REPAIR

Using Badges to Increase Railway Sustainability

REPAIR supports the Sustainable Development Goals

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INTELLECTUAL OUTPUT 3

REPAIR PACK

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1. INTRODUCTION

1.1 About REPAIR

REPAIR is an ERASMUS+ project intended to test the application of open badges in the railway sector.

Badges are a new type of credential which use digital technology to recognise a person's skills, accomplishments, interests, and more. One example of a traditional (i.e., analogue) credential is an academic degree.

Digital badges are already being used by many institutions and companies to help identify people with skills or interests. Examples include using a corporate digital badges system to identify people with the skills needed for a given project team. IBM is using badges extensively both within the organisation and offering certified badges to persons outside the organisation. In 2020 IBM had already issued over 3 million badges (see https://www.linkedin.com/pulse/ibm-awards-its-three-millionth-digital-badge-disrupts-david-leaser/ for a summary of badges and how they are used by IBM).

Similarly, many educational and training institutions are now using badges to certify that individuals have completed a course of study or examination.

The badges outlined above recognise accomplishments in a highly structured environment (i.e., badge holders have passed a formal exam on a given computer language recognised by the badge-issuing organisation). In contrast to these highly formalised badges, open badges are created in an "open" process where "anyone" can create a badge to recognise some accomplishment, quality, desire and more. This is an important difference from badges that are issued by "official" organisations such as universities or companies.

The REPAIR project is focusing on open badges because we believe that this open process can lead to the informal sharing of best practices and ideas (e.g., tacit knowledge) that can significantly improve the performance of organisations and companies.

For example, someone creates a badge for reducing energy use by train drivers; other train drivers see this badge, add their own experience to the platform, and are "awarded" badges; gradually a community of practice (CoP) is built which shares ideas for reducing energy use by train drivers. Such a badge could also be created by a company (and should be) but allowing anyone to create a badge (these badges would be validated – people can't just create a nonsense badge) encourages sharing of tacit knowledge – in other words, things workers and trainees don't learn in school or in corporate training: how you can really achieve the objective in practice.

Given the very broad potential application of open badges in the railway sector, the REPAIR project focused on using badges to support implementation of the United Nations Sustainable Development Goals (SDGs) by railway organisations.

More specifically, the project has tested how open badges can be used by railway organisations to improve their performance in relation to the UIC (International Union of Railways) Railway SDG Index. The UIC SDG Index is a set of measures developed by the UIC to gauge railway organisation progress towards achieving seven SDGs that are most appropriate for railways. See the REPAIR homepage: https://repair.uic.org/.

1.2 REPAIR Overview

The REPAIR team completed the following five main activities during the project:

1. REPAIR Framework – Developed a conceptual and practical framework for using open badges in helping support the UIC Railway SDG program; including developing a common understanding among team members about open badges and their use (see REPAIR Intellectual Output 1).
2. REPAIR Ecosystem – Developed tools to co-construct a map of practices (competencies) in railway sustainability including development and testing of badges and badge administration software in a prototype application created for the Railway SDG Index introduction webinar (see REPAIR Intellectual Output 2).
3. REPAIR Pack – Created a set of resources to support testing of open badges by communities of practice to improve SDG Index performance (i.e., mapping) based on the earlier activities (see REPAIR Intellectual Output 3 – this document).
4. REPAIR Mapping – Tested the ability of open badges to improve organisational performance on the UIC Railway SDG Index in real communities of practice (see REPAIR Intellectual Output 4).
5. REPAIR Analysis – Evaluated the results of the test and made general recommendations for using badges in the railway sector (see REPAIR IO 5).

The project started in September 2020 and ended in August 2023.

1.3 About this Document

This document (IO 3) presents resources to help railway employees (communities of practice) identify practices which contribute to the UIC SDGs, and to create badges supporting implementation of these practices.

It begins with an introductory description of badges, and then presents specific recommendations for identifying (mapping) occupational practices and recognising them (using badges). It serves as a "how-to" manual for defining, awarding, displaying, managing, and most importantly, using badges to improve organisational performance (in the case of REPAIR: improving organisational performance on the UIC Railway SDG Index).

A draft version of this document was used as part of the REPAIR project field studies carried out in the REPAIR Mapping project activity (Autumn 2022 – Spring 2023); this final version has been revised based on results of the test application.

Chapter 2 provides a more detailed background on how badges can be used to recognise talents, skills, accomplishments, ideas and more. It presents some of the general ideas for using badges and methods for putting them into practice.

Chapter 3 summarises how badges were developed and tested during the REPAIR project. It is meant as background to help understand this Intellectual Output; for more details on the project and results please see the REPAIR final report and the other intellectual outputs.

Chapter 4 presents an overview of how individuals and organisations can use the badge administration platform developed as part of REPAIR (called: ORCA) to improve the quality and participation in Communities of Practice, and then describes how to use the main functions of the ORCA platform. Chapter 4 is the "how to" manual.

2. BACKGROUND: BADGES AND RECOGNITION

2.1 What are badges?

Badges are a new type of credential for recognising skills, accomplishments, desires, and other qualities.

Badges are designed specifically for the digital age both in terms of administration (i.e., methods for creating, managing, and using badges) and in terms of content (i.e., what qualities are recognised by the badges).

The administration of traditional badges (e.g., academic degrees, course certifications) is often complicated and time-consuming. But digital technology makes it easy to create and manage badges. These are especially important today as new technologies create the need for new skills, and because many skills are attained throughout a career (lifelong learning).

As digital credentials, badges can be created to recognise many more qualities than traditional credentials including tacit skills (i.e., how to actually accomplish objectives like energy-efficient train driving in the field). Today many organisations and educational institutions are using badges to recognise skills, qualities, certifications, and desires. Additional information about badges is available in this excellent video by Eric Ullrich (Hackerlab.org): https://youtu.be/fHKEZ232-j0 and from the website: https://openbadges.org/

Please note: While most of the text in this document refers to persons receiving badges, it's also possible to award badges to organisations or groups.

2.2 How can you use badges?

Badges are a form of recognition. They show that a person or group has some specified quality, skill, certification, or desire.

There are three main uses for badges:

1. Human resources management – badges can be used to create a very comprehensive description of personal skills and qualifications that can be easily kept up to date.
2. To motivate behaviour – badges can be awarded to encourage people to behave in a certain manner. For example, to thank people for acting in a certain way. The badge may include some tangible reward and/or confer status.
3. To share and develop new knowledge – badges can be used to jump-start the creation of communities of practice which then create and share tacit knowledge needed to actually implement larger organisational goals (e.g., energy-efficient driving).

Of course, badges can fulfil all these uses simultaneously.

In addition to these uses for badges, the actual process of creating badges can also be helpful because it entails closely examining activities to identify specific qualities that support personal or organisational goals (and then creating a badge for that quality).

Several examples serve to help illustrate these uses.

One of the most traditional credentials is an academic degree. Educational institutions issue degrees to encourage students to complete a precisely defined program of studies. Students are motivated to complete the program because the degree will help them get a job. The institution is motivated to keep close track of degrees to protect the reputation of the degree (i.e., the quality which others attribute to the degree: i.e., a degree from University X is worth more than University Y) and, thereby its own reputation. (Of course, there will be students who complete a degree program for intrinsic reasons as well, but they do not care about receiving the credential.)

A second example is IBM which uses badges to identify employee competencies (e.g., demonstrated skills, completed projects, educational certifications). These badges are displayed on an internal network which managers can use to identify people with the skills needed to complete specific projects and maintain an up-to-date view of organisational skills. This is a very highly structured badge system. As outlined above, IBM also offers a badge system to persons outside IBM that certify they have attained given skills (e.g., competence in a programming language).

A less structured example is the REPAIR project. REPAIR is testing the potential of badges to improve organisational performance on the UIC Railway SDG Index. The badges would define specific activities (qualities) that improve the organisation's SDG Index score. These badges would be developed working closely with railway organisations and workers (i.e., communities of practice). The process of developing badges is called mapping.

2.3 Badge Management

Badge management consists of the following five activities:

- Process Planning;
- Defining badges;
- Awarding badges;
- Displaying badges; and,
- Badge administration.

There are many open-source software applications that can be used to effectively perform these activities. In addition, many companies offer customised badge management applications including Moodle (a commonly used educational application), Open Badge Factory, and the new ORCA software developed as part of REPAIR.

This section summarises the five badge management activities. Chapter 3 presents a specific plan for implementing them in the REPAIR project.

Process Planning

Process planning consists of three steps:

1. Identify project objective (what is your goal?).
2. Assess how badges could be used to help achieve this goal.
3. Decide whether badges are the best technique for achieving this goal.

Step 1 consists of specifically defining the goal to be achieved. For example, IBM was seeking a method for identifying employees with specific skills. The UIC is seeking a method for helping railway organisations increase their Railway SDG Index scores.

Step 2 consists of determining how badges could be used to help achieve the goal. A good starting point is to consider whether achieving the goal involves the three main uses for badges (human resources management, motivation, and/or development and sharing of tacit knowledge). If so, badges may be a good technique and you should precisely specify how badges can help achieve the goal.

Step 3 consists of determining whether badges are the best technique for achieving the goal by comparing the costs and benefits of a badge program to other techniques. The two most important points are: (1) effectiveness (are badges a good way of achieving the goal?); and (2) fatal flaws that increase the cost or difficulty of using badges (e.g., no appropriate social network available for displaying a badge). The fatal flaw analysis should consider all four badge management activities listed below.

Finally, if badges are chosen as the best technique for achieving the goal, then a plan should be developed for defining, awarding, displaying, and administering the badge program (i.e., identifying the best badge software platform and determining how precisely you will use it).

Defining Badges (Mapping Process)

The process of defining badges consists of three steps:

1. Identify the quality which you wish to recognise.
2. Define the measurable attributes which demonstrate this quality.
3. Create a badge for this quality with the associated attributes.

Several aspects of this process require more explanation.

First, the unlimited nature of digital technology means badges can be created for anything you can imagine recognising. This ranges from traditional credentials (e.g., course certification) to personal desires (e.g., desire to increase your company's sustainability) to accomplishments (e.g., award for courteousness) to job performance skills (e.g., skill in repairing a motor).

However, while badges can be used to recognise any quality it is important to consider why you might want to recognise a given quality (i.e., asking how recognising this quality helps achieve your goal). Therefore, just as including elementary school graduation in a CV isn't likely to be helpful to potential employers, it makes no sense to create badges for qualities that are not useful for achieving your overall goal.

The measurable attributes are used to determine whether someone should be awarded the badge. Here again the possible attributes are almost unlimited. The attribute for a "desire" badge might just be saying you want one, while the attribute for a university-sponsored educational degree badge would be a long set of specific requirements for classes, exams, and documents. In all cases the badge attributes should be precisely defined and non-subjective – because someone will use these attributes to decide whether to award the badge.

The last step, creating the badge, is relatively easy. It consists of entering the badge name (quality) and attributes into a badge administration software (e.g., Moodle, open badge factory, ORCA). Information on using the software chosen for REPAIR is presented in Chapter 4.

One final note: The process of defining badges can be done top-down, bottom-up, or in a combination of both. An example of top-down would be a university administration setting the requirements for an academic degree.

In contrast, a bottom-up process consists of having a community of practice – i.e., people who are actually doing the work related to achieving the organisational goal (e.g., increasing sustainability) – identify the qualities to be recognised using badges. The great advantage of using a community of practice (COP) to define badges is their ability to identify activities or qualities that may not be obvious to observers (e.g., tacit knowledge).

In a combined process the input from several communities of practice and/or organisations is distilled into badges. The REPAIR project used a combined process of working with railway operators, the UIC, and railway workers.

Awarding Badges

The process of awarding badges consists of reviewing badge applications and determining whether the applicant should be awarded the badge.

As a rule, if the badge applicant meets the badge attributes, the badge should be awarded.

It is important to consider the resources needed to award a badge when you are designing the badge. The more complicated the badge attributes, the more resources you will need for determining whether an applicant should be awarded the badge or not.

In general, these resources mean people reviewing applications; more complicated attributes = more hours spent. On the other hand, some badges could be awarded by software, for example badges recognising "desire" (i.e., all applications approved).

Displaying Badges

Recognition is, by definition, public. Badges provide recognition by being displayed publicly. Of course, the public may be restricted, for example to group members.

The ideal place for displaying badges is on a well-used social network because this would widely communicate that person X has been awarded the badge (both encouraging the person and publicising the badge to others). The (digital) badge would consist of a small icon with the badge name and link to badge information (e.g., description, attributes needed, contact information).

Examples of possible social networks are Open Badge Passport and LinkedIn. Open Badge Passport is designed specifically for displaying badges produced using the Open Badge Factory. LinkedIn users can already add badges to the "certifications" section of their profile. IBM uses an in-house employee network to display badges.

It is also possible to recognise qualities using a physical object that the awardee could wear (like a sheriff's badge – which is where the term comes from) or otherwise display physically (e.g., printed certificate). To increase the level of recognition these and/or the digital badges could be awarded in public ceremonies.

An interesting finding from the REPAIR workshop on creating badges held in March 2023 was that participants themselves suggested physical awards in the context of energy-efficient driving. One of the participants said, "Physical badges would be great because I may be riding a train in another country, one of the staff might see my badge and we could start talking about ideas and strategies for saving energy. I might learn something they are doing in their country that we don't know." This potential internationalisation of tacit knowledge is of huge importance in the railway industry which today is highly nationalised; and, this nationalisation is a major problem facing railway training and operations.

One final note, the amount of motivation a person gains from being awarded a badge will depend on the badge's visibility. In other words, awarding someone a badge that no one sees, perhaps because no one uses the social network, will be less motivating than having the badge displayed to a large audience. Therefore, careful consideration should be given to where and how the badge will be displayed when planning the badge.

Badge Administration

Badge administration consists of keeping track of the badges your organisation has issued and controlling the processes of creating, awarding, and displaying badges.

The amount of administration needed depends on how you want to use your badges. It could range from almost nothing for organisations using badges to recognise "desires" which could be awarded automatically, to very complex for organisations using badges to recognise qualities such as academic certifications.

Here again, it is important to consider administration early in the badge planning process.

On the basis of early prototyping carried out in REPAIR, the project came to a recommendation that the badge creator (again this might be an organisation or individual) be assigned the role "badge administrator". This badge administrator would create the badge using the administration software platform (e.g., ORCA), and then act as "convenor" of the community of practice created around the badge.

This community of practice would use a separate communications platform to discuss ideas (e.g., tacit knowledge related to the badge subject), create policies around badge management and administration, and to coordinate community activities. The communications platform would be chosen by the badge administrator and could be changed later by the community. Example communications platforms include a "what's app" or LinkedIn group or any number of open source group communications platforms. Importantly, the badge administration platform (ORCA) developed in REPAIR does not provide a communications platform, although it could be added in the future.

Individuals would use the badge creation software to see what badges are available and apply for any badges they wish. When the badge is approved (using the process defined by the badge administrator on the administration software), the awardee would be sent an email with instructions on how to join the community of practice communications platform by the badge administrator.

In summary, the badge administration software would be used solely by badge administrators for administration and by interested individuals for finding appropriate badges. The community of practice work would be done using a separate platform.

2.4 A Skills-Level Framework for Badge Definition

When planning how your organisation might use badges one possible framework to consider is using a skills-level structure for badge definition. As outlined above badges should be defined to recognise specific qualities that help the organisation achieve a clear goal. IBM's badges describe staff skills and make personnel management more effective. REPAIR's badges identify specific skills that can be used to improve an organisation's Railway SDG Index performance.

In addition to identifying specific skills, badges can be used to differentiate between different levels of skills. The following structure could be used as a general framework for considering skill-level in badge definition:

- (A) → Aspiring badge for "wanting" to acquire a skill or quality.
- (K) → Knowledge badge for taking a class/passing a test on a known technique.
- (T) → Teaching badge for being expert enough to teach the technique to others.
- (I) → Implementation badge for actually using the technique in field (e.g., energy efficient train driving).

Another level of skill is developing new techniques/skills/qualities that help achieve the desired goal. In this case badges could be defined for:

- (D) → Developer badge for inventing a new technique.
- (P) → Pedagogy badge for creating a "course" to teach the technique to others.

These developer and pedagogy badges could be general, in the sense that everyone who developed any technique or training program (no matter what the technique) would get the same "Developer" or "Pedagogy" badge.

This framework could be helpful in defining specific badges. More specifically, the A, K, T, and I badges could be defined for each specific quality identified in the badge definition process that helps the organisation achieve its goal. Similarly D and P badges could be defined for those identifying new qualities/techniques that help the organisation achieve its goal.

3. REPAIR: OPEN BADGES IN THE RAILWAY SECTOR

REPAIR was an ERASMUS+ project which investigated the feasibility of using badges in the railway sector. The project ran from September 2020 until August 2023 and was carried out by a team of six organisations. Chapter 2 presented a theoretical description of badges; this chapter describes the process used by REPAIR to develop and test badges in the railway sector. Chapter 4 presents instructions for using the tools developed in REPAIR.

3.1 REPAIR Badges: Process Planning

The objective of REPAIR was to assess the possible use of badges in the railway sector, therefore the decision to use badges was made before starting the project. In fact, the team decided to prepare the ERASMUS+ proposal based on their assessment that badges could be a very useful technique for approaching many of the challenges currently faced by the railway industry (e.g., aging workforce, rapid technological change, society's need for a more sustainable transport system).

Given the very broad potential application of open badges in the railway sector, the REPAIR partners chose to focus on using badges to increase the sustainability of railway organisations based on the United Nations Sustainable Development Goals (SDGs).

Project partner UIC (International Union of Railways) has developed specific criteria for evaluating railway organisation performance on the seven SDGs most appropriate for railways. These criteria are combined into the UIC's Railway SDG Index. Therefore, REPAIR's specific objective was testing how badges could be used to improve organisational performance in relation to the Railway SDG Index.

During the first two REPAIR activities the project partners considered various ways badges might be used in the railway sector to improve an organisation's Railway SDG Index score. As part of this process design thinking techniques were used to define specific Railway SDG Index badges and badge management processes.

For example, one measure on the Railway SDG Index is the share of renewable energy used in the organisation. However, as this example shows, the Railway SDG Index measure may not have *specific relevance to the work real people are doing*. How, for example, does a railway maintenance worker impact the share of renewable energy used by the organisation?

In fact, there are many activities a maintenance worker can perform to increase the share of renewable energy. The process of badge definition consists of identifying these activities and creating badges to recognise them. This also illustrates the importance of the bottom-up communities of practice process tested to help define badges in REPAIR.

Similarly, several approaches for managing the badges created in REPAIR were developed and considered. As part of this process various software programs were tested (e.g., Open Badge Factory, ORCA).

In May 2022, a prototype badge was developed and tested in conjunction with a webinar organised by the UIC to explain the Railway SDG Index. The badge simply certified that the person had attended the webinar. The participants were invited to apply for the badge and the

badge administration was performed by REPAIR team members. The Quantitative Worker and Trainer Survey (see Annex I) was sent to participants asking them how they perceived the badge application process and whether they thought badges could be helpful in their organisation. The prototype proved helpful in understanding badge administration. These activities are described in REPAIR IOs 1 and 2.

In June 2022, a workplan was developed for a larger-scale test of developing several badges and a process for using them to help railway organisations improve their Railway SDG Index performance based on the theoretical work and protype testing outlined above. The workplan was revised several times based on partner input and results of ongoing activities.

The process of developing badges is called mapping and was carried out from Autumn 2022 until Spring 2023. It consisted of two parts, collecting input and actual design of the badges.

A key event in this effort was a badge creation workshop hosted at the UIC Railway SDG celebration in March 2023. At this event staff from many railway organisations participated in small group discussion to create badges that could help railways improve their SDG score (and, more importantly, their sustainability), and to discuss how effective badges could be in their organisation for increasing sustainability. More details about the workshop results are presented in Intellectual Output 4 and the project final report.

Once the badges were created, they were tested in railway organisations. This process was carried out in Spring 2023. The final part of REPAIR was evaluating the process of badge development and testing with the objective of making recommendations for the future use of badges for improving railway organisation sustainability.

This document is REPAIR Project Intellectual Output 3. Chapters 1 and 2 (above) present information about badges and badge management that were used to help inform the mapping process. This chapter describes REPAIR's workplan for mapping and testing of badges. Or, more precisely, the processes used to define, award, display, and manage the railway SDG Index badges. Chapter 4 describes how to use the badge administration software developed in the project (ORCA).

The actual results of badge development and testing are described in the project's Intellectual Output 4, while Intellectual Output 5 describes the project recommendations.

3.2 Creating Badges in REPAIR (Mapping) – Part 1: Input

The main task in defining badges is identifying the specific personal or group qualities that help an organisation achieve the goal it is seeking. In REPAIR this means identifying qualities that help an organisation improve its performance on the UIC Railway SDG Index.

The REPAIR project used communities of practice to help define badges. It focused on the following three communities of practice:

1. REPAIR project railway partner training departments.
2. REPAIR project railway partner workers.
3. SDG Index contributors (i.e., persons responsible for compiling the SDG Index in the UIC member organisations).

The process to be used by each of these groups is outlined below.

Railway Training Departments

The training departments of two railway organisations are partners in REPAIR: Slovenian Railways (a train operating company) and ADIF (the Spanish railway infrastructure owner). These employees took part in two REPAIR project tasks. In Task 1 they were sent a questionnaire asking them about their knowledge of SDGs and badges. In Task 2 a workshop was held to introduce SDGs and the idea of badges, and to collect ideas for improving sustainability at railways. (Chapter 4 of this document provides a project workplan.)

The questionnaire (Task 1) asked the following questions:

- Have you heard of / are you aware of the SDGs?
- Can you imagine integrating SDG related action in your work? (If yes: Which one).
- Are you integrating an SDG related action in your work? (If yes: Which one).
- Is your SDG related action recognized by others?

This questionnaire was used to develop a baseline for measuring project effectiveness and to help guide later activities. The questionnaire is available in Intellectual Output 5.

The workshops (Task 2) consisted of an introductory presentation on SDGs for railways, the UIC's RSi, recognition, badges, and possibilities for using badges to increate sustainability. Following the presentation an exercise was made where participants designed badges based on their ideas for specific activities that can increase sustainability (e.g., RSi performance). These workshops were held in autumn 2022 and spring 2023.

Following the initial workshops, the Slovenian Railways developed a "Sustainable Railway Trainer Badge" which was then publicised to trainers and awarded. This took place in late spring 2023 and made use of the new ORCA badge administration software. The Quantitative User Survey (Annex III) was made of badge holders (described in IO 5).

The introductory presentation (***Railways and Sustainability***) was prepared first in English by the REPAIR team and then translated into Slovenian and Spanish. The presentation is available on YouTube at https://youtu.be/s4ku8448Tv0?feature=shared.

Railway Workers

All workers at the Slovenian Railways and ADIF were asked to participate in the REPAIR project. These workers were sent the online Quantitative Worker and Trainer Survey (see Annex I) about their understanding of sustainability and badges (Task 3), provided with an online presentation (***Railways and Sustainability***, see above) to learn more about these topics (Task 4), and invited to take part in an online workshop to define badges (Task 5).

An important point is that worker participation was a voluntary. Project partners Slovenian Railways and ADIF sent out the survey and information about the presentation and workshop to their employees, but there was no requirement to participate.

The online presentation video created for the railway trainers and narrated the local languages was used to provide information to workers. The online workshop was made in local languages and content was similar to that used in the badge development exercise for the trainers.

These activities took place in autumn 2022 and spring 2023.

SDG Index Contributors

The SDG Index contributors are UIC member organisations who are participating in the Railway SDG program. They are already familiar with the SDGs (they are completing data collection for the program), and some are familiar with badges from the May 2022 SDG Index launch webinar.

The SDG Index Contributors were asked to complete a questionnaire (Q-2) asking them to identify specific activities that were used at their railway that helped improve sustainability as measured with the SDG Index. The questionnaire asked the following questions:

- What were the most important specific activities completed at your railway to improve your implementation of the SDGs?
- Who was in charge of/managed/completed these activities?
- Did this person receive any recognition for their activities?

The questionnaire results were used to help define specific badges during the badge creation workshop. The questionnaire was sent out in Autumn 2022. The questionnaire is more fully described in Intellectual Output 5.

3.3 Creating Badges in REPAIR (Mapping) – Part 2: Badge Definition

The second part of creating badges in REPAIR is precisely defining a set of badges that can be tested by railway organisations. This process used input collected from the communities of practice (as described above).

Preliminary Badge Definition

In early Spring 2023 the partners reviewed input from the communities of practice and developed a set of preliminary badge definitions that were used as a starting point in the badge creation workshop.

In addition to creating these draft badges, the partners developed a precise agenda for the badge creation workshop to facilitate the workshop's effectiveness.

Badge Creation Workshop

A badge creation workshop was held in Spring 2023 (UIC Railway SDG Index celebration) to define a set of badges and criteria for testing. The workshop attendees included trainers and SDG Index contributors in addition to the REPAIR partners.

A second workshop was held in Madrid as part of the REPAIR Dissemination Conference in June 2023.

The result of these workshops was set of specific badges designed to help organisations improve their SDG Index performance, as well as processes for awarding, displaying (including ideas for awarding badges in railway organisation ceremonies), and managing the badges. The REPAIR team created these badges using the ORCA badge administration software created as part of the project.

3.4 Awarding Badges in REPAIR

The REPAIR team was responsible for checking and approving badge applications developed in these workshops and activities. The early activities used the Open Badge Factory software, and the 2023 activities used the new ORCA software.

3.5 Displaying Badges in REPAIR

The SDG Badges were displayed in the ORCA software.

The REPAIR team also developed instructions for adding earned badges to popular social networks (e.g., LinkedIn).

Plans for awarding badges in ceremonies at railway organisations were discussed at the badge creation workshop. Possibilities include awarding badges at a UIC event, which would generate high visibility for the SDG practices and/or at local railway organisation events.

3.6 Managing Badges in REPAIR

The REPAIR team managed the SDG Badges during the project using the ORCA software system. The main task was awarding the badges since the badges are unlikely to be used for any tangible reward system (e.g., individual promotions) during the short time remaining in the project and therefore unlikely to be "gamed".

A key question in the REPAIR Assessment (see below) is whether to continue the SDG badges program and, if so, recommendations for continuing it. One possibility is for the UIC's SDG Training department to take control of the program, perhaps integrating it into their Railway Skills Platform.

Finally, as outlined above, the concept of creating "badge administrators" for particular badges was identified as a good strategy for facilitating the communities of practice which are of utmost importance in the REPAIR project objectives. This idea came up as a result of the project's analysis of administration strategies during the prototype badge development process carried out as part of the project.

3.7 Assessment of REPAIR Badges

The final part of REPAIR was assessing the effectiveness of the badges and badge management processes used in the project, and using this information to make conclusions and recommendations.

Data for this assessment was collected with a series of qualitative interviews (see Annex II. Interview with Trainers) with all project participants. These interviews asked questions including:

- Quality of the process (ease of use).
- Impact of badges on work (did receiving a badge change the way you approached or did your job? How?)
- Impact of badges on achievement of SDG Index (likely only qualitative answers).

The REPAIR project ended in August 2023 and therefore a draft final report containing these conclusions and recommendations was discussed by the team in Summer 2023. In addition to the report the project's Intellectual Outputs were revised to include the latest results.

4. REPAIR PACK: USING BADGES

This chapter summarises how people and organisations can use badges to help accomplish shared goals and objectives. It begins by summarising the overall process and then describing specific steps with reference to the online tools developed by REPAIR.

4.1 General Process for Using Badges

Badges are a tool that can be used by individuals to help accomplish certain objectives. While this sounds quite specific, in fact these "objectives" are very loosely defined. Essentially, they can be anything (e.g., action, accomplishment, idea, etc.) which the individual or organisation wishes to recognise.

This section describes how badges can be used as a tool in the context of a general process for accomplishing objectives. This background is helpful for understanding the later sections which describe how individuals (and groups) can use the badge administration platform developed in REPAIR.

The general process for using badges consists of the following steps:

1. A person or organisation decides they want to accomplish an objective (e.g., improve railway sustainability).
2. Person/organisation decides that a good way of accomplishing the objective is to create a ***Community of Practice*** (CoP). A CoP is a group of people who share a goal and discuss ways of accomplishing this goal together using any possible means of communications (e.g., in person, online, etc.).
3. Person/organisation identifies badges as a tool that can help improve the quality and participation in the CoP.
4. Person from CoP creates a badge for a CoP related objective using the ***Badge Administration Platform*** (BAP). For example, a badge for energy-saving railway locomotive driving; so, a person with this badge has done something related to energy-saving driving (the NN badge criteria, provided by the NN badge creator, describe what specifically needs to be done to be awarded the badge). (Where NN = name of the specific badge.)
5. The person from the CoP who creates the badge is designated as the ***NN Badge Administrator***. (This badge creator can use the badge administration platform to designate multiple badge administrators.)
6. The Badge Administration Platform reviews the NN badge description information provided by the badge creator for completeness and if it is satisfactory approves the NN badge. This review is done automatically by the BAP since the platform only checks that the data needed by the platform is complete.
7. The Badge Administration Platform places the NN badge on its publicly available database of badges and provides a "Badge Approved" message on the screen. The approval process is very quick and takes place while the NN Badge Administrator is still on the entry page (i.e., if badge is OK, the page simply reloads with the approval message).

8. If the NN badge data is incomplete the BAP notifies the badge administrator that they need to provide additional data and indicates which fields are needed (again this takes place in real time). It is also possible for the badge administrator to save the badge data and return to complete it later, and to revise the data after the badge has been approved.
9. After the badge has been approved, the badge creator and their community of practice use their normal communications channels to publicise the existence of the NN badge and provide instructions for claiming it.
10. Someone interested in the community of practice topic learns about the NN badge and applies for it using the badge administration platform. This is called “Claiming” the badge.
11. If the badge applicant meets the NN badge criteria, they are awarded the badge automatically by the platform and sent an email telling them they have been awarded the badge, describing how to display the badge through their own media channels, and encouraging them to participate in the community of practice.
12. The NN badge administrator is sent a mail with the contact information for the new NN badge holder automatically by the platform.
13. The NN badge administrator contacts the new badge holder welcoming them to the community of practice, encouraging them to participate actively, and provides directions for joining the community’s communications channels.

The most important aspect of this process to recognise is that badges are simply a tool to facilitate the work of a person or group interested in achieving some objective (e.g., improving railway sustainability). In this document this person or group is called community of practice, but it is no different from how people and organisations work today.

More specifically, the CoP uses badges to encourage participation and the development of new ideas, that can help the CoP accomplish its objectives.

Most of the steps outlined above are already done by persons and groups using their own methods (e.g., weekly meetings). Badges are simply an add-on to these existing processes.

The next sections describe how individuals use the badge administration platform in more detail. but it is important to understand the general process outlined above.

4.2 Creating and Using Badges with the REPAIR Software

This section reviews how badge creators use the REPAIR software platform to create, revise, and administer badges, and describes how badge applicants use the platform to claim badges. The REPAIR platform is called ORCA and provides a user interface similar to many other websites. Therefore, people will be familiar with using the platform functions already. In addition, the platform provides instructions and information on the interface pages to help users with any problems they experience. Full documentation for the ORCA software platform is available in the ORCA user guide (REFERENCE).

Login and Account Creation

People who wish to create or claim badges must register on the ORCA platform.

Once a person has an account, they can use it to claim or create badges.

The person's account has a dashboard listing badges claimed and badges created.

The registration process is similar to most other websites and so is not further described here.

Create a Badge

To create a badge a person logs into ORCA, navigates to the "Create Badge" page and enters data for their proposed badge. The "Create Badge" page is a data entry form which contains all the required and optional data fields needed to create a badge. The badge creator enters the data and when finished clicks the button at the bottom of the page asking ORCA to review and approve the new badge.

The ORCA platform reviews the badge data entered by the badge creator for completeness. This means ORCA checks that the data provides all the information ORCA needs to display and award the badge; ORCA does not check the badge's technical content or whether it is similar to some other badge. The ORCA review is completed in a few seconds.

After ORCA reviews the badge, the data entry page reloads with a message either (1) saying the NN badge has been approved and can be claimed (i.e., all required data has been provided); or (2) asks the badge creator to provide the missing data (missing data is highlighted).

It is possible to save a draft badge description and return to it on another occasion. In this case the badge creator can just click the save draft button at the bottom of the page.

Revising Badge Data

Badge creators can revise approved badges they have created by returning to the saved badge data stored in their account (from their dashboard). Clicking on the badge will reopen the badge data entry page described above.

The badge creator then can change data in the fields by simply replacing or supplementing it. When finished the creator can click the button at the bottom of the page asking ORCA to review and approve the badge, as described in the previous section.

It is only possible for the badge creator to revise the badge data for the badge they created. However, as described below, the badge creator can use the badge's administrative settings to designate additional people as badge creators so they can revise the badge data.

Revising Badge Administration Settings

The badge data includes both content information (e.g., description of the badge, illustration) and administrative settings for the specific NN badge. The two types of data are clearly identified on the data entry form page.

A common example of administrative setting data is the badge creator designation. The person who first creates the badge (provides data to ORCA and requests approval) is the badge creator, but that person can also designate other people as badge creators so that these people can edit the NN badge data and perform other functions related to the NN badge (e.g., delete badge).

The process for revising badge administrative settings and content information is the same (i.e., click on created badge from the dashboard, enter revised data into the form, click review and approve) as outlined above in 4.2.3.

Claiming a Badge

As outlined earlier in this document, badges are a tool for increasing engagement in communities of practice. Therefore, the goal of a badge creator is to encourage people outside the existing community of practice to join by claiming a badge.

Once a badge has been created and placed in the ORCA badge database for claiming, the badge creator and their community of practice will publicise the badge availability and instructions for claiming it (i.e., website link directly to the NN badge). Someone who learns about the badge and decides to claim it is called the "applicant".

The applicant clicks on the NN badge link which takes them to the NN badge claim application form on the ORCA website. If the applicant already has an account on the ORCA platform, they can simply login. If the applicant does not have an account, they will be directed to the registration process (in some versions of the software this registration takes place automatically upon submission of the badge claim application).

The applicant enters the required data on the NN badge application form. This required data generally consists of some information on the applicant and why they should be awarded the badge as specified by the badge creator when creating the badge. When the applicant is finished entering this data, they click the claim badge button at the bottom of the page.

The ORCA platform reviews the badge application data for completeness. After this review ORCA reloads the application page with a message either (1) saying the application is complete and will be reviewed (by whatever means the badge creator has entered in the NN badge settings data, see below); or (2) asks the applicant to provide the missing data (missing data is highlighted).

The ORCA platform provides badge creators with several options for approving badge claim applications. The most common are (1) automatic: all complete applications are approved; anyone can claim the badge; (2) NN badge creator review: the data submitted by the applicant is reviewed by the badge creator and the creator decides whether to approve the applicant or not. These options can be set in the NN badge administrative settings.

If all applications for the NN badge are automatically approved then ORCA will tell the applicant in a message when the badge application form reloads after ORCA review (i.e., immediately). If the application must be further reviewed the applicant will receive a message saying their claim is being evaluated and they will hear back shortly if it has been approved.

It is possible for an applicant to save a draft badge application and return to it on another occasion. In this case the applicant can just click the save draft button at the bottom of the page.

ANNEX

Please see the document “REPAIR Annex” for:

Annex I: Quantitative Worker and Trainer Survey

Annex II: Interview with Trainers

Annex III: Quantitative Users Survey