

OT1.1 - Responsible Green Destination Tourism Impact Model - RGD TIM

Project	Responsible Green Destination Amazon of Europe
Acronym	Amazing AoE
Duration	1.7.2020 – 31.12.2022
Website	http://www.interreg-danube.eu/approved-projects/amazing-aoe
Work Package	T1
Output/Deliverable	Output
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Date	31.5.2021

INDEX

1. EXECUTIVE SUMMARY	4
2. WHAT IS RGD TIM?	4
2.1. The benefits of using RGD TIM for a destination	4
2.2. How RGD TIM works	5
2.3. RGD TIM questionnaire	6
2.4. Easy to understand results (RGD TIM report)	9
2.5. Sustainable Development Goals (SDGs)	12
3. HOW IS RGD TIM CONSTRUCTED	14
3.1. Technologies used in RGD TIM	14
3.2. MADM model	14
3.3. Connection with Tourism 4.0 digital tools	15

1. EXECUTIVE SUMMARY

The sustainable framework of Responsible Green Destination Tourism Impact Model (RGD TIM) is based upon the Tourism Impact Model (TIM) developed by Arctur before the project. In this regard, RGD TIM builds upon the methodology of TIM and is functioning using Arctur's IT platform called AAT.

In chapter 2 we present how RGD TIM functions, its use and its features (RGD TIM questionnaire, RGD TIM report). In chapter 3 we present technical aspects of RGD TIM, specifically the MADM model for data analysis and connection with Tourism 4.0 digital tools.

2. WHAT IS RGD TIM?

The Responsible Green Destination Tourism Impact Model (RGD TIM) is based upon the Tourism Impact Model (TIM) developed by Arctur before the project. In this regard, RGD TIM builds upon the methodology of TIM and is functioning using Arctur's IT platform called AAT.

Tourism Impact Model (TIM) is an award-winning tool using real data to create an objective picture of the impact of tourism in a certain micro-location. It analyses different societal aspects: from environment, economy and culture to collaboration. By modelling the impact using different scenarios, it also acts as a digital twin of a tourist destination and allows data-driven strategic planning aligned with the [UN Sustainable Development Goals](#).

2.1. The benefits of using RGD TIM for a destination

Local inhabitants, tourist service providers, authorities ... every stakeholder has its own subjective perception of the reality. RGD TIM brings **real data in the perception of the impact of tourism** to sharpen the real picture for everyone and allow data driven strategic planning.

The benefits for a destination:

- Built-in transparency and inclusion of local inhabitants in strategic planning.
- Supervised collecting of data from various sources and their transformation into valuable information which can also be used for the creation of a Digital Twin.
- Real picture of the whole spectrum of positive and negative impacts of tourism based on real data.
- Complex concepts made simple and understandable through visualisation of results and sets of recommendations for improvements.

- Dynamic real data simulations of possible scenarios for quick and competent response in all situations.

2.2. How RGD TIM works

The process is supervised by certified RGD TIM experts and includes the below described steps. In the Amazing Amazon of Europe, project partners will become RGD TIM expert.



Definition of the most appropriate geographical micro-location



Mapping the data sources



Completing the questionnaire and launching the Automated Assessment Tool



Automatic report generation



Validation of the results and detailed recommendations by experts (optional)

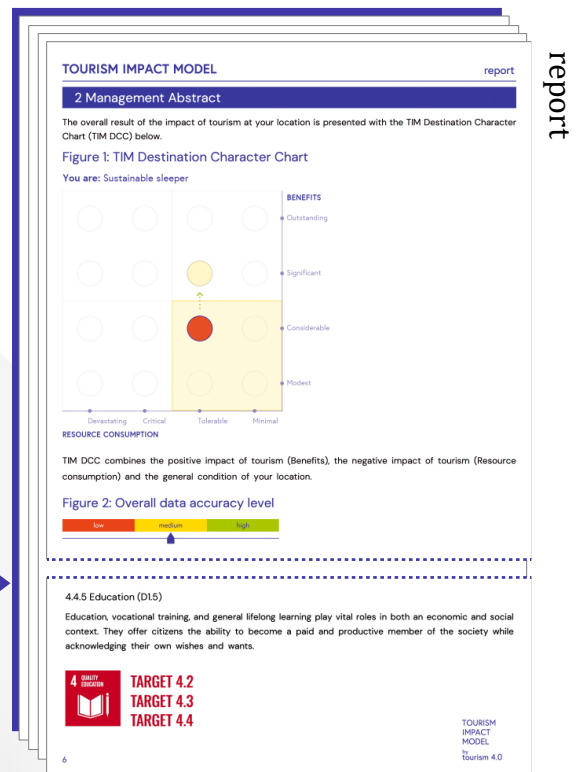
300+ indicators

- 5 groups
- 23 categories
- 67 question sets
- 138 SDAQ question sets
- Min 2000 up to 100.000 data inputs

questionnaire



The screenshot shows a questionnaire interface for 'B3.1 Electricity Consumption and electrical grid'. It includes a table for 2019 (last year) and 2020 (estimation) with columns for '2019' and '2020' and rows for '2019' and '2020'. The 2019 value is 24,2 and the 2020 value is 26,9. The interface also includes navigation buttons like 'Previous step' and 'Next step'.



RGD TIM assessment can be repeated at any time intervals and in this way, it enables constant monitoring and evaluation of the progress of the tourism impact at the selected location.

2.3. RGD TIM questionnaire

Building upon the TIM questionnaire, the RGD TIM questionnaire includes 310 questions (2000 data inputs minimal with up to 100.000 and more available) or sustainable indicators grouped into 23 categories and 5 groups, presented in the table below:

Group	Category
1. Basic info	1. Basic Questions
2. Environment	2. Air Quality 3. Water Sanitation 4. Electricity Management 5. Waste Management 6. Sustainable Transportation 7. Tourism Infrastructure 8. Spatial and Land Management 9. Green Infrastructure and Policies
3. Economy	10. Tourism Income 11. Tourism Accommodation Capacity 12. Jobs in Tourism 13. Local Economy 14. Real Estate and Consumer Goods
4. Society and Culture	15. Quality of Life 16. Health and Safety 17. Inclusion of Vulnerable Groups 18. Preservation of Heritage
5. Collaboration	19. Local Residents 20. National Government 21. Third Sector, Voluntary and Civic Sector 22. Tourism Service Providers 23. Other Stakeholders

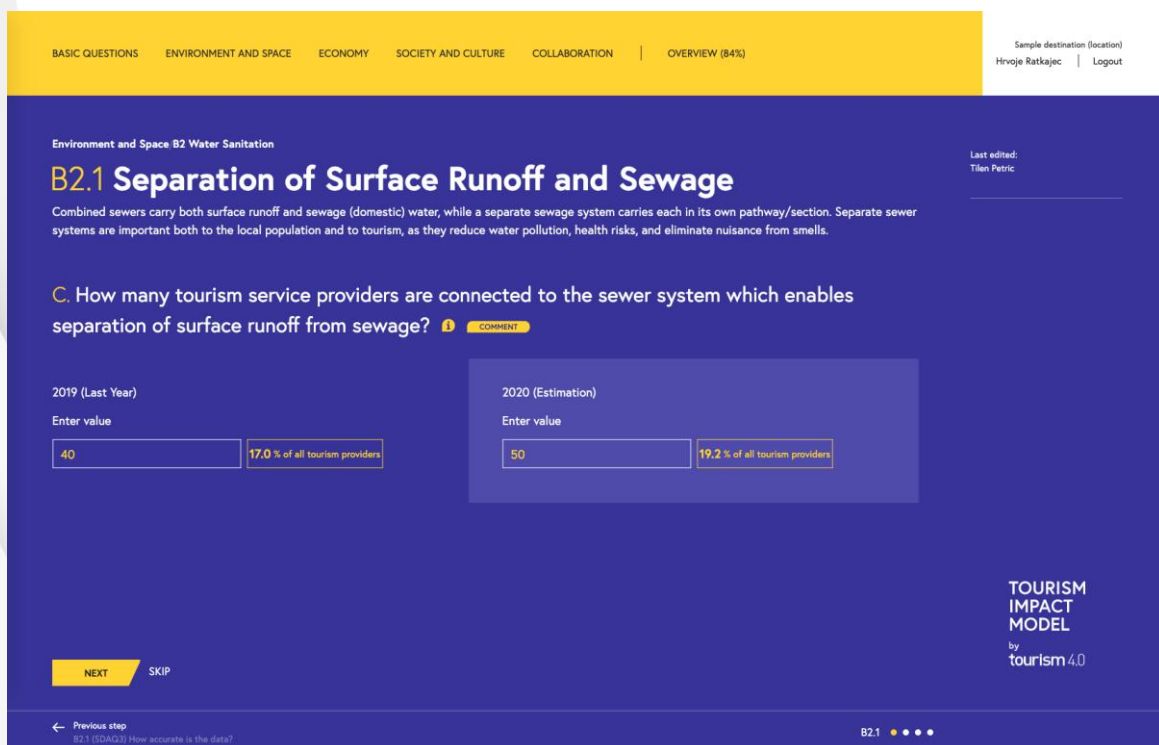
Besides the above-mentioned indicators, it also includes 138 Standard Data Accuracy Questions (SDAQ) question sets (one set is composed of three standardized questions) to measure the accuracy of the data provided for the indicators.

All in all, the RGD TIM questionnaire is composed of more than 700 questions, but it is practical and easy to use the tool:

- Easy categorisation: main groups are marked by a capital letter: A, B, C, etc. Each group has one or more categories marked as A1, B1, B2, etc. Each category has one or more question sets marked as A1.1, A1.2, B1.1, B1.2, etc. In each question set,

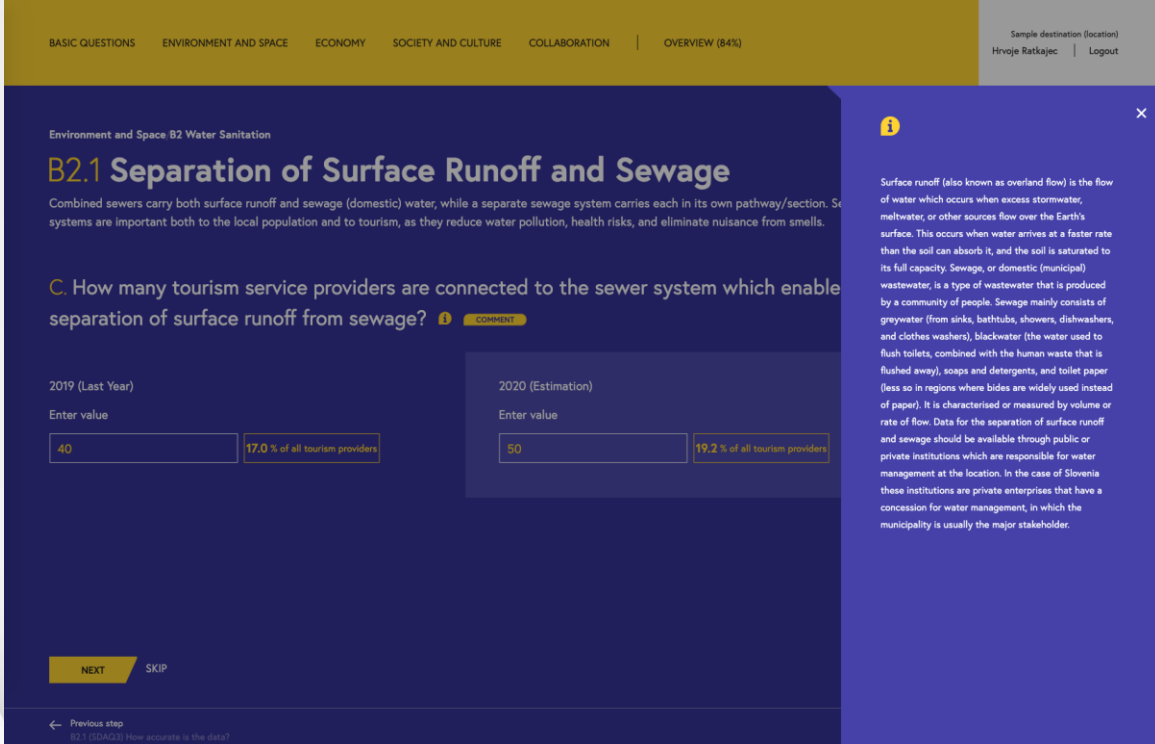
there are usually around 2-5 questions, marked with a lowercase letter (eg. A1.1a, A1.1b etc.)

- Different types of answers: The data are inserted into the questionnaire through different types of answers (radio button, checkboxes, calendar)
- Last year and current year: Most of the questions ask for data for two different variants: for the last (completed) year and your estimation for the current year. In this way, in the RGD TIM report, we can provide a comparison between last year and the current year.
- Intro: Each question set has an introductory text with information about the topic of the question set.



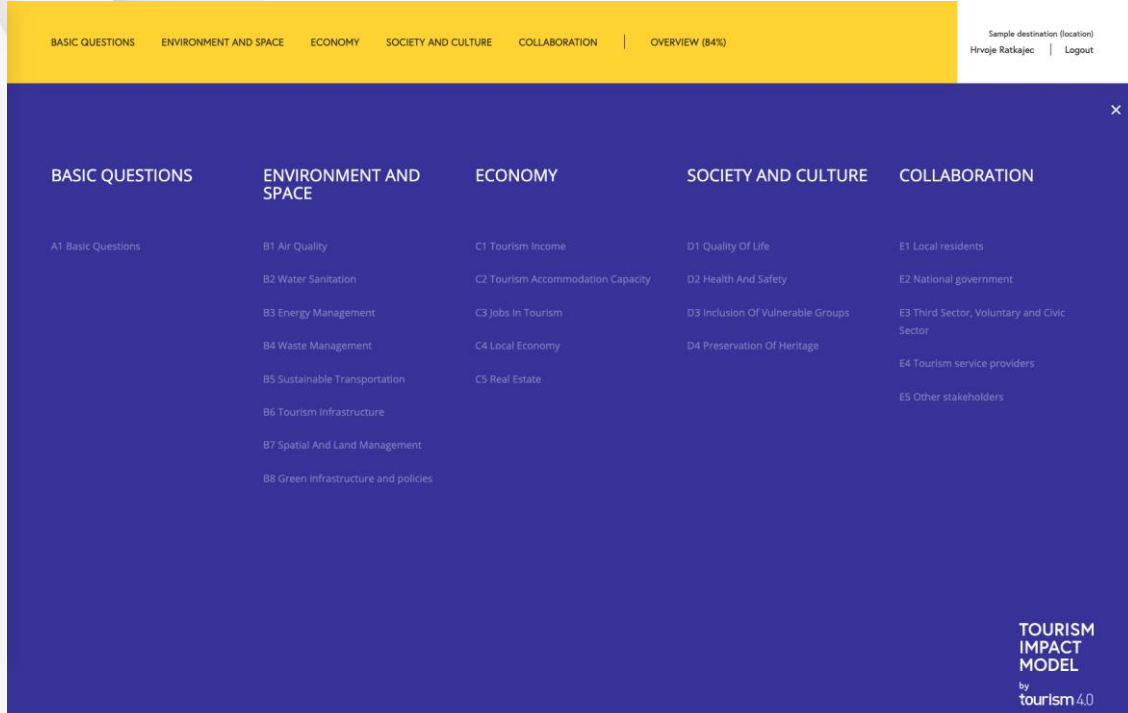
The screenshot shows a questionnaire interface with a yellow navigation bar at the top containing: BASIC QUESTIONS, ENVIRONMENT AND SPACE, ECONOMY, SOCIETY AND CULTURE, COLLABORATION, and OVERVIEW (84%). The current page is titled "Environment and Space B2 Water Sanitation" and "B2.1 Separation of Surface Runoff and Sewage". Below the title is a descriptive paragraph: "Combined sewers carry both surface runoff and sewage (domestic) water, while a separate sewage system carries each in its own pathway/section. Separate sewer systems are important both to the local population and to tourism, as they reduce water pollution, health risks, and eliminate nuisance from smells." The question is: "C. How many tourism service providers are connected to the sewer system which enables separation of surface runoff from sewage?". There are two input sections: "2019 (Last Year)" with an input field containing "40" and a label "17.0 % of all tourism providers", and "2020 (Estimation)" with an input field containing "50" and a label "19.2 % of all tourism providers". At the bottom, there are "NEXT" and "SKIP" buttons, and a footer with "TOURISM IMPACT MODEL by tourism 4.0".

- **Info:** Each question has a small information icon (yellow “i”). When clicking on it, a detailed explanation of the question that can help you by answering appears.



The screenshot shows a questionnaire interface with a navigation menu at the top: BASIC QUESTIONS, ENVIRONMENT AND SPACE, ECONOMY, SOCIETY AND CULTURE, COLLABORATION, and OVERVIEW (84%). The current question is B2.1 Separation of Surface Runoff and Sewage. The question asks: "How many tourism service providers are connected to the sewer system which enable separation of surface runoff from sewage?". The interface shows input fields for 2019 (Last Year) and 2020 (Estimation). The 2019 input is 40, resulting in 17.0% of all tourism providers. The 2020 input is 50, resulting in 19.2% of all tourism providers. An information popup is open on the right, explaining surface runoff and sewage. The popup text reads: "Surface runoff (also known as overland flow) is the flow of water which occurs when excess stormwater, meltwater, or other sources flow over the Earth's surface. This occurs when water arrives at a faster rate than the soil can absorb it, and the soil is saturated to its full capacity. Sewage, or domestic (municipal) wastewater, is a type of wastewater that is produced by a community of people. Sewage mainly consists of greywater (from sinks, bathtubs, showers, dishwashers, and clothes washers), blackwater (the water used to flush toilets, combined with the human waste that is flushed away), soaps and detergents, and toilet paper (less so in regions where bides are widely used instead of paper). It is characterised or measured by volume or rate of flow. Data for the separation of surface runoff and sewage should be available through public or private institutions which are responsible for water management at the location. In the case of Slovenia these institutions are private enterprises that have a concession for water management, in which the municipality is usually the major stakeholder."

- **Navigation menu:** The navigation menu allows skipping individual questions, skipping to other sets of questions, other categories and groups.

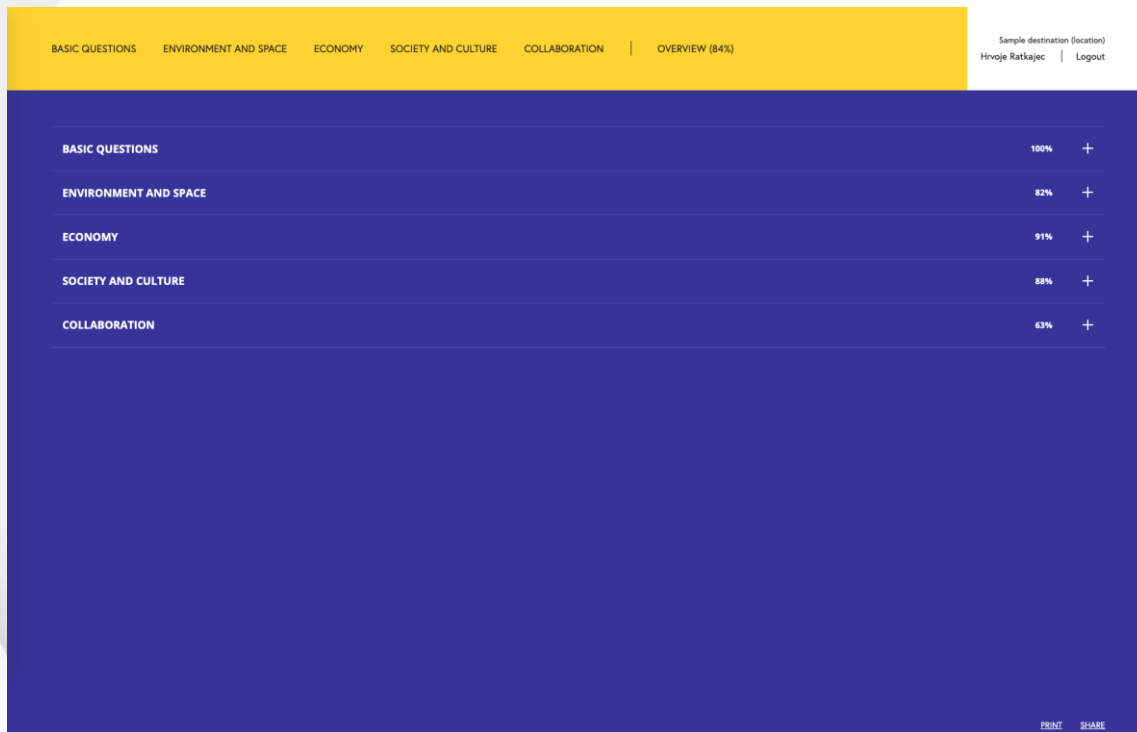


The screenshot shows the navigation menu with the following categories and sub-questions:

BASIC QUESTIONS	ENVIRONMENT AND SPACE	ECONOMY	SOCIETY AND CULTURE	COLLABORATION
A1 Basic Questions	B1 Air Quality	C1 Tourism Income	D1 Quality Of Life	E1 Local residents
	B2 Water Sanitation	C2 Tourism Accommodation Capacity	D2 Health And Safety	E2 National government
	B3 Energy Management	C3 Jobs In Tourism	D3 Inclusion Of Vulnerable Groups	E3 Third Sector, Voluntary and Civic Sector
	B4 Waste Management	C4 Local Economy	D4 Preservation Of Heritage	E4 Tourism service providers
	B5 Sustainable Transportation	C5 Real Estate		E5 Other stakeholders
	B6 Tourism Infrastructure			
	B7 Spatial And Land Management			
	B8 Green infrastructure and policies			

The logo "TOURISM IMPACT MODEL by tourism 4.0" is visible in the bottom right corner of the menu.

- **Overview:** The overview menu gives a quick summary of the questionnaire completed down to each question set, category and group. There is also a print and share option to send the overview to somebody else.

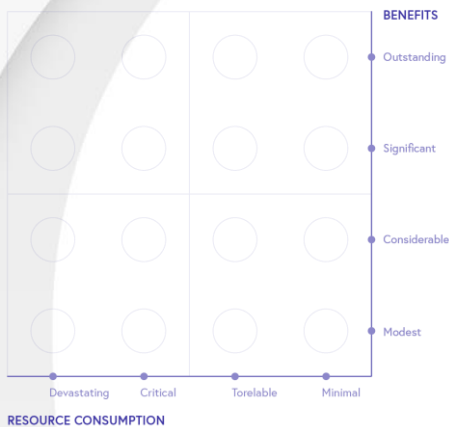


2.4. Easy to understand results (RGD TIM report)

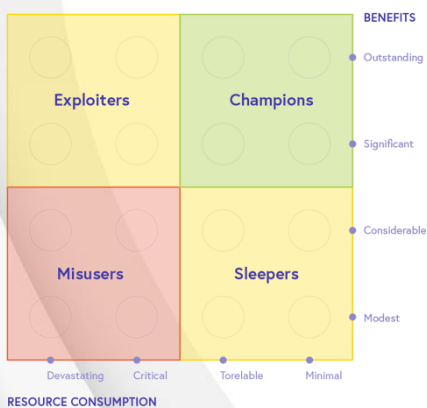
Results from the RGD TIM assessment are presented in a detailed report spanning over 100 pages. It is comprised of multiple indicators and graphs including the Destination Character Chart which enables easily comparable overall results.

Destination Character Chart

Destination Character Chart (DCC) is a tool for visualisation of the destination character, summarising values of hundreds of indicators grouped into a 3-dimensional matrix combining: Positive impact of tourism (**Benefits**), negative impact of tourism (**Resource consumption**) and **General conditions** of the destination. The main DCC is complemented by so called *mini DCCs* which visualise the results for individual sections. Each DCC (main and mini) is also accompanied by its data accuracy level presented by a graphic.



Benefits are represented on Y axis (from 1 to 4), **Resource consumption** on X axis (from -1 to -4), all together we have 16 (4x4) possible positions.



There are 4 different groups of primary characters, each containing 4 positions:

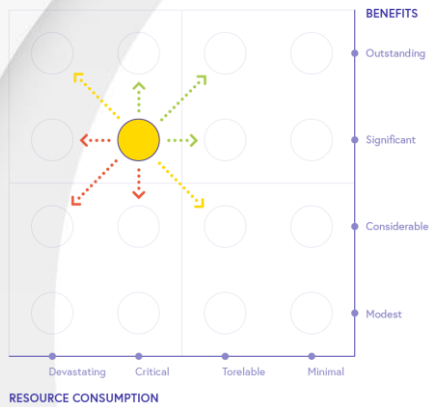
- **Champions** (high benefits, low resource consumption)
- **Sleepers** (low benefits, low resource consumption)
- **Exploiters** (high benefits, high resource consumption)
- **Misusers** (low benefits, high resource consumption)



Each destination is placed in **one of 16 positions** according to the given answers.



The third dimension, representing the **General condition of the destination**, is the colour of the position: it can be green (excellent), yellow (mediocre) or red (bad).



As many questions contain an additional answer where values for the near future are estimated, a trend where the specific destination is heading is presented in a form of a trend vector: the **green arrows are good**, heading towards the better positions (sustainable directions), **yellow are neutral** (partly sustainable) while **red ones are heading towards the bad impact** (unsustainable) and should be avoided.



The final result is a combination of the DDC graph alongside the overall data accuracy level.

DCC graph is presented by the 3-dimensional matrix (X, Y and colour) and the trend vectors, showing past position (if available from previous assessment) and the current trend of development (estimations for the future). **The final name of the destination character** is a combination of past and present positions, as well as trends.

For example: Sustainable champion (low resource consumption and high benefits of tourism) with excellent general condition of the location. Trend: sustainable advancement from the past and also towards the future.



Data accuracy level is displayed next to DCC graphs. It consists of a three tiered scale which indicates the trust in the accuracy of the given data: low, medium or high. It is calculated based on the **source, frequency of measurement and accuracy of the data**.

The data accuracy level has three positions:

- a) low: the data provided is unreliable, meaning that the DCC can't present an objective impact of tourism.
- b) medium: the data provided is partially reliable, meaning that the DCC presents a somewhat objective impact of tourism.
- b) high: the data provided is reliable, meaning that the DCC presents an objective impact of tourism.

2.5. Sustainable Development Goals (SDGs)

The 17 Sustainable Development Goals (SDGs) are special goals that were adopted by all United Nations Member States in 2015 to move the world forward in a more sustainable manner. The goals take into account the world as a whole with the emphasis on the countries furthest behind. Each SDG is also composed of numerous targets that more specifically define the goal.

The 17 goals are:

1. No poverty
2. Zero hunger
3. Good health and well-being
4. Quality education
5. Gender equality
6. Clean water and sanitation
7. Affordable and clean energy
8. Decent work and economic growth
9. Industry, innovation and infrastructure
10. Reduced Inequalities
11. Sustainable cities and communities
12. Responsible consumption and production
13. Climate action
14. Life below water
15. Life on land
16. Peace, justice and strong institutions
17. Partnerships for the goals

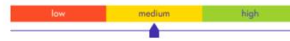
The relevance of the precise measuring of SDGs on a local level has been growing fast last few years. It was additionally confirmed during the COVID-19 crisis in which quick and competent responses have been required to lower their negative impact of measures on the quality of life of citizens. The more locally the data is gathered, the more different measures can be developed and adapted to local needs.

Sustainable Development Goals (SDGs) and RGD TIM

RGD TIM is the perfect tool to help in paving this way because it facilitates the collecting of information also for SDGs and gives you an insight into your position on the global scale. Each section includes the list of one or more SDGs and their targets most closely related to the content that follows.

An example from one of the sections

Figure 4: Environment data accuracy level



3.2.1 Air quality (BI)

Air quality is an important factor for local residents and visitors alike. We measure it according to two factors, CO₂ and PM10 fine particulate matter.

CO₂ is one of the main greenhouse gases which are responsible for the greenhouse effect - warming the Earth's surface. Higher levels of CO₂ indicate more fossil fuel burning, which is not sustainable. Knowing the quantity of CO₂ emissions, it is significant for the location to promote itself as sustainable and thereby attract tourism.



TARGET 9.4



TARGET 11.6

Fine particulate matter like PM10 is a common way of measuring air pollution at any location. Air polluted with PM10 has a negative effect on human health, and influences how attractive a location is for tourism.



TARGET 11.6

More information on SDGs available at:

- <https://sdgs.un.org/goals>
- <https://www.undp.org/content/undp/en/home/sustainable-development-goals.html>
- <https://www.un.org/sustainabledevelopment/sustainable-development-goals/>
- <http://tourism4sdgs.org/>

3. HOW IS RGD TIM CONSTRUCTED

3.1. Technologies used in RGD TIM

RGD TIM uses Arctur's AAT (Automated Assessment Tool), a very flexible IT platform that can support hundreds of questions with answers, which TIM is also using.

AAT platform is composed of:

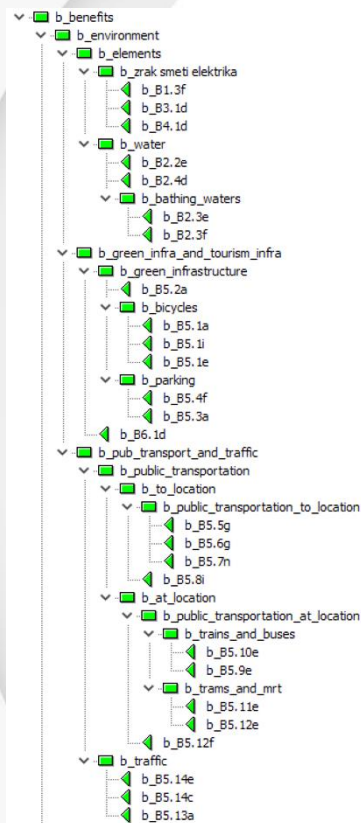
- Database using open-source MariaDB (similar to Oracle's MySQL);
- An online questionnaire using Angular and connecting it with the database using Java (backend);
- MADM model using open-source DEXi software;
- Automatically generated reported presenting results of the MADM model using JasperReports (Java).

Because TIM and RGD TIM use the same platform, RGD TIM currently also has TIM GUI (Graphic User Interface).

3.2. MADM model

MADM model is a model in which different "types" of questions from the RGD TIM questionnaire (qualitative and quantitative) are combined and easily organized into a tree-like structure to enable the generation of one result.

The proposed methodology is anchored in the Multi-Attribute Decision Making (MADM) theory (Keeney & Raiffa, 1976; Saaty, 1980; Chankong & Haimes, 1983; Dyer et al., 1992). These methods are based on the decision theory utility theory, and they are well accepted in solving real life complex decision problems (Cestnik & Bohanec, 2001; Leben & Bohanec, 2003; Bohanec et al., 2004; Taškova, Stojanova, Bohanec, & Džeroski, 2007; Kljajić Borštnar, Ilijaš & Pucihar, 2015).

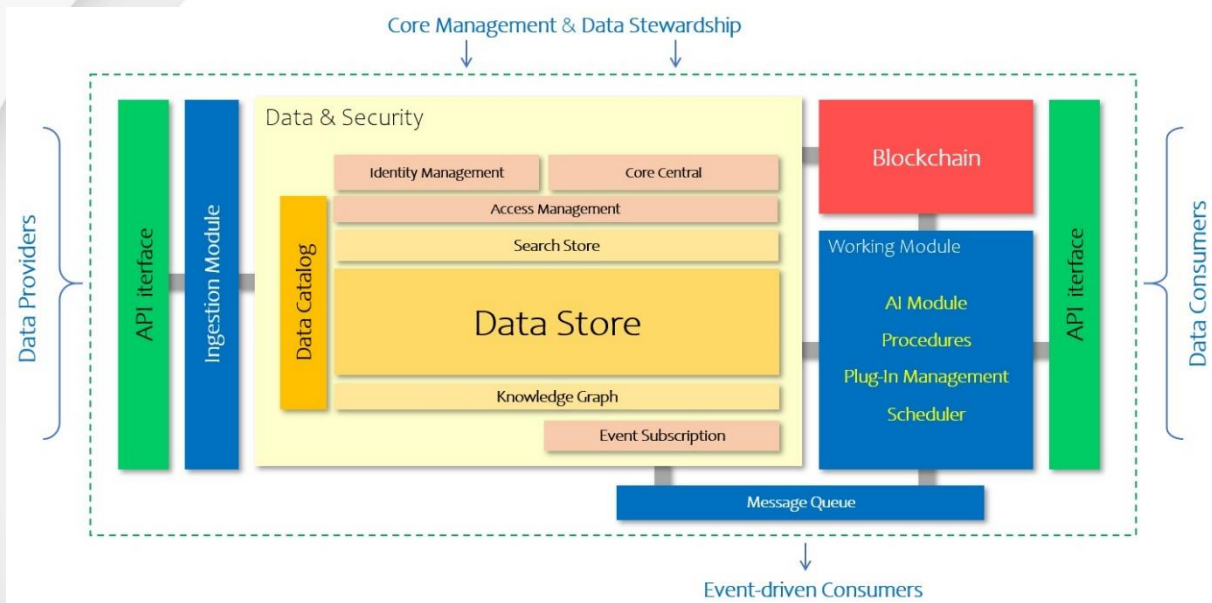


To be specific, the methodology of MADM is based on the decomposition of large, complex problems into subproblems, which are smaller, less complex and easier to solve than the complete problem, presented with a hierarchical tree of attributes. Each alternative is evaluated by each attribute and later on composed back to a single value. Aggregation of values (utility function) is defined by a set of simple “if-then” rules, which are compared to the linearly weighted sum, more suitable for expressing nonlinearities in decision knowledge and are easier to understand. Qualitative attribute scales are described by discrete descriptive attribute values and are more understandable to the decision maker. The hierarchical tree of attributes and a set of decision rules (utility functions) represent the knowledge base.

3.3. Connection with Tourism 4.0 digital tools

All the data regarding RGD TIM (data from the RGD TIM questionnaire, results, RGD TIM report data etc.) are stored on the Arctur’s Tourism 4.0 (T4.0) platform, concretely on T4.0 Core. T4.0 Core is a modern data architecture that aims to valorise data and encourage the integration of third-party solutions (ie. Amazon of Europe Booking&Management System) into the T4.0 platform. It can facilitate the discovery and understanding of data through a common vocabulary (semantics), processing data using machine learning and creation of a knowledge base with graph technologies to encourage stakeholders to integrate and use data to enrich relevant services and improve user experience with personalisation.

The T4.0 Core ensures that all the data, including that from RGD TIM, is not only accessible but also structured, described and searchable.



Picture of T4.0 Core. Author: Arctur d.o.o.

Under the Tourism 4.0 designation, Arctur is developing other Tourism 4.0 digital tools, like DOTI (Personal Digital Passport) and CIT (Collaboration Impact Token). Both tools work closely with T4.0 Core.

DOTI is a tool (in the form of a mobile application) with which each user can create their personal tourism profile, enter their data and preferences and share them anonymously with tourism service providers for personalized services.

CIT is a digital token, with the aim to direct tourism flows and stimulate more sustainable tourism offer. Tourists can be influenced by the targeted distribution of tokens or also by dynamically changing values, which can be tied to a tourism location, type of tourism experience, the scale of environmental impact and similar.

CIT requires the DOTI as a basis for functioning, as DOTI hold the wallet of CIT. Through DOTI, the user can access the CIT wallet and functionalities such as wallet balance overview, handover/payment and payment history.

RGD TIM is integrated into the T4.0 Core but from the tourism service provider's side, as RGD TIM results or reports are available to tourism service providers via the API. This means that the tourism service provider with their application (ie. AOE BMS) offers their services along with RGD TIM information and the ability to use CIT, which Consumer (tourists) can access by using DOTI and pay for with CIT. This all functions through the T4.0 Core and its APIs.