential - Cost curve based on depth of flooding versus average cost of damage for a typical residential dwelling
- Commercial - Various cost curves based on depth of flooding versus average cost of damage per m2 for a variety of different commercial buildings. The type of commercial building and floor area is defined in the National Receptor Database
- Railways - Cost curve produced based on financial losses due to flooding of railway between Torquay and Paignton
- Traffic - Cost curve produced based on the cost of traffic diversion routes should the road have to be closed
- Emergency Costs - The calculation for emergency costs is based on 10.7% of property damage during the flooding event
- Infrastructure - Cost curves are based on guaranteed service standards for each critical infrastructure supplier and are identified as a cost per residential or commercial property affected. Note no details available in Multi-Coloured Handbook
- Tourism - Cost curve based on flood area of tourist accommodation versus depth of flooding. Note no details available in Multi-Coloured Handbook

A number of scenarios (see Figure below) have been created in CIRP for 3 different geographic regions (Torquay, Paignton and Brixham), for different return periods and different situations (rain, overtopping, with or without adaptation measures).

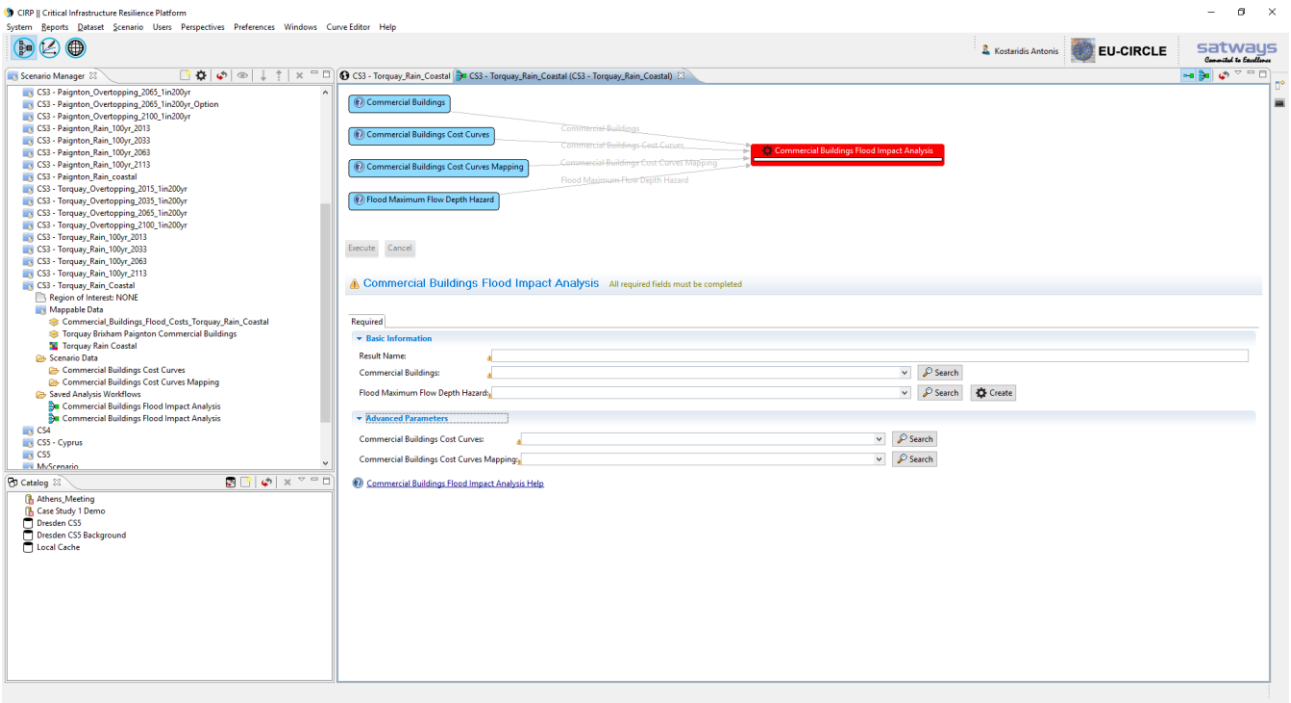

Figure 3: Case Study 3 scenarios in CIRP

The following analyses have been developed and demonstrated in this Case Study:

- **Flood Inundation Analysis**: This analysis is utilizing CADDIES in order to calculate the flood inundation for a given geographical region according to rainfall event and/or overtopping event.
- **Commercial Buildings Flood Impact Analysis**: This analysis calculates the impact of flood on commercial buildings according to the MCM based cost curves that have been ingested in CIRP.
- **Residential Building Flood Impact Analysis**: This analysis calculates the impact of flood on residential buildings according to the MCM based cost curves that have been ingested in CIRP.
- **Loss of revenue due to flooded touristic properties**: Calculates the loss of revenue, caused by flooded tourist attractions and accommodations based on money spend by tourists. It takes as input the buildings layer (shapefile) with floor area of every touristic property (touristic properties can be identified by MCM code), the "Depth of Flood (m)" Hazard Dataset (Raster data, CADDIES output), the amount of money spend by tourists per year in the area, a flood level threshold, which determines if building is closed (default: 150mm) and the total time of incident. The produced output is the loss of revenue for touristic properties as shape file
- **Costs for evacuation and emergency services due to flood hazard**: Calculates the costs of evacuating affected people in flooded areas taking as input the buildings layer with cost parameter and an evacuation cost percentage (default 10,7 % as provided by MCM data)
- **Compensation Costs for flooded Railway Tracks**: This analysis calculates the compensation costs for railway companies, if trains are delayed or cancelled because of flooded tracks. It takes as input the Railway Network (shapefile), Passenger numbers on the connection per year, "Depth of flood (m)" Hazard Dataset (Raster data, CADDIES output), Duration of flood incident, Percentage of delayed trains (defaults to 40%), Percentage of cancelled trains (defaults to 60%), Percentage of delayed compensations, Percentage of cancelled compensations and produces the compensation costs for every connection of rail network.
- **Costs for national economy caused by traffic diversions**: This analysis calculates the costs of traffic diversions based on diversion length and duration of flood event.

In the following Figures selected results of the aforementioned analyses are presented:

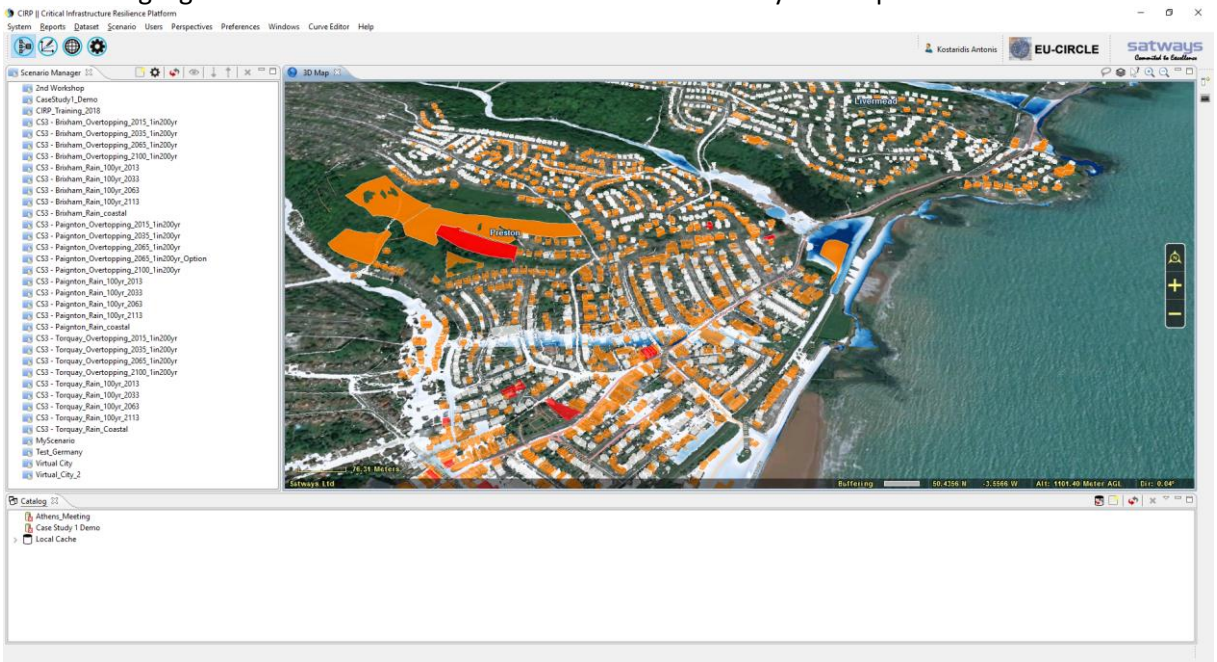

Figure 4: Residential properties flood impact

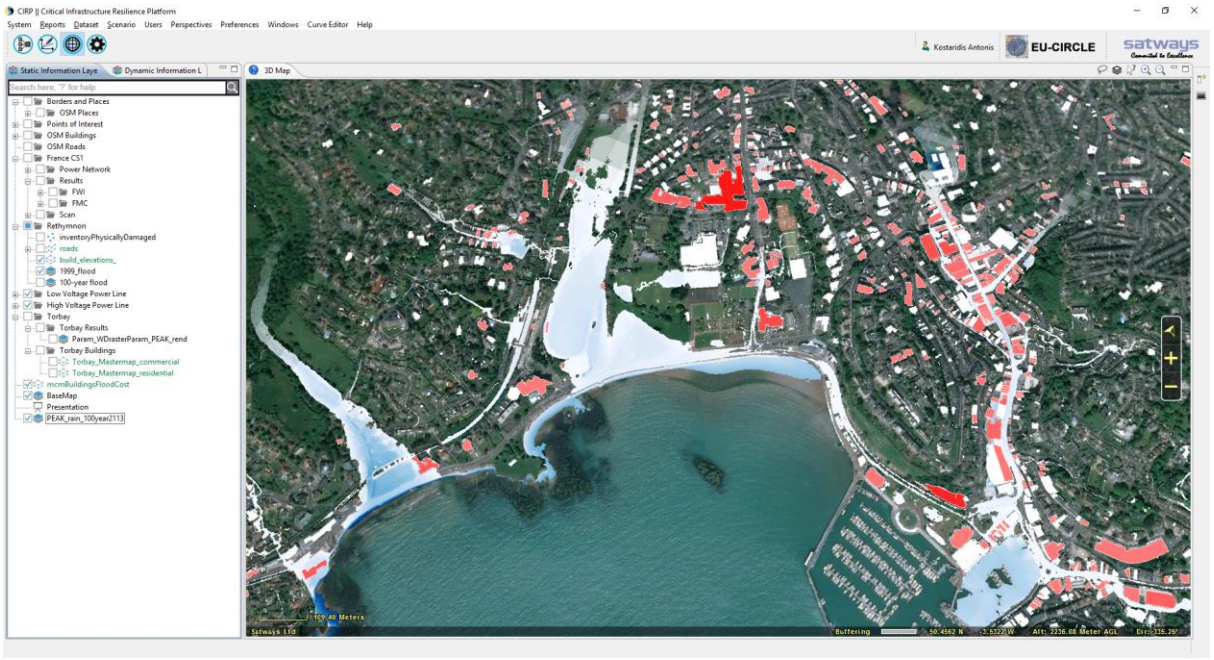

Figure 5: Commercial buildings flood impact in Torquay

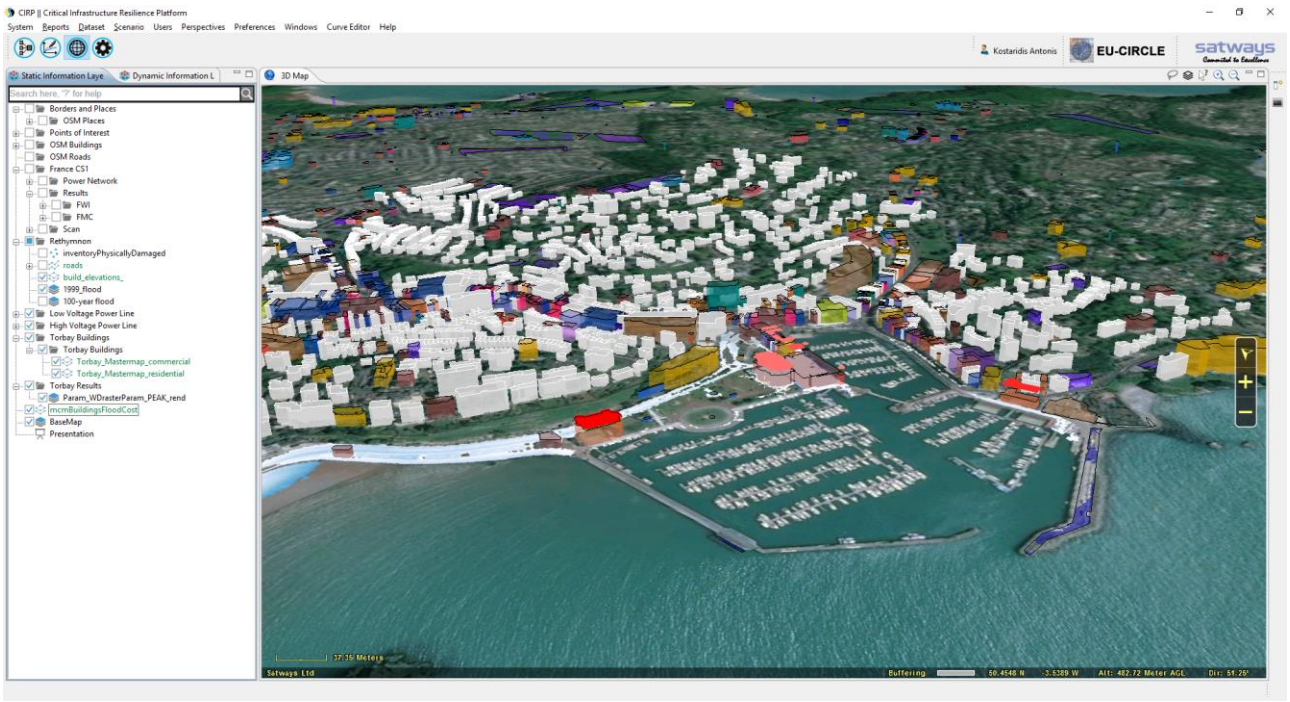

Figure 6: 3D View of flood impact results.

3 Communication and evaluation

3.1 Evaluation of flood modelling results

Figure 3 shows a 1 in 100 year pluvial event (left) and a 1 in 200 year coastal overtopping event (right), for current climate conditions. It can clearly be seen in Figure 3 that large populated areas are under risk from extreme events, with the majority of risk to the town centre coming from the coastal events. The overtopping has a wider spread flood extent along coastal area while the pluvial flooding are scatter and following the road network. Given 50 years of climate change, Figure 4 shows a 1 in 100 year pluvial (left) and a 1 in 200 year (centre), risks are only set to increase. The coastal flooding in the current scenario (Figure 3) are largely bounded by the railway line and station, however with the increased rainfall and/or overtopping for 50 years of climate change, the railway line and station are completely overwhelmed.

Considering the likelihood for both extreme events (i.e. 1 in 100 year pluvial and 1 in 200 year coastal overtopping) occurring at the same time is rare (Svensson and Jones 2005), a moderate combination of both situations was considered to represent the joint extreme event (i.e. 1 in 50 year pluvial and 1 in 50 year coastal overtopping at the same time). The modelled flood extent is shown in Figure 4 (right).

Figure 3 Flood extents of 1 in 100 year return period pluvial event (left) and 1 in 200 year return period overtopping event (right) for the present scenario

It is clear in Figure 3 and Figure 4 that the coastal overtopping causes the largest risk to a very concentrated area, and therefore an adaptation plan has been developed to make improvements to the sea wall defences. Shown in Figure 5, are the resulting flood depths for a 1 in 200 year coastal overtopping event, given 50 years of climate change, but with the planned improvements to the sea wall drastically reducing the amount of flow, and clearly protecting Paignton from the majority of flooding.

In Paignton, an adaptation measure to install a secondary flood defence was proposed for flood mitigation. Different defence heights were also taken into account to evaluate the benefits of these options.

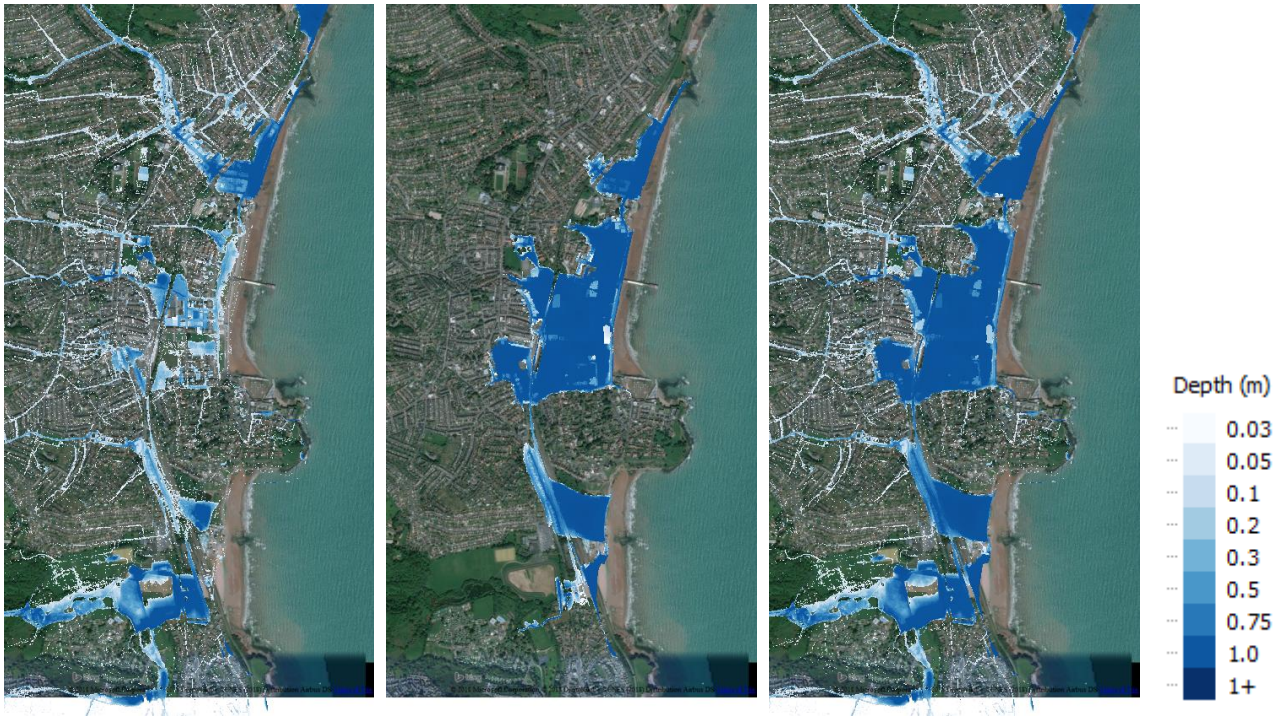

Figure 4 Flood extents of 1 in 200 year return period overtopping event (left) and 1 in 100 year return period pluvial event (centre), and combined 1 in 50 year pluvial and coastal overtopping event (right), for the 50 years of climate change scenario

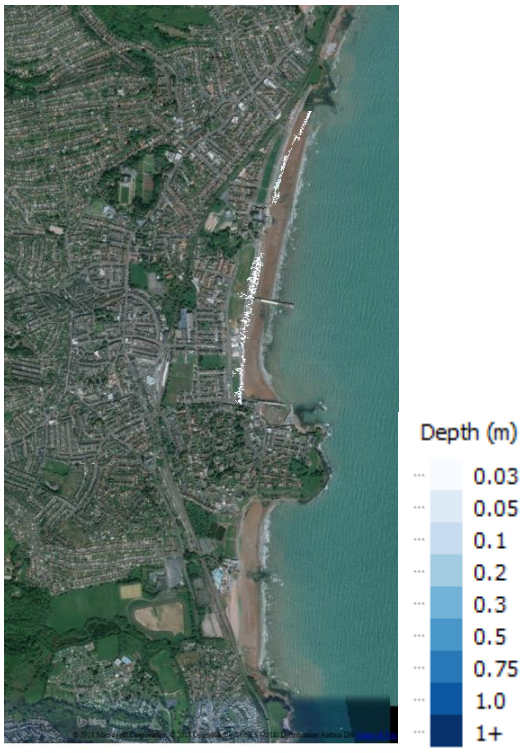

Figure 5 Flood extents of 1 in 200 year coastal overtopping event with 50 years of climate change, and adaptations made the sea wall defences

3.2 Evaluation of flood impact to CIs

The CADDIES modelling results for Case Study 3 were overlapped with the building layouts from the Ordnance Survey Mastermap (Ordnance Survey 2017), together with the building use information from the Nation Receptor Dataset (NRD; Environment Agency 2017) and the depth damage relationships from the Multi-Coloured-Manual (MCM; Penning-Rowsell *et al.* 2010) to evaluate the direct flood damage of each property. NRD contains the detailed use of individual properties or critical infrastructure. Most of the properties are also assigned a specific code that is corresponding to a particular depth-damage function in MCM for estimating the flood damage. The analyses were done using the CORFU/PEARL damage assessment tool that was originally developed to evaluate flood impact to properties in the CORFU project (Chen *et al.* 2016, Khan D.M. *et al.* 2018). Its functions were further enhanced in the PEARL project (Vojinovic 2017).

The CORFU/PEARL damage assessment tool was integrated with the cascading effect assessment methodology developed within EU-CIRCLE, as described in D6.6. Both the spatial and temporal influences of flood propagations were considered in the analyses, as shown in Figure 6, to improve the understand of the evolution of flood damage and cascading effect.

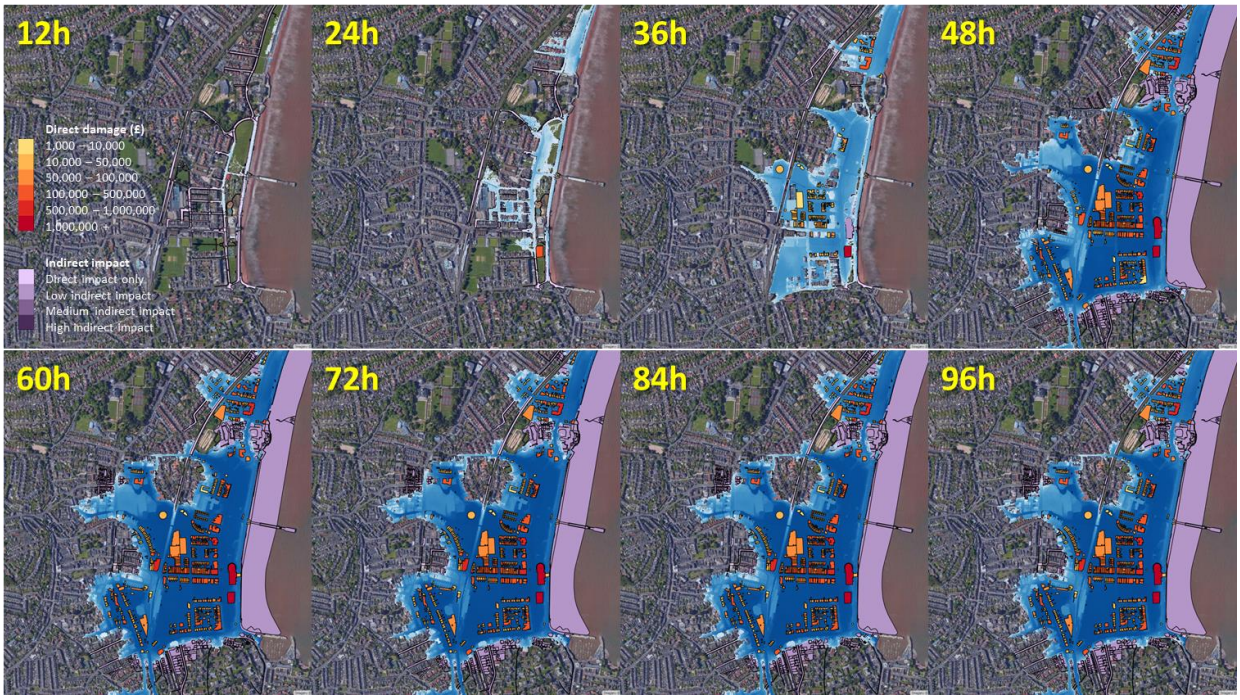

Figure 6 The spatiotemporal evolution of flood damage and impact caused by 1 in 200 year coastal overtopping event with 50 years of climate change in Paignton

The questions raised by the stakeholders during the first engagement workshop were also investigated in the impact assessment. Table 2 lists the cost to different sectors under coastal overtopping event with 50 years of climate change in Paignton. For a 1 in 200 year event, a total of 1,085 properties will suffer more than £1,000 direct flood damage, including 718 residential, 339 commercial, 167 hotels and 25 with other uses. In addition, there are 7.7km roads and 244 metre rail sections will be closed due to flood depth greater than 15cm. Based on the results, the expected annual damage of costal overtopping events in Paignton is estimated at £2,947,357.

The effectiveness and benefits for the four climate change adaptation measures for the secondary flood defence in Paignton were also analysed, as shown in Table 3. The results showed that the secondary flood defence can successfully reduce the flood situation in Paignton and Preston areas, while Goodrington area in the south part will still have significant flood risk if there is no adaptation plan. Considering the life time

of the flood defence as 50 years, the total benefit the critical infrastructure could contribute is more than £130 million. On top of the economic benefits, the improvement of the safety to the citizens and avoided disruption to the public are also the key profits from the adaptation plan.

Table 2 The direct flood damage for different sectors caused by coastal overtopping events with 50 years of climate change in Paignton (Unit: £)

Damage type	Return period (y)					
	200	100	75	50	20	10
Residential	19,941,618	13,557,261	13,233,774	11,497,632	6,056,702	3,974,685
Commercial (exc. tourism)	11,351,490	8,547,275	8,405,233	7,328,324	4,995,592	3,106,801
Public	688,803	406,611	390,578	291,289	105,841	58,750
Hotels	10,298,884	7,867,720	7,721,834	6,835,924	4,329,338	2,272,517
Other tourism	8,506,156	6,848,037	6,702,540	5,908,470	3,897,662	2,181,080
Total Damage	50,786,952	37,226,905	36,453,958	31,861,638	19,385,134	11,593,833

Table 3 The benefit-cost analyses for the secondary flood defence options in Paignton

Secondary flood defence height (m)				Total Benefit	Total Cost	Benefit/
Paignton	Preston	EAD (£)	Annual Benefit (£)	(£)	NPV (£)	Cost Ratio
1.60	2.10	341,541	2,605,816	130,290,796	3,382,977	38.5
1.40	1.80	342,099	2,605,258	130,262,917	3,179,998	41.0
1.20	1.60	342,747	2,604,610	130,230,511	3,035,013	42.9
1.05	1.00	350,269	2,597,088	129,854,410	2,735,378	47.5

3.3 Evaluation Questionnaires

Within the case-study workshop, an in-depth evaluation has been conducted. All workshop participants were asked to fill in a questionnaire and were also given the opportunity to express their opinion and possible suggestions. For the purpose of EU-CIRCLE evaluation, the following two questionnaires had been prepared, distributed to the participants, filled and collected for further analysis:

1. System Usability Scale Questionnaire (Annex I)
2. End-User Test Trial Questionnaire (Annex II)

The results obtained from the questionnaires are included within the Annexes to this report.

4 Global lessons learned and recommendations

4.1 From the operators

The consensus of opinion was that the CS had successfully demonstrated the tools that have been developed as part of the EU-CIRCLE Project. The stakeholders were impressed with the visualisation and CIRP tools that were presented and made available for further demonstration during the comfort breaks.

Discussions took place with regard to future uses of the tools by the CI operators. These included the following:

- Network Rail were very interested in using the tools for their control room and as part of their risk management assessments, as this would enable them to see how the railway would be affected by future climate change.
- Could vulnerability of residents also be incorporated within the CIRP tool? It was explained that this and other data could be used to tailor results to specific requirements.
- Can the tools be incorporated or modified to work with other software in order make the CI operators proactive rather than reactive? This should be investigated as part of the exploitation of the project.
- How easy would it be to carry out similar analysis in other areas? It was explained that this is a generic approach and can be applied to other areas as long as the data is available.
- Local Authorities in the South West of England expressed an interest in using the CIRP tool as part of the Shoreline Management Plan review process when considering future climate change.

4.2 From project partners

CS3 has successfully tested the integration of EU-CIRCLE tools in the CIRP platform. The practice also allowed EU-CIRCLE partners to better understand the main concerns of stakeholders regarding CI resilience to climate change and tailored the research outcome to address those key questions. The methodology and results were demonstrated via the engagement workshops that trigged more discussions among the involved parties. The study also showed the needs for further scientific research (e.g. the physical damage to underground infrastructure caused by erosion during flooding). The outcomes have attracted other local stakeholders who would like to implement EU-CIRCLE approach to other coastal protection planning in the Southwest England.

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6 Acknowledgment

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7 Annexes

7.1 Annex 1 System Usability Scale Questionnaire (Questionnaire 1) – All Participants

	Strongly disagree				Strongly agree
1. I would like to use this system frequently	1	2	3	4	5
2. I think the system is unnecessarily complex	1	2	3	4	5
3. I found 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 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 can 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 would need to learn a lot before I could get going with this system	1	2	3	4	5

7.2 Annex 2 End User Test Trial Questionnaire (Questionnaire 2) – Focus Group

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 efficiently 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?**

Risk:

Resilience

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

☐Strongly agree ☐Agree ☐Disagree ☐Strongly disagree

8. **Would EU-CIRCLE solution 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. **Would EU-CIRCLE solution help you to understand impacts originating from secondary/cascade effects (propagated consequences)?**

☐Strongly agree ☐Agree ☐Disagree ☐Strongly disagree

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

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

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

11. **Please elaborate in which way EU-CIRCLE can achieve it (e.g. More accurate time management, better resource planning).**

_____

_____

12. **Do you find the EU-CIRCLE risk/resilience estimations to be very close to what I would expect, based on my experience?**

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

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

13. **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) ☐Strongly agree ☐Agree ☐Disagree ☐Strongly disagree

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

Product Assessment – Usability

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

☐Strongly agree ☐Agree ☐Disagree ☐Strongly disagree

15. **If you (strongly) disagree with the above, which components do you find problematic and why?**

_____

_____

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

☐Strongly agree ☐Agree ☐Disagree ☐Strongly disagree

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

☐Yes ☐No

18. **Does your organization have data suitable for the EU-CIRCLE analyses?**

☐Yes ☐No

If yes, in what format they're available?

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

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

☐Strongly agree ☐Agree ☐Disagree ☐Strongly disagree

20. **If you (strongly) disagree, which component(s) do 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 of CIRP, which kind of support do you prefer?**

☐FAQ ☐E-Mail ☐Telephone-Hotline ☐Internet

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

☐Very Clear ☐Clear enough ☐A bit confusing ☐Incomprehensible

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

☐Consistent ☐Understandable/Clear ☐Compliant to standard terms ☐Inconsistent

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

☐Helpful ☐Quite complex ☐Not really useful ☐Incomprehensible

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

☐Well-designed/Ergonomic ☐Polished ☐Simple ☐Intuitive

28. **Evaluate the responsiveness of the CIRP platform:**

☐Very fast ☐Reasonably fast ☐Underwhelming ☐Too slow

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

☐Very reliable ☐Reliable enough ☐Not very reliable ☐Unreliable

30. **Do you agree that 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 regarding 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 is quite innovative and interesting 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 competitive 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 or 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	☐Less than 2,000€	☐2,000€ - 4,000€	☐More than 4,000€
	Yearly fee	☐Less than 2,000€	☐2,000€ - 4,000€	☐More than 4,000€
	Per use fee	☐Less than 100€	☐100€ - 1,000€	☐More than 1,000€
	Per license/user fee	☐Less than 500€	☐500€ - 2,000€	☐More than 2,000€

44. **Would you recommend the EU-CIRCLE solution?**

☐Yes ☐No ☐With modifications

Please elaborate:

_____

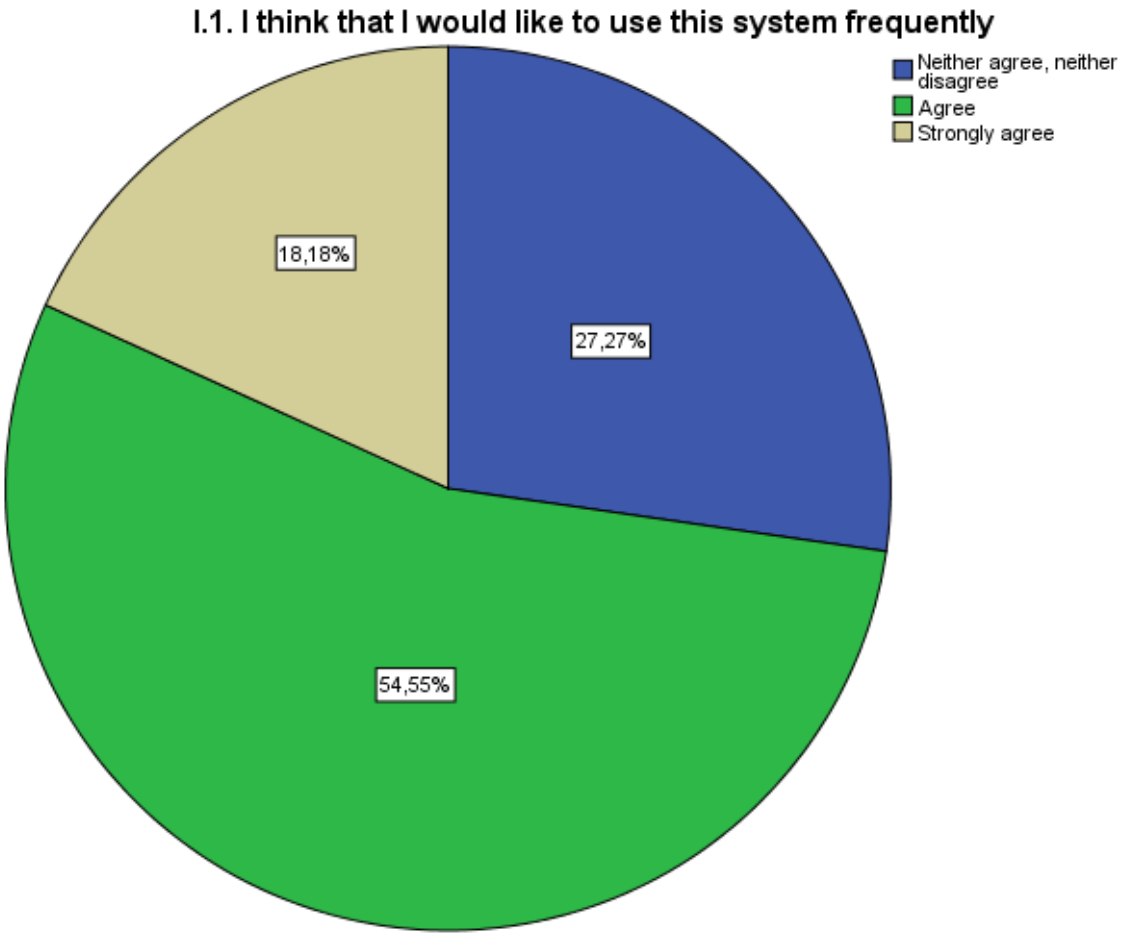
_____

7.3 Annex 3 Questionnaire Results

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

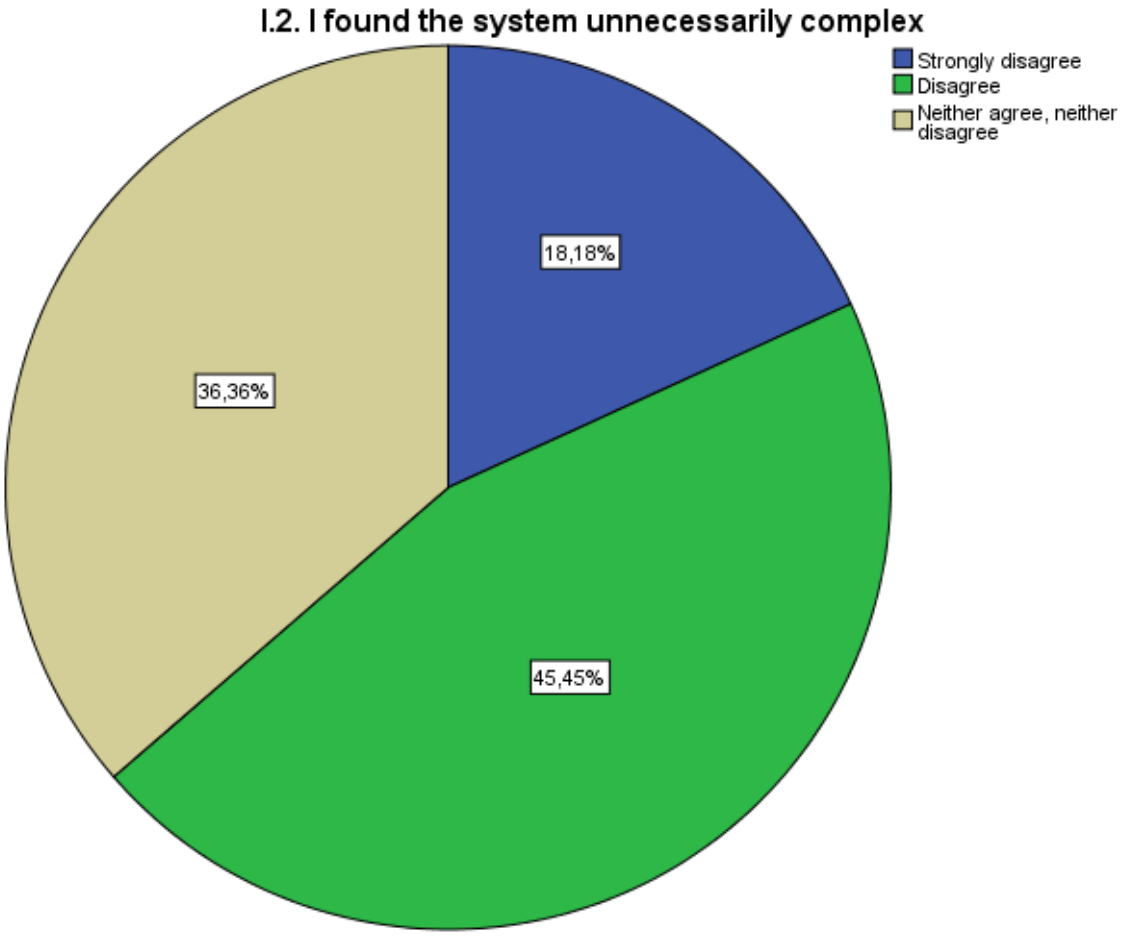
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Neither agree, neither disagree	3	27,3	27,3	27,3
	Agree	6	54,5	54,5	81,8
	Strongly agree	2	18,2	18,2	100,0
	Total	11	100,0	100,0	



I.2. I found the system unnecessarily complex

I.2. I found the system unnecessarily complex

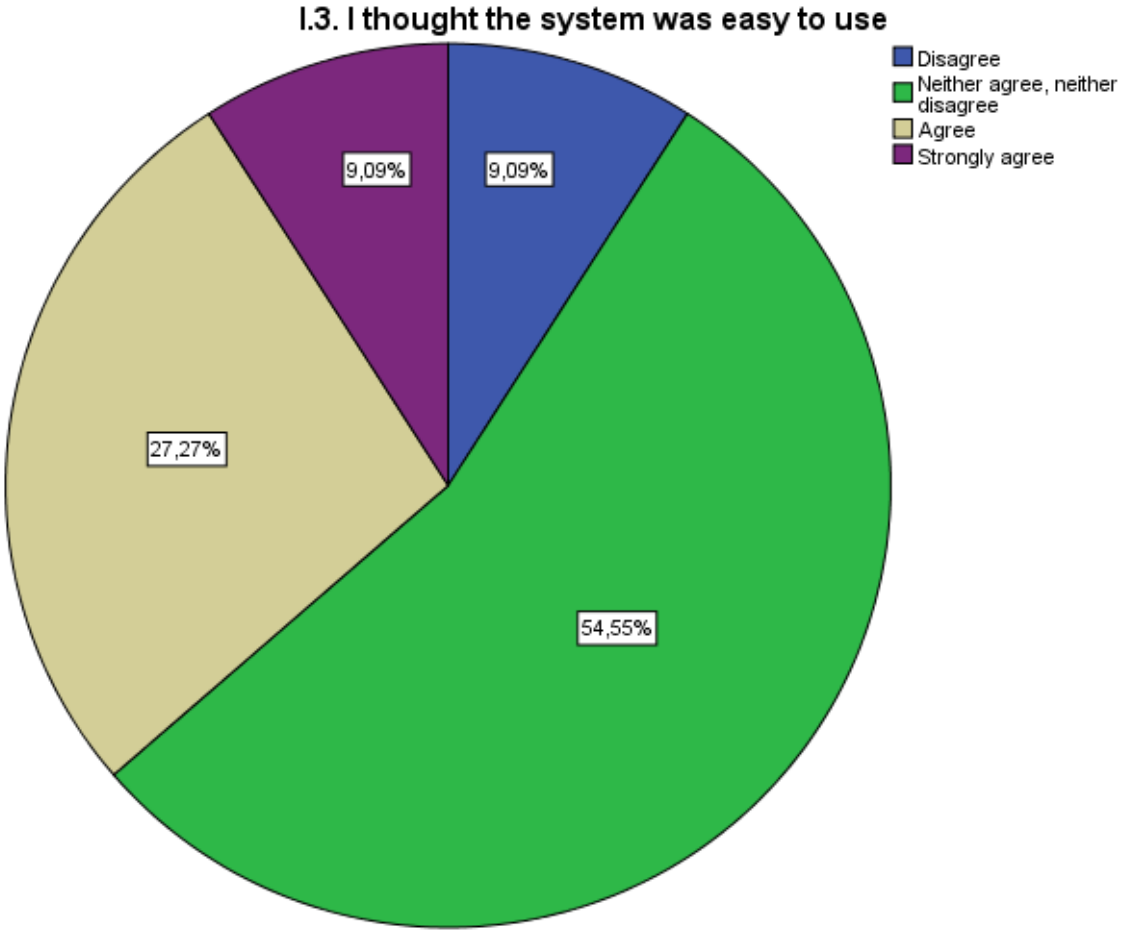
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	2	18,2	18,2	18,2
	Disagree	5	45,5	45,5	63,6
	Neither agree, neither disagree	4	36,4	36,4	100,0
	Total	11	100,0	100,0	



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

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

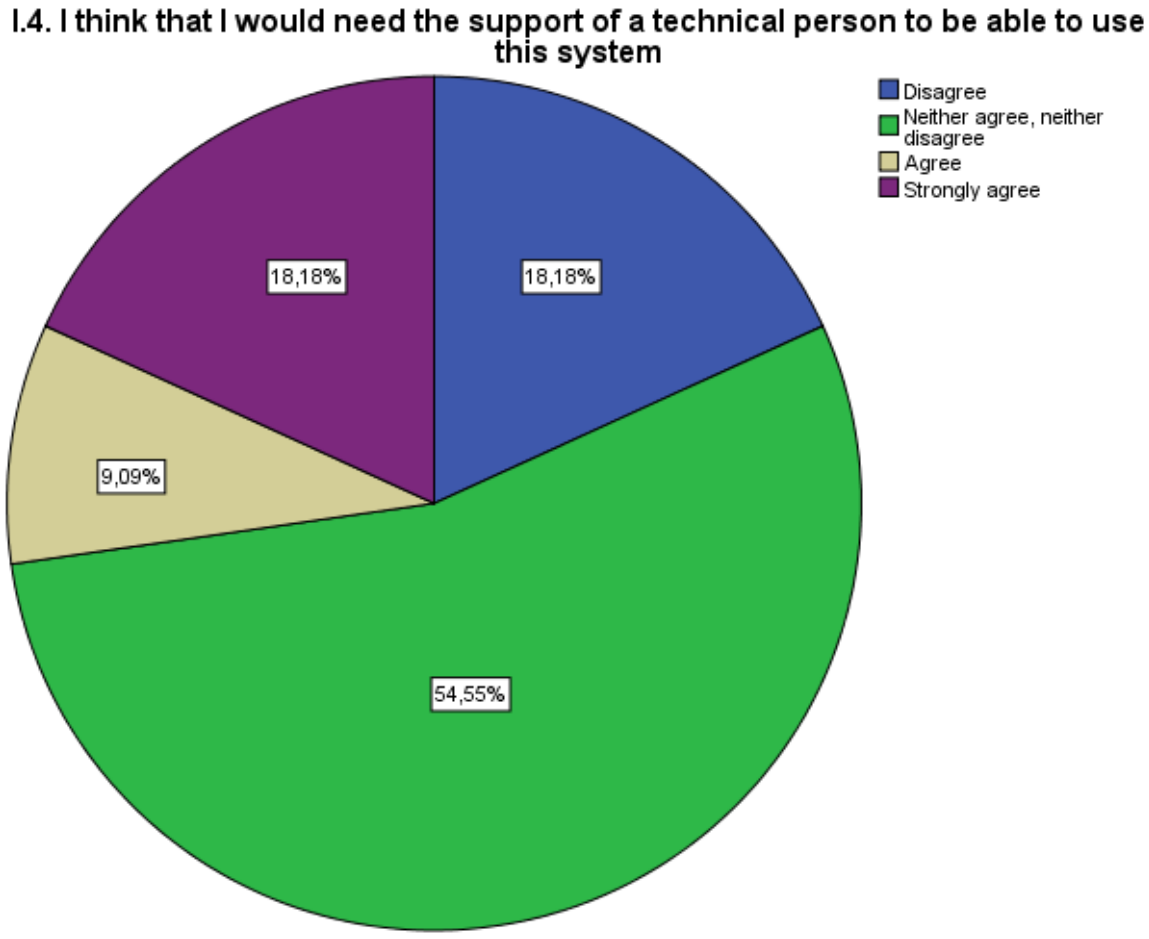
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	1	9,1	9,1	9,1
	Neither agree, neither disagree	6	54,5	54,5	63,6
	Agree	3	27,3	27,3	90,9
	Strongly agree	1	9,1	9,1	100,0
	Total	11	100,0	100,0	



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

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

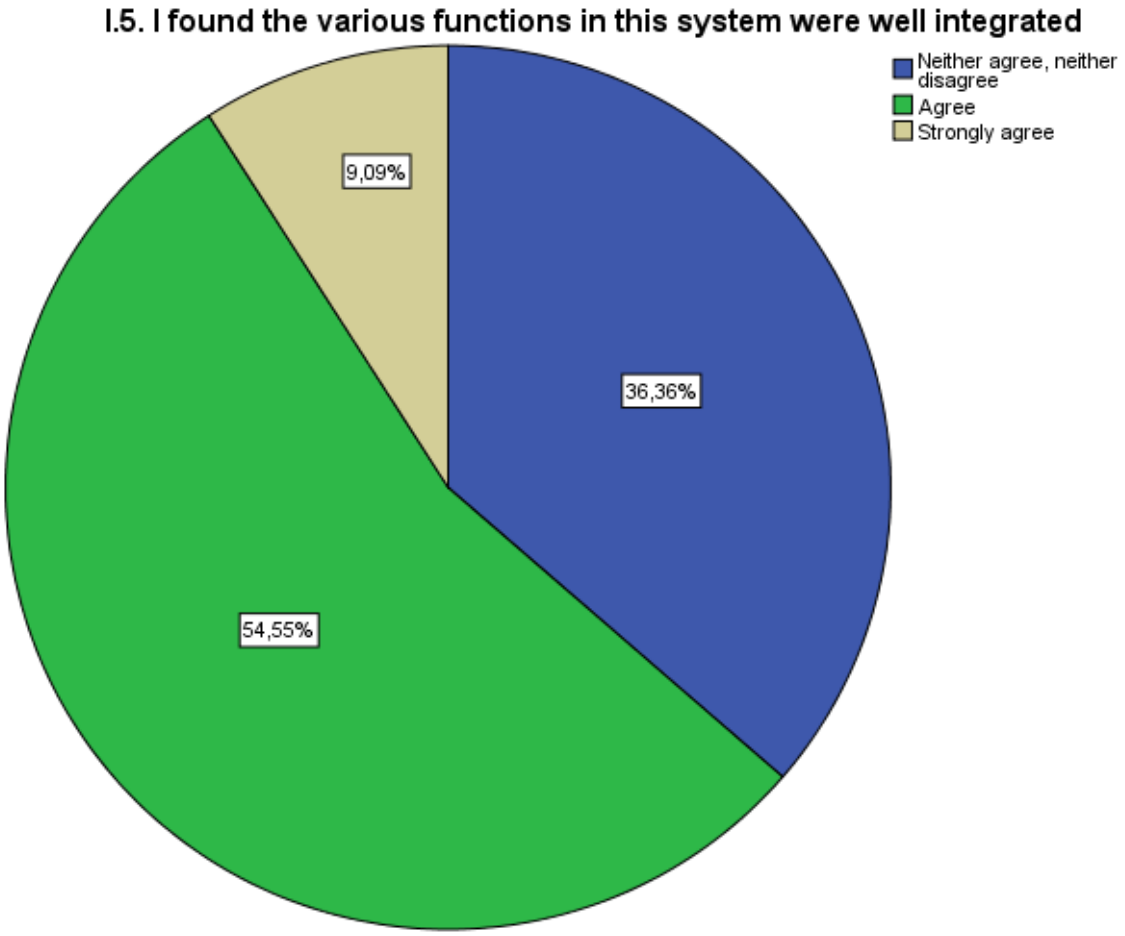
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	2	18,2	18,2	18,2
	Neither agree, neither disagree	6	54,5	54,5	72,7
	Agree	1	9,1	9,1	81,8
	Strongly agree	2	18,2	18,2	100,0
	Total	11	100,0	100,0	



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

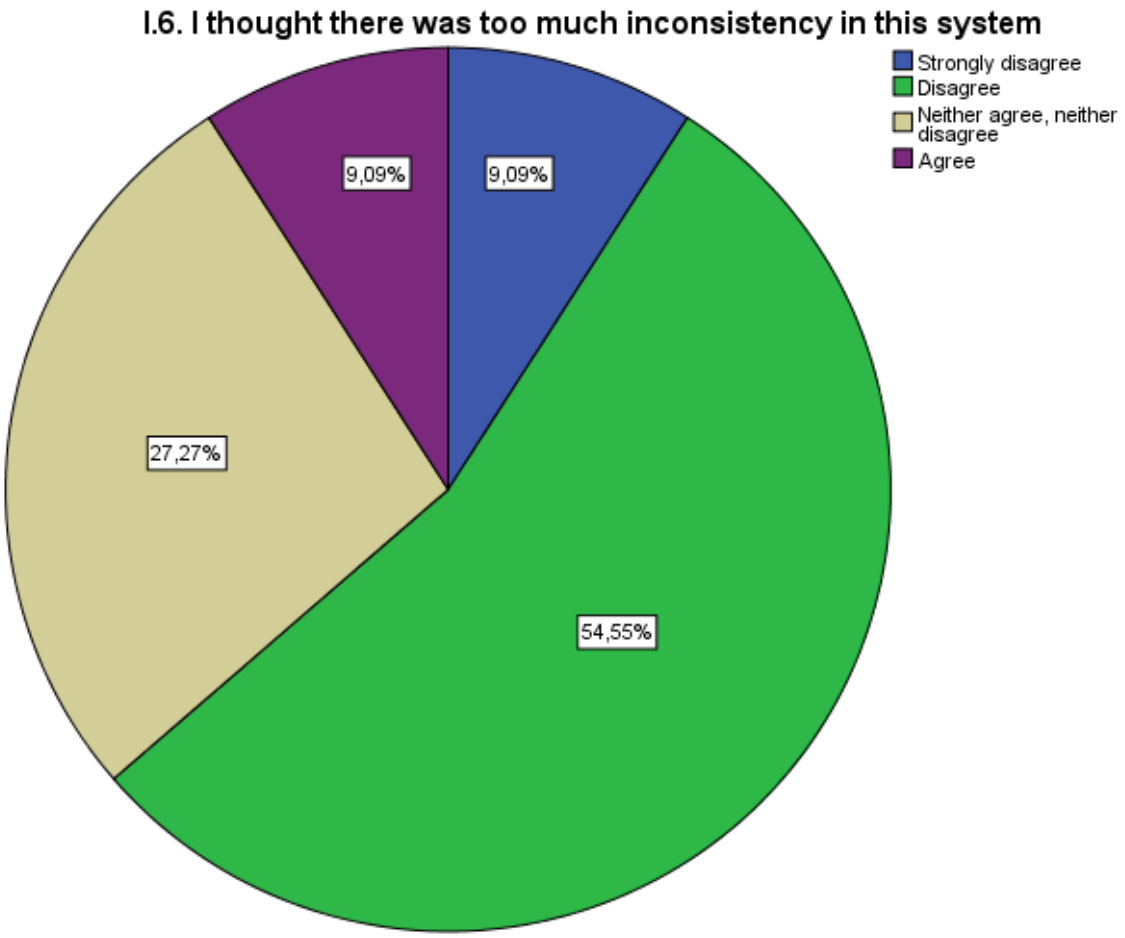
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Neither agree, neither disagree	4	36,4	36,4	36,4
	Agree	6	54,5	54,5	90,9
	Strongly agree	1	9,1	9,1	100,0
	Total	11	100,0	100,0	



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

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

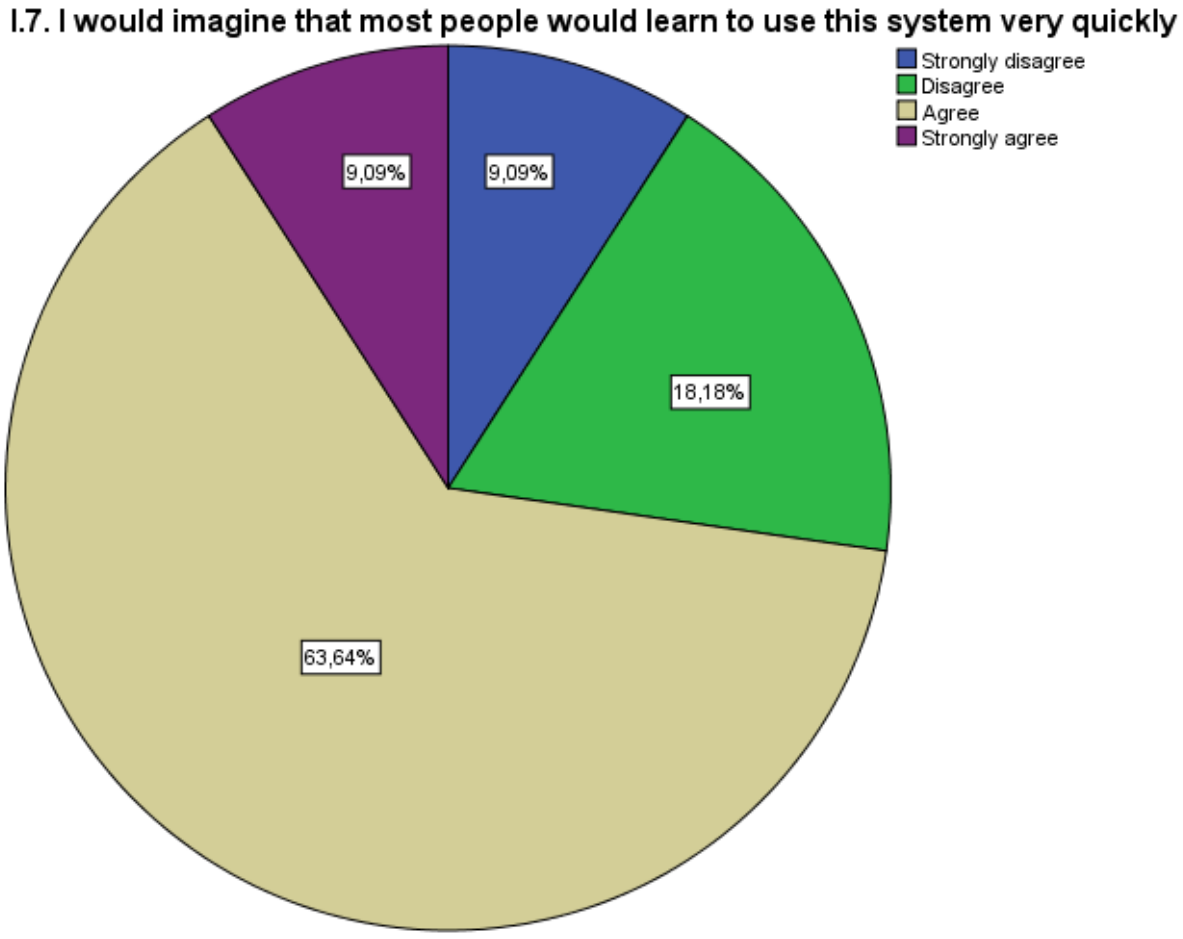
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	1	9,1	9,1	9,1
	Disagree	6	54,5	54,5	63,6
	Neither agree, neither disagree	3	27,3	27,3	90,9
	Agree	1	9,1	9,1	100,0
	Total	11	100,0	100,0	



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

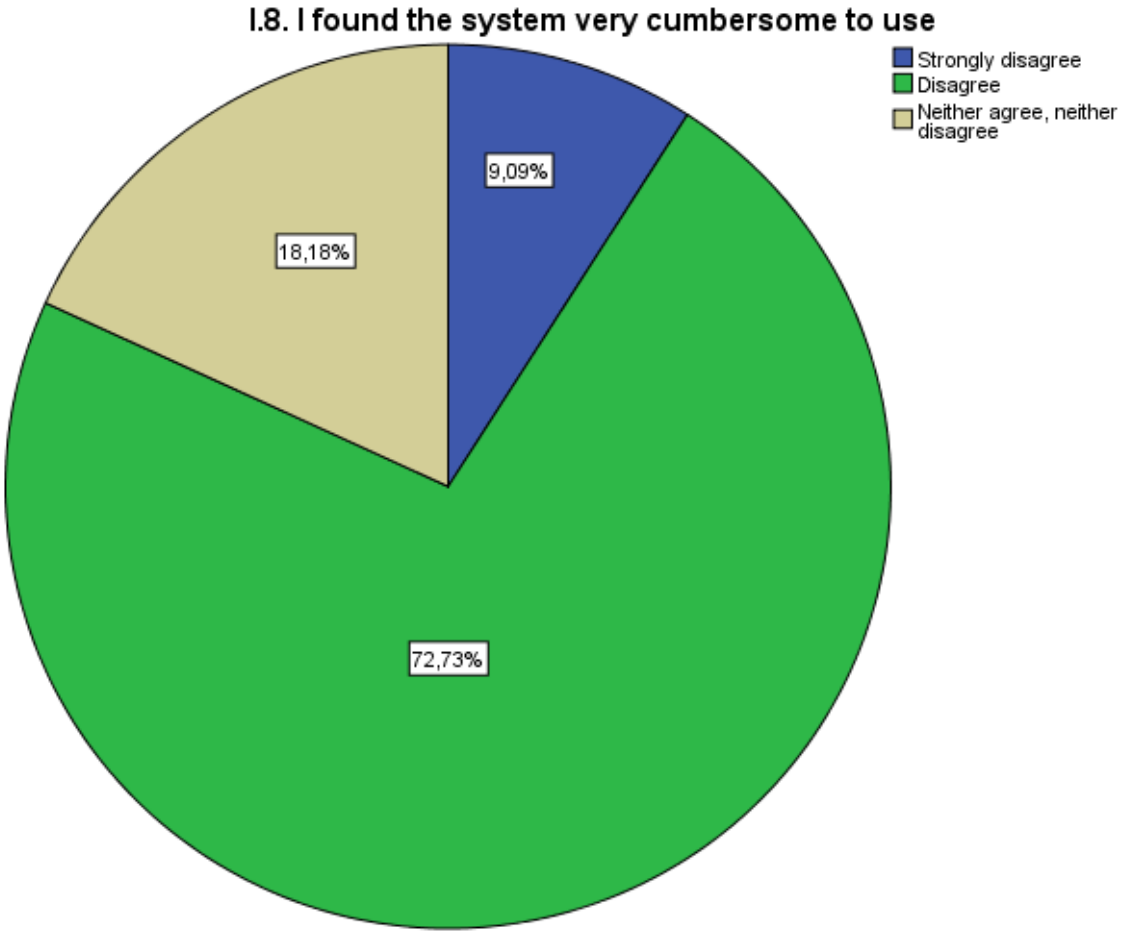
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	1	9,1	9,1	9,1
	Disagree	2	18,2	18,2	27,3
	Agree	7	63,6	63,6	90,9
	Strongly agree	1	9,1	9,1	100,0
	Total	11	100,0	100,0	



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

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

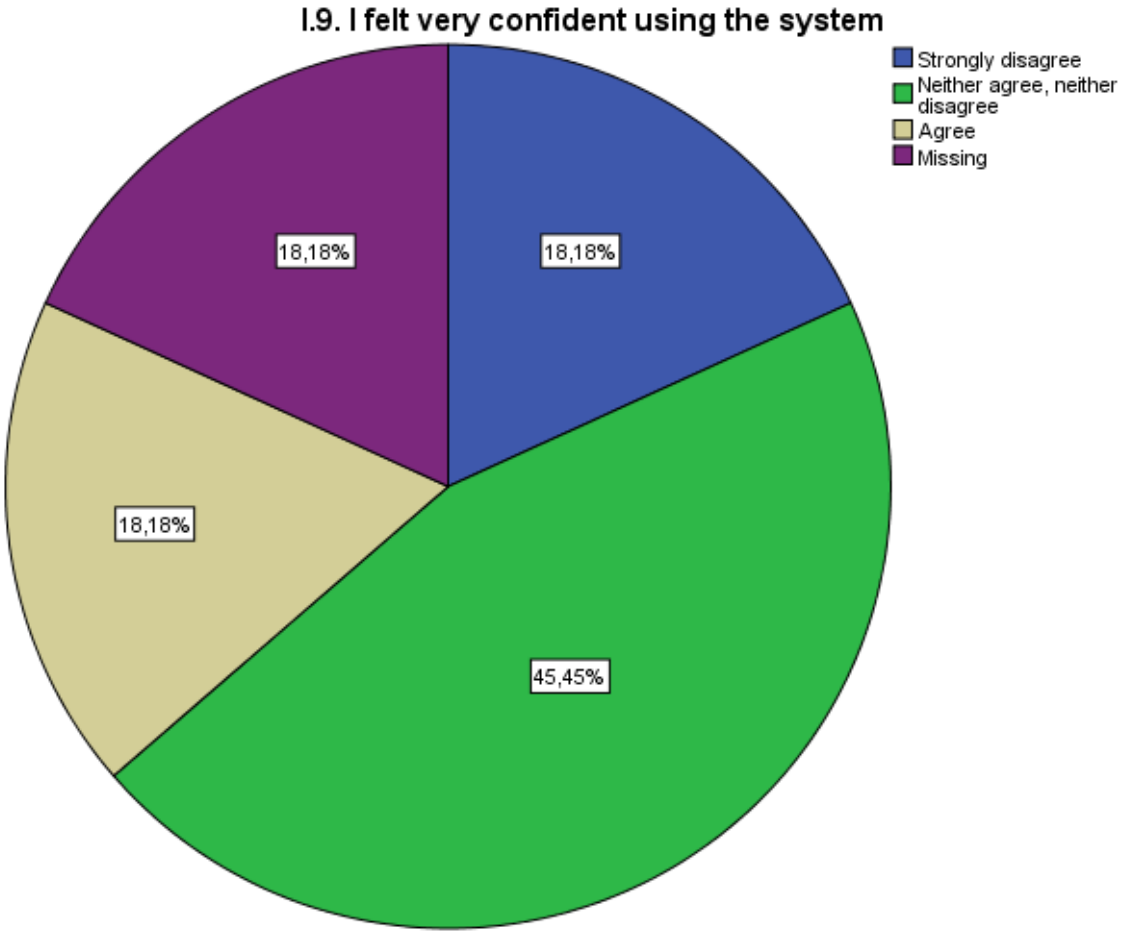
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	1	9,1	9,1	9,1
	Disagree	8	72,7	72,7	81,8
	Neither agree, neither disagree	2	18,2	18,2	100,0
	Total	11	100,0	100,0	



I.9. I felt very confident using the system

I.9. I felt very confident using the system

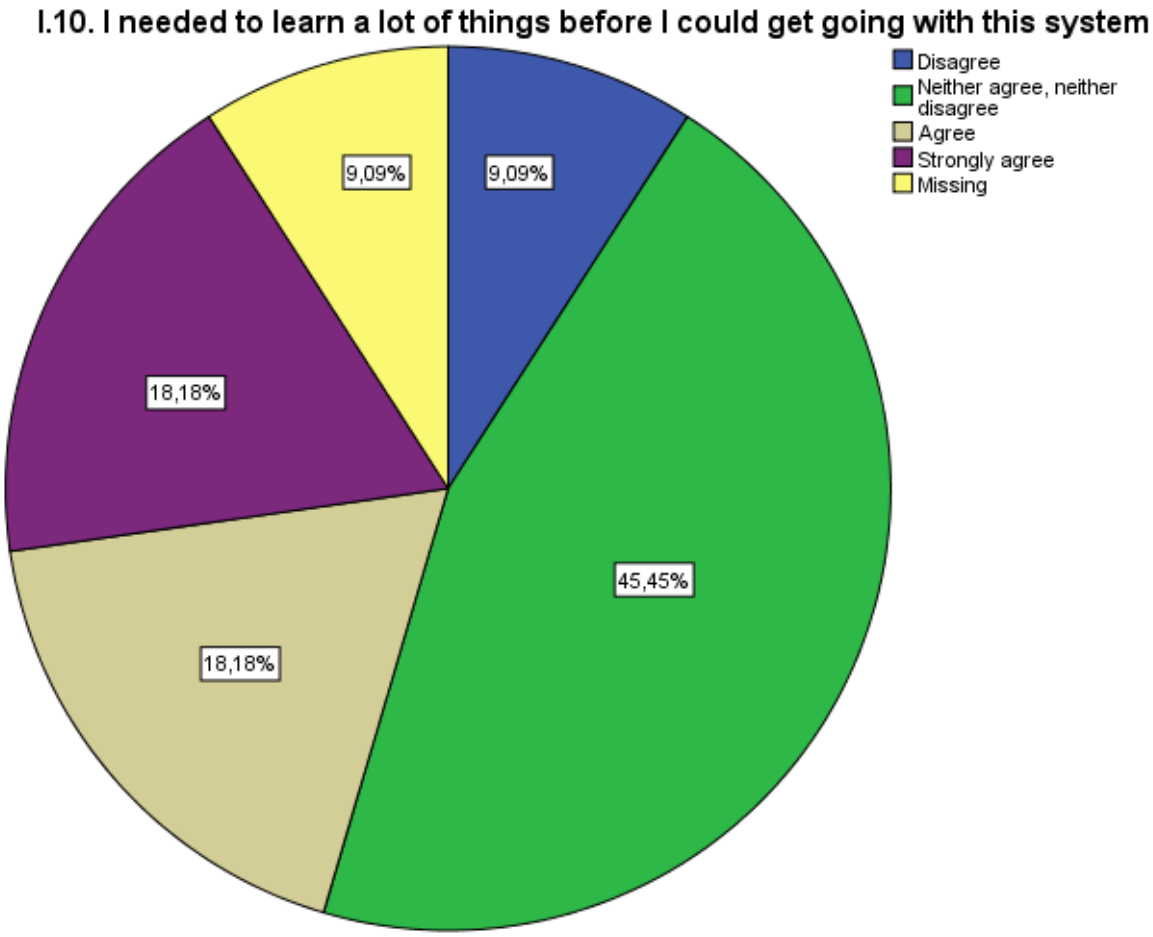
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	2	18,2	22,2	22,2
	Neither agree, neither disagree	5	45,5	55,6	77,8
	Agree	2	18,2	22,2	100,0
	Total	9	81,8	100,0	
Missing	System	2	18,2		
Total		11	100,0		



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
Valid	Disagree	1	9,1	10,0	10,0
	Neither agree, neither disagree	5	45,5	50,0	60,0
	Agree	2	18,2	20,0	80,0
	Strongly agree	2	18,2	20,0	100,0
	Total	10	90,9	100,0	
Missing	System	1	9,1		
Total		11	100,0		



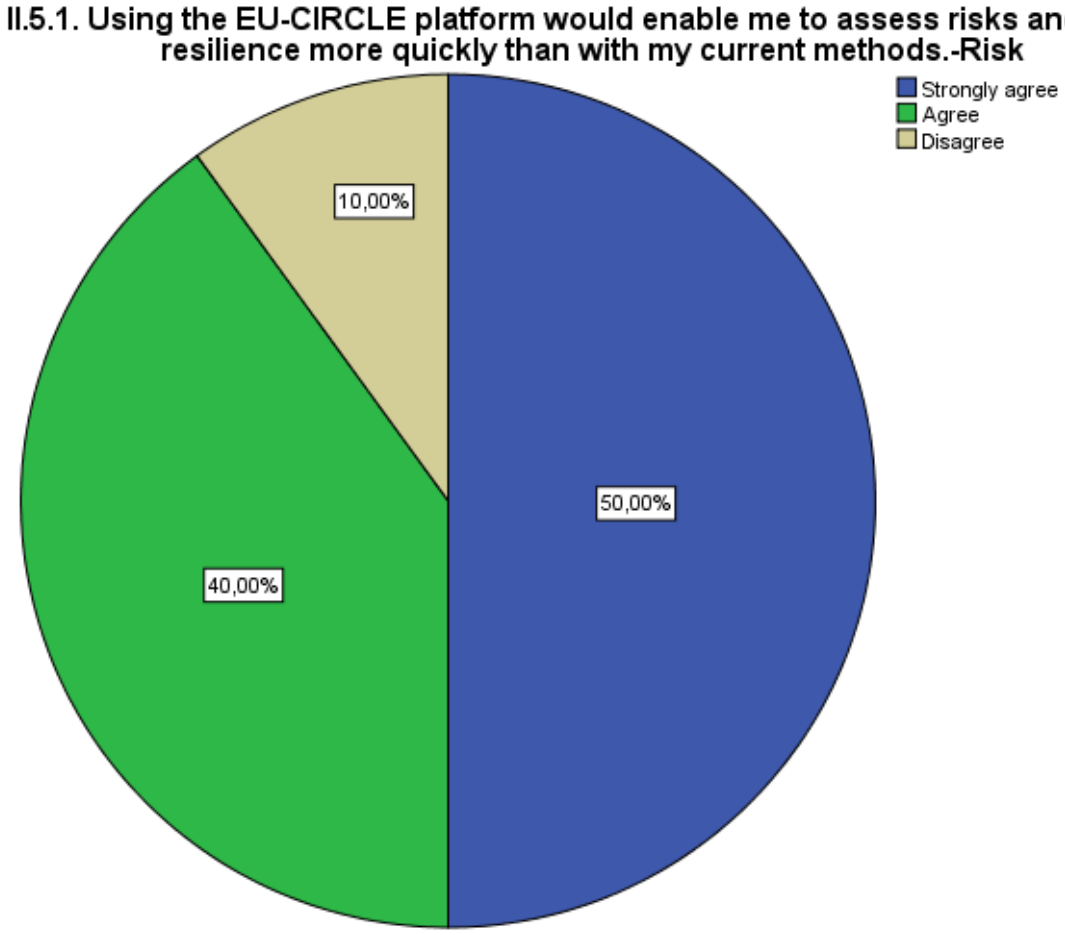
System Usability Scale Means
(Low score indicate strong average disagreement while high scores indicate strong average agreement to the responding statement)

I.1. I think that I would like to use this system frequently	3,91
I.5. I found the various functions in this system were well integrated	3,73
I.10. I needed to learn a lot of things before I could get going with this system	3,50
I.7. I would imagine that most people would learn to use this system very quickly	3,45
I.3. I thought the system was easy to use	3,36
I.4. I think that I would need the support of a technical person to be able to use this system	3,27
I.9. I felt very confident using the system	2,78
I.6. I thought there was too much inconsistency in this system	2,36
I.2. I found the system unnecessarily complex	2,18
I.8. I found the system very cumbersome to use	2,09

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

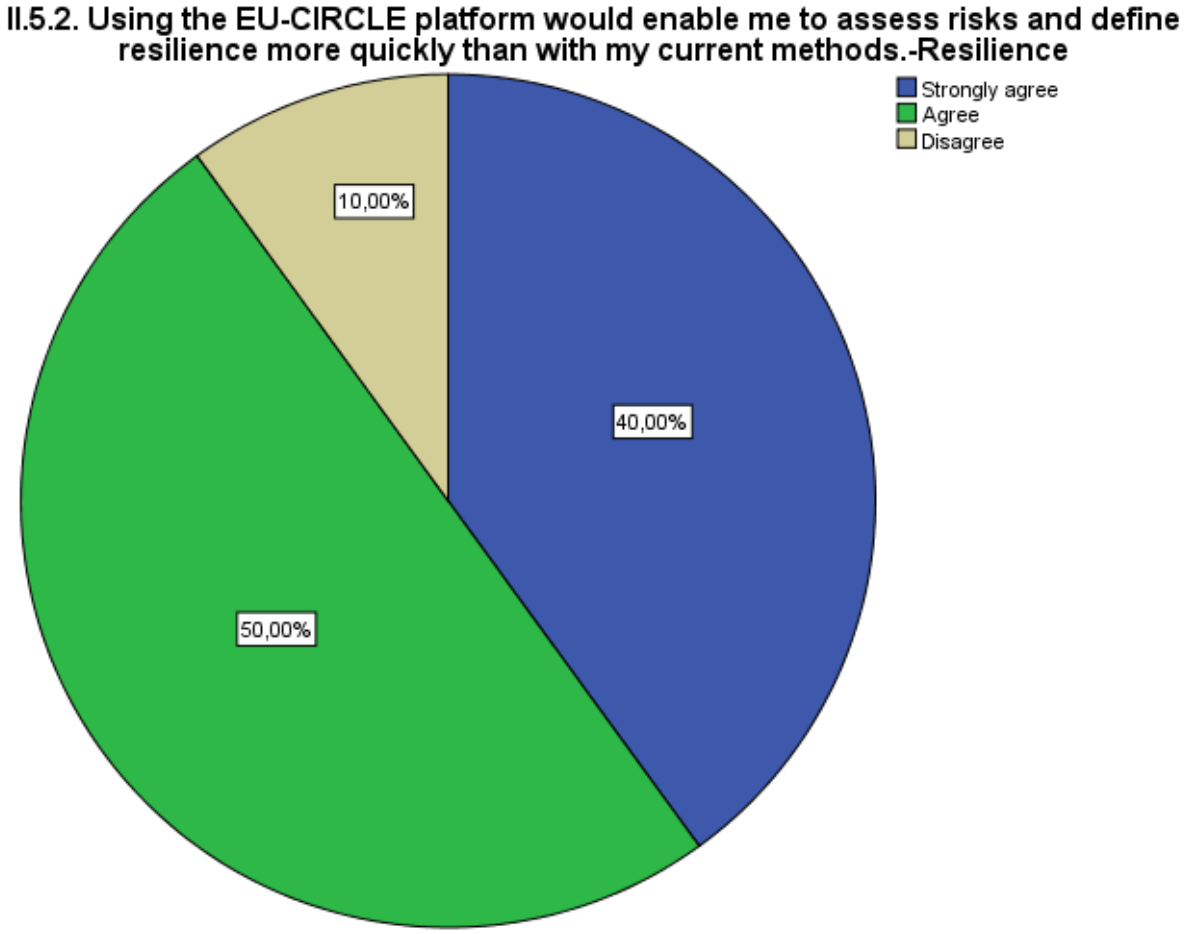
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	5	50,0	50,0	50,0
	Agree	4	40,0	40,0	90,0
	Disagree	1	10,0	10,0	100,0
	Total	10	100,0	100,0	



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

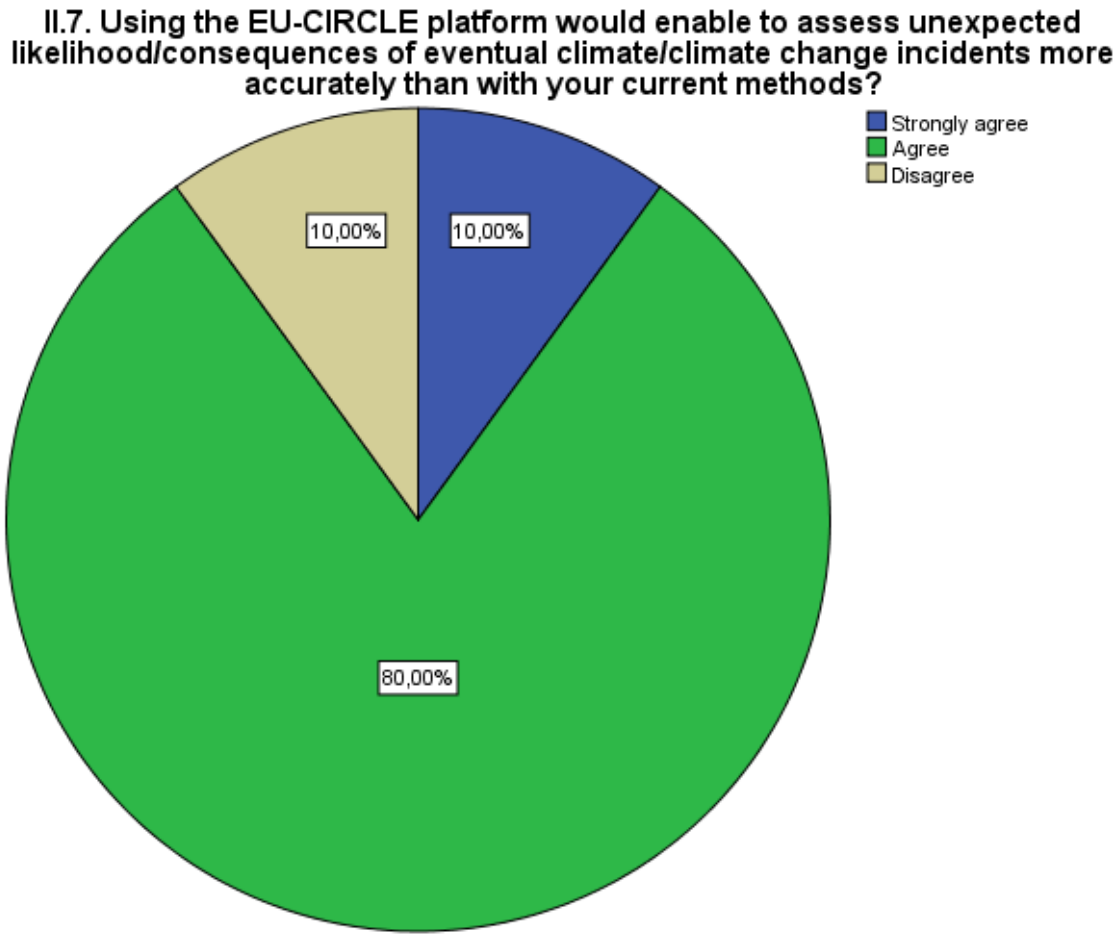
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	4	40,0	40,0	40,0
	Agree	5	50,0	50,0	90,0
	Disagree	1	10,0	10,0	100,0
	Total	10	100,0	100,0	



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?

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?

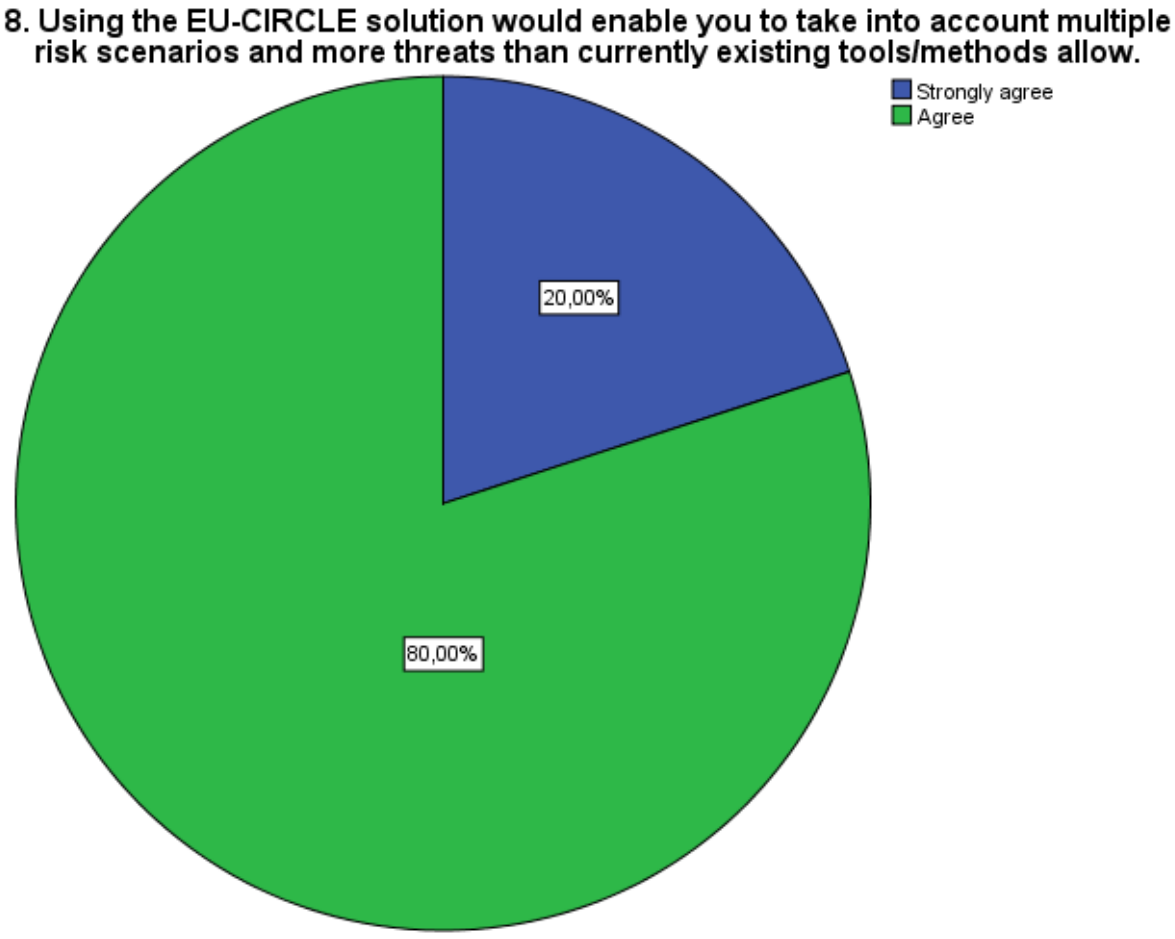
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	1	10,0	10,0	10,0
	Agree	8	80,0	80,0	90,0
	Disagree	1	10,0	10,0	100,0
	Total	10	100,0	100,0	



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.

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.

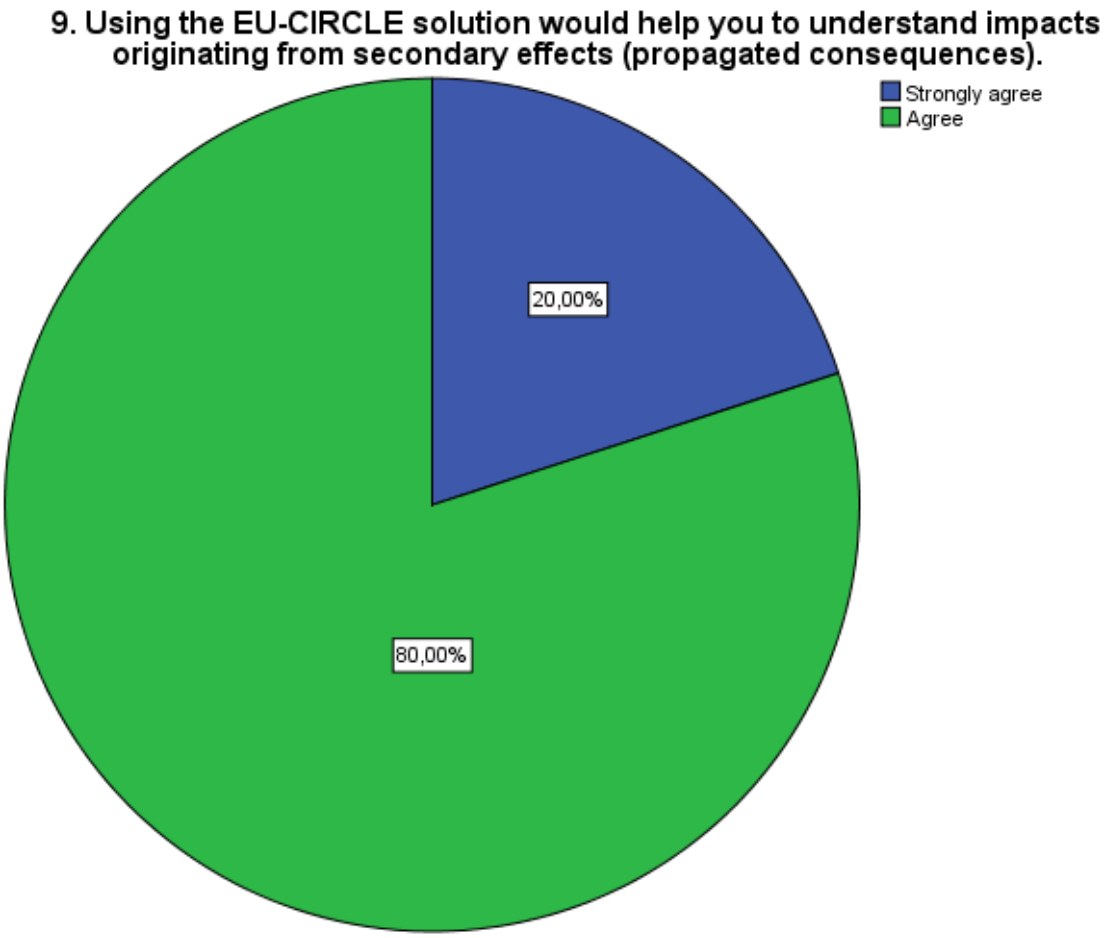
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	2	20,0	20,0	20,0
	Agree	8	80,0	80,0	100,0
	Total	10	100,0	100,0	



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

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

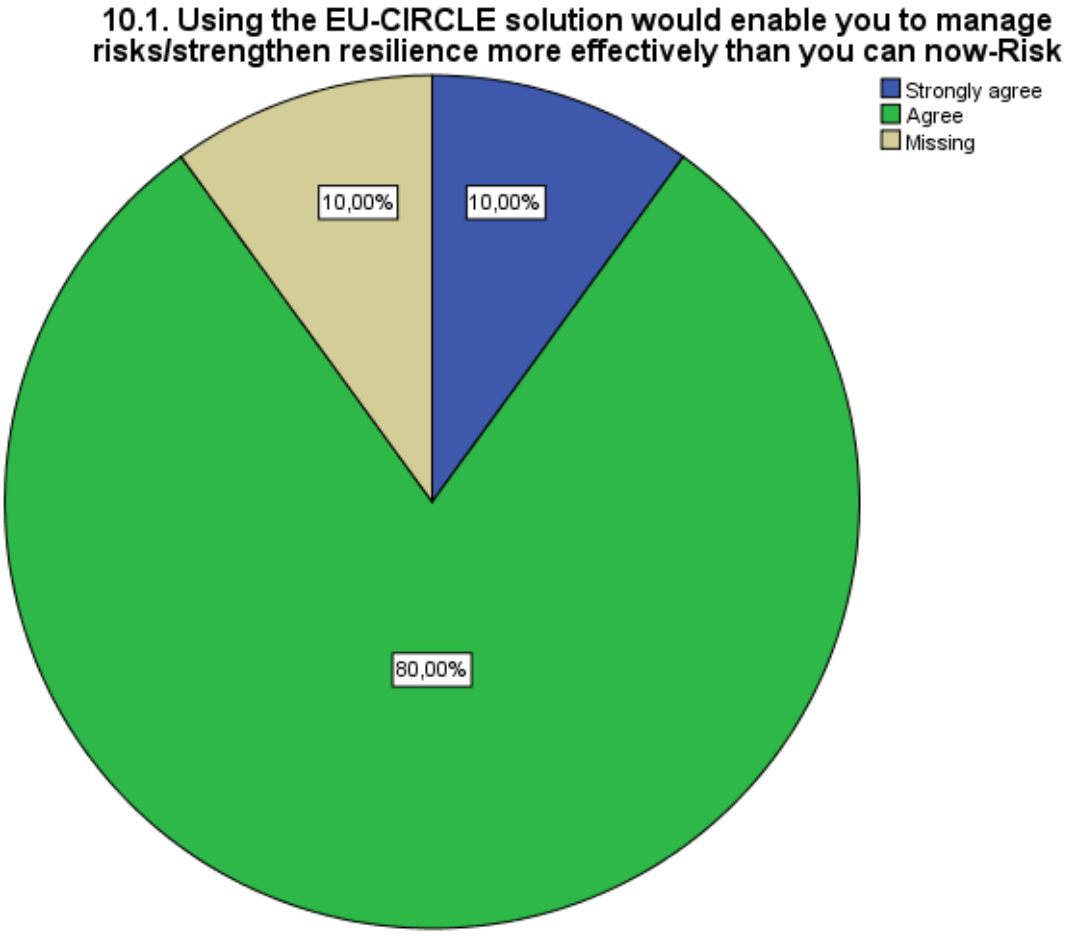
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	2	20,0	20,0	20,0
	Agree	8	80,0	80,0	100,0
	Total	10	100,0	100,0	



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

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

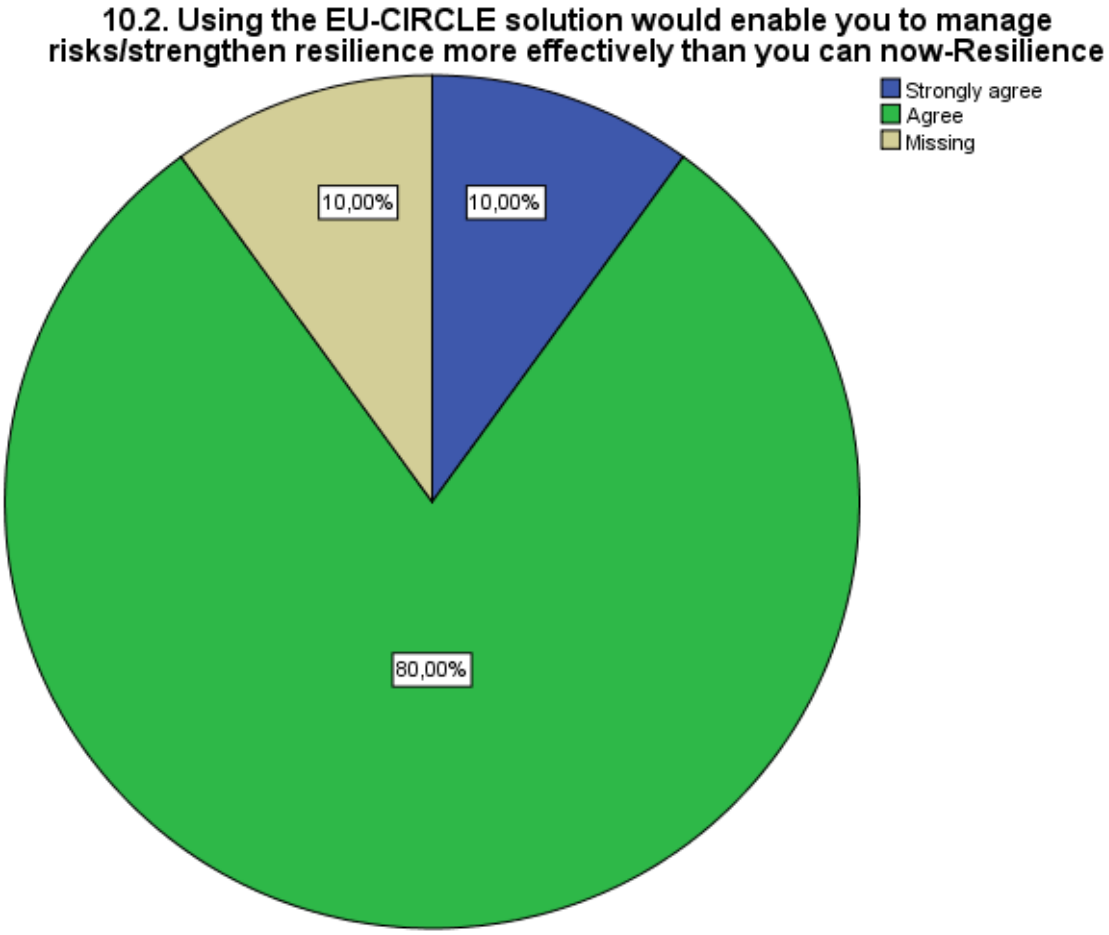
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	1	10,0	11,1	11,1
	Agree	8	80,0	88,9	100,0
	Total	9	90,0	100,0	
Missing	System	1	10,0		
Total		10	100,0		



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

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

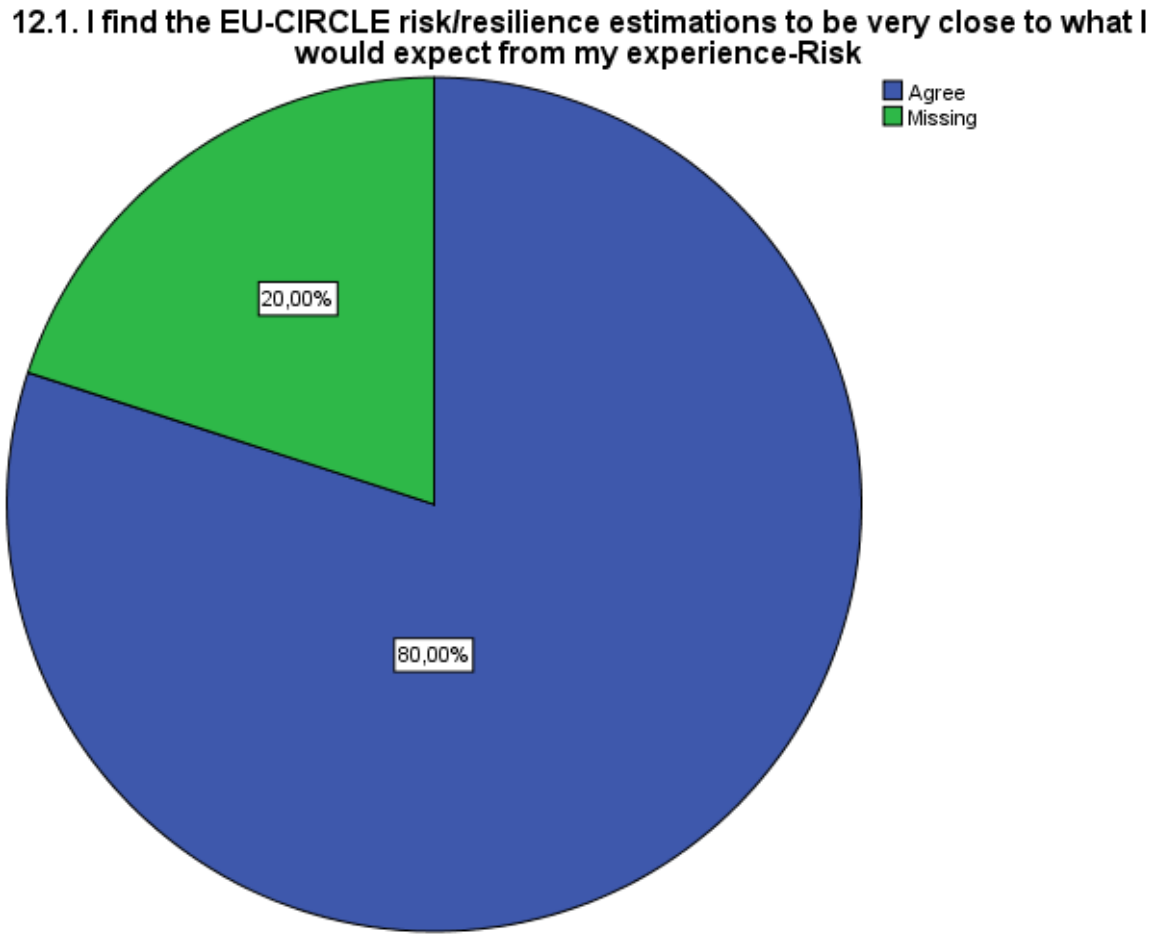
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	1	10,0	11,1	11,1
	Agree	8	80,0	88,9	100,0
	Total	9	90,0	100,0	
Missing	System	1	10,0		
Total		10	100,0		



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

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

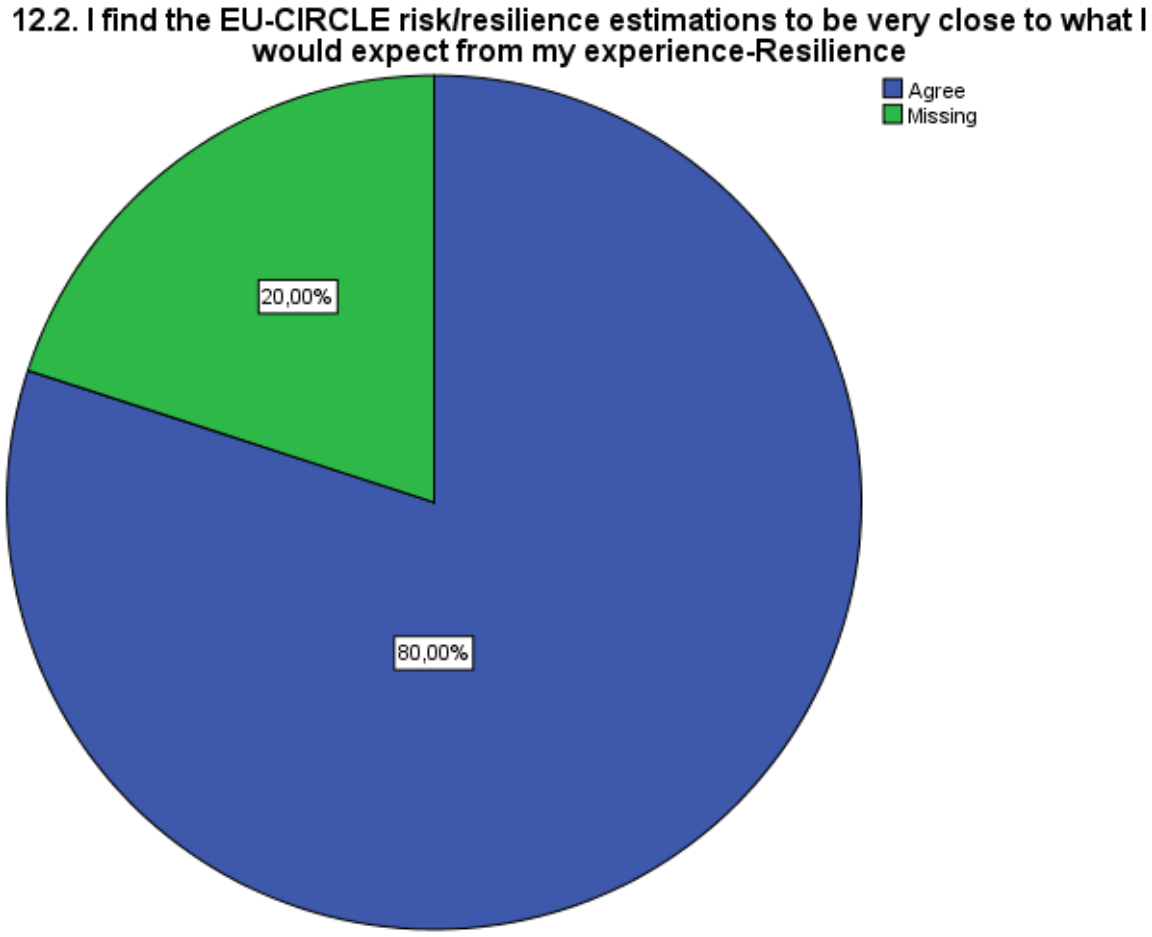
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	8	80,0	100,0	100,0
Missing	System	2	20,0		
Total		10	100,0		



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

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

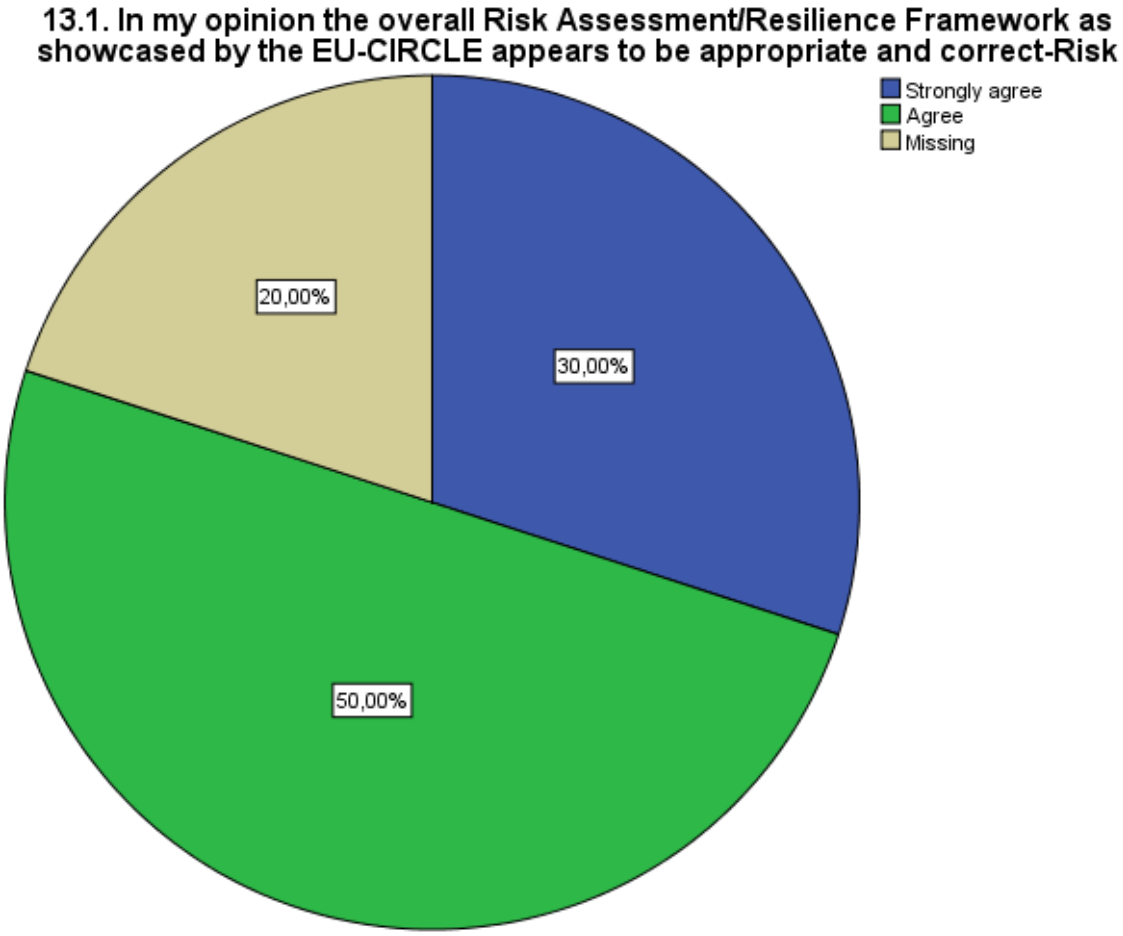
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	8	80,0	100,0	100,0
Missing	System	2	20,0		
Total		10	100,0		



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

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

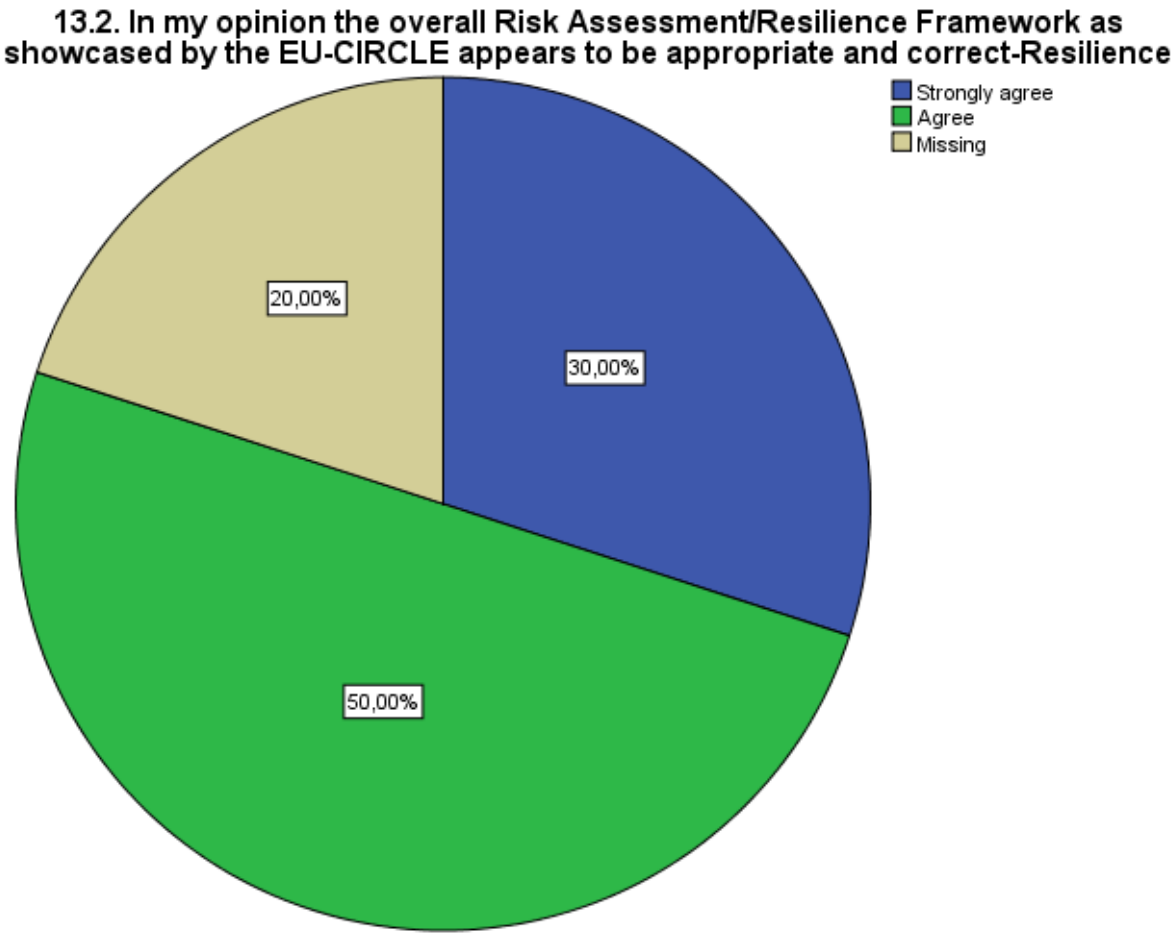
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	3	30,0	37,5	37,5
	Agree	5	50,0	62,5	100,0
	Total	8	80,0	100,0	
Missing	System	2	20,0		
Total		10	100,0		



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

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

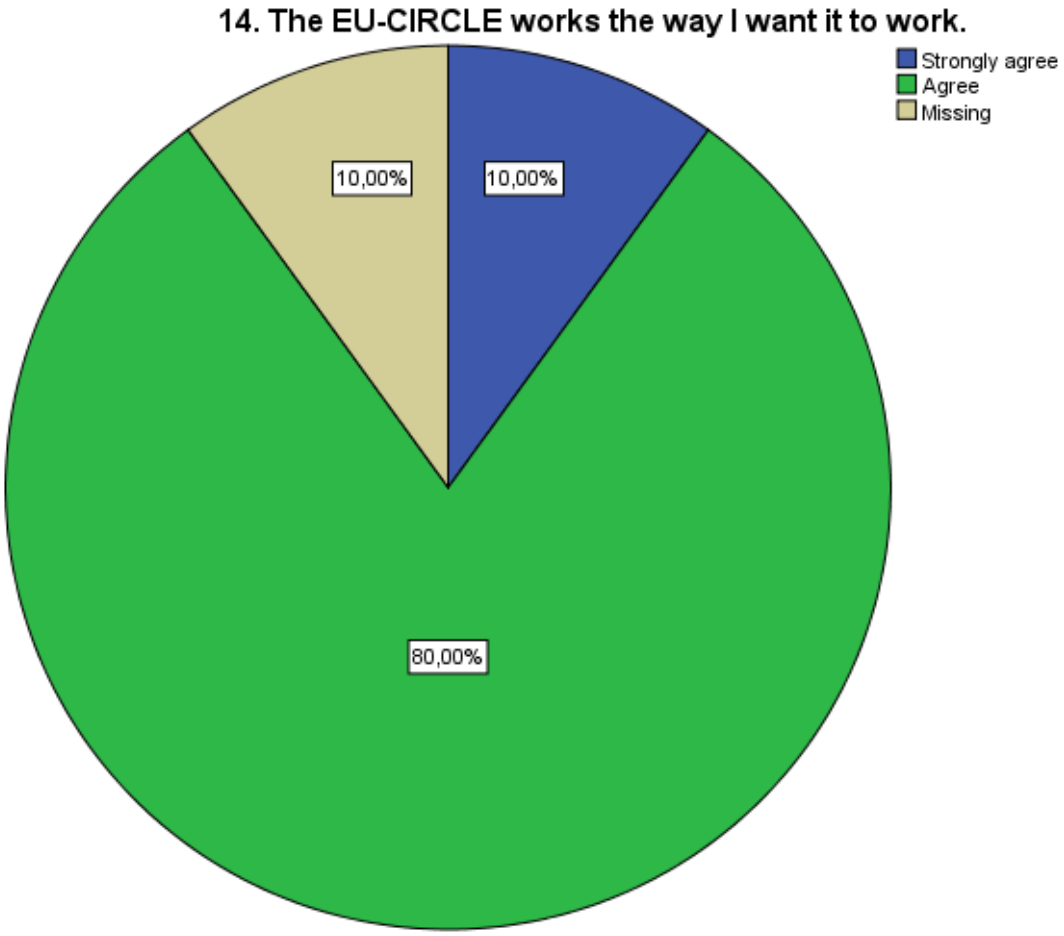
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	3	30,0	37,5	37,5
	Agree	5	50,0	62,5	100,0
	Total	8	80,0	100,0	
Missing	System	2	20,0		
Total		10	100,0		



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

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

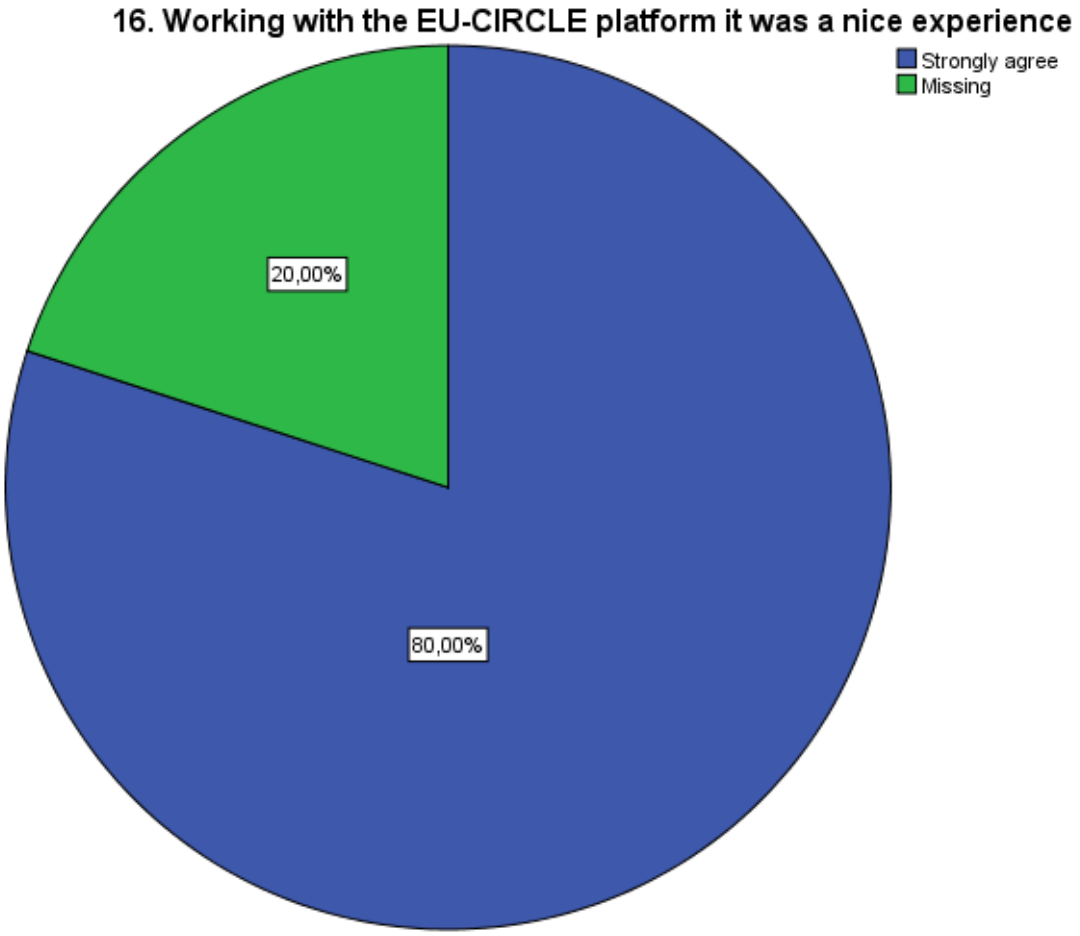
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	2	20,0	25,0	25,0
	Agree	6	60,0	75,0	100,0
	Total	8	80,0	100,0	
Missing	System	2	20,0		
Total		10	100,0		



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

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

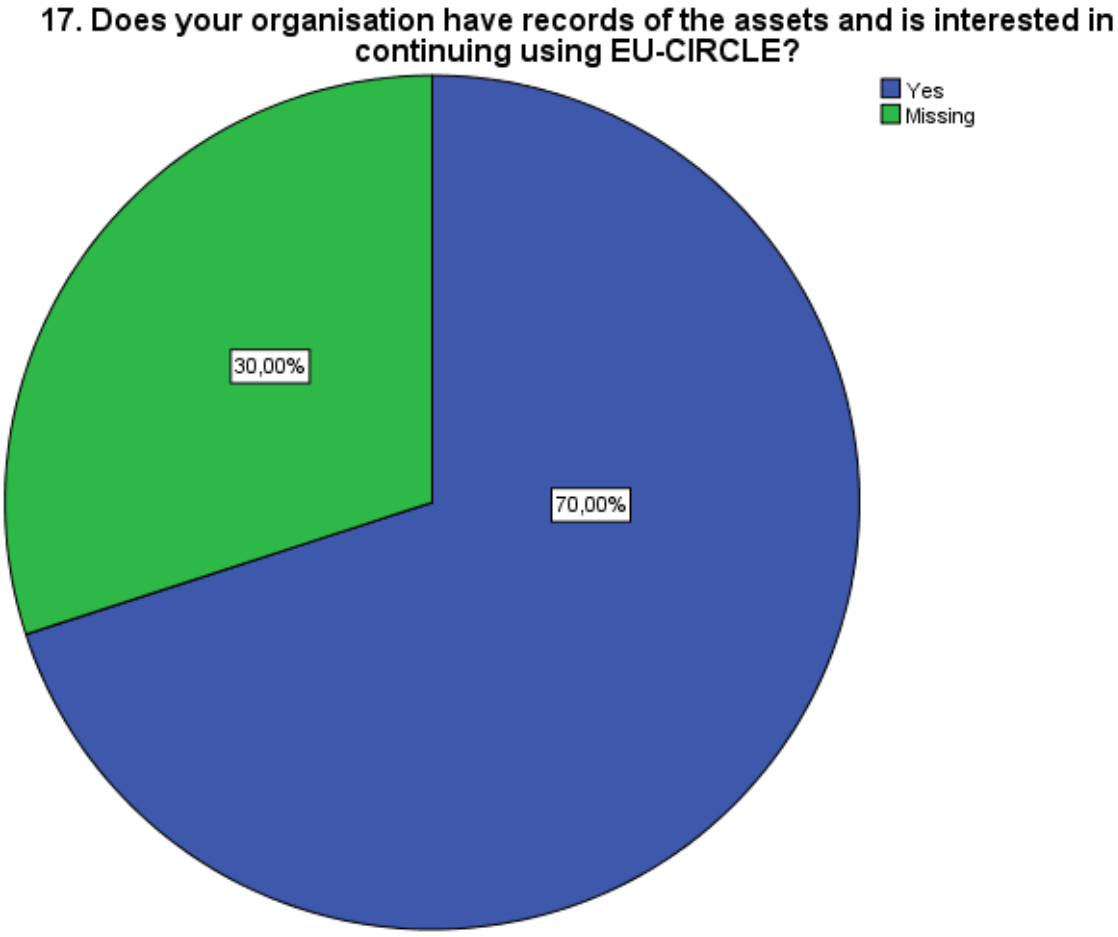
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	1	10,0	11,1	11,1
	Agree	8	80,0	88,9	100,0
	Total	9	90,0	100,0	
Missing	System	1	10,0		
Total		10	100,0		



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

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

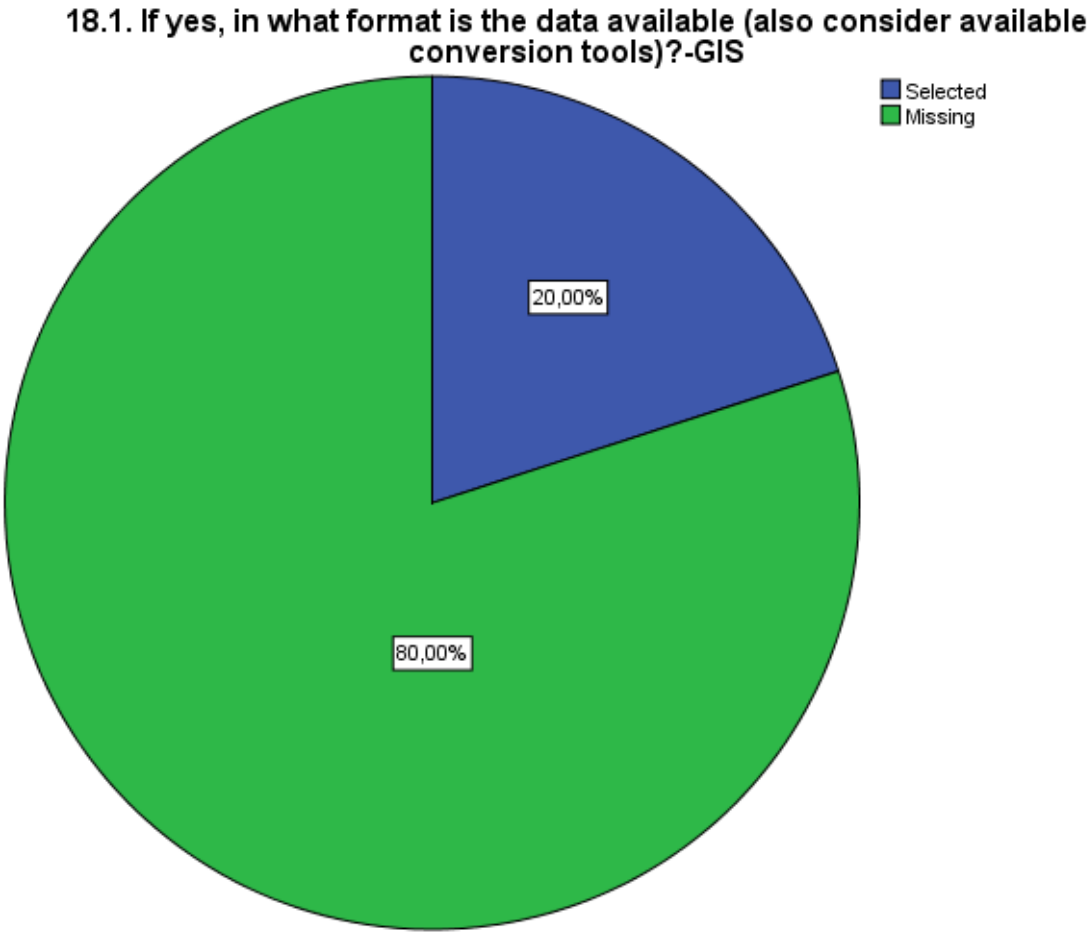
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	7	70,0	100,0	100,0
Missing	System	3	30,0		
Total		10	100,0		



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

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

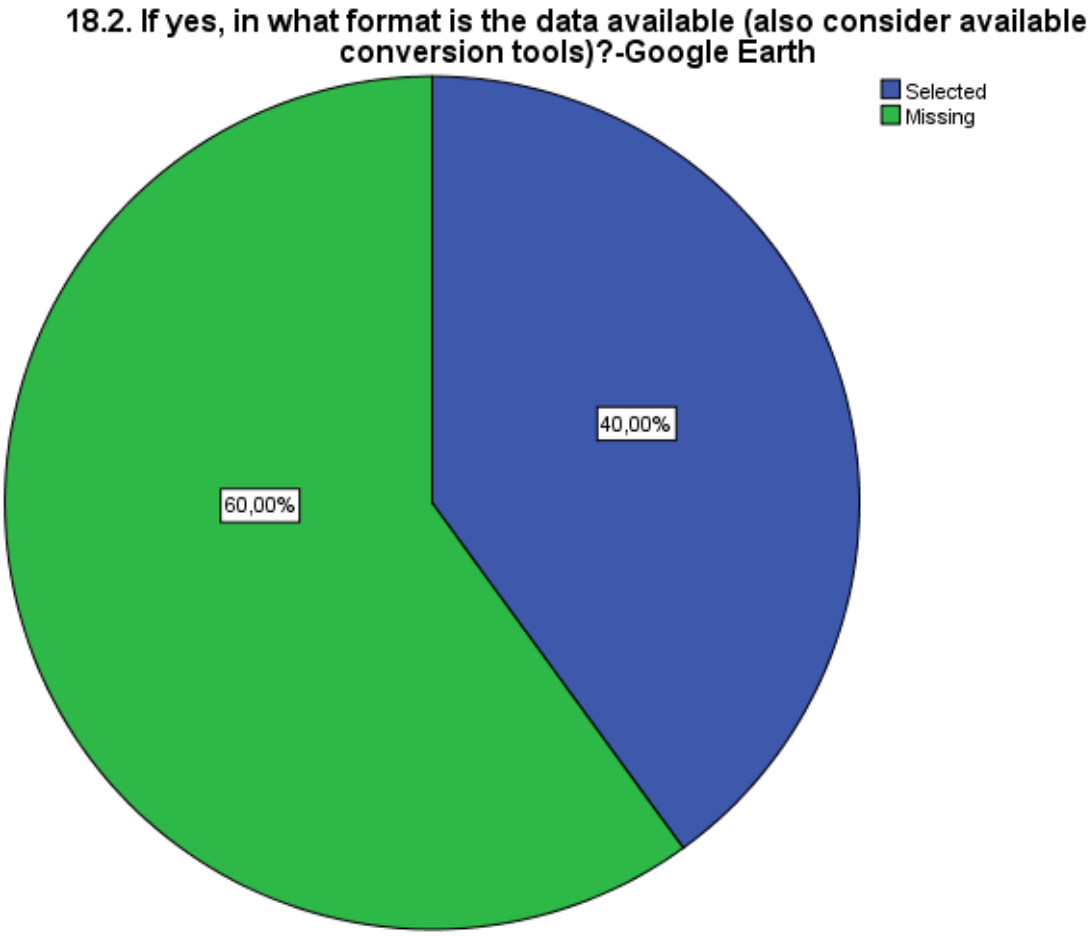
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Selected	8	80,0	100,0	100,0
Missing	System	2	20,0		
Total		10	100,0		



18.2. If yes, in what format is the data available (also consider available conversion tools)?-Google Earth

18.2. If yes, in what format is the data available (also consider available conversion tools)?-Google Earth

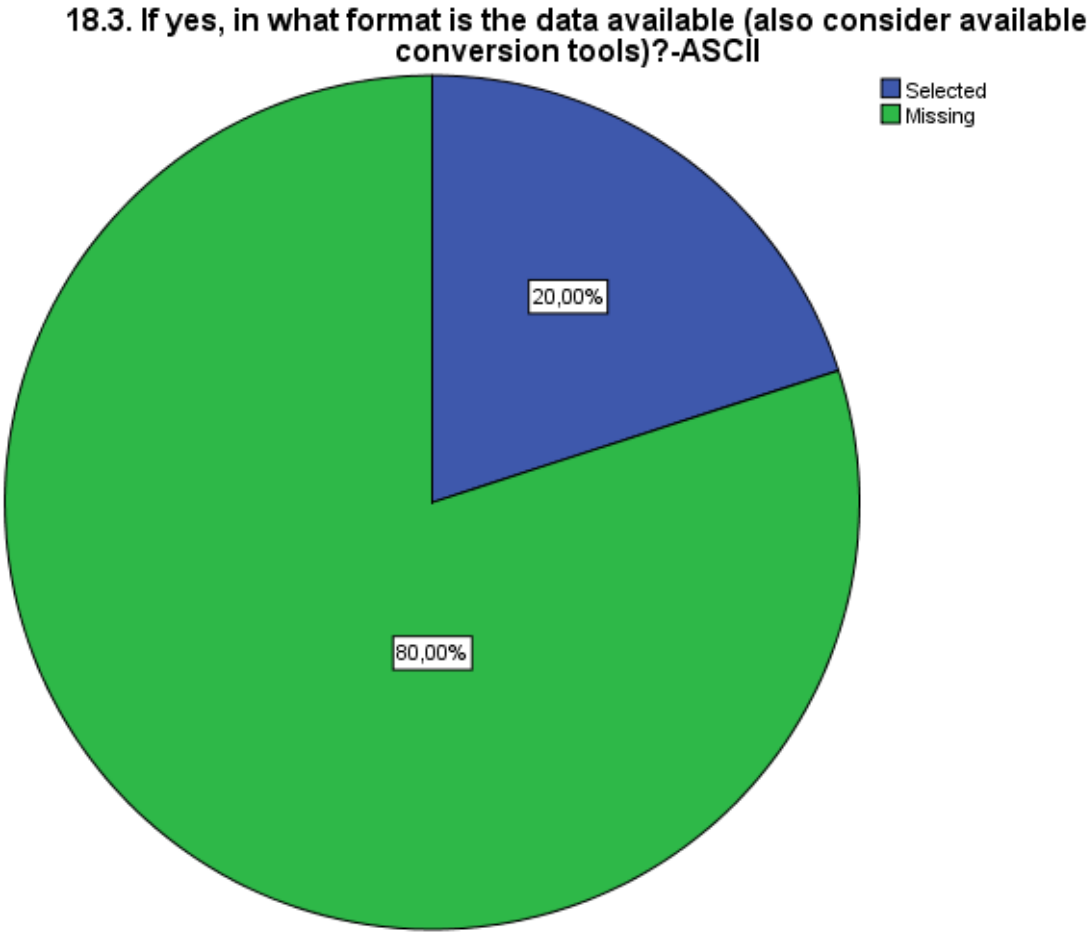
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Selected	4	40,0	100,0	100,0
Missing	System	6	60,0		
Total		10	100,0		



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

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

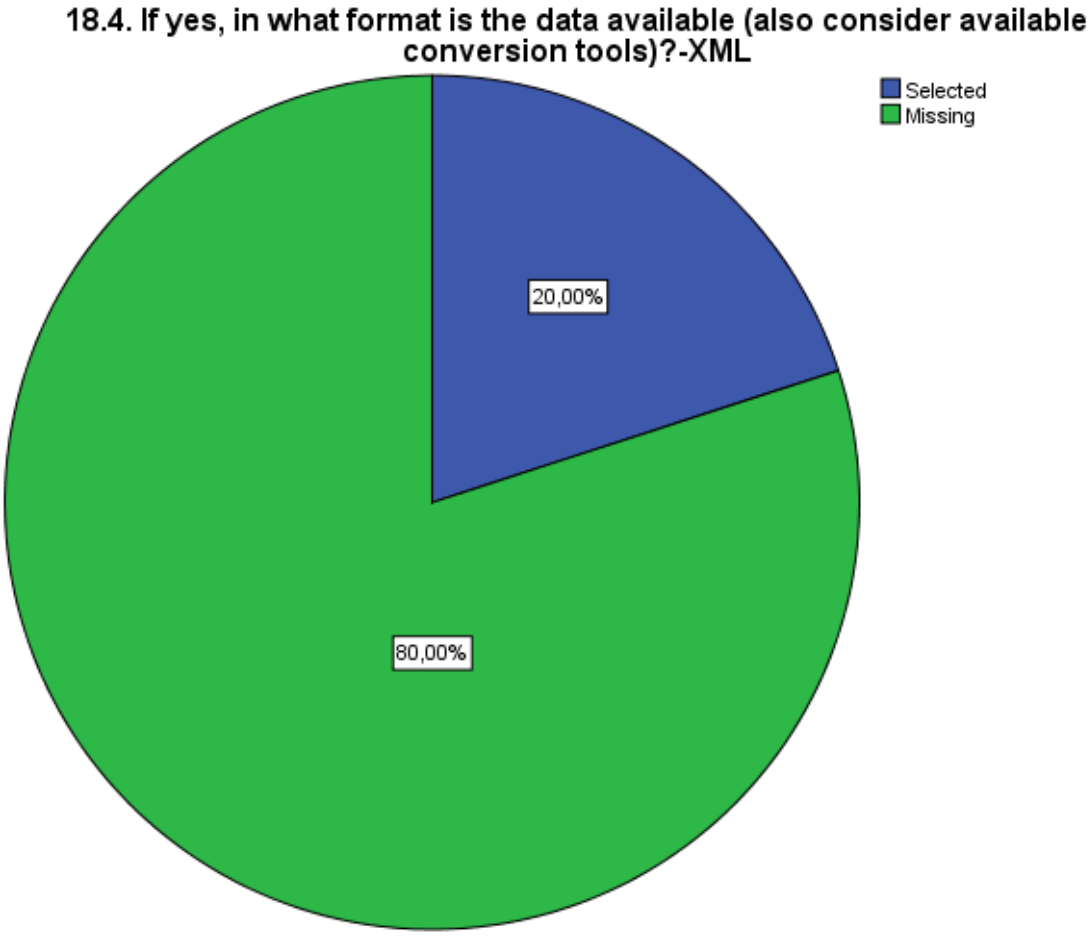
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Selected	2	20,0	100,0	100,0
Missing	System	8	80,0		
Total		10	100,0		



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

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

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Selected	2	20,0	100,0	100,0
Missing	System	8	80,0		
Total		10	100,0		



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

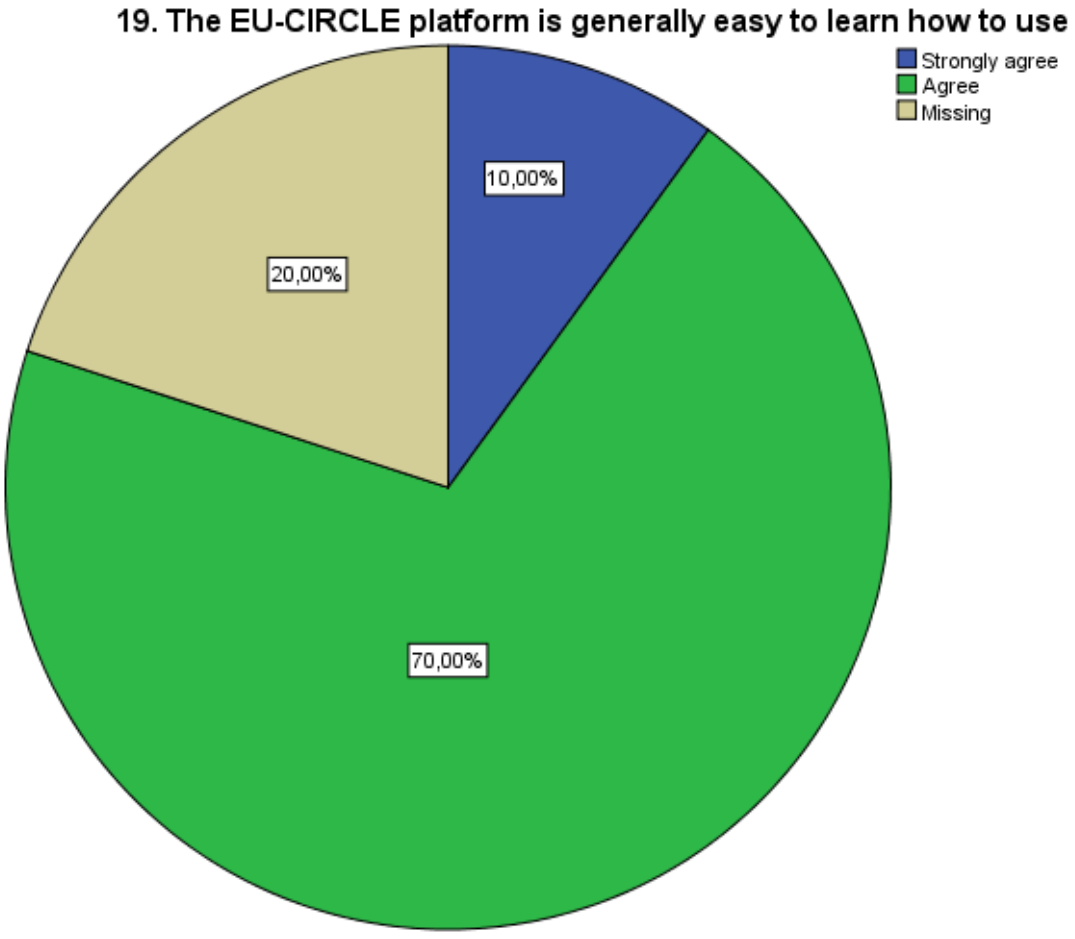
18.5. If yes, in what format is the data available (also consider available conversion tools)?-Other

		Frequency	Percent
Missing	System	10	100,0

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

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

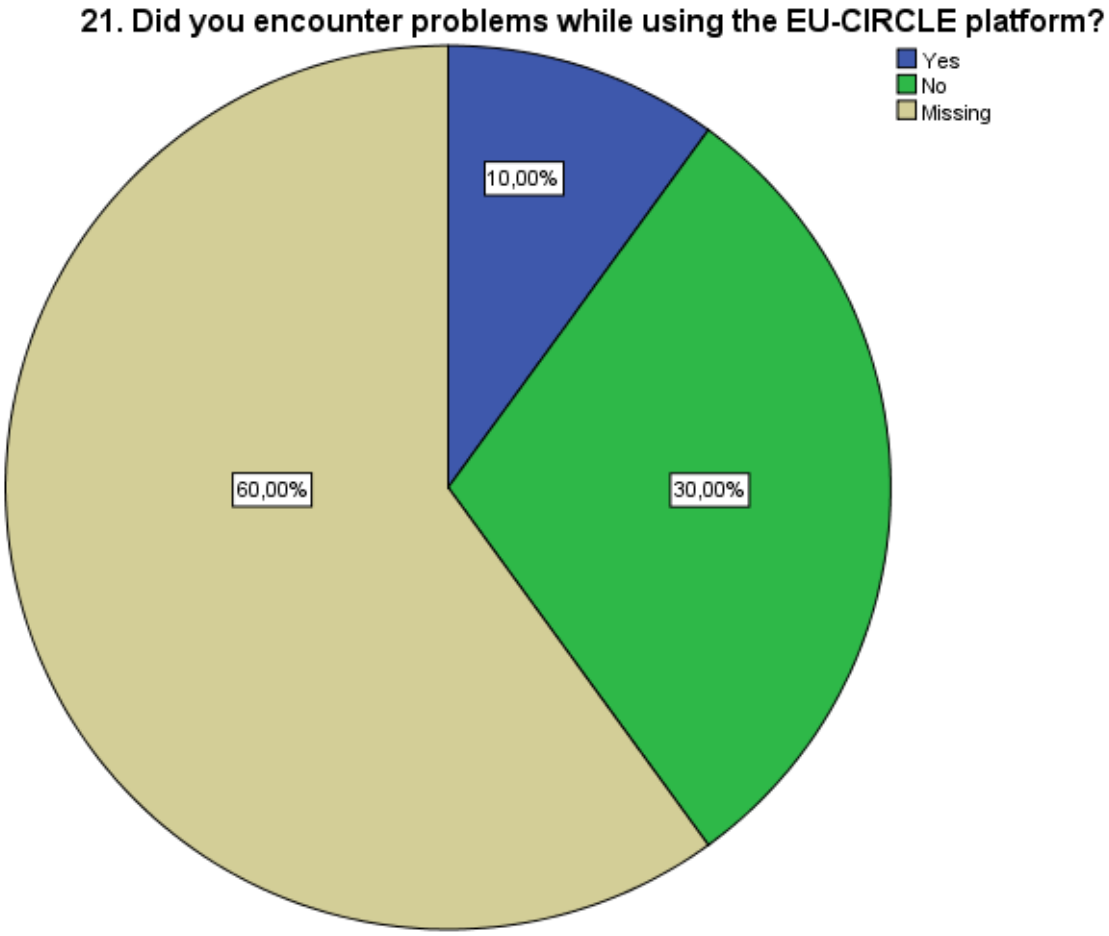
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	1	10,0	12,5	12,5
	Agree	7	70,0	87,5	100,0
	Total	8	80,0	100,0	
Missing	System	2	20,0		
Total		10	100,0		



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

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

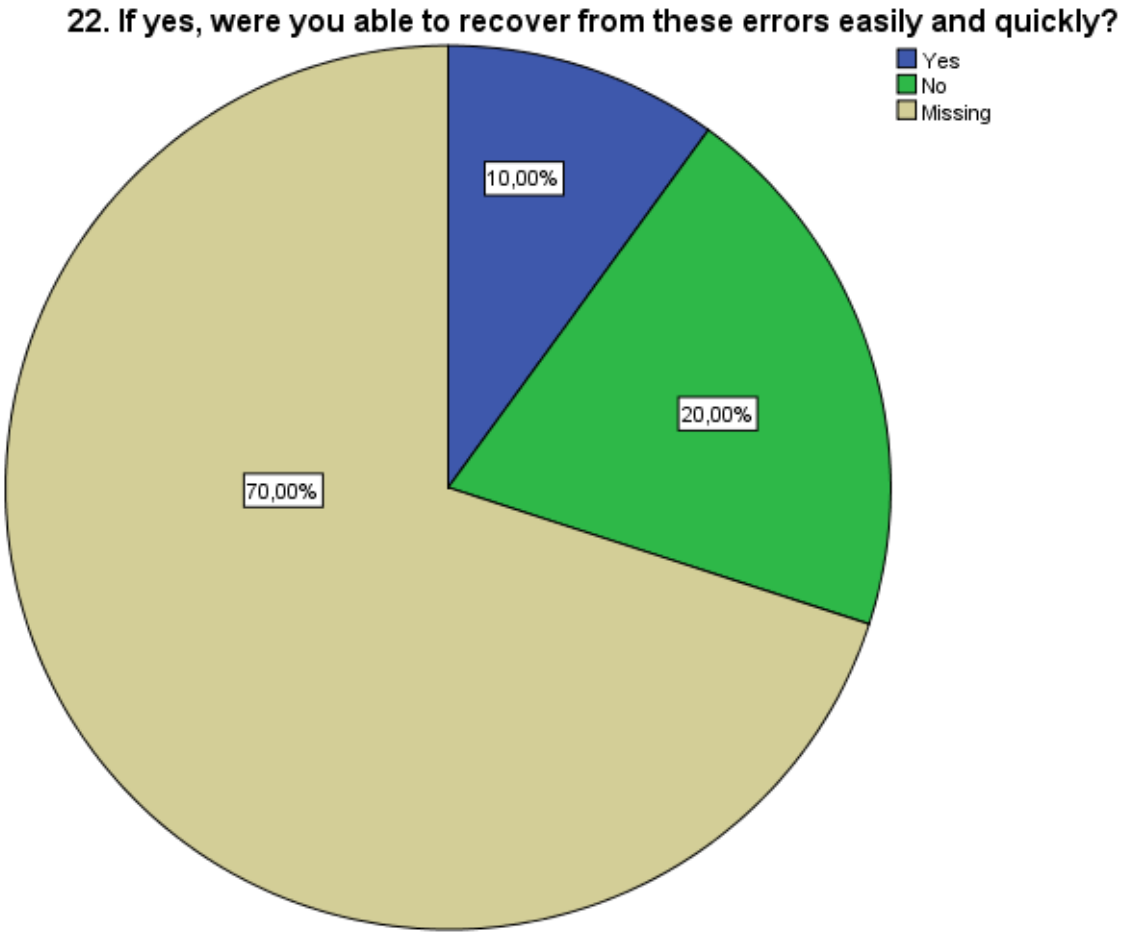
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	1	10,0	25,0	25,0
	No	3	30,0	75,0	100,0
	Total	4	40,0	100,0	
Missing	System	6	60,0		
Total		10	100,0		



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?

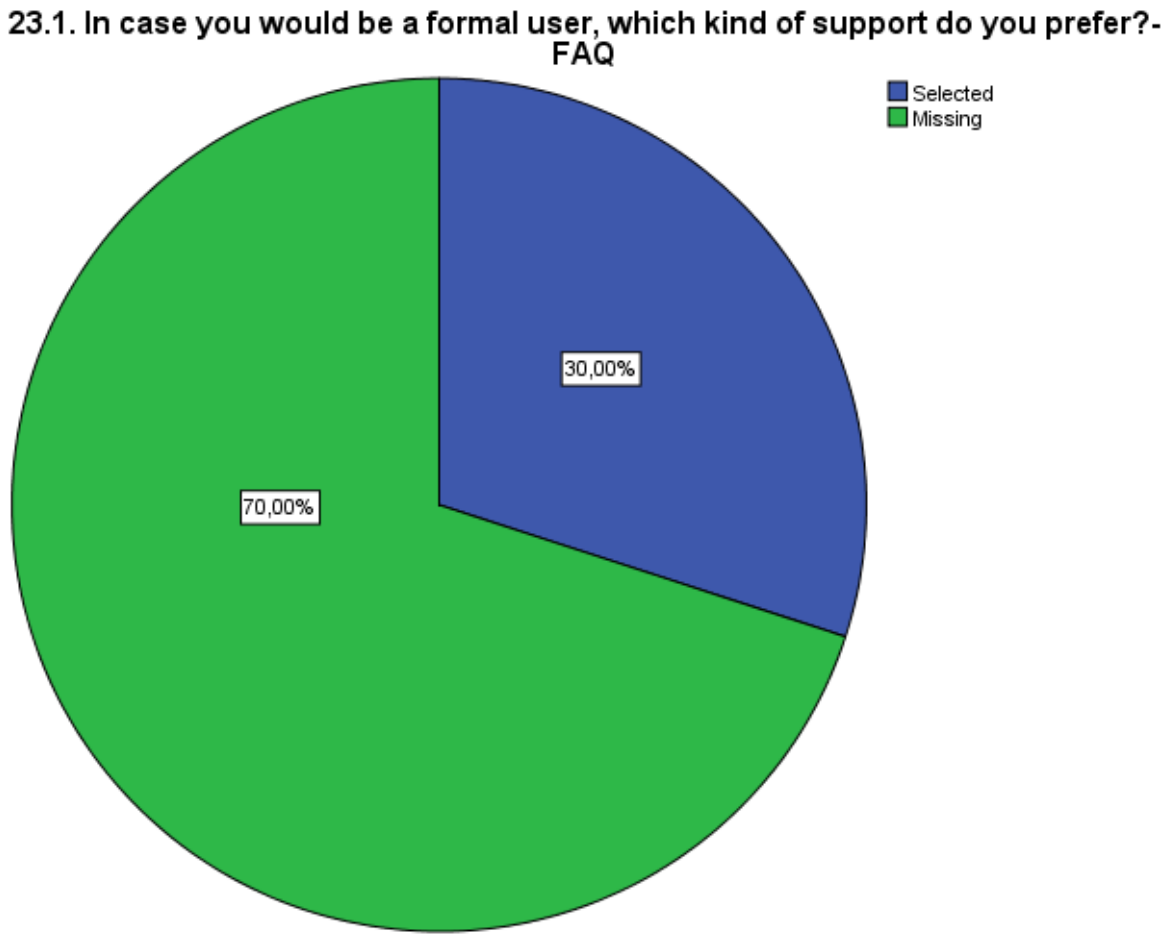
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	1	10,0	33,3	33,3
	No	2	20,0	66,7	100,0
	Total	3	30,0	100,0	
Missing	System	7	70,0		
Total		10	100,0		



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

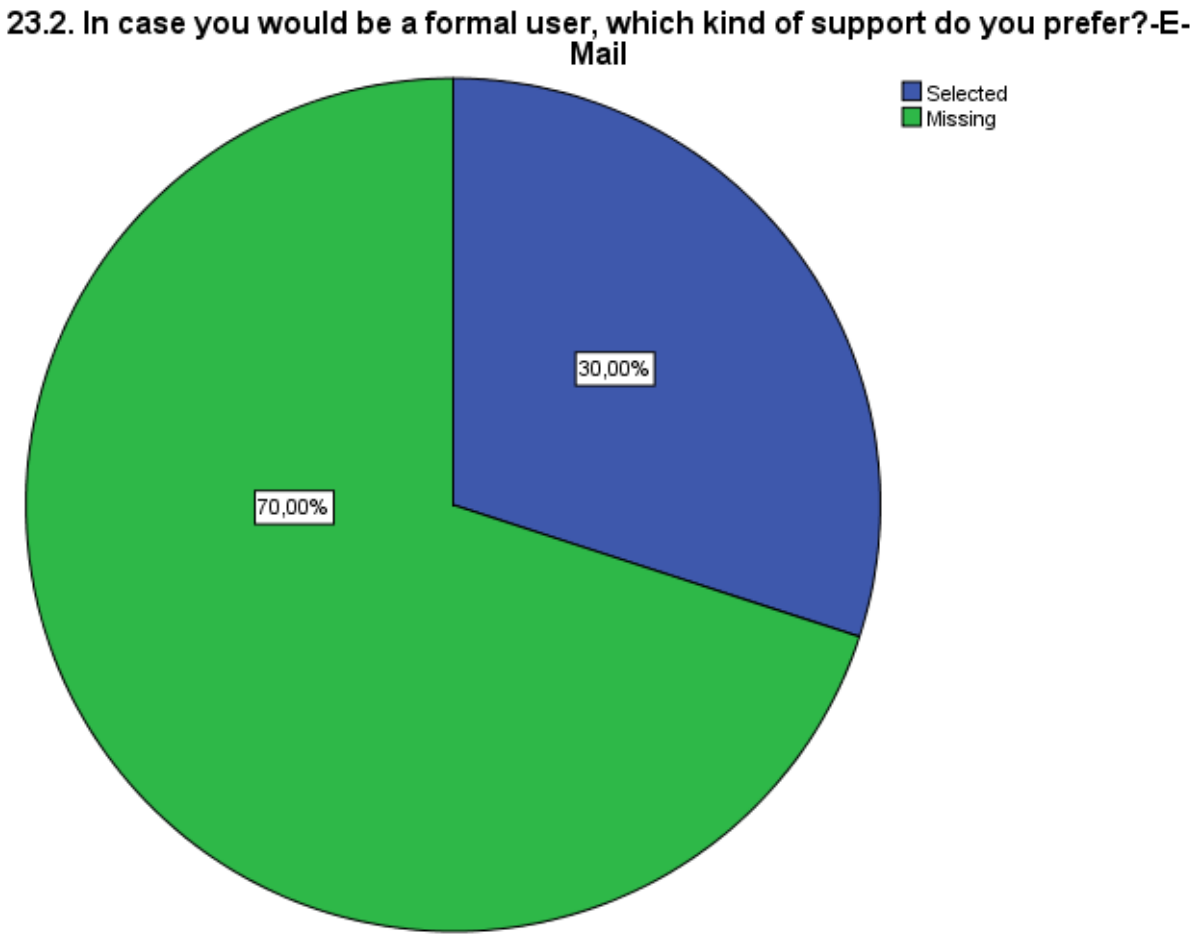
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Selected	3	30,0	100,0	100,0
Missing	System	7	70,0		
Total		10	100,0		



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

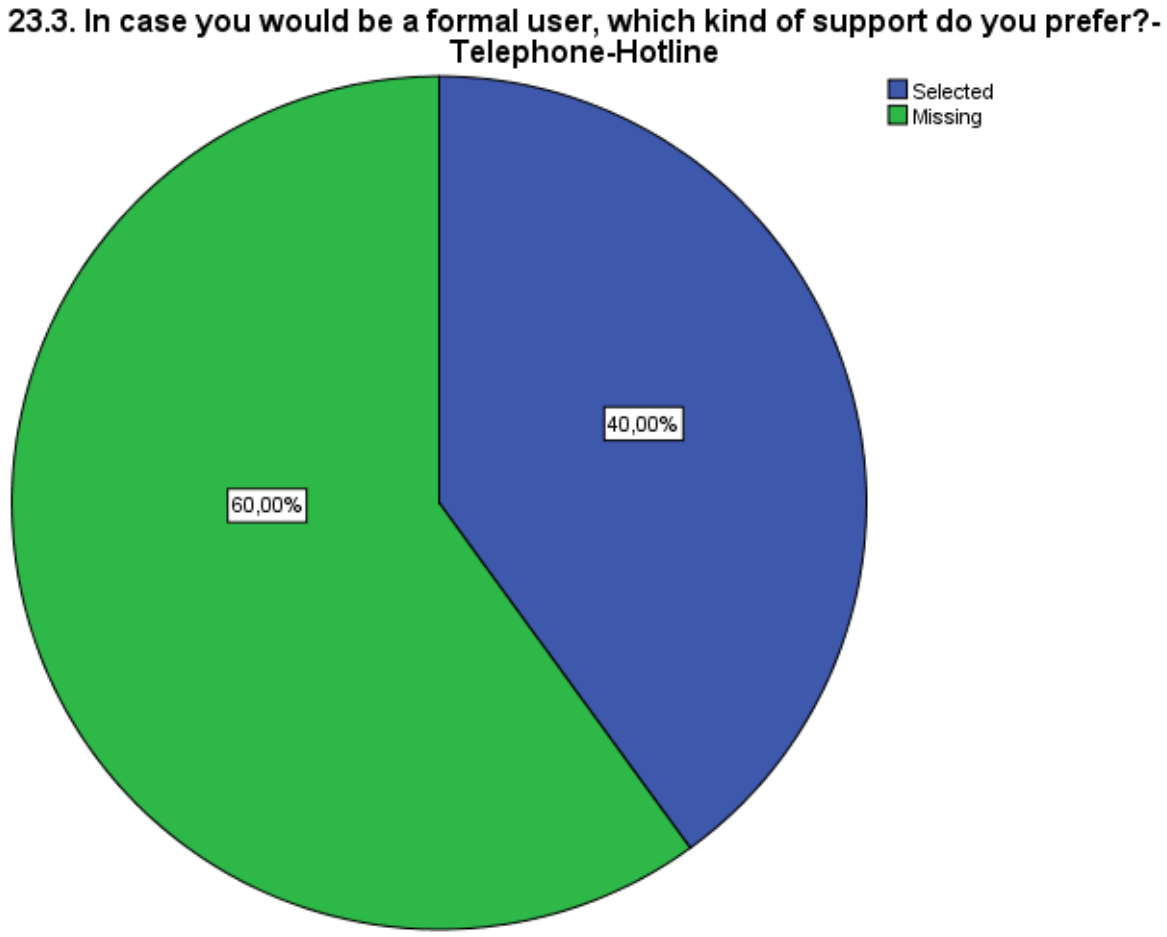
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Selected	3	30,0	100,0	100,0
Missing	System	7	70,0		
Total		10	100,0		



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

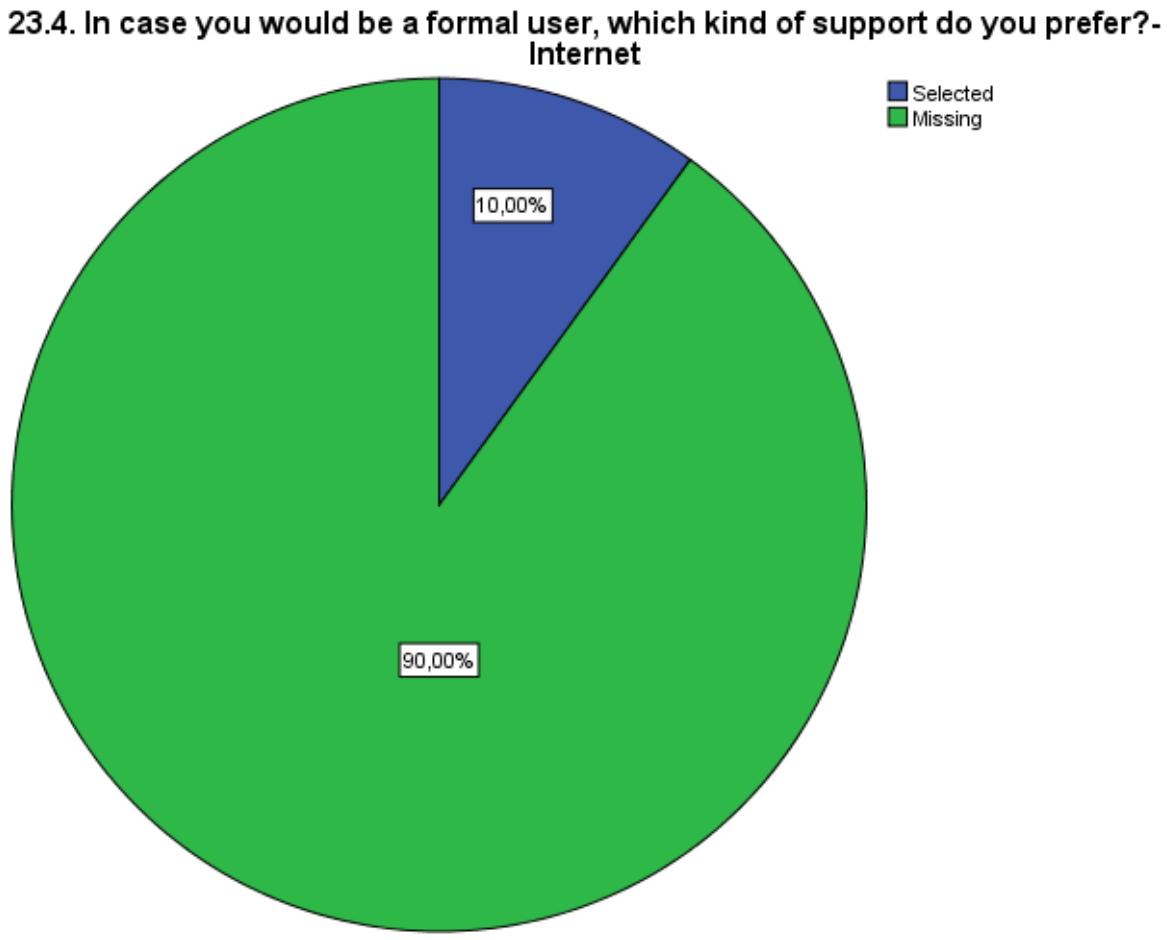
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Selected	4	40,0	100,0	100,0
Missing	System	6	60,0		
Total		10	100,0		



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

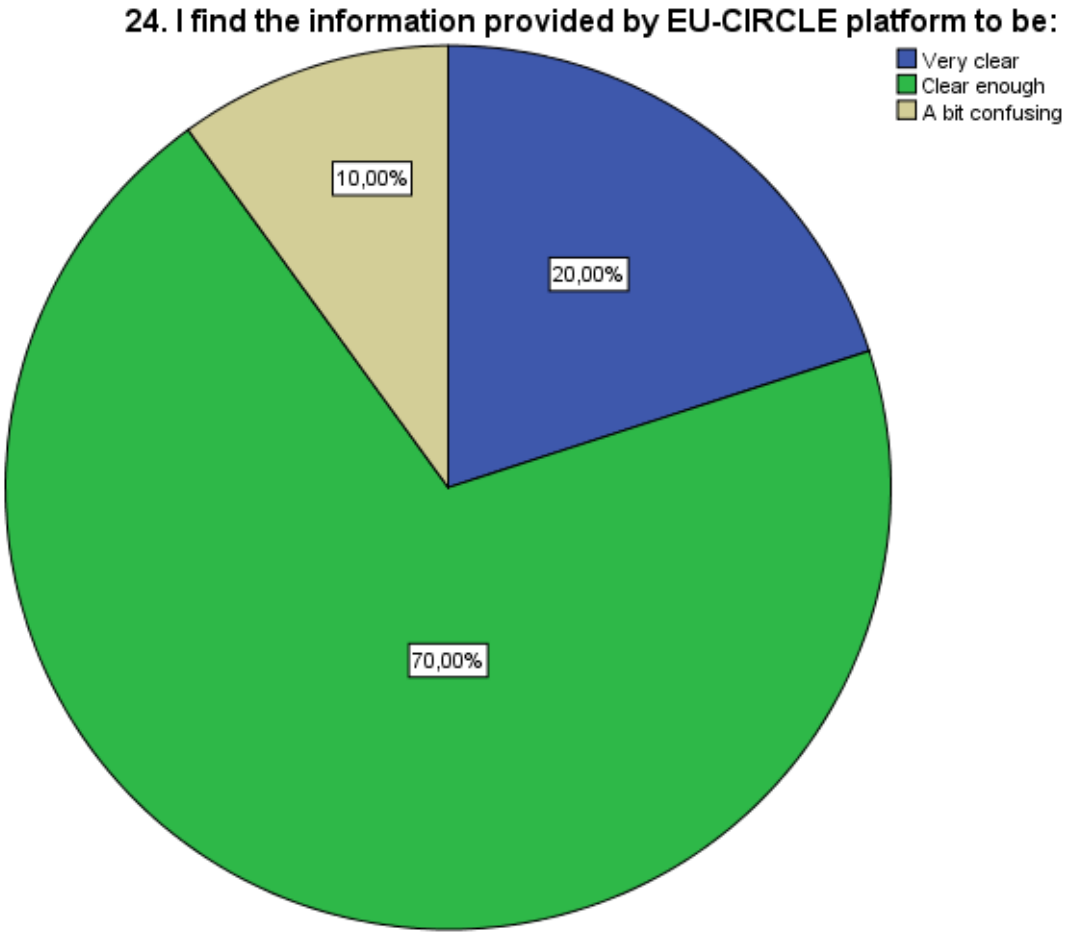
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Selected	1	10,0	100,0	100,0
Missing	System	9	90,0		
Total		10	100,0		



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

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

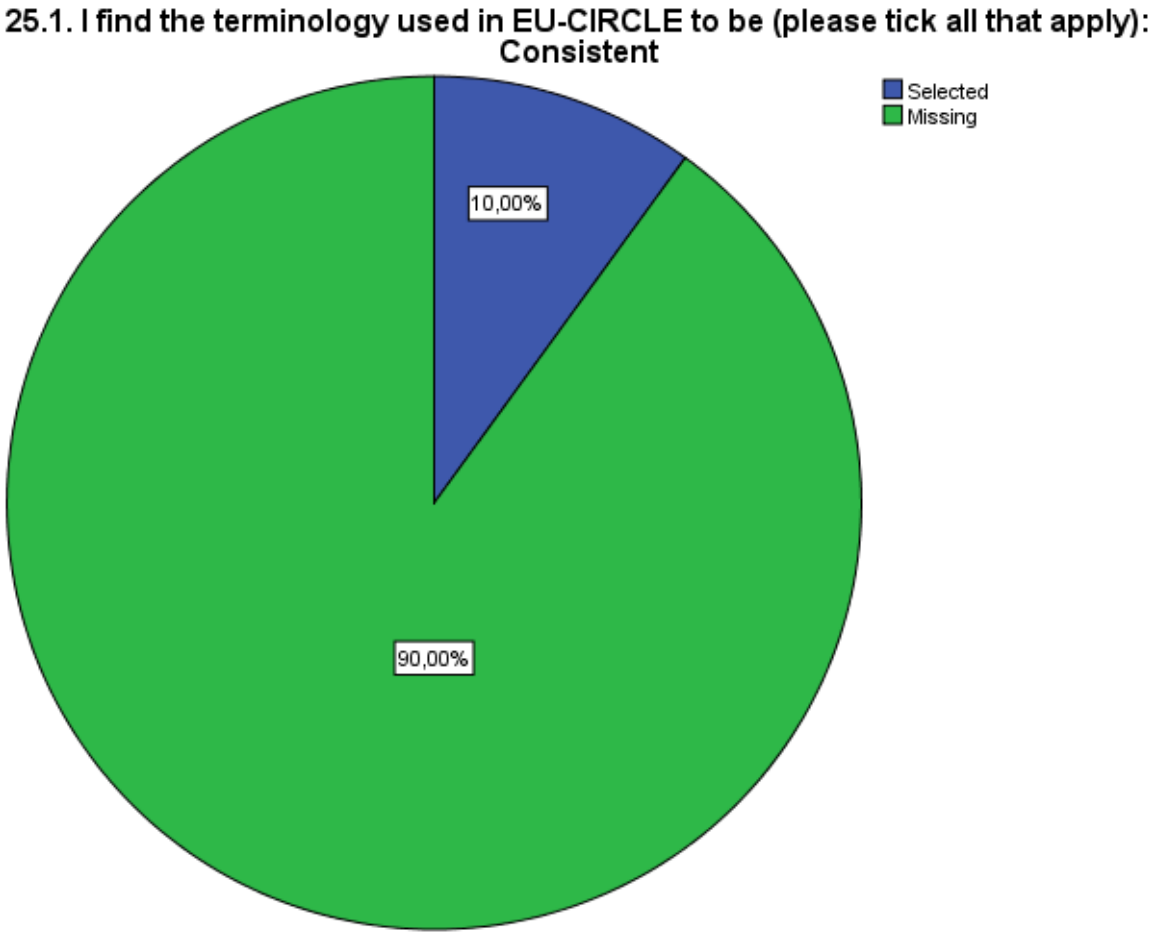
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very clear	2	20,0	20,0	20,0
	Clear enough	7	70,0	70,0	90,0
	A bit confusing	1	10,0	10,0	100,0
	Total	10	100,0	100,0	



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

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

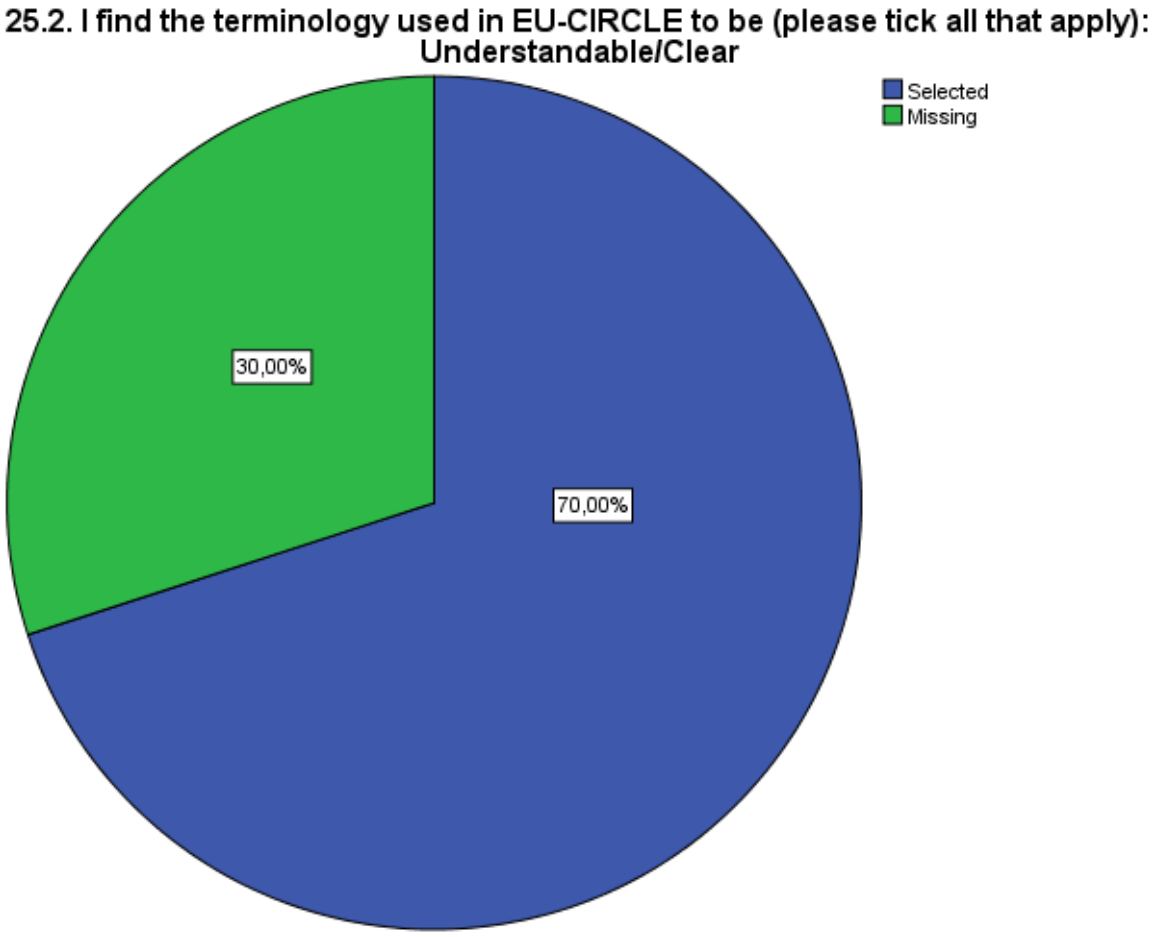
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Selected	1	10,0	100,0	100,0
Missing	System	9	90,0		
Total		10	100,0		



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

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

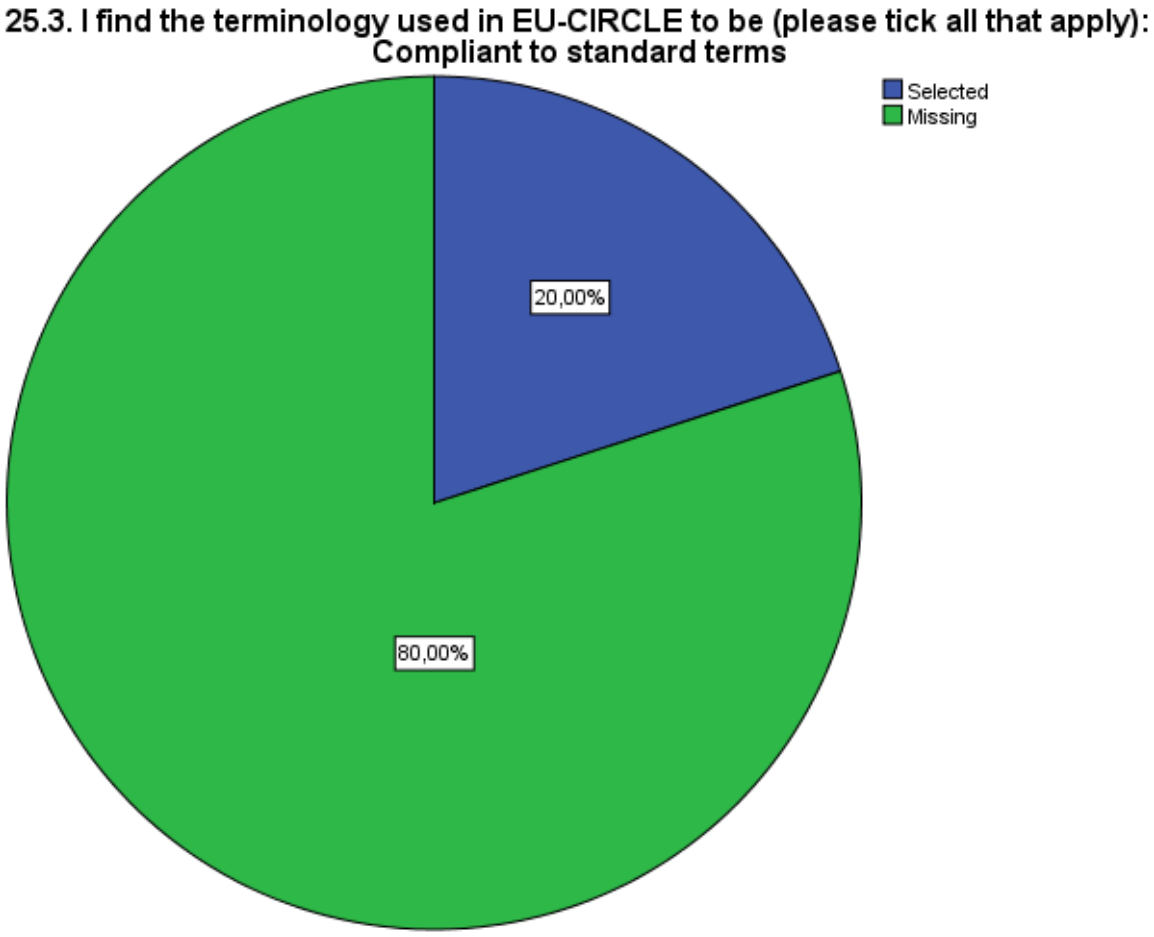
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Selected	7	70,0	100,0	100,0
Missing	System	3	30,0		
Total		10	100,0		



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

25.3. I 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	2	20,0	100,0	100,0
Missing	System	8	80,0		
Total		10	100,0		



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

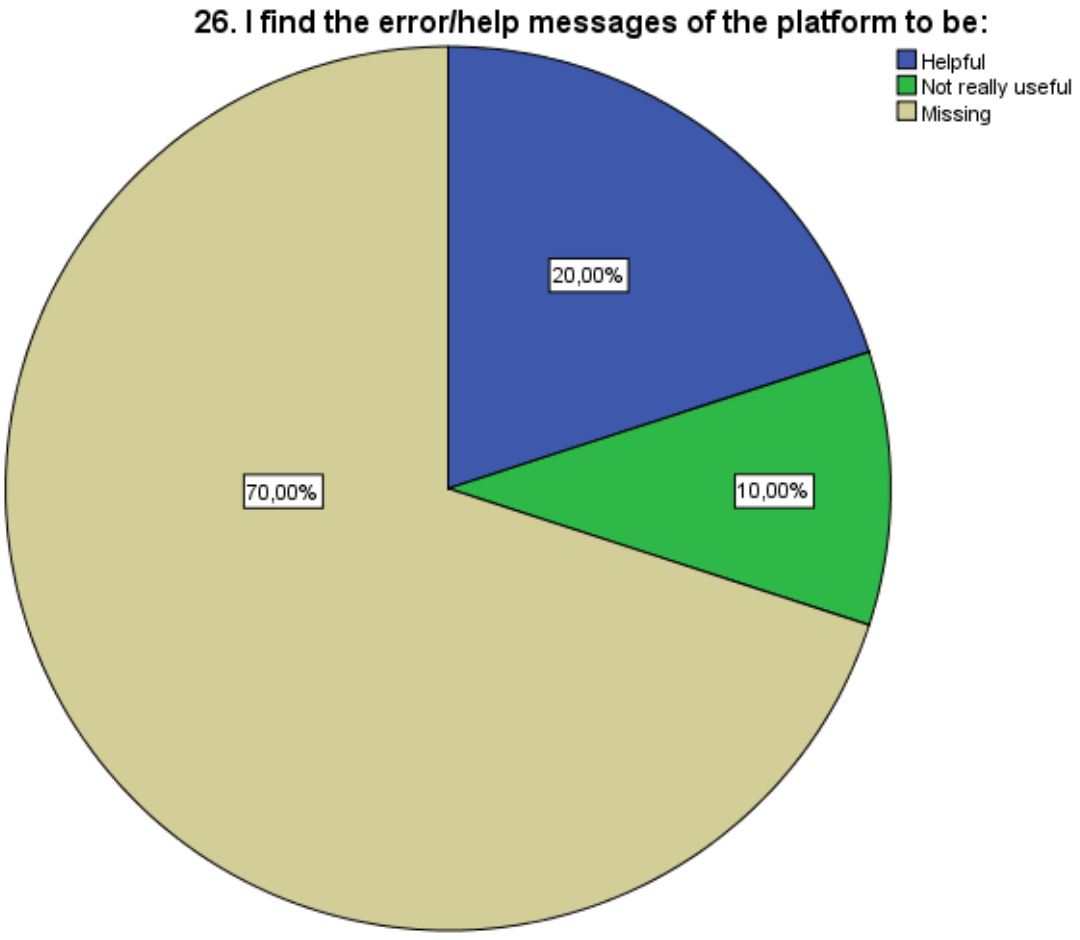
25.4. I find the terminology used in EU-CIRCLE to be (please tick all that apply): Inconsistent

		Frequency	Percent
Missing	System	10	100,0

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

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

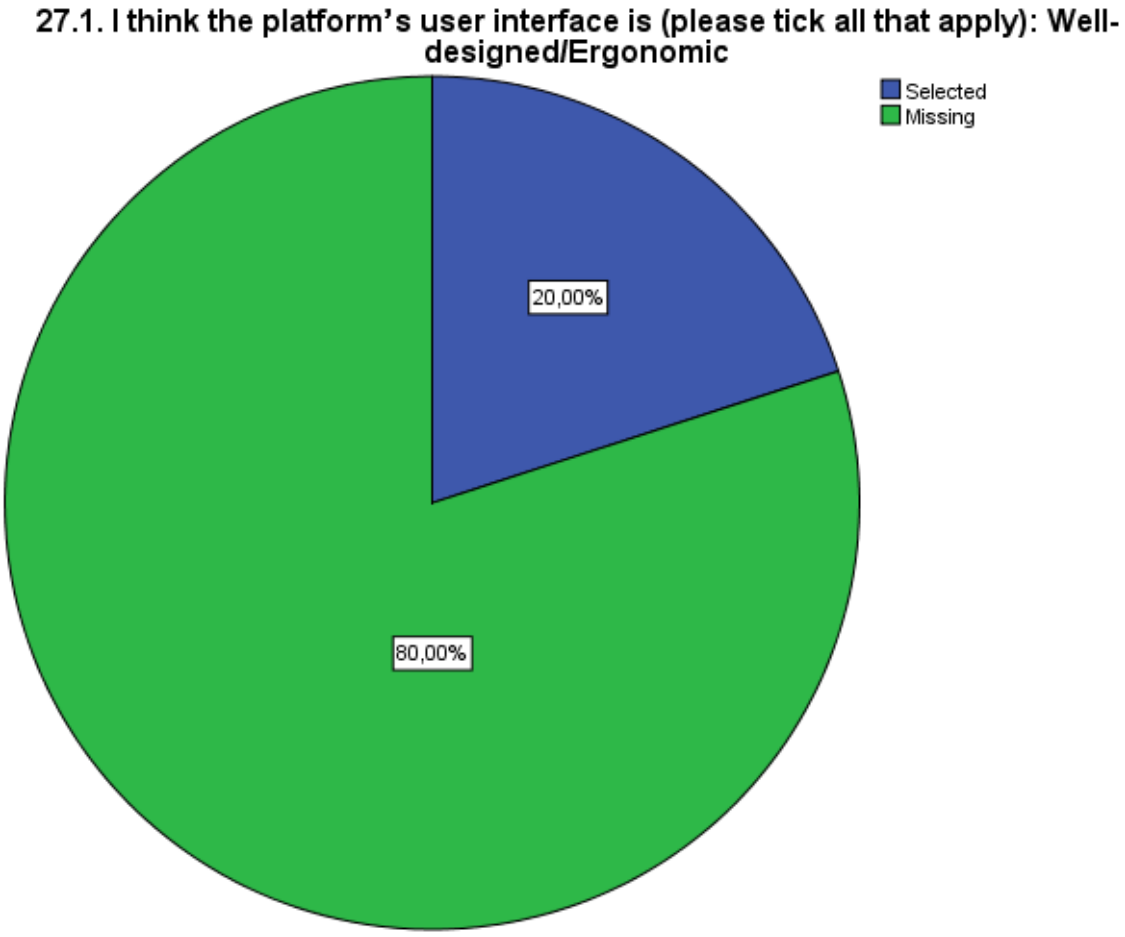
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Helpful	2	20,0	66,7	66,7
	Not really useful	1	10,0	33,3	100,0
	Total	3	30,0	100,0	
Missing	System	7	70,0		
Total		10	100,0		



27.1. I think the platform's user interface is (please tick all that apply): Well-designed/Ergonomic

27.1. I think the platform's user interface is (please tick all that apply): Well-designed/Ergonomic

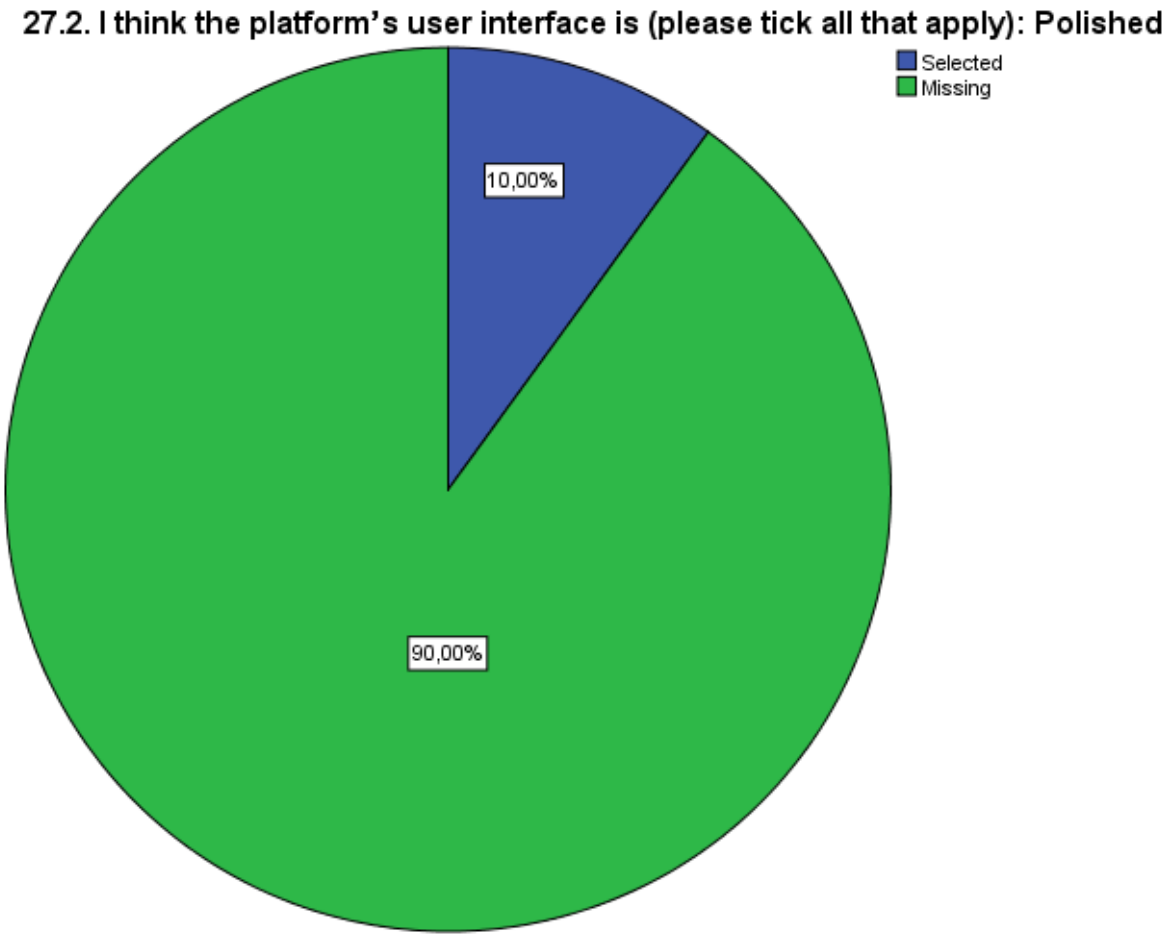
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Selected	2	20,0	100,0	100,0
Missing	System	8	80,0		
Total		10	100,0		



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

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

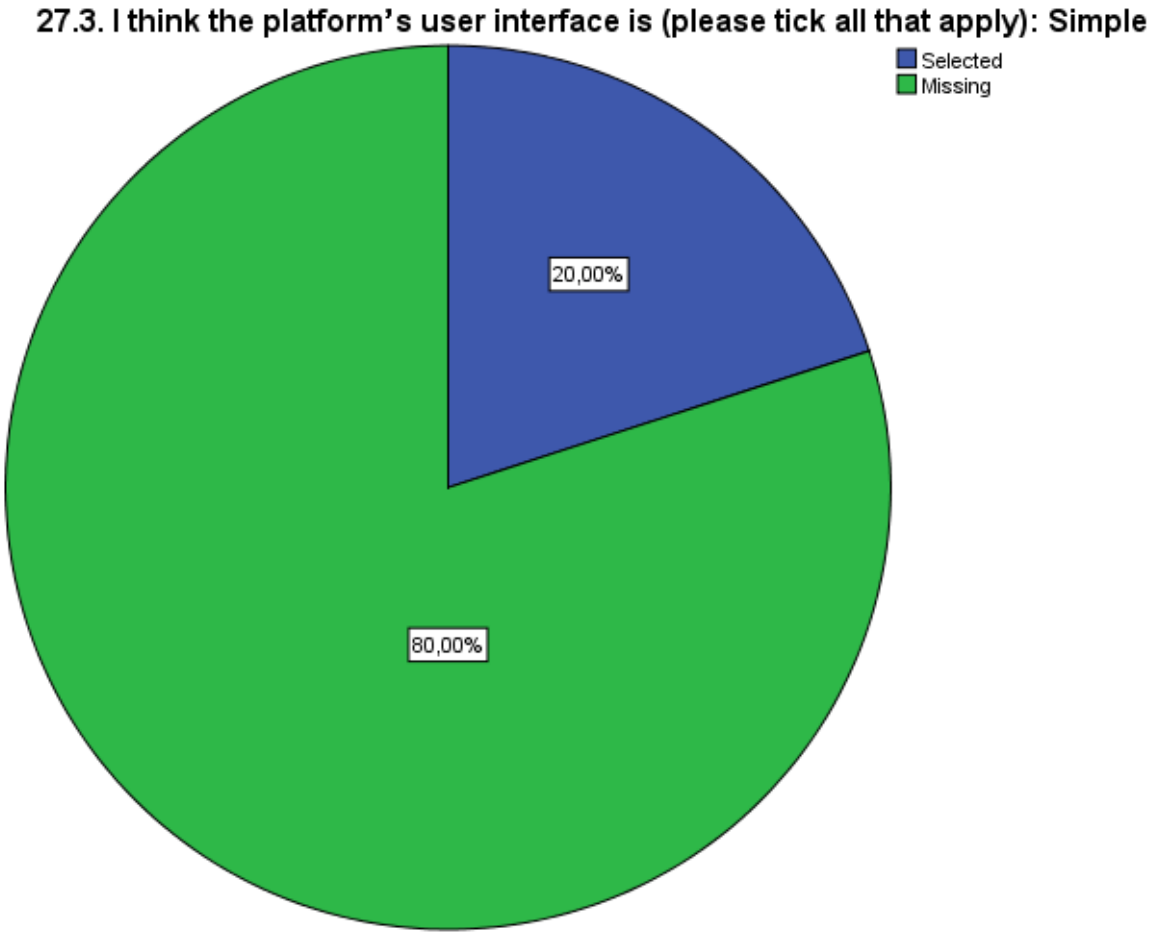
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Selected	1	10,0	100,0	100,0
Missing	System	9	90,0		
Total		10	100,0		



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

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

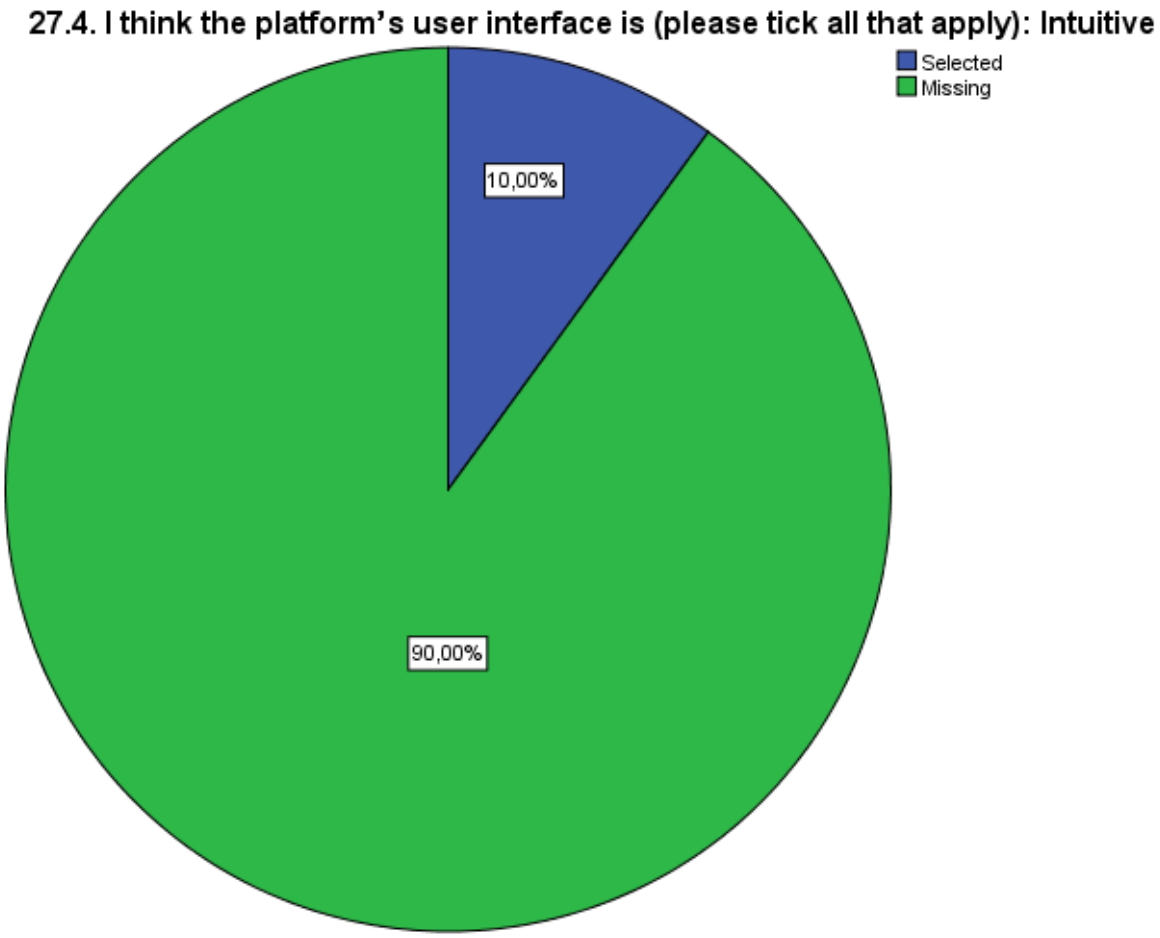
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Selected	2	20,0	100,0	100,0
Missing	System	8	80,0		
Total		10	100,0		



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

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

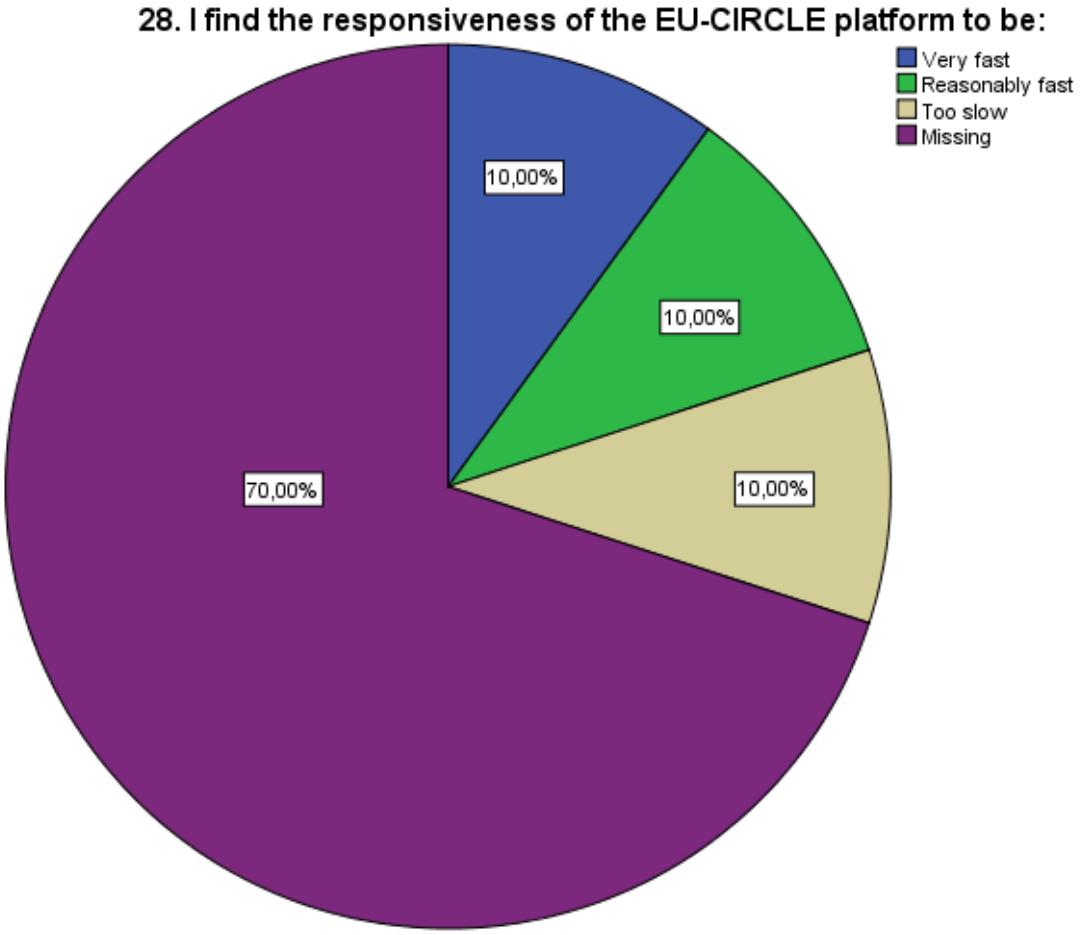
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Selected	1	10,0	100,0	100,0
Missing	System	9	90,0		
Total		10	100,0		



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

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

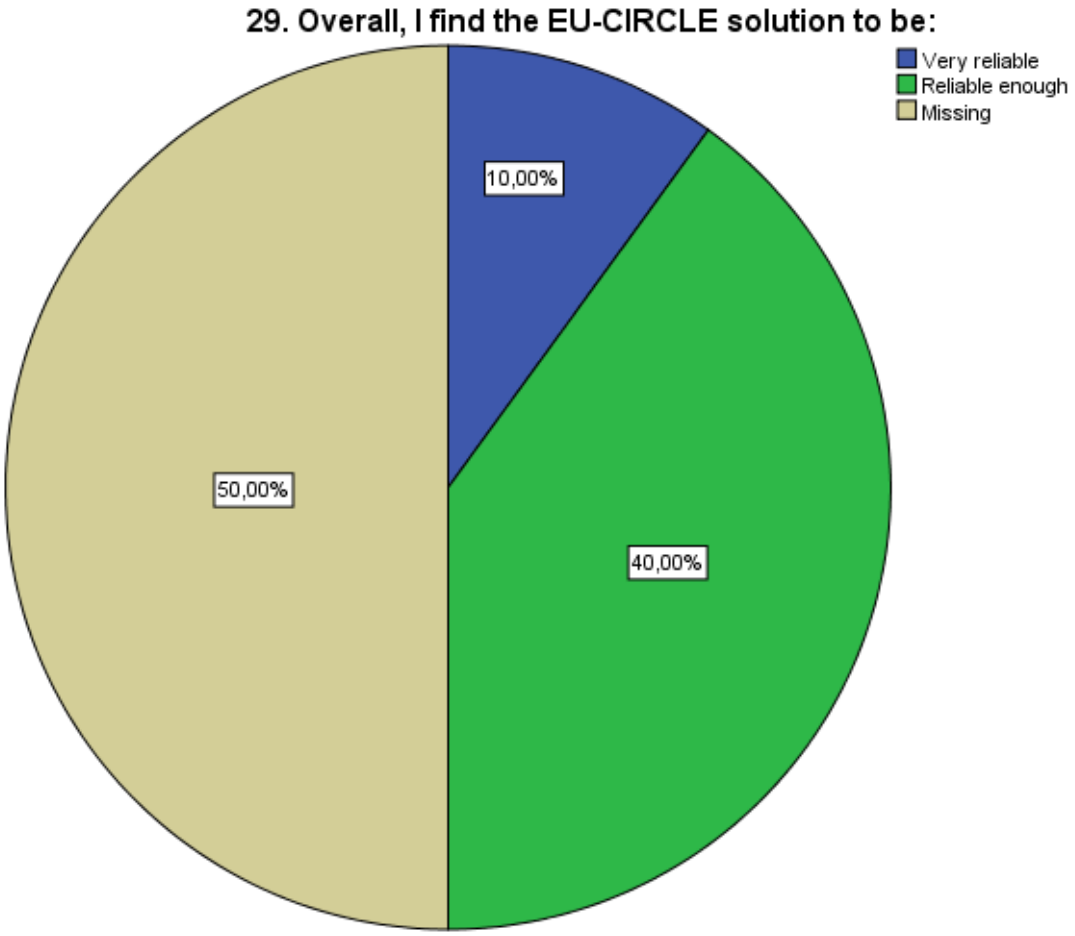
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very fast	1	10,0	33,3	33,3
	Reasonably fast	1	10,0	33,3	66,7
	Too slow	1	10,0	33,3	100,0
	Total	3	30,0	100,0	
Missing	System	7	70,0		
Total		10	100,0		



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

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

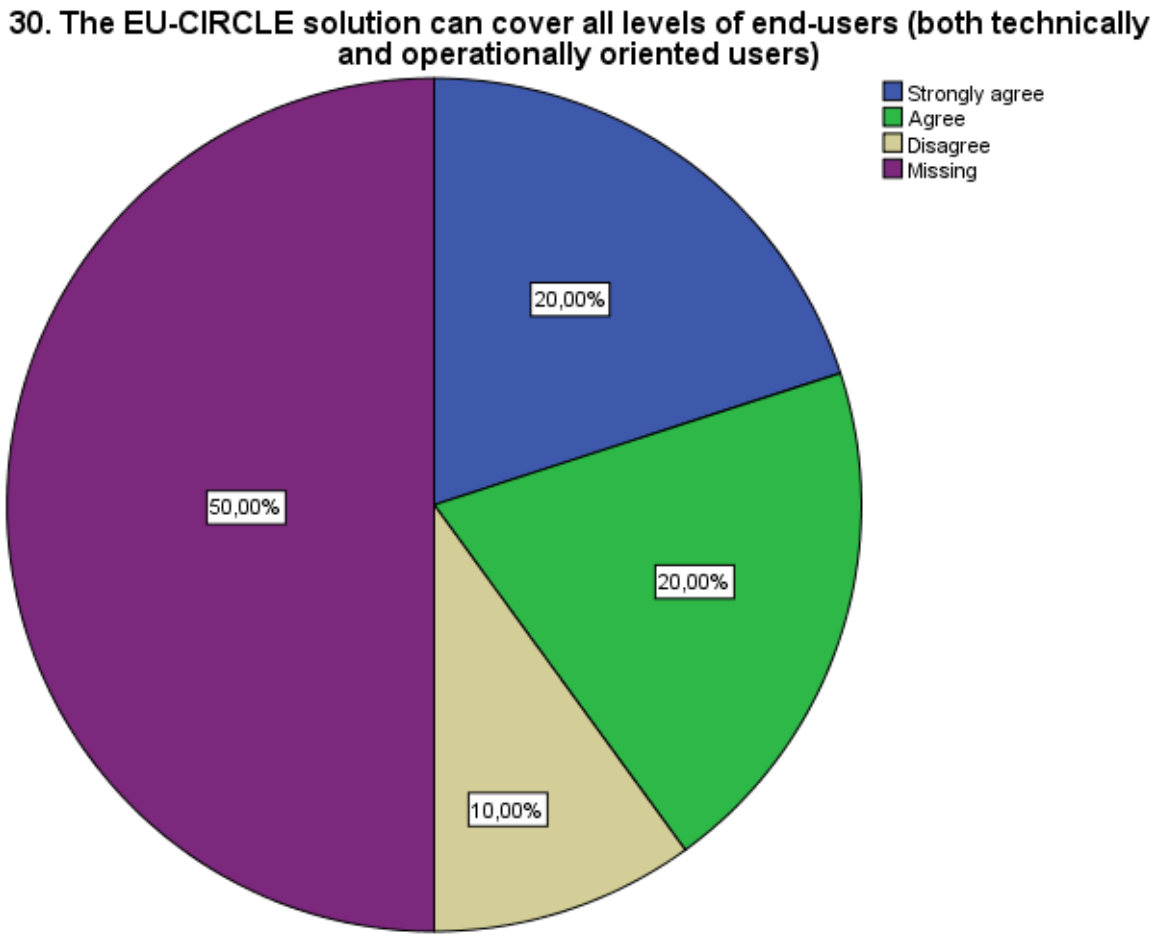
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very reliable	1	10,0	20,0	20,0
	Reliable enough	4	40,0	80,0	100,0
	Total	5	50,0	100,0	
Missing	System	5	50,0		
Total		10	100,0		



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

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

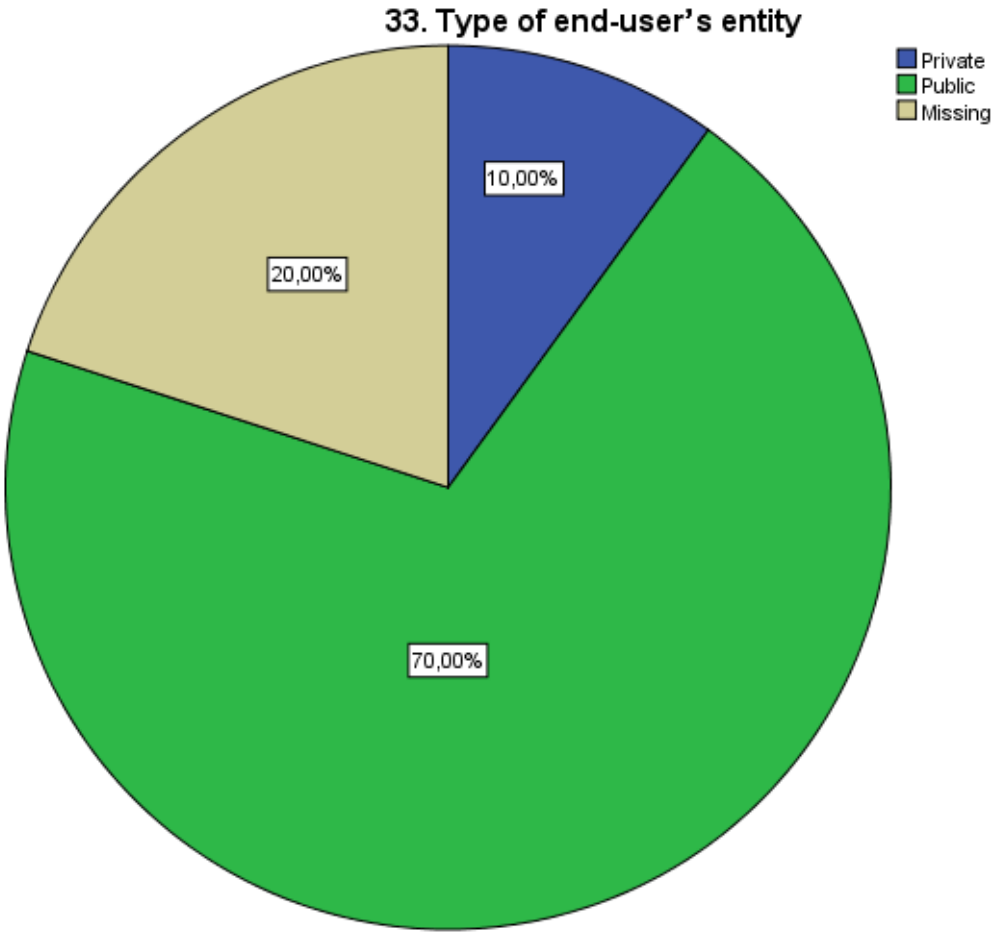
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	2	20,0	40,0	40,0
	Agree	2	20,0	40,0	80,0
	Disagree	1	10,0	20,0	100,0
	Total	5	50,0	100,0	
Missing	System	5	50,0		
Total		10	100,0		



33. Type of end-user's entity

33. Type of end-user's entity

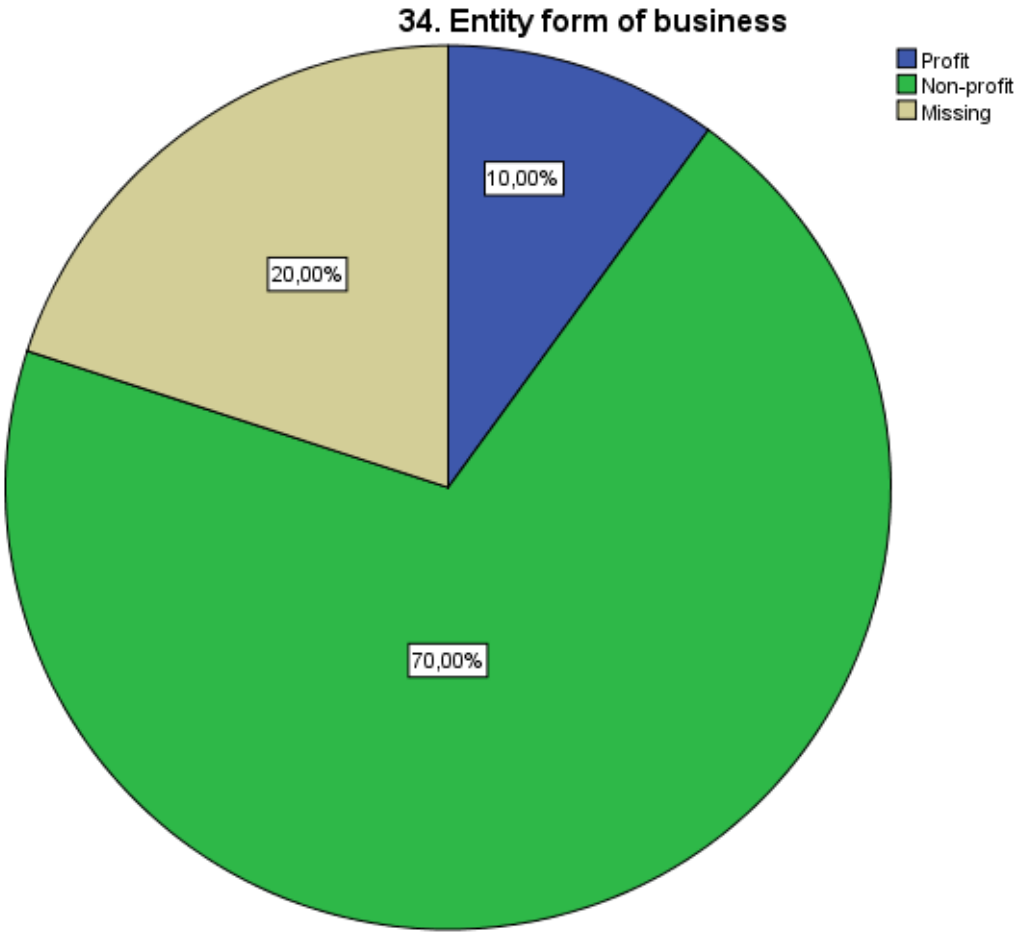
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Private	1	10,0	12,5	12,5
	Public	7	70,0	87,5	100,0
	Total	8	80,0	100,0	
Missing	System	2	20,0		
Total		10	100,0		



34. Entity form of business

34. Entity form of business

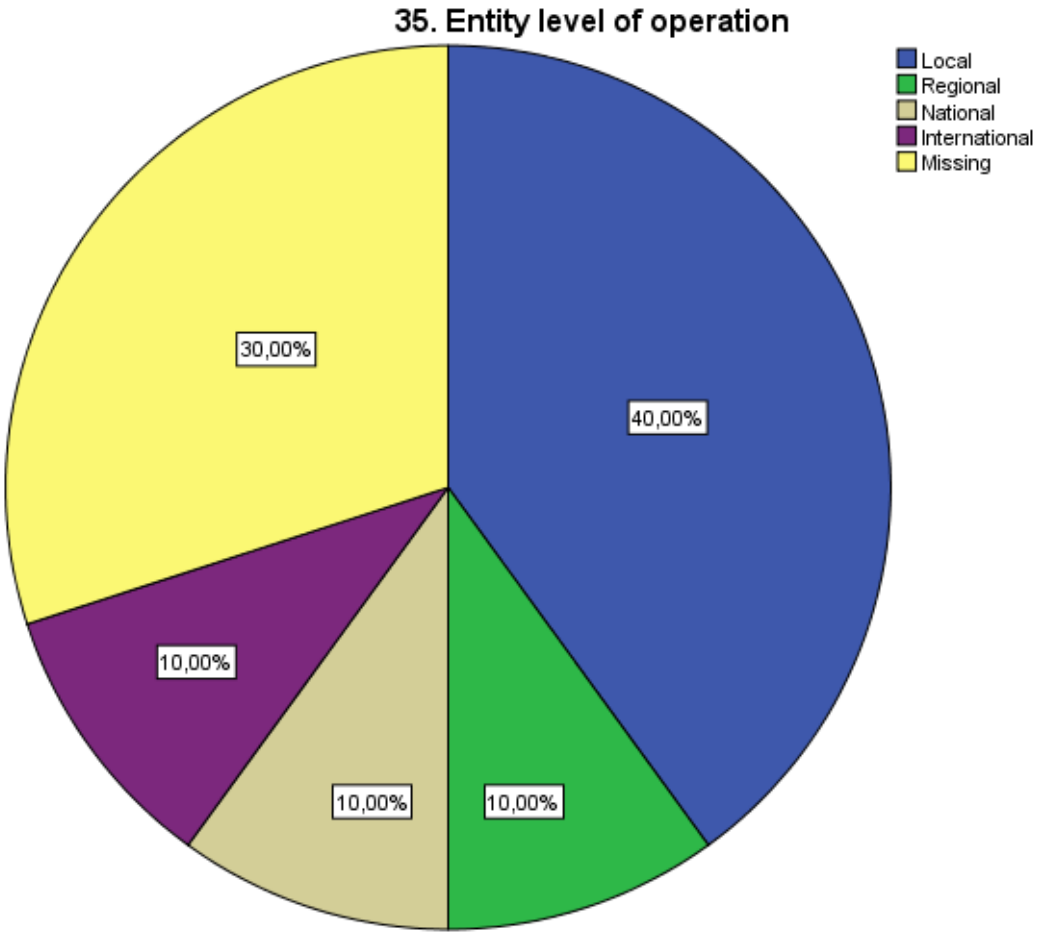
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Profit	1	10,0	12,5	12,5
	Non-profit	7	70,0	87,5	100,0
	Total	8	80,0	100,0	
Missing	System	2	20,0		
Total		10	100,0		



35. Entity level of operation

35. Entity level of operation

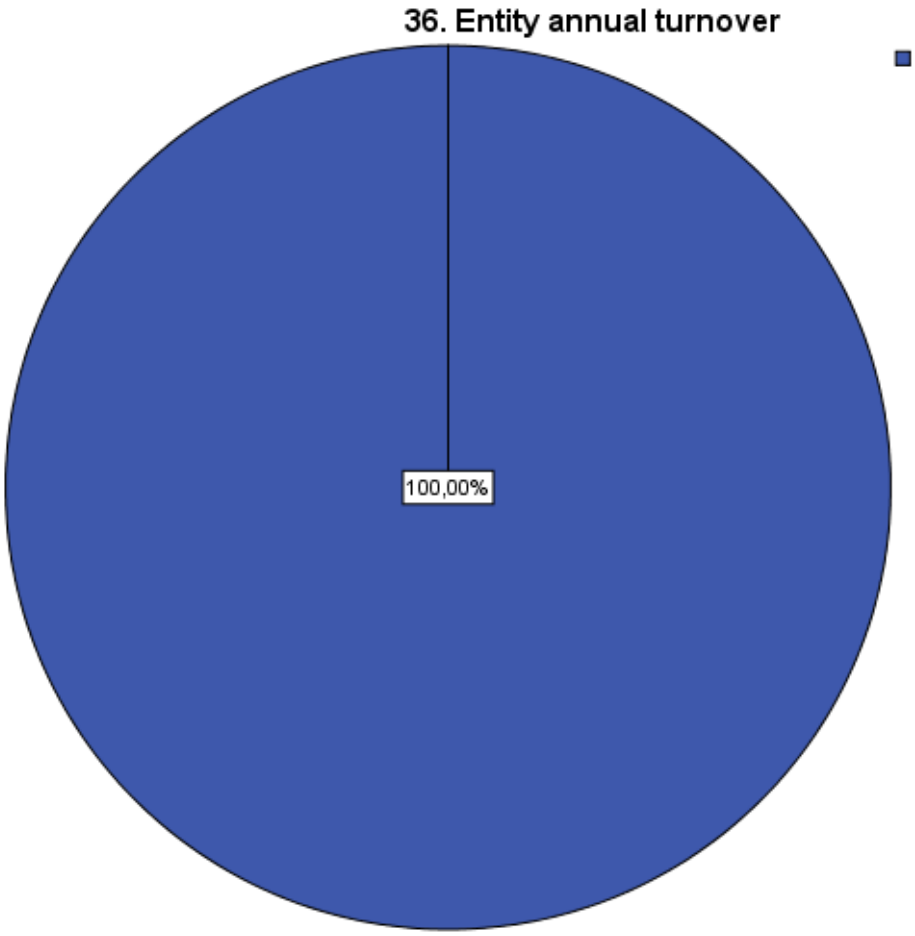
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Local	4	40,0	57,1	57,1
	Regional	1	10,0	14,3	71,4
	National	1	10,0	14,3	85,7
	International	1	10,0	14,3	100,0
	Total	7	70,0	100,0	
Missing	System	3	30,0		
Total		10	100,0		



36. Entity annual turnover

36. Entity annual turnover

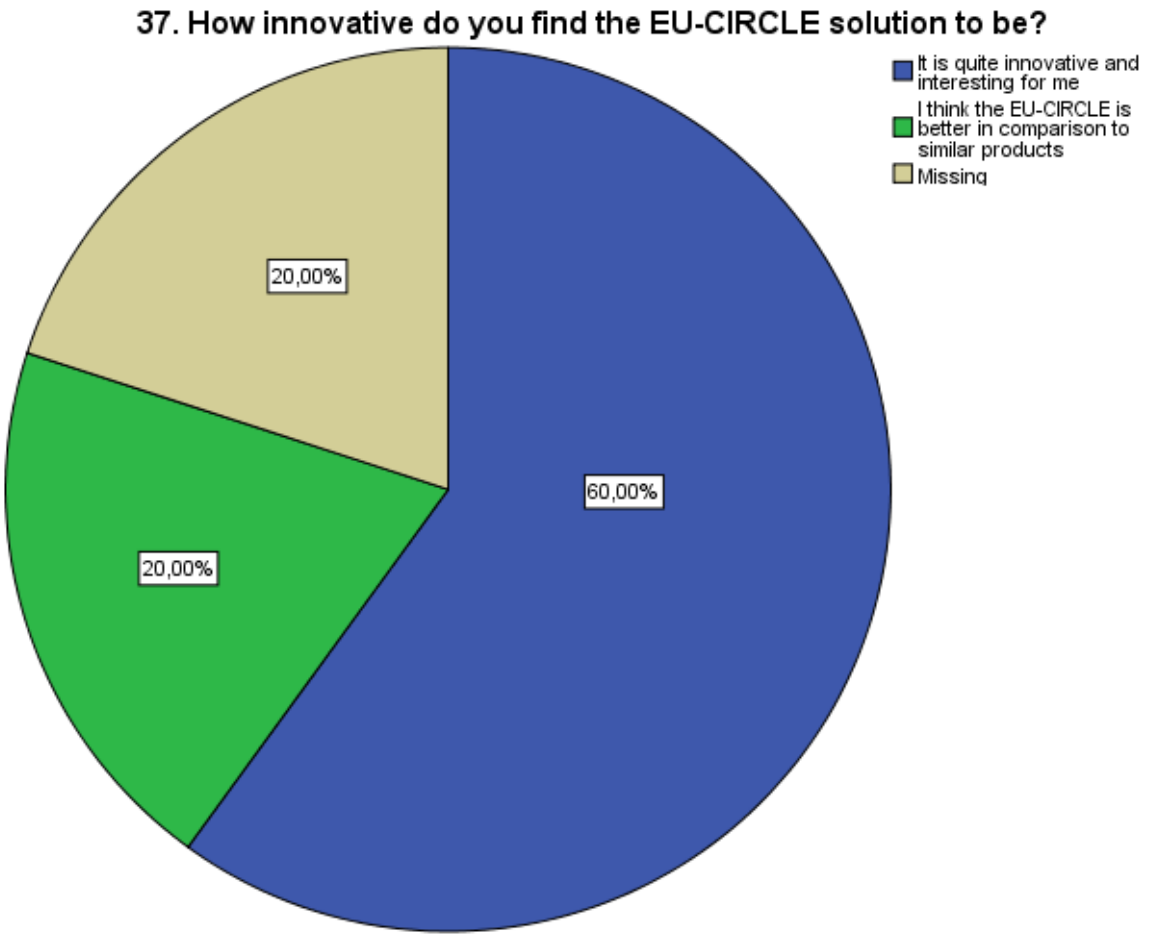
	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	10	100,0	100,0	100,0



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

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

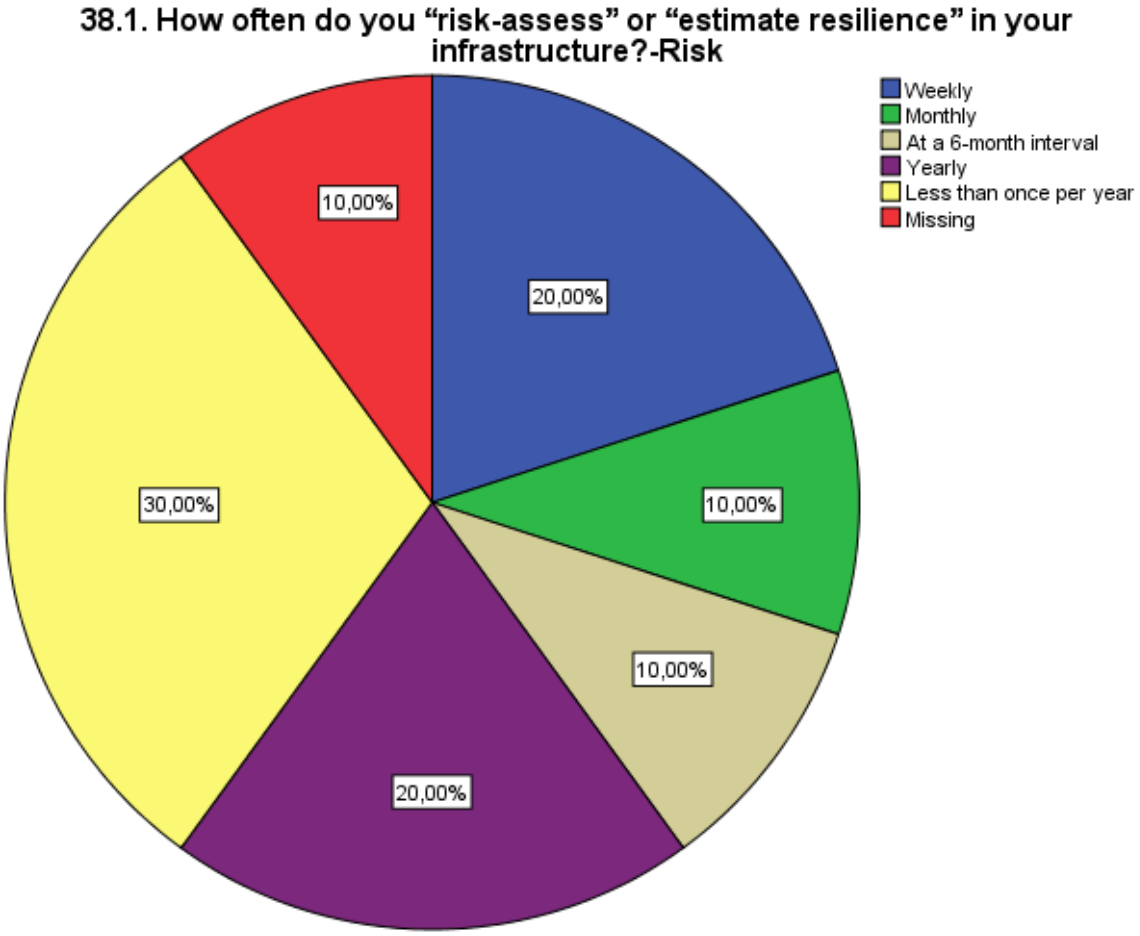
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	It is quite innovative and interesting for me	6	60,0	75,0	75,0
	I think the EU-CIRCLE is better in comparison to similar products	2	20,0	25,0	100,0
	Total	8	80,0	100,0	
Missing	System	2	20,0		
Total		10	100,0		



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

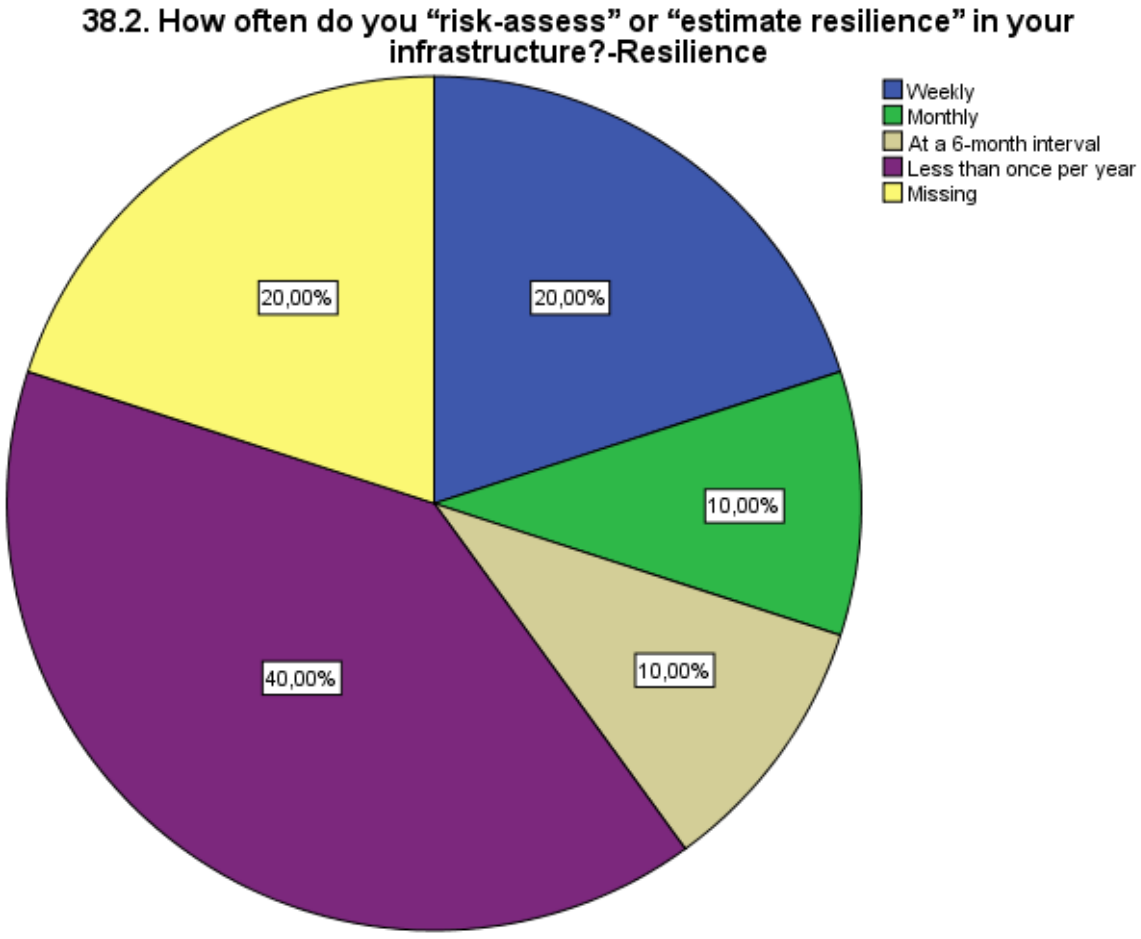
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Weekly	2	20,0	22,2	22,2
	Monthly	1	10,0	11,1	33,3
	At a 6-month interval	1	10,0	11,1	44,4
	Yearly	2	20,0	22,2	66,7
	Less than once per year	3	30,0	33,3	100,0
	Total	9	90,0	100,0	
Missing	System	1	10,0		
Total		10	100,0		



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

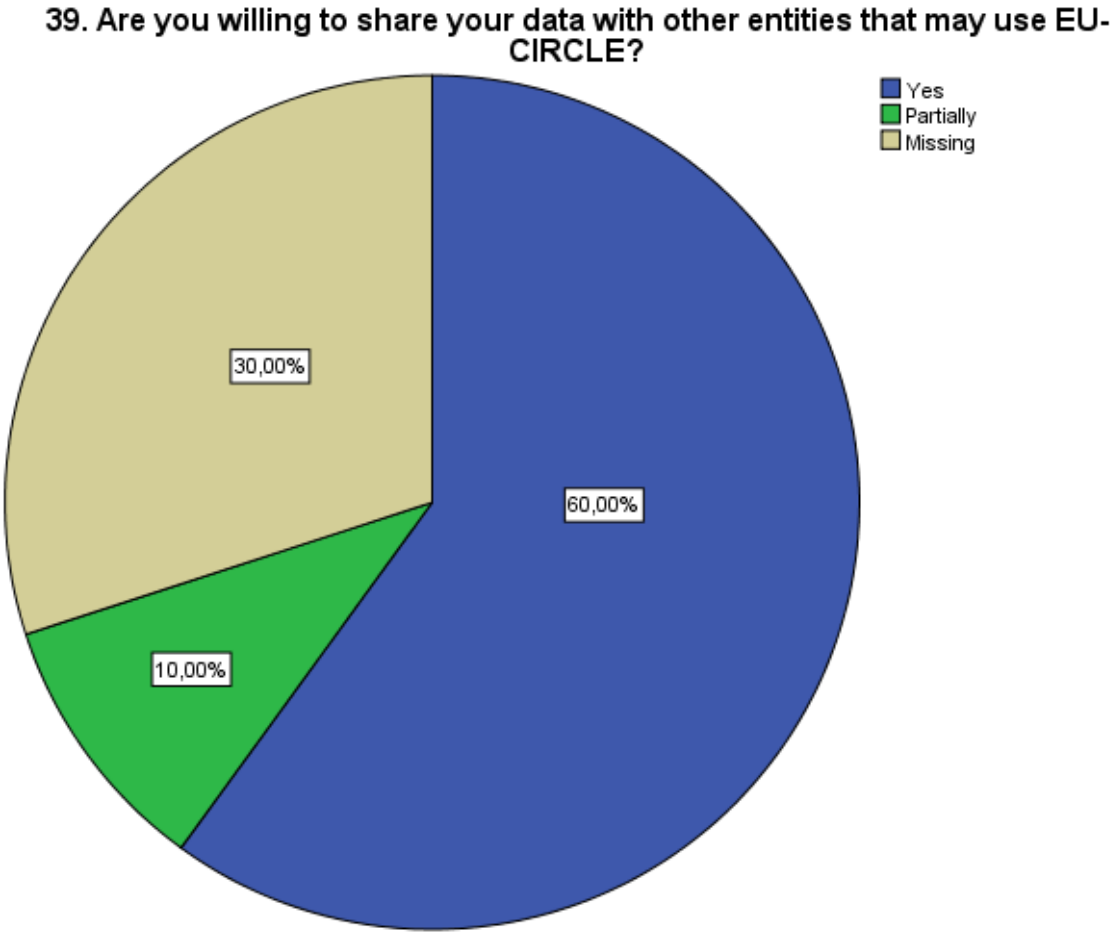
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Weekly	2	20,0	25,0	25,0
	Monthly	1	10,0	12,5	37,5
	At a 6-month interval	1	10,0	12,5	50,0
	Less than once per year	4	40,0	50,0	100,0
	Total	8	80,0	100,0	
Missing	System	2	20,0		
Total		10	100,0		



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?

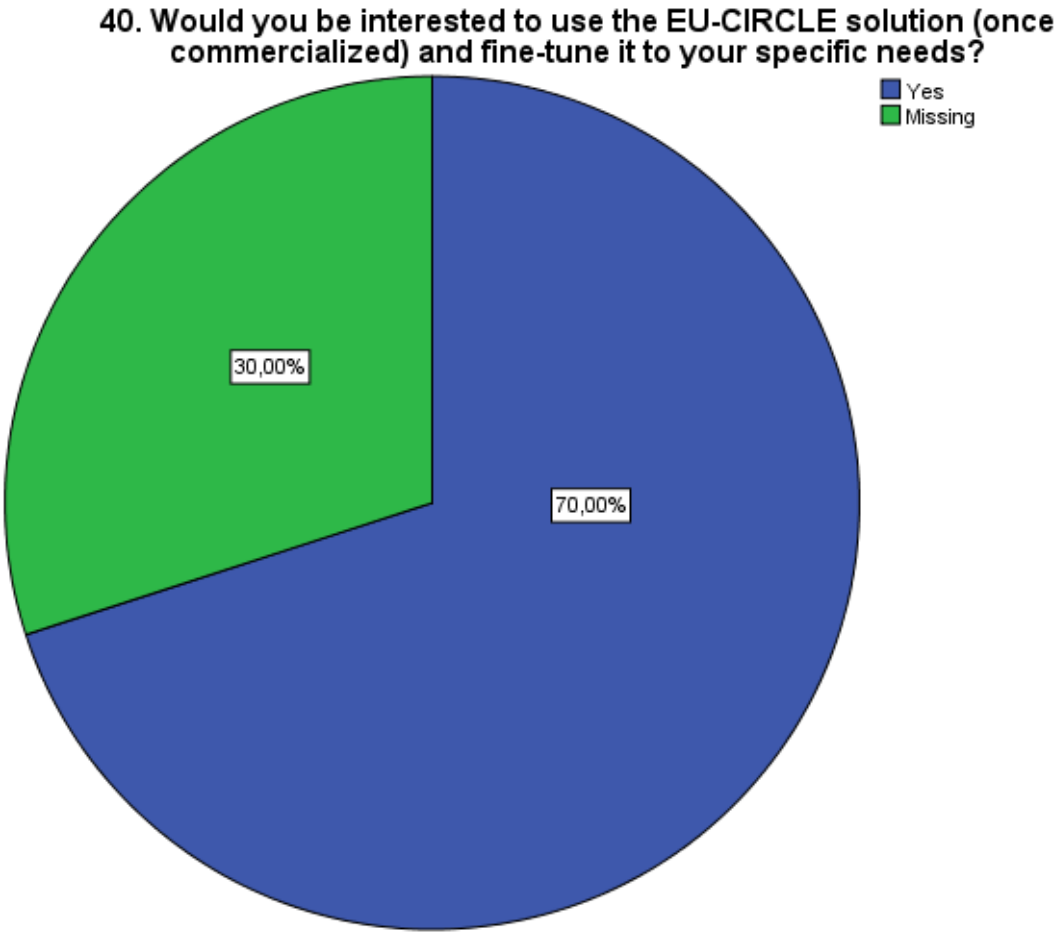
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	6	60,0	85,7	85,7
	Partially	1	10,0	14,3	100,0
	Total	7	70,0	100,0	
Missing	System	3	30,0		
Total		10	100,0		



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?

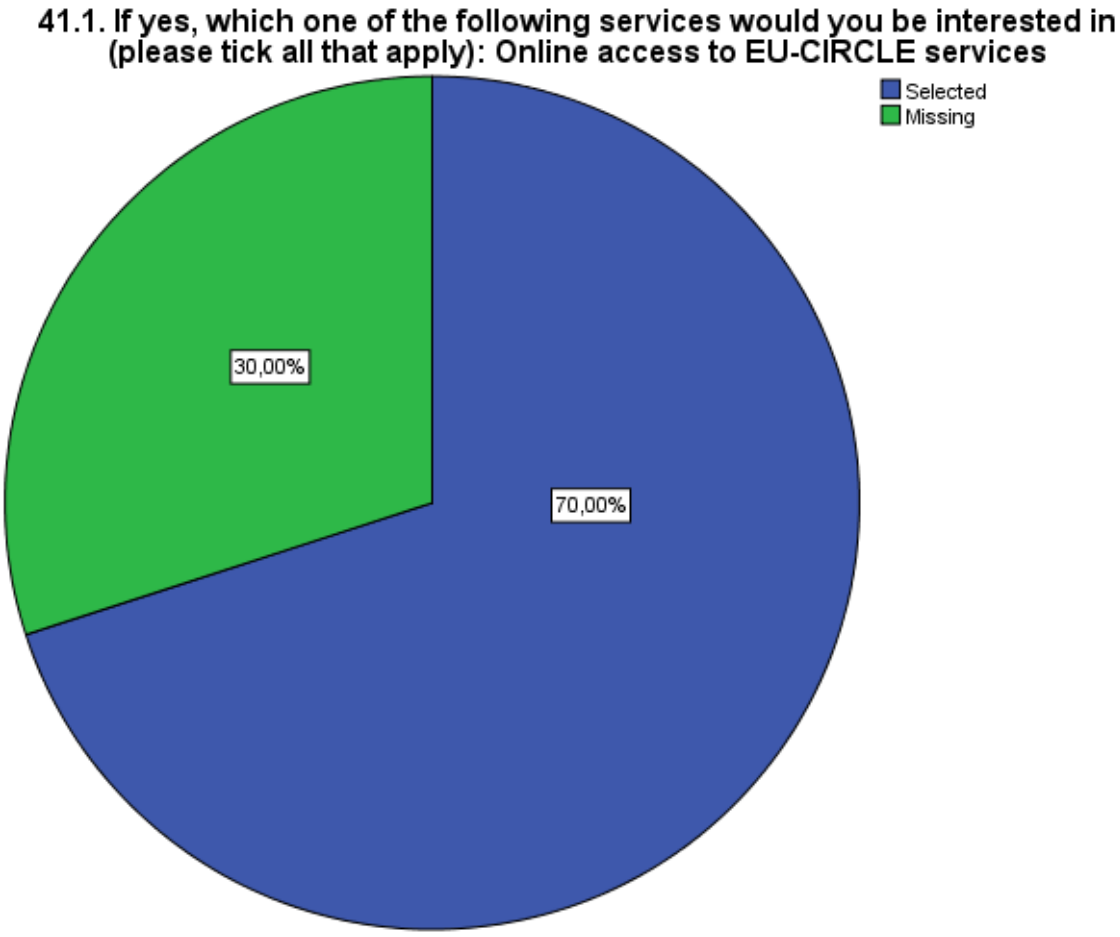
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	7	70,0	100,0	100,0
Missing	System	3	30,0		
Total		10	100,0		



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

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

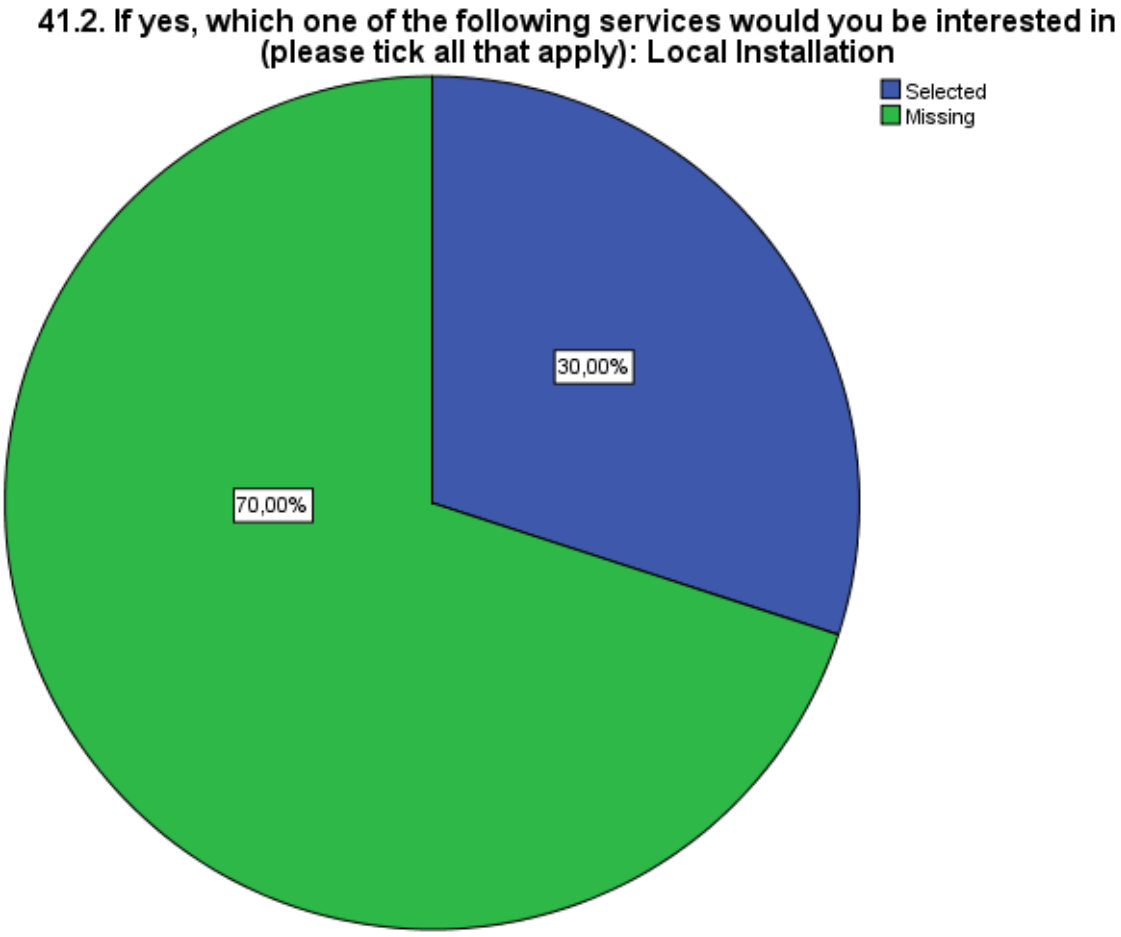
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Selected	7	70,0	100,0	100,0
Missing	System	3	30,0		
Total		10	100,0		



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

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

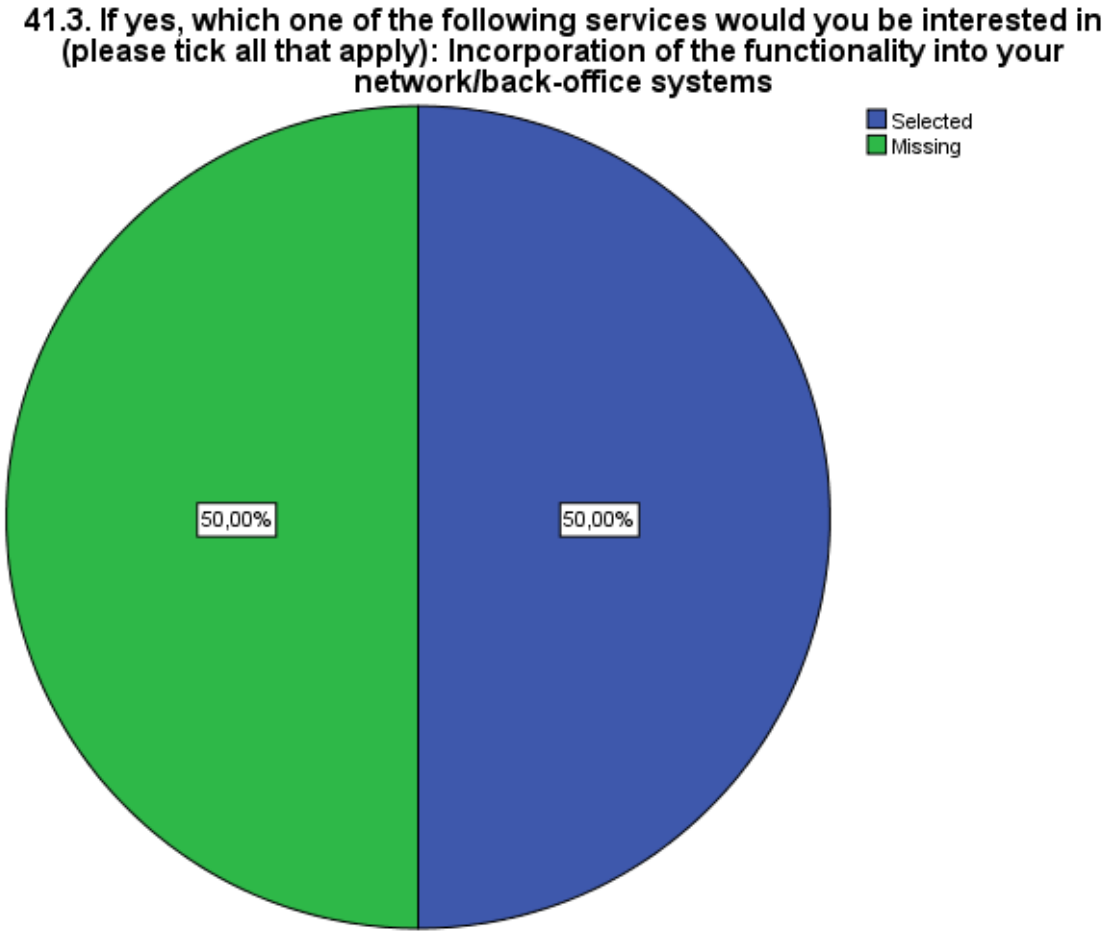
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Selected	3	30,0	100,0	100,0
Missing	System	7	70,0		
Total		10	100,0		



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

41.3. 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

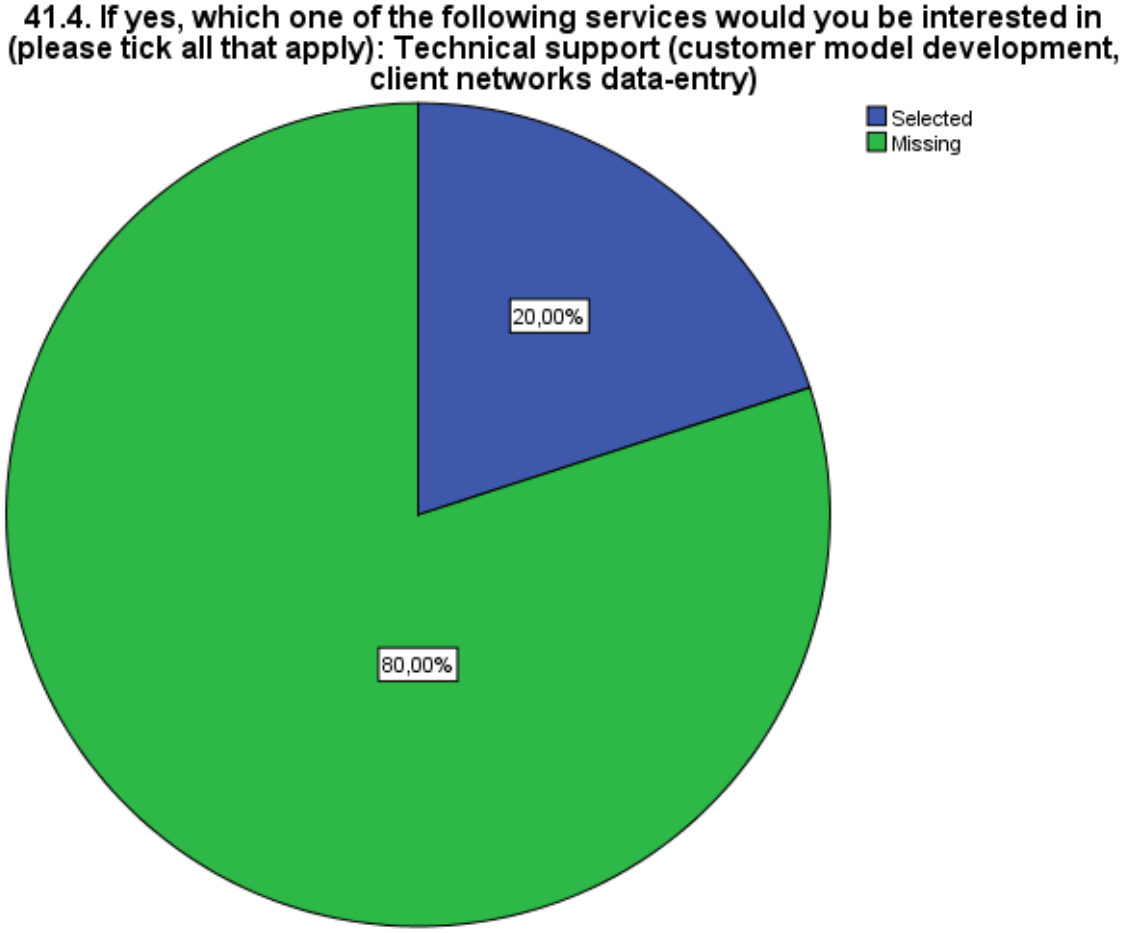
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Selected	5	50,0	100,0	100,0
Missing	System	5	50,0		
Total		10	100,0		



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)

41.4. 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)

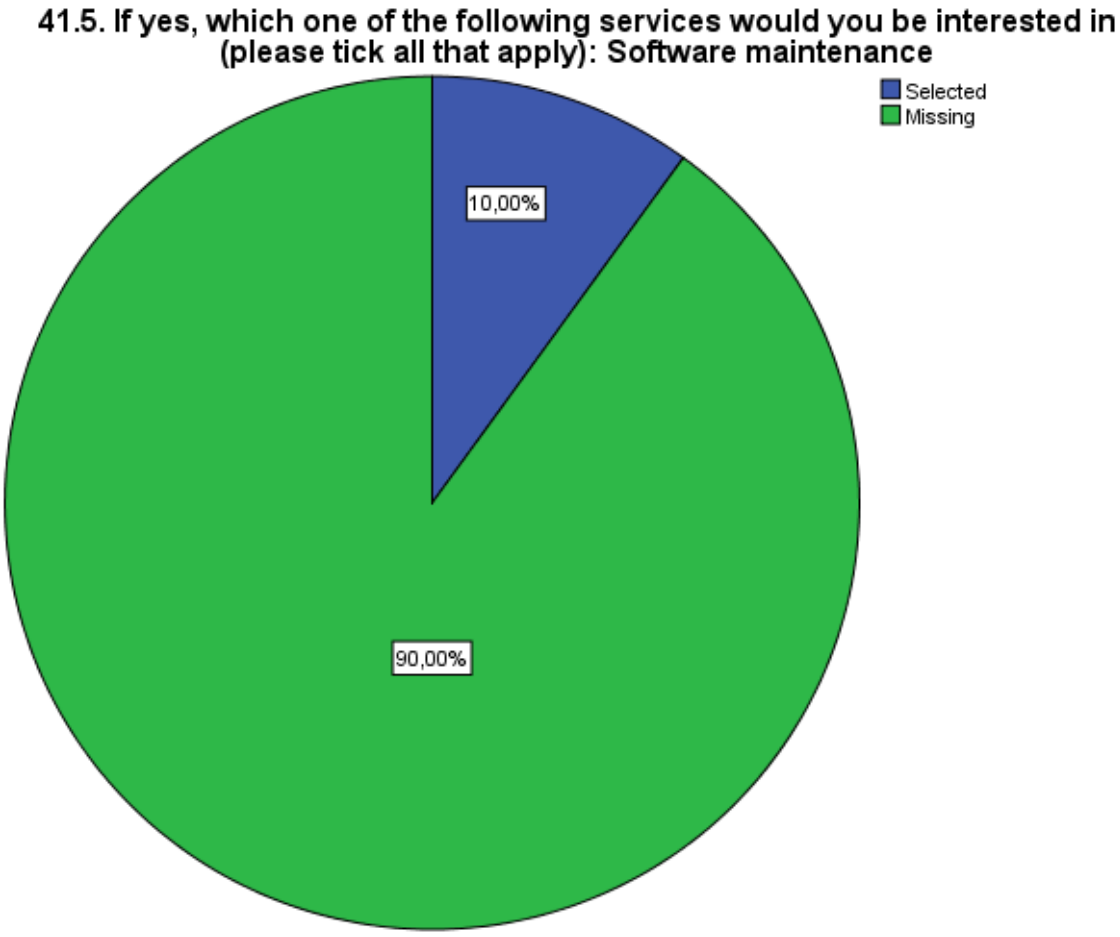
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Selected	2	20,0	100,0	100,0
Missing	System	8	80,0		
Total		10	100,0		



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

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

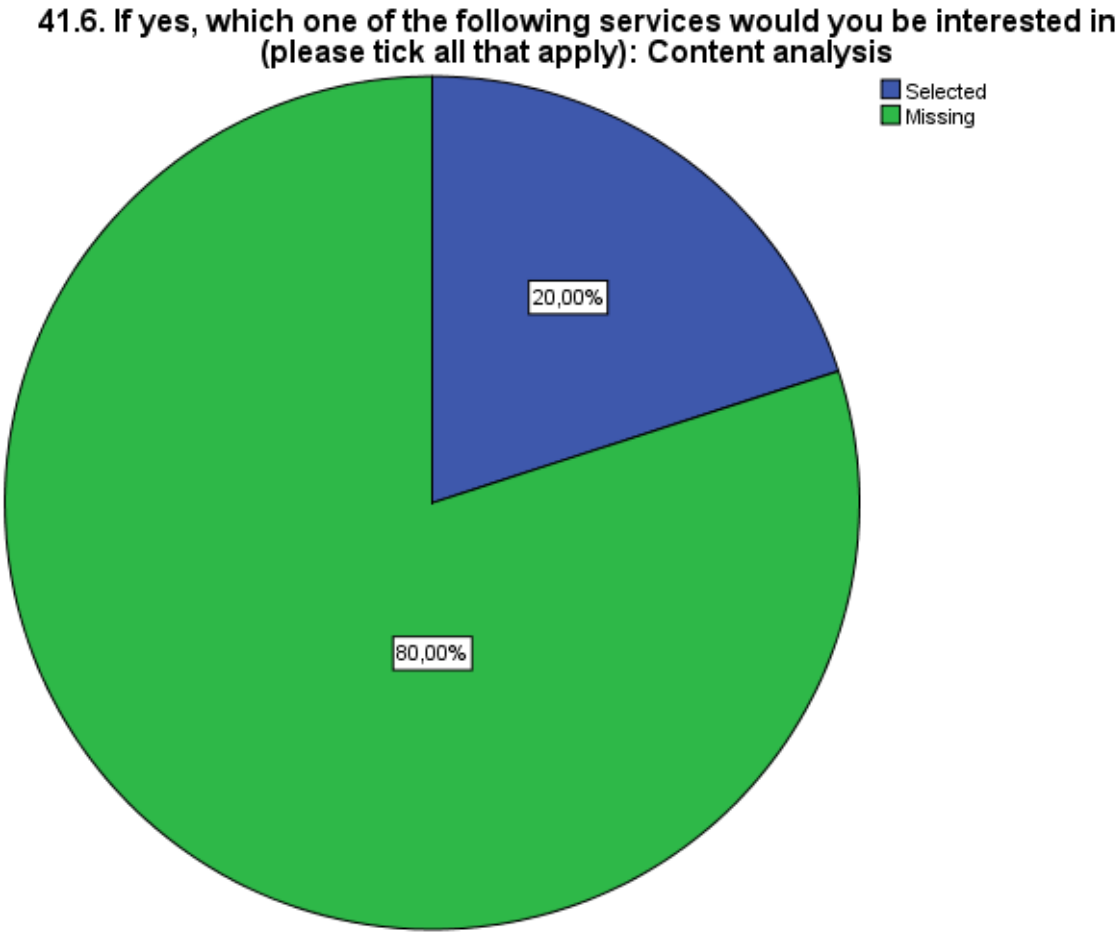
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Selected	1	10,0	100,0	100,0
Missing	System	9	90,0		
Total		10	100,0		



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

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

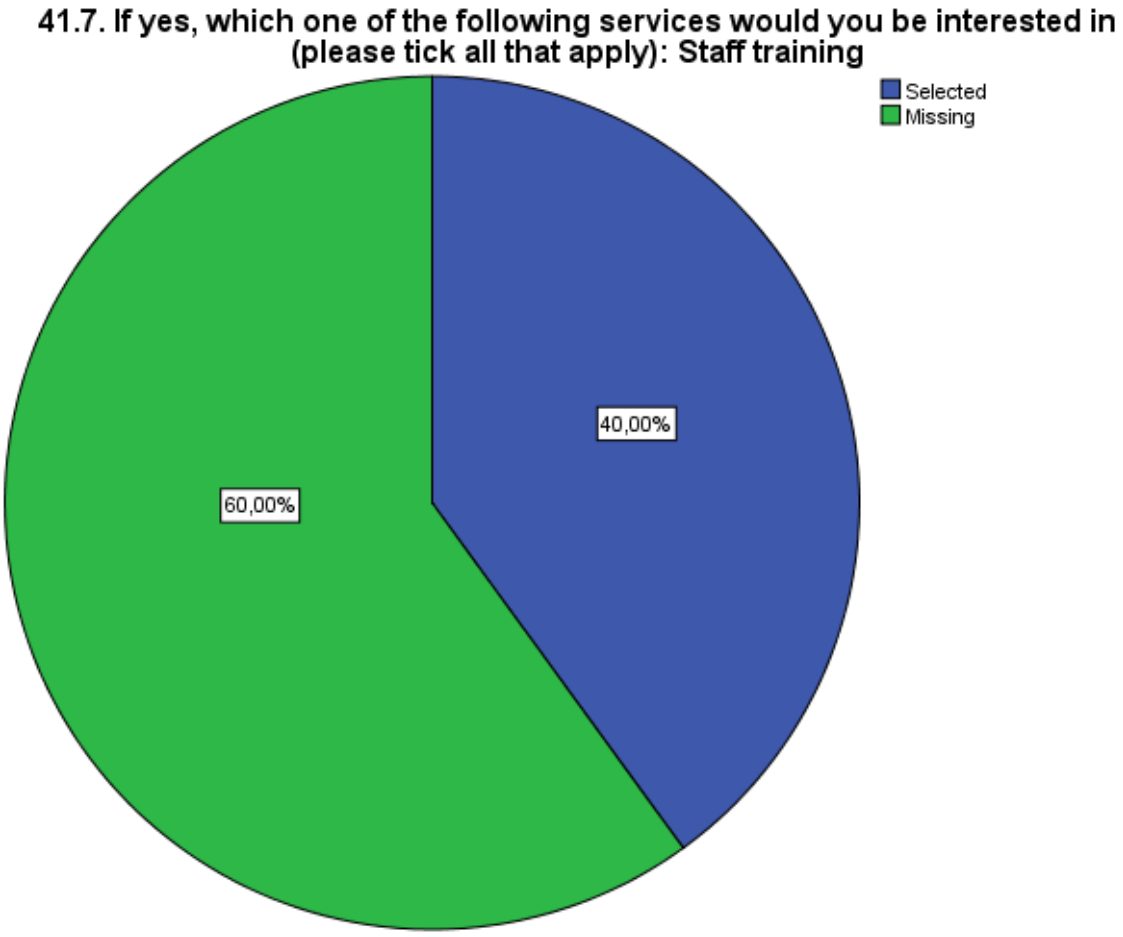
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Selected	2	20,0	100,0	100,0
Missing	System	8	80,0		
Total		10	100,0		



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

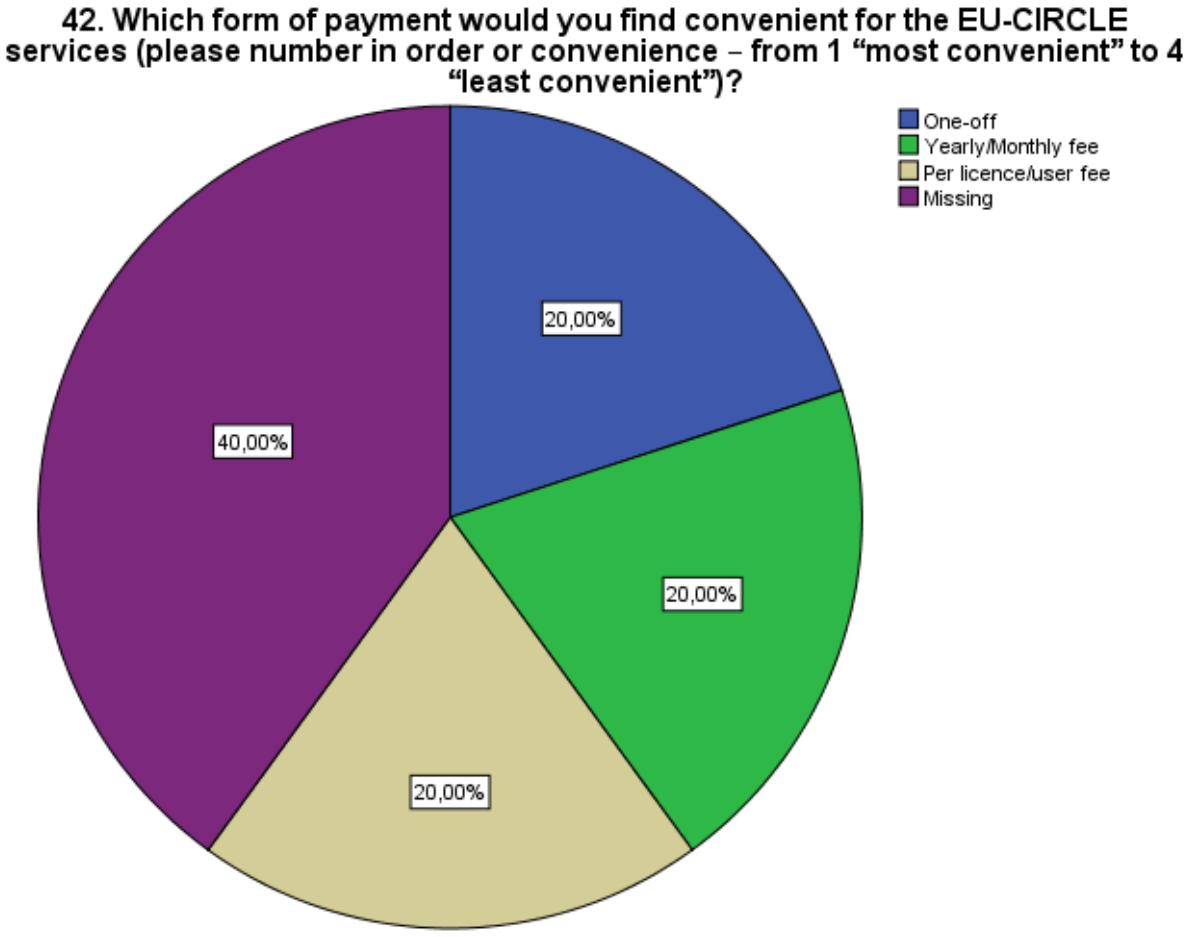
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Selected	4	40,0	100,0	100,0
Missing	System	6	60,0		
Total		10	100,0		



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

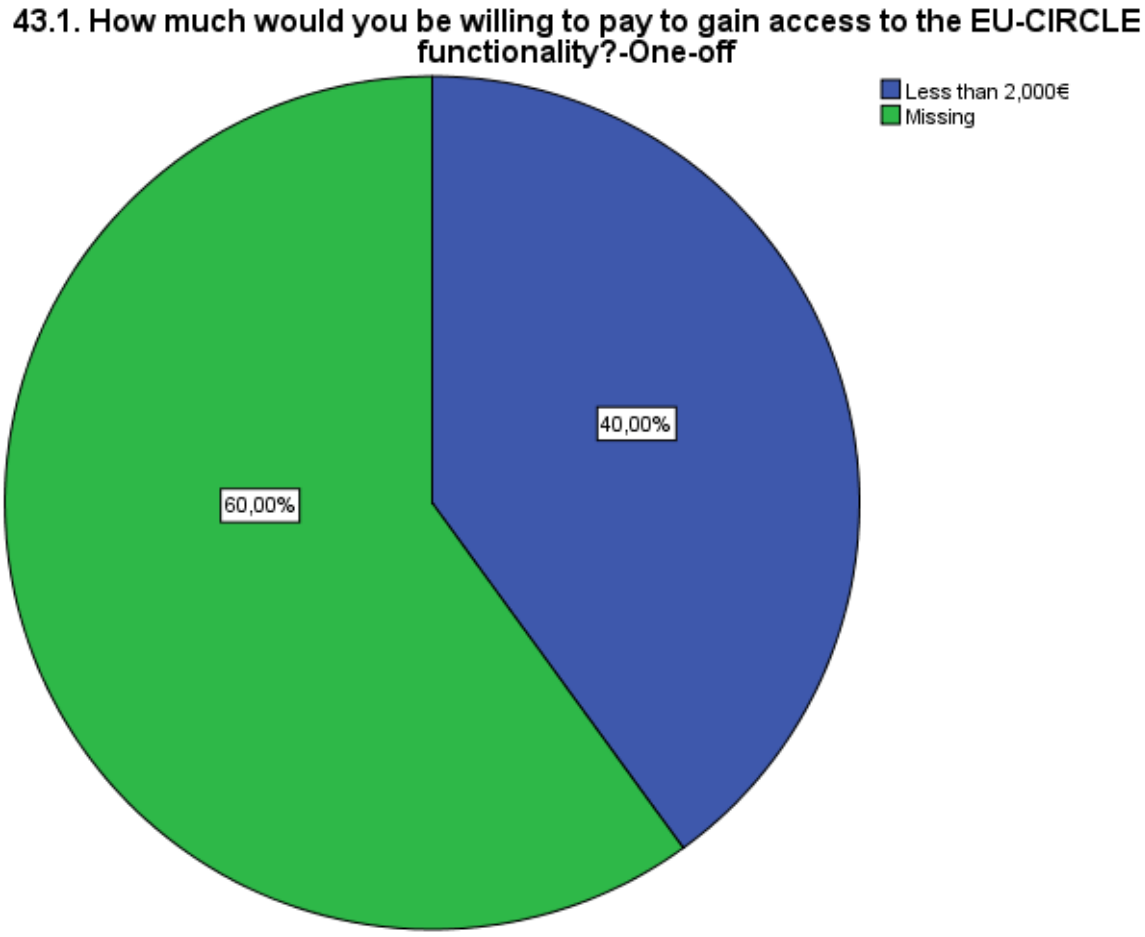
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	One-off	2	20,0	33,3	33,3
	Yearly/Monthly fee	2	20,0	33,3	66,7
	Per licence/user fee	2	20,0	33,3	100,0
	Total	6	60,0	100,0	
Missing	System	4	40,0		
Total		10	100,0		



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

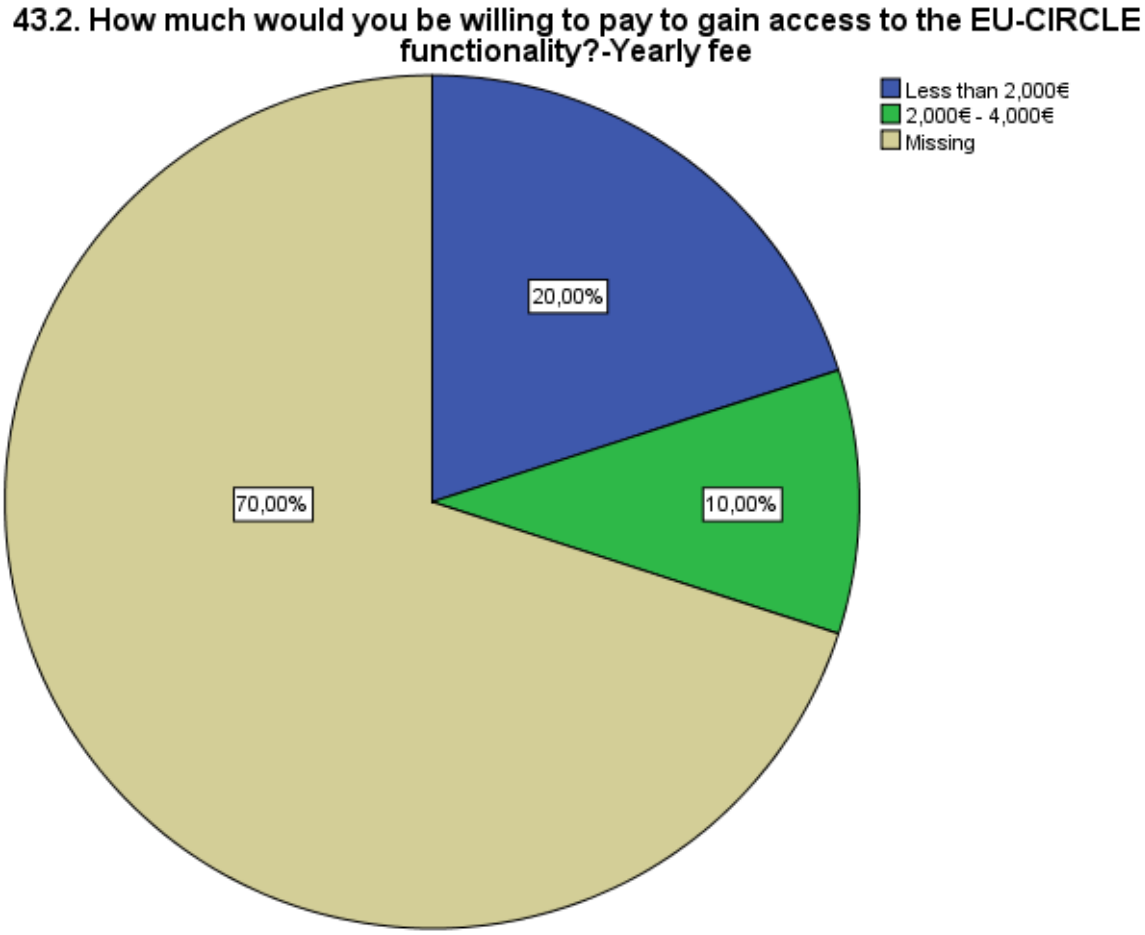
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less than 2,000€	4	40,0	100,0	100,0
Missing	System	6	60,0		
Total		10	100,0		



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

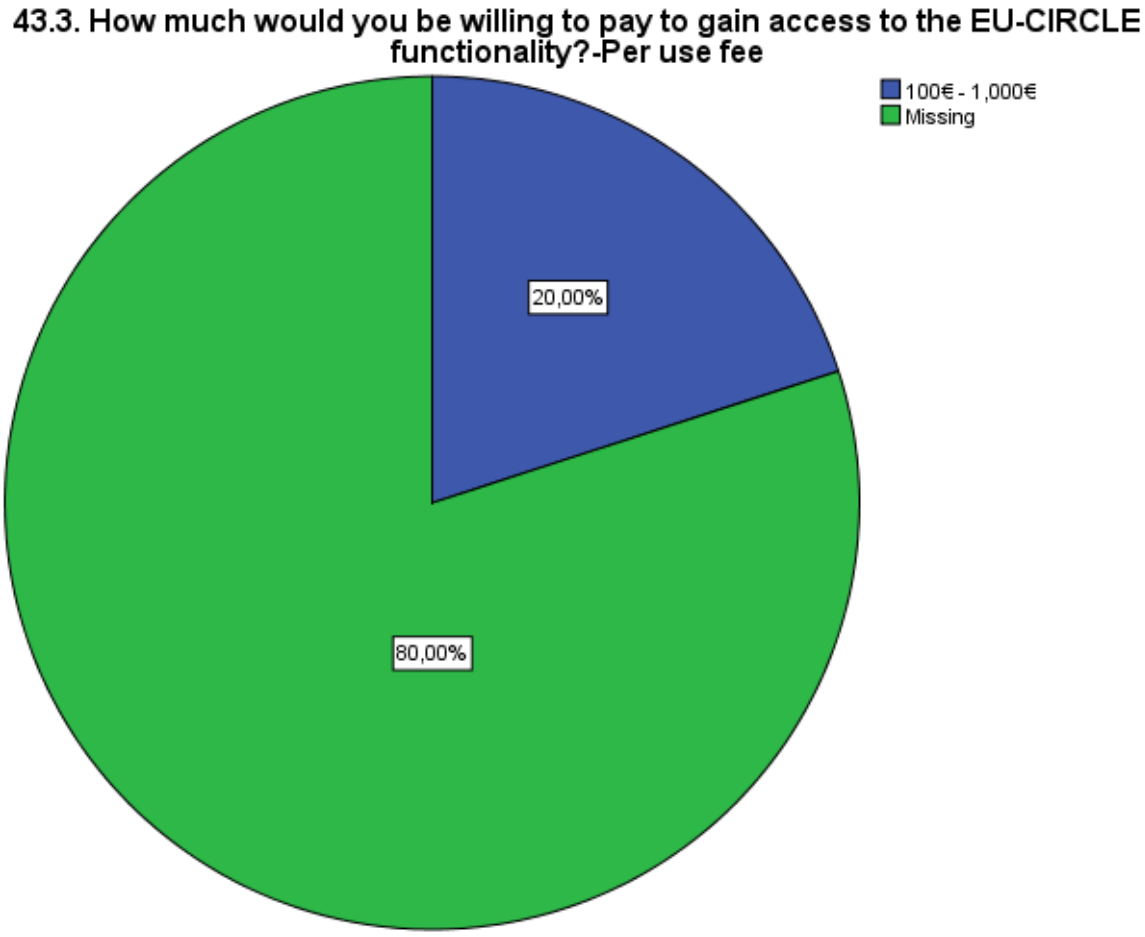
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less than 2,000€	2	20,0	66,7	66,7
	2,000€ - 4,000€	1	10,0	33,3	100,0
	Total	3	30,0	100,0	
Missing	System	7	70,0		
Total		10	100,0		



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

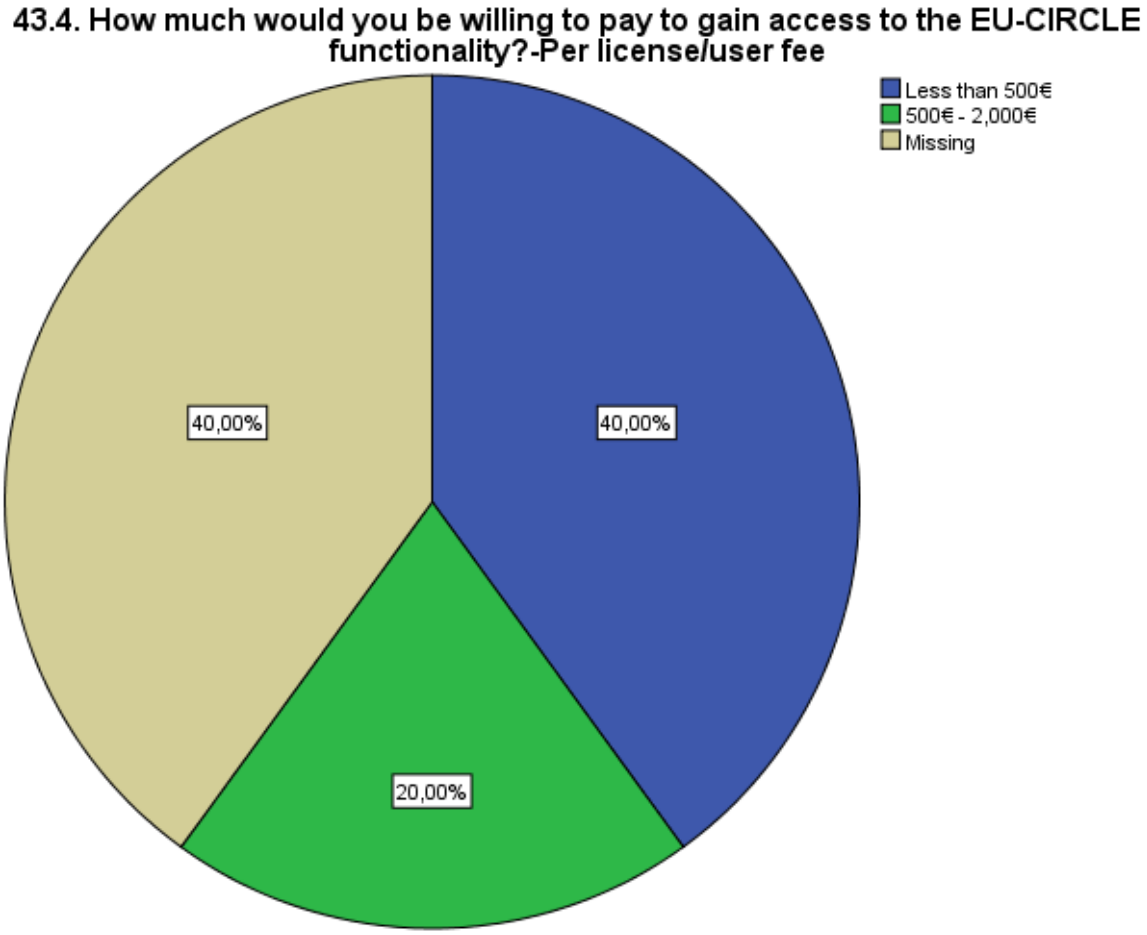
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	100€ - 1,000€	2	20,0	100,0	100,0
Missing	System	8	80,0		
Total		10	100,0		



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	Valid Percent	Cumulative Percent
Valid	Less than 500€	1	10,0	33,3	33,3
	500€ - 2,000€	2	20,0	66,7	100,0
	Total	3	30,0	100,0	
Missing	System	7	70,0		
Total		10	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	4	40,0	66,7	66,7
	With modifications	2	20,0	33,3	100,0
	Total	6	60,0	100,0	
Missing	System	4	40,0		
Total		10	100,0