Methodology for a Socio-Technical Approach to Sharing Knowledge and Promoting Dialogue via Use of a Knowledge and Communication Platform [†]

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Abstract: This paper outlines the methodology of a Knowledge and Communication Platform (KCP) as part of the Horizon2020 project Energy System Transition Through Stakeholder Activation, Education and Skills Development (ENTRUST). The ENTRUST project provides a mapping of Europe's energy system and an in-depth understanding of how human behaviour around energy is shaped by both technological systems and socio-demographic factors. Central to the project is an in-depth engagement with six communities across Europe. The purpose of the KCP is to disseminate and share knowledge and to facilitate and promote dialogue on energy efficiency and transitioning to a low carbon system.

Keywords: ENTRUST; Socio-technical; knowledge; communication; communities; smartphone; human behaviour; energy; efficiency

1. Introduction

The ENTRUST project is seeking to better understand the way in which individuals and their communities interact with energy and the wider socio-technical networks that constitute the energy system. The project is working collaboratively with six communities across Europe to achieve two broad aims: firstly, to ascertain their existing knowledge, beliefs, and attitudes in relation to the many aspects of the energy system; and secondly to facilitate these communities to envision their ideas of a low carbon energy future.

Socio-technical regimes are typically defined as relatively stable configurations of institutions, techniques and artefacts, as well as rules, practices and networks that determine the development and use of technologies [1,2]. A focus on regimes recognises that organisations and technologies are embedded within wider social and economic systems [1]. Socio-technical systems are thus conceptualised as clusters of aligned elements, such as technical artefacts, knowledge, markets, regulation, cultural meaning, rules, infrastructure [3]. As socio-technical regimes have become the focal unit of analysis, the policy challenge is to transform them into more sustainable configurations [2]. With a focus on socio-technical regimes as the analytical unit, the policy challenges consist of transforming such regimes into more sustainable configurations [2]. Depending on timing and qualitatively different niche-regime-landscape interactions, transitions can evolve following different types of transition pathways [4].

This paper outlines the methodology of a socio-technical approach to sharing knowledge and promoting dialogue on energy efficiency via use of a Knowledge and Communication Platform (KCP) across six communities. The ENTRUST knowledge and communication platform (KCP) is to: (i) provide information and supporting material on a range of relevant topics; (ii) facilitate peer-to-peer communication; and (iii) be designed with user engagement in mind, incorporating approaches such as gamification, non-financial incentivisation, and social networking.

This paper focuses on the development of the KCP user platform (app and website).

2. KCP User Platform

The user platform consists of a smartphone app and dynamic website, and is considered as the social platform of the KCP where users can acquire knowledge, collected by ENTRUST partners and uploaded via the CMS (refer to overview in Appendix A, Figure A1), and engage in discussions via the knowledge base and community feed features. Aspects of gamification are also included.

The user platform (dynamic website) mirrors the branding, feel and features of the user platform (smartphone app).

Figure 1 outlines the main features of the user platform. Explanations are provided in detail below. Figure 1 denotes two workflows. All features are accessible to registered users. Non-registered users are restricted to features denoted by a star in Figure 1. To mitigate against barriers to use non-registered users can access the tour and read only features of the user platform in the form of sample data for six knowledge articles and six community posts. Intention being that non-registered users can experience a taste of the user platform features prior to registration, while maintaining privacy of community feeds.
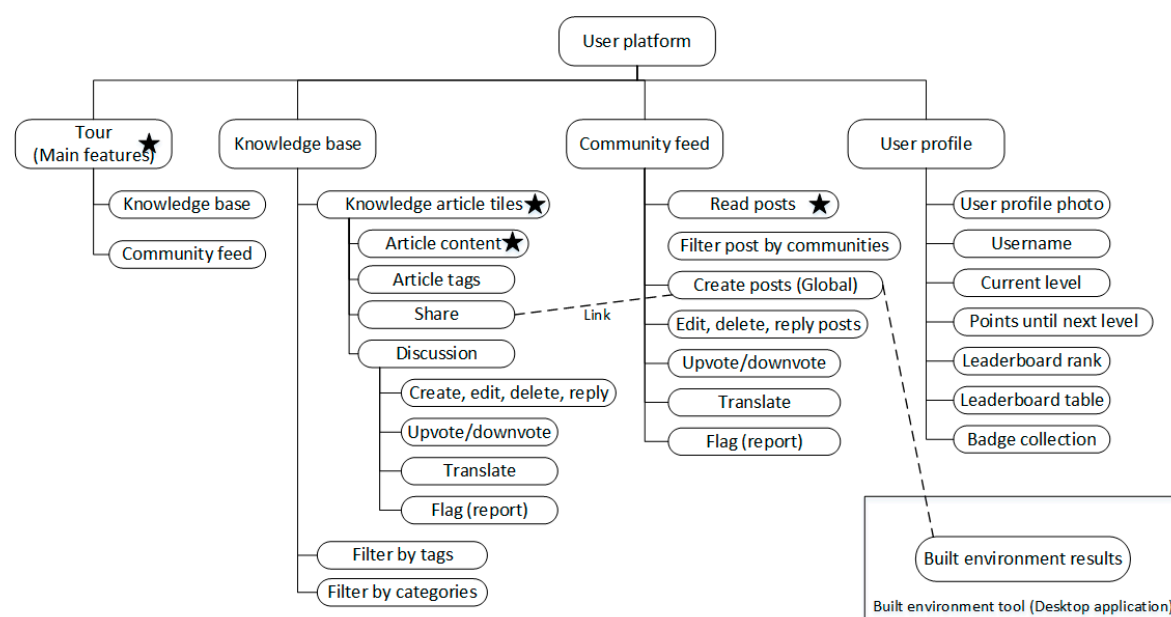

Figure 1. KCP high-level features–non-registered vs. registered accessibility.

2.1. Tour

The tour is a high-level overview of the features of the user platform. Intention is to mitigate against barriers to use e.g., user registration prior to use.

2.2. Registration

Registered users acquire full access to the features of the user platform, Figure 1. Registration requires user input; user email, user password and user screenname. Users are also requested to select an ENTRUST related community.

2.3. Knowledge Base

Figure 2 is a wireframe of the registered user 'Knowledge base' section of the user platform. Figure 2a illustrates the upper level of the knowledge base. Knowledge content, refer to Appendix B, are displayed in tiles. Users can apply article tag and category filters to search content. Article tags relate to subject areas outlined in Table A1. Upon clicking on a knowledge article, users are directed to article content. Figure 2b illustrates the lower level of the knowledge base i.e., article content. Users can share links to articles via the community feed. Users can also post article comments, and upvote/downvote other user comments. A category filter refers to the source of the content; news article, journal paper etc.
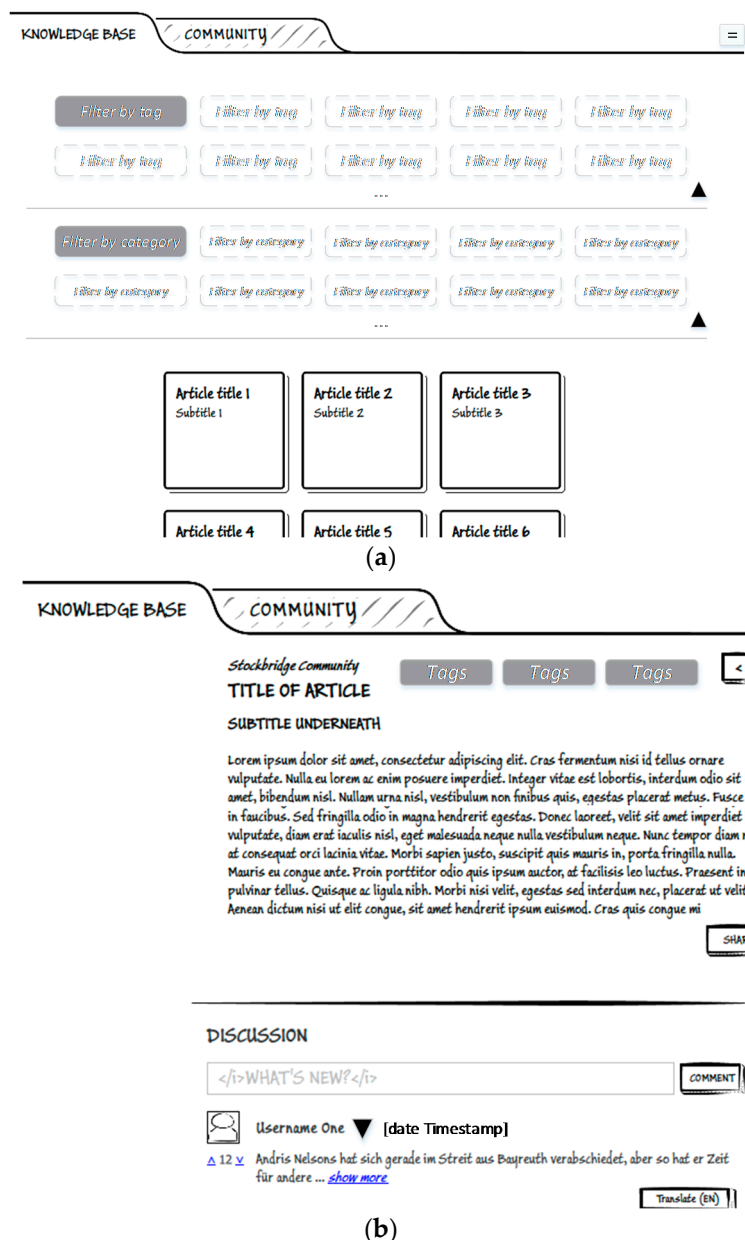
Figure 2. User platform–Knowledge base (registered user view) (**a**) Upper level (article tiles); (**b**) lower level (article content).

2.4. Community Feed

Figure 3 is a wireframe of the registered user 'Community feed' section of the user platform. Users' post are viewed globally within the community feed and can be filtered based on selected communities of interest. Users can also post comment replies, and upvote/downvote other user

comments. In addition, users can translate posts from different communities into the following languages, English, French, Italian and Catalan. Users have the option to flag unsuitable post content. Flagged posts are removed from the community feed. Other types of posts are shared, i.e., knowledge based articles and built environment tool results, Figure 1.
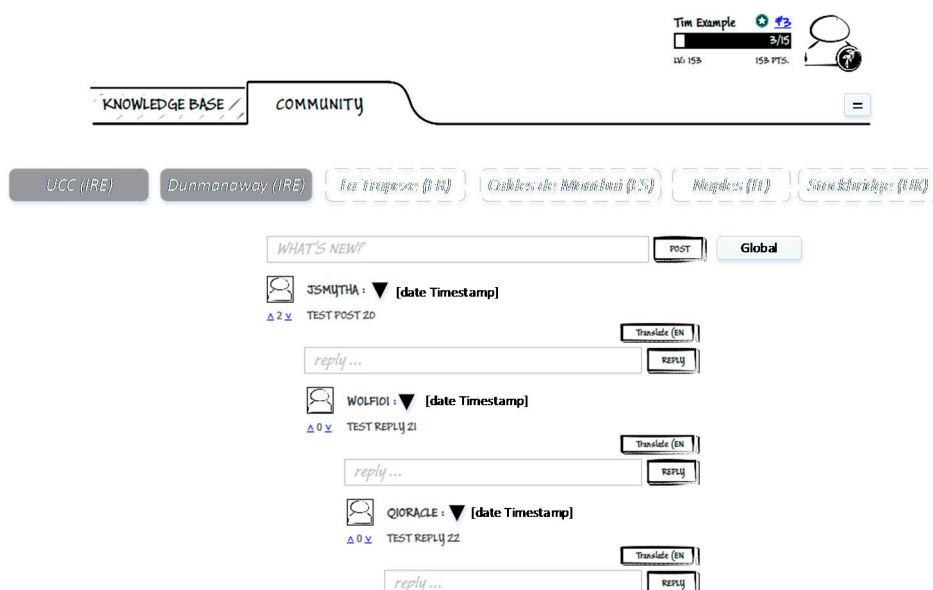

Figure 3. User platform–Community feed (registered user view, filtered for Ireland communities).

2.5. Gamification

The objective of the KCP is to facilitate and promote dialogue on energy efficiency and transitioning to low carbon system. Within the context of the user platform two areas are designed to facilitate this dialogue, knowledge base and community feed. The knowledge base provides content in the form of articles to users. Via the comment feed at the foot of each article users can write comments. Users can also share links to articles via their community feed. Within the community feed dialog users can create posts and reply to posts. Posts and replies can be up-voted and down-voted by users. All of the above is centred around social interaction between users. Gamification [5–7] techniques, such as points system, leaderboard and badges, are used to further encourage social interaction within the user platform. Gamification features are only accessible by registered users of the user platform. Registered users can decide to opt out of leaderboard standings, accessible by all communities. Further details are included in Appendix C.

3. Conclusions

This paper outlines the methodology for development of a KCP and content creation. The ENTRUST project aims to uncover fresh perspectives on the energy system, and the energy transition—drawing on the perspectives, and insights, that the members of six diverse communities share. The building of content for the KCP is, and will remain, a dynamic process between the ENTRUST team and the six communities of practice and is intended to be legacy output of the project.

The user platform aims to facilitate community engagement through development of the following key features; knowledge base; community feed and gamification.

Author Contributions: Michael Oates, Giulia Barbano and Jessica Bergs, from IES, with assistance from Alberto Landini, from STAM, conceived the methodology outline of the KCP and user platform, features and design content. Niall Dunphy and Breffni Lennon, from UCC, contributed on socio-technical regimes and knowledge content creation.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A. Knowledge and Communication Platform Structure

Figure A1 is an overview of the ENTRUST KCP, outlining flow of information/data between KCP components. The KCP consists of three areas of front-end user interface (UI) development:

- Energy Communities portal (website)
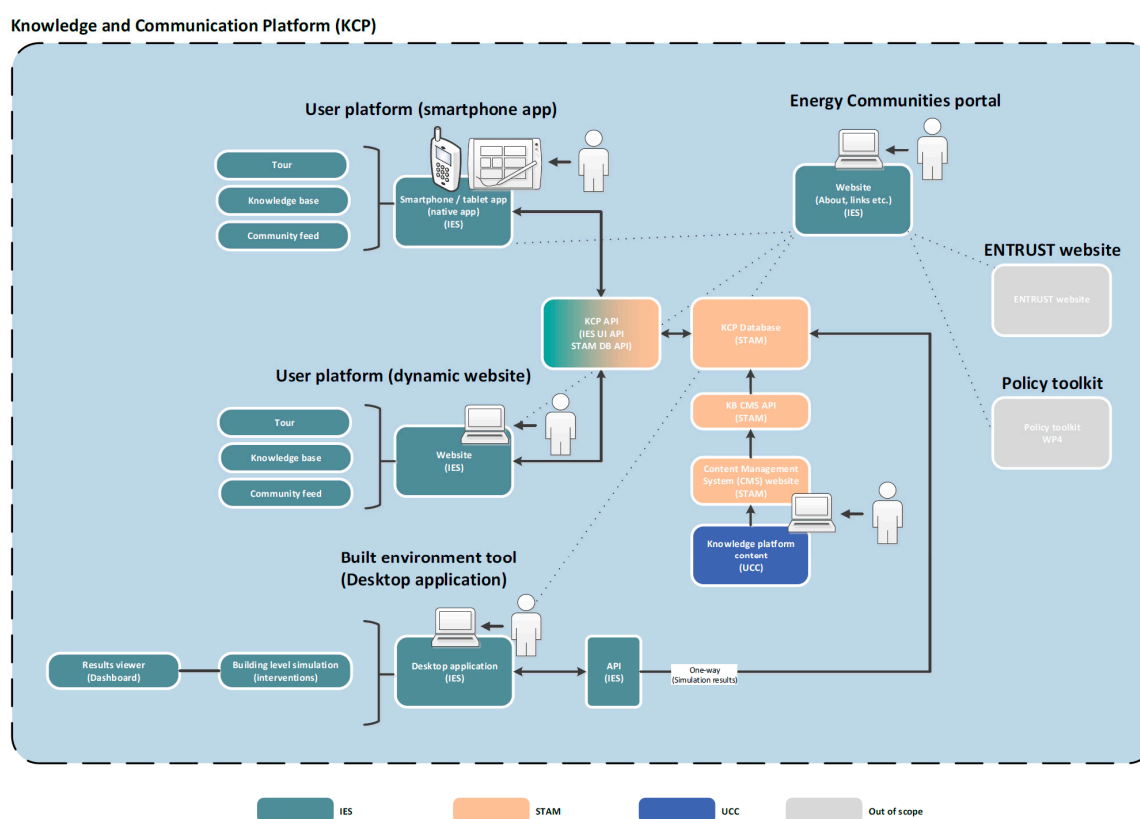- User platform (smartphone application (app) and dynamic website)
- Built environment tool

Figure A1. Overview of the ENTRUST knowledge and communication platform (KCP).

The Energy Communities portal acts as a central reference to all KCP related tools including the ENTRUST official website. The user platform and built environment tool are tailored to facilitate and promote dialogue on energy efficiency and transitioning to low carbon system at different levels of expertise. The KCP framework also includes back-end development; KCP (database), application program interfaces (APIs), and a content management system (CMS).

The built environment tool (desktop application) is intended to enable users to explore more about their built environment in terms of understanding energy usage based upon user defined inputs. The desktop application also allows the user to apply interventions to identify opportunities for saving energy and money through applying simulated outcomes to their built environment. For example, a user can apply photovoltaic (PV) panels to reduce grid electricity demand, energy bills and greenhouse gas emissions. Results from the built environment tool (desktop application) can be shared with the user platform.

Built environment tool (desktop application) features include:

- Import map 2 dimensional (2D)
- Import or draw polygons from/on map (2D)
- Geometry creation (3D)
- Assign object (building) attributes and interventions (e.g., PV)

- o   Run simulation (desktop) and view results (dashboard)
- o   Upload, in summary text form, results to KCP database, shared via user platform (app and dynamic website)

Appendix B. Knowledge Base Content

Knowledge is often divided into two types of knowledge—'explicit knowledge' and 'tacit knowledge' [8,9]. Explicit knowledge is akin to information, and can be broadly described as 'know what' or 'intellectual' knowledge; whereas tacit knowledge is more like 'practical knowledge' and can be described as 'know how' or as 'embodied knowledge'. One of the most significant differences between the two types of knowledge is that tacit knowledge cannot easily be explained using language, or mathematics, as opposed to explicit knowledge that can be. Hildreth and Kimble [10] propose that tacit knowledge is best shared through involvement in communities of practice. Their work suggests that the 'community of practice' model is useful for providing: 'an environment for people to develop knowledge through interaction with others in an environment where knowledge is created, nurtured and sustained'. Central to the ENTRUST project is the in-depth engagement with six communities in five different countries: France, Ireland, Italy, Spain and the United Kingdom. These 'communities of practice' have been invited to be co-designers of their own energy transition. In keeping with this approach, and to ensure the content is accessible, intuitive, and relevant to people's needs and capacities, the materials for the KCP are to be created collaboratively, involving an iterative reflexive participatory process involving both community workshops and expert stakeholders.

Bringing together different types of knowledge—theoretical, technological, practical, empirical, and that of embodied lived experience will allow the ENTRUST project to develop a sophisticated understanding of the human factor in the energy system. While this level of developed understanding will not be explicitly featured on the KCP, it will, however, contribute to the process of developing the knowledge content for the platform.

Table A1 illustrates a three-tiered approach to the knowledge base content. The first-tier, energy transition, is the foundational concept of the ENTRUST project and the knowledge content. The second-tier thematic headings are intended to be a top tier broad category. As the ENTRUST project proceeds, and knowledge of the 'human factor' in the broader energy system develops and grows through engagement with the communities of practice, these categories will be developed and expanded into a cascading series of discrete, and interlinked, subject areas (third-tier) as shown in Table A1.

Table A1. Knowledge content–tiered approach.

First-Tier	Second-Tier	Third-Tier
Energy transition	Climate change	Science
		Impacts and risks
		Adaptation
		Mitigation
	Community and empowerment	Communication
		Mobilisation
		Knowledge sharing
		Participatory strategies
	Technology	Energy distribution
		Energy using products
		Buildings
		Transport
		Energy production
	Public policy	Political system
		Planning
		Geopolitics

	Third sector actions
	Context
	Home
Practices and behaviour	Work/education
	consumption
	Leisure
	Organisation
Business	Business models
	Financial instruments

Appendix C. Gamification Implementation

Table A2 is a summary of points received by a user for in-application activities. A user scores points for initial registration and knowledge base and community feed activities. Users can also gain and lose points if another user up-votes or down-votes on their posts. Up-voting and down-voting is to be used by users to value a user's initial posts and comments. For example, refer to Stackoverflow [11].

Table A2. Gamification–points scoring.

Activities	Points	Occurrence
Registration	500	One-off
Receive points for commenting on an article **(KB)**	50	Users initial comment
Receive points for replying to an article post **(KB)**	50	Per reply
Receive points for sharing an article **(KB)**	50	Per share
Receive points if your comment is up-voted by others **(KB)**	10	Per up-vote
Lose points if your comment is down-voted by others **(KB)**	−10	Per down-vote
Receive points for creating a new post **(CF)**	250	One-off
Receive points for replying to a post **(CF)**	50	Per reply
Receive points if your comment is up-voted by others **(CF)**	10	Per up-vote
Lose points if your comment is down-voted by others **(CF)**	−10	Per down-vote

KB = Knowledge base, CF = Community feed.

Appendix C.1. User Profile Panel

Figure A2 illustrates the header of the smartphone application. A user profile is dynamic and parameters change over time such as user level, points until next level and badge icon (representative of the latest badge award).
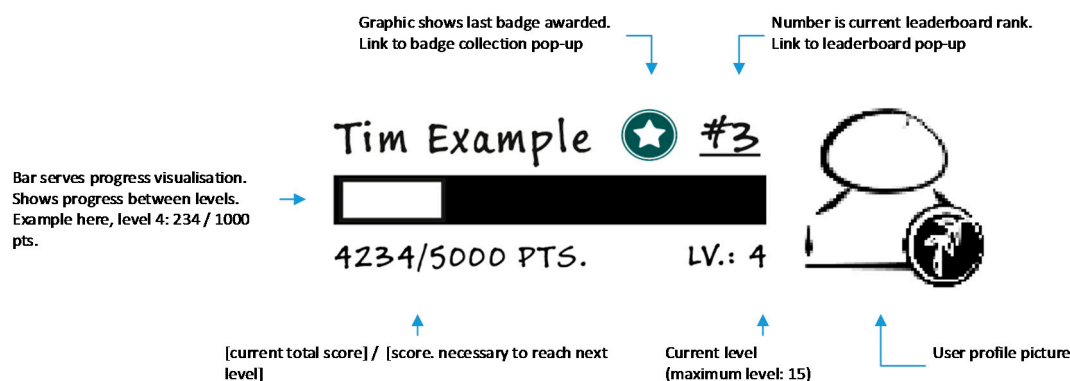
Figure A2. User platform–User profile panel.

Appendix C.2. Leaderboard

A pop-up of the current leaderboard is presented to the user upon clicking on the rank number in Figure A3.
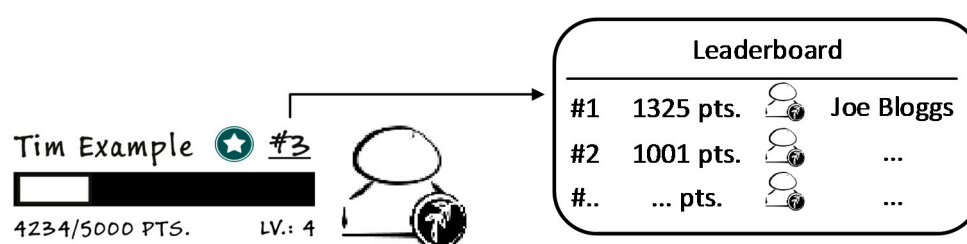
Figure A3. User platform–Leaderboard based on gamification.

Appendix C.3. Badges

A pop-up of a user's badge collection is presented to the user upon clicking on the badge icon in Figure A4.
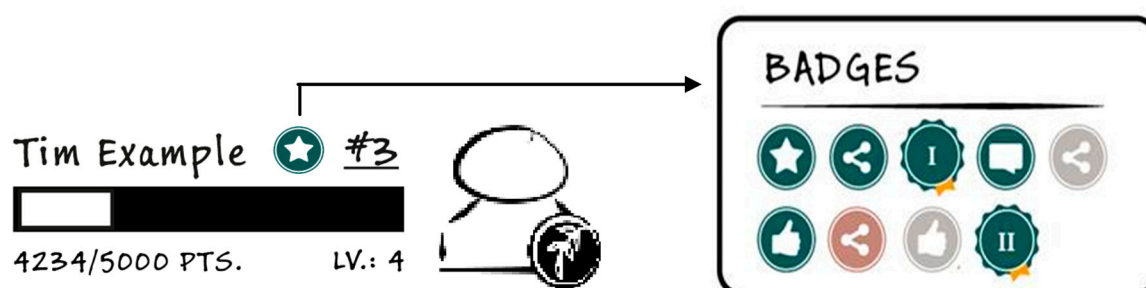
Figure A4. User platform–Users badge collection based on gamification.

Badges are awarded to a user upon achieving milestones such as:

- Registration (Refer to Table A3)
- Achieving enough points to enact the next Level (Refer to Table A3)

    - Repeated activities (Refer to Table A4):
    - Knowledge base

        o Commenting on articles
        o Replying to article posts
        o Sharing articles

    - Community feed

        o Creating new posts
        o Replying to posts

    - Up-votes (received by other users); tallied across both knowledge base and community feed

The registration badge is a one-off award, refer to Table A3. Level badges are given at discrete intervals in relation to a user's points-score tally. Levels 1 to 10 badges are given at 1000 point intervals. Levels 11 to level 15 badges are awarded at 10,000 point intervals. With level 15 being the maximum level a user can achieve. Users can continue to score points after level 15 but will not be awarded further level badges, refer to Table A3.

Table A3. Gamification–Points tally (and level badges).

Levels	0	0	1	2	…	10	11	…	15
Points	0	500	1000	2000	…	10,000	20,000	…	60,000
Registration	-	⭐	-	-	-	-	-	-	-
Level Badges	-	-	I	II	…	X	XI	…	XV

Table A4 indicates the relationship between repeated activities and badge awards. A tally of activities is to be kept within a user's personal account. Badges are awarded at each milestone.

Table A4. Gamification–badge system.

	Beginner Award (Occurrence)	Novice Award (Occurrence)	Intermediate Award (Occurrence)	Expert Award (Occurrence)	Champion Award (Occurrence)
Receive points for commenting on an article **(KB)**	(1)	(20)	(50)	(75)	(100)
Receive points for replying to an article post **(KB)**	(1)	(20)	(50)	(75)	(100)
Receive points for sharing an article **(KB)**	(1)	(20)	(50)	(75)	(100)
Receive points for creating a new post **(KB)**	(1)	(10)	(30)	(60)	100)
Receive points for replying to a post **(CF)**	(1)	(20)	(50)	(75)	(100)
Up-votes (received by other users) **(KB/CF)**	(1)	(20)	(50)	(75)	(100)

KB = Knowledge base, CF = Community feed.

For example: A user creates 'x' number of new posts:
- 1 new post = Badge: Creating a new post (Beginner award)
- 10 new posts= Badge: Creating a new post (Novice award)
- 30 new posts= Badge: Creating a new post (Intermediate award)
- 60 new posts= Badge: Creating a new post (Expert award)
- 100+ new posts = Badge: Creating a new post (Champion award)

A majority of the activities listed above are awarded for a user's own actions such as create a new post. Whereas, up-votes are awarded by other users. A tally of the number of up-votes awarded to a user is to be monitored within a user's personal account. The up-vote tally is to be monitored across all new posts and replies to articles and posts that a user has contributed to in both the knowledge base and community feed. There are no multiple award of badges.

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