



HARMONISE - A Holistic Approach to Resilience and Systematic Actions to make Large Scale Urban Built Infrastructure Secure

D6.1 The development of a virtual centre of excellence linking institutions and urban areas

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Executive Summary

This document reports on the intentions and actions surrounding the development of the HARMONISE Project into a legacy structure described in the Project documentation as a ‘Virtual Centre of Excellence’ and achieved as the ‘HARMONISE Community. It is intended to outline the key objectives, processes and procedures related to WP6: Dissemination & Communication, Education/Training and Exploitation, Task 6.4, Education, Training and CPD and forms the Deliverable D6.1 – The development of a virtual centre of excellence linking institutions and urban areas.

The main focus of WP6 is to disseminate the key findings and outcomes of the HARMONISE project in a coherent manner to a varied stakeholder audience. The main purpose of the Work Package is therefore to:

- Build a strong HARMONISE brand
- Raise awareness – let others know what we are doing
- Inform – educate the stakeholder community
- Engage – get input/feedback from the community
- Promote – ‘sell’ our outputs and results
- Make sustainable – ensure that HARMONISE will be sustained after the project
- Facilitate the integration of HARMONISE outputs into Stakeholder practice and integration with existing complementary systems
- Encourage adoption of the HARMONISE products

A key element is the development of a robust, realistic strategy for maintaining and further developing the HARMONISE Concept post Project, to ensure that the envisioned impact is achieved.

The HARMONISE Platform, Tools and Partnerships will be propagated via the HARMONISE Community to provide a Virtual Centre of Excellence (VCE) in Urban Resilience, linking Institutions and Urban Areas.

1 Introduction

The objective of this report is to provide a rationale and development path for the development of the HARMONISE Concept and Project Deliverables into a Virtual Centre of Excellence in Urban Resilience linking Institutions and Urban Areas. The report will identify the core concept in this activity – The HARMONISE Community and will identify and detail the main concepts, components, products and participants which will be mobilised to bring this to fruition.

1.1 Background

The urban environment is becoming more and more complex, not least with regard to security aspects following a decade of continuous threats to our existing and planned large scale urban built infrastructure. Such infrastructure are critical nodes within the intertwined networks of these urban areas, which include not only physical components, but also integrated hardware and software aspects. To date, a comprehensive and holistic (systematic) approach to improve the resilience and security of large scale urban developments against attacks and disruptions has not been developed thoroughly.

The general aim of *HARMONISE - A Holistic Approach to Resilience and Systematic Actions to Make Large Scale Built Infrastructure Secure* - is to develop a comprehensive, multi-faceted, yet mutually reinforcing concept for the enhanced security, resilience and sustainability of urban infrastructure and development. HARMONISE will result in resilience enhancement methods for large scale urban built infrastructure. It will see the development of a concept to improve the security and resilience of this infrastructure, encompassing the design and planning phases of such projects (and thereby leading to robust built infrastructure invulnerable to natural/man-made disasters). HARMONISE will improve the design and planning of urban areas, thereby increasing their security and resilience to new threats.

The Thematic Review and subsequent analysis in analysis of tools and stakeholder engagement has confirmed the potential for HARMONISE to meet an unmet need for a holistic urban resilience product offer to aid effective delivery of resilient large scale built infrastructure. Review of the state-of-the-art provides further evidence to the view that there is an absence of a comprehensive, proactive and holistic approach to improve resilience and security of large scale urban built infrastructure. The vulnerabilities of urban areas to terrorism and natural disasters together with the mechanisms to address them continue to be examined and addressed. However,

the evidence presented by the HARMONISE Project continues to highlight that no holistic approach has been formulated to develop a systematic approach to the design and planning of large scale urban built infrastructure. This gap provides the business opportunity that HARMONISE can exploit, with its range of products and an associated capacity to provide valuable evidence based consultancy services and highlight the need for further research and development in this important area.

1.2 Scope of the Deliverable

The role of the Virtual Centre of Excellence is to provide a viable mechanism to propagate the holistic vision of HARMONISE to its intended multidisciplinary audience and to continue to build usage of and confidence in the HARMONISE Project Concept and Products. The aim is to build a multidisciplinary community in the urban resilience field, to facilitate the spreading of best practice and ultimately to foster excellence in the urban resilience practice and help to build, maintain and operate safer urban places. The deliverable will examine each of the elements of the task in turn. Firstly the concept of a Centre of Excellence shall be considered and HARMONISE will be mapped to this concept. Second, the aspect of linking organisations and urban areas will be considered. Finally, the mechanisms for achieving the ‘virtual’ vision will be considered.

2 Delivering the HARMONISE Community Virtual Centre of Excellence

2.1 Virtual Centre of Excellence

The initial question of note here is: What is a Virtual Centre of Excellence (VCE)? In this context it has been useful to consider the definitions and scope of Virtual Centres of Excellence as described in other EU security projects, such as the SOURCE Network of Excellence and VOX-POL. From a wide consideration of the actions, activities and structures commonly associated with centres of excellence it is considered that such an entity is based on certain key activities: networking, research, education / training, and knowledge dissemination. Virtual versions of this concept also typically involve interaction with some form of central ‘hub’ or ‘portal’ which acts both as an information repository and as a central communication node. The HARMONISE Community VCE clearly fits with this understanding, as it is centred on a central platform and toolkit, hosting the results of a considerable amount of research and educational material. As discussed in more detail later, it also facilitates both direct and virtual networking and is a robust and sustainable method to host a ‘community of interest’ in urban resilience.

2.2 Linking Organisations and Urban Areas

A key element of the HARMONISE Community VCE involves activities to link organisations and Cities. This activity has been developed in earlier in WP6 activity, including identification of the target market of HARMONISE in D6.5 and links to the dissemination of Project results occurring in T6.2, and to the product testing and fine tuning of the Platform and Tools.

This activity was embedded via the organisation of risk screening workshops in each of the Case Study cities. These workshops were an ideal opportunity to begin the process of linking organisations, predominantly the key stakeholders in each to their relevant cities. This activity has contributed to the development of the Platform and Tools and builds forward into the identification and development of educational and CPD activity and the organisation of a major conference to showcase the Project under the auspices of T6.4.

These activities build upon earlier stakeholder engagement with the aim of identifying key markets for HARMONISE and tailoring HARMONISE products for those markets. The challenges facing these cities and the best practice emanating from them has been captured by the HARMONISE project and made available to the other case study cities, with the best practice

and BSOA tools developed being also made available to the organisations involved and others who have registered or otherwise liaised with the Project. D6.5 has identified the key stakeholder organisations as including all actors, agencies and individuals in the wider community, but primarily being those who are closely involved in the planning, design and operation of large scale built infrastructure, including the municipal government, police and security services and other civil contingency organisations and the owners and developers and advisors involved in large scale built infrastructure. The engagement with these groups has built a solid community of interest around the urban resilience theme, centred on the the HARMONISE Project. This is a clear example of research informed knowledge dissemination building a supportive network and contributing to a centre of excellence.

FIGURE 1 MAJOR HARMONISE COMMUNITY VCE MEMBERSHIP GROUPINGS



2.3 Achieving the ‘Virtual’ Centre of Excellence Functionality

2.3.1 The HARMONISE Platform as a VCE Enabler

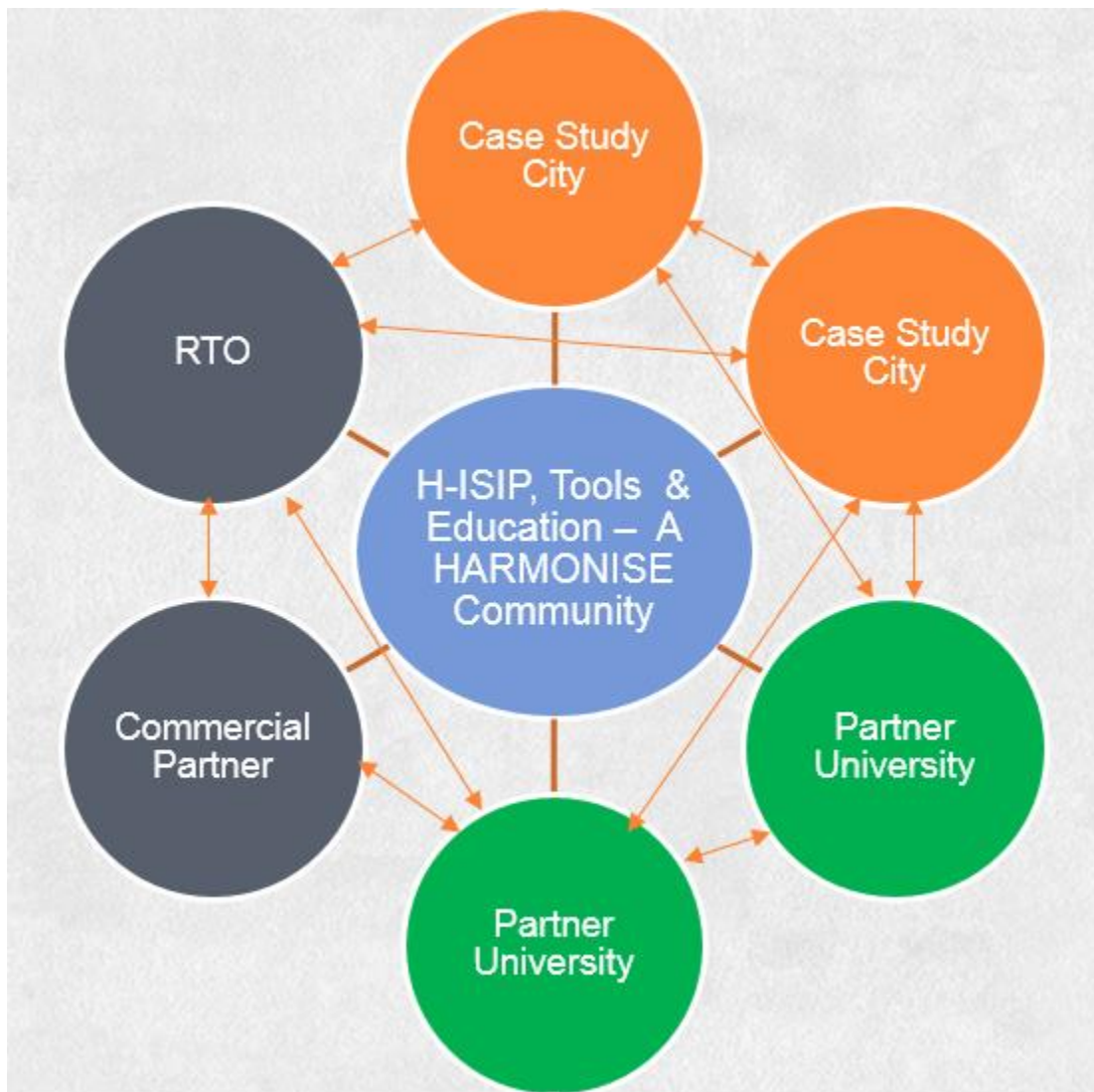
The HARMONISE Platform has the capacity to underpin a robust and sustainable VCE via its ability to support a repository of high quality curated relevant material, structured via the design

and adoption of a thematic framework, enabled via a three stage semantic search functionality. This functionality is a major boon and attraction for potential Community members, as the repository and semantic search functionality is capable of supporting decision making by end users who require a robust, holistic, urban resilience evidence base. This functionality has real value to Urban Resilience practitioners who can interact with the repository of material directly and with the other HARMONISE Community VCE members indirectly. As discussed, there is a large quantity of high quality material of use to practitioners held in the Platform, which can be interrogated via the semantically enhanced thematic search functionality. This functionality has the capacity to generate a tailored evidence base for informed decision making, resulting in a valuable service to end users who will have much to gain and to contribute over time by engaging with the Platform under the auspices of the HARMONISE Community VCE. With extended use of and contribution to the material held, the semantic functionality will become iteratively optimised, providing a considerable incentive to continued Community membership and activity.

The Platform (in future HARMONISE Community) registration process captures relevant information concerning the nature of the Community member, work interests and areas of expertise, all of which is captured and can be interpreted by the Platform to build a variety of ‘communities of interest’ within the overall HARMONISE Community VCE.

The figure below gives a visual indication of the way in which organisations of different types – public sector, private sector, educational and research organisations – will be able to interact with each other and with urban areas – to enable the VCE. The original members are the consortium members who are a remarkably representative group. This membership has already begun to expand and will grow organically moving forward. In this diagram the arrows represent the routes of communication enabled via membership of the HARMONISE Community VCE.

FIGURE 2 THE HARMONISE COMMUNITY VCE



2.3.2 Education Training and CPD

The Educational service provided is a critical aspect of the HARMONISE Community VCE. This element operationalizes the objectives of the Project relating to the continuing impact of HARMONISE on urban built environment policy, policy evaluation and how and where this influences and advances curriculum development, training and CPD activity. The formal outputs relate to developing project outputs into an educational offering which will be made available via an electronic platform hosted on the HARMONISE Platform and forming a key component of the HARMONISE Community VCE offering post project.

The Educational service draws on key elements from Project Deliverables (particularly D1.1 and additional material not utilised for the formal D1.1). The Educational service is delivered Moodle (Modular Object-Oriented Dynamic Learning Environment), which is a free open-source

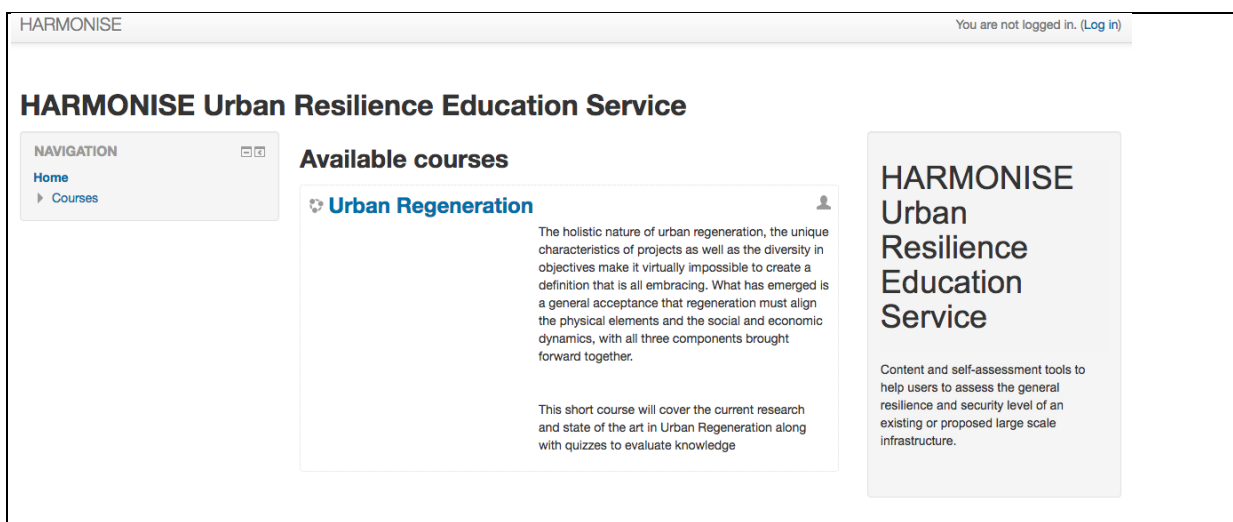
learning management system or e-Learning platform that serves educators and learners across the globe. It is the most widely used LMS in the world and currently has over 68 million users world-wide via Open Source. This Virtual Learning Environment (VLE) is accessible via the Project Platform, which also hosts the Educational Tool (as a crucial 'orientation' tool). This HARMONISE Community VCE VLE provides a number of free to use Reusable Learning Objects. Whilst this material is constantly being augmented it is intended to launch the service with a number of key modules including:

- Introduction to Urban Resilience
- Urban Resilience in Public Policy
- Current State of the Art in Urban Resilience
- Urban Resilience and Security Structures
- Urban Resilience and Fire Safety Engineering
- Urban Resilience and Material science
- Urban Resilience and Access Logistics
- Urban Regeneration

These serve to orient the user both into the Urban Resilience SOA milieu, and also as a potential route to more formal CPD and Educational modules & programmes which are under consideration by the three Academic Partners directly, and other partners indirectly. An early example is the introduction of a Resilient Cities Module into the Ulster University Integrated Masters (MSci) Planning, Regeneration and Development Degree, which will draw upon elements of the HARMONISE Project such as the Educational Tool, the Planning & Design Guidance Tool, the Platform functionality itself and the educational offerings hosted in the Platform.

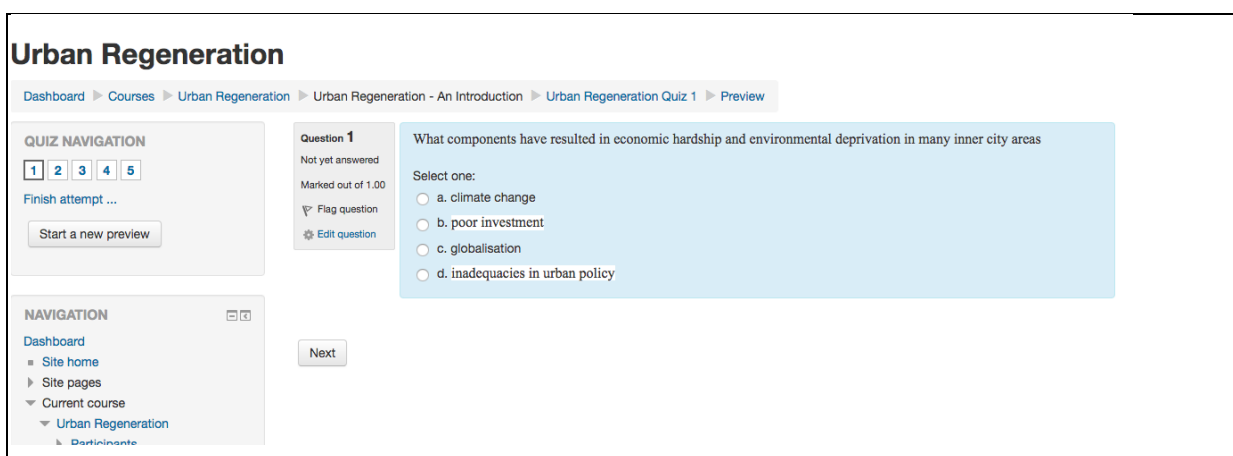
A view of the Service is displayed below:

FIGURE 3 THE HARMONISE COMMUNITY VCE URBAN RESILIENCE EDUCATION SERVICE



The Educational Service provides the facility to host educational material and also to provide online testing facilities – this provides the opportunity for users of the Education service to interact with the material and then undertake online self-assessment to determine their level of understanding of the material. This will also allow the issuing and recording on the system of completion of a module by the Community member. Whilst these modules will not be credit bearing initially it will be possible to issue CPD module completion certification which will be of great value to the professionals who will use the service and who are generally expected to undertake at least 24 hours of CPD per annum. An image of the testing element is depicted in the Figure below:

FIGURE 4 SELF ASSESSMENT IN THE HARMONISE COMMUNITY VCE EDUCATIONAL SERVICE



2.3.3 Powering the ‘Virtual Mentoring’ Element of the Harmonise Community VCE

In recent years we have observed an explosion in the availability of digital information, resources and on-line content. Users are now confronted with a wealth of information and the sheer variety and volume of content available can make it difficult to find information that most meet their needs. To address this problem, recommender systems (RS) have emerged to aid in information extraction, filtering information and predicting relevant information for a user. They are used in various fields, ranging from commerce to financial services, to recommend items of interest to users. The HARMONISE Community VCE applies a novel RS utilizing two aggregation operators, namely a OWA and uninorm operators, to the Urban Resilience domain. This provides a form of ‘virtual mentoring’ which enhances the performance of the virtual centre of excellence.

Urban areas are highly complex with multipurpose and interlinking - and sometimes non-interlinking - characteristics, involving multiple actors, interests and resources. Systems such as telecommunications, water supply, sewerage, electricity and transportation add an additional layer of complexity to urban developments. Large scale built infrastructure is a critical component within the intertwined networks of urban areas. The HARMONISE project aims to improve the resilience and security of critical large scale urban built infrastructures through the integration of multi-disciplinary tools and methodologies. This has resulted in the HARMONISE platform. The platform has the capacity to contain vast amounts of high quality curated and relevant urban resilience information and tools deposited by a wide range of professionals including planning, security services and service suppliers. The platform provides a central framework to foster sharing of urban resilience resources across communities and practitioners worldwide. This is achieved through the provision of search, diagnostic and modelling tools. To improve user experience in terms of the search functionality and the filtering of relevant information to systems – to enable a form of ‘virtual mentoring’ facility within the HARMONISE VCE – The ‘HARMONISE Community’ utilises an innovative RS.

One of the most extended types of RS are the ones based on Collaborative Filtering (CFRS), a class of methods that recommend items to users based on the preferences shown by other users over these items [2]. Typically, a CFRS identifies a group of similar users - i.e. neighbours - to the target user based on their preferences and other relevant information, and recommends him/her new items positively rated by neighbour users.

As the HARMONISE platform aims to provide relevant content to users across communities of members from vastly diverse backgrounds and areas of expertise, CFRS was a particularly

suitable information filtering approach. Nevertheless, some additional criteria that would be desirable when filtering urban resilience resources to end users in this particular context, were identified:

1) Information in the user profile (e.g. field of expertise, membership to specific urban resilience communities, etc.) must play a relevant role in the recommendation process. Therefore, identification of similar users to the target user must be predicated on two main aspects: (i) users' preferences (given by content items they marked as favourite), and (ii) the information in their user profile.

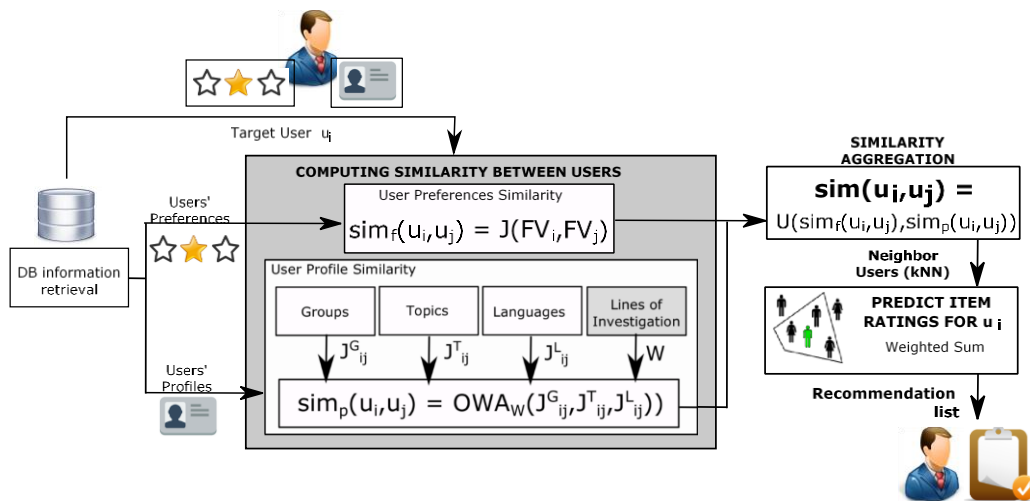
2) When determining the similarity degree between two users, it would be desirable to emphasize the cases when both their preferences and profile are highly similar. Those cases in which two users are highly dissimilar in both aspects should also be conversely taken into consideration.

3) When comparing two users' profiles, special attention must be paid to their lines of investigation: this is the only field in the user profile whose information can be freely introduced by the user, i.e. there is no limited set of predefined values, hence two users with one or more common lines of investigation should be regarded as particularly similar to each other.

Given the necessity of a bespoke CFRS model that suits the context-specific criteria stated above for the HARMONISE platform, HARMONISE adopts a CFRS model that combines information about users' preferences and profile to find a target user neighbourhood, and recommend new urban resilience tools/resources that might be of potential interest to him/her. The OWA and uninorm aggregation operators whose properties make them particularly suitable to satisfy the stated criteria, are used to fuse user information and obtain global degrees of similarity between them.

The system installed to deliver this high level performance is depicted in the Figure below:

FIGURE 5: THE HARMONISE COMMUNITY VCE 'VIRTUAL MENTORING' ENABLER



In this way, without any direct contact between them, expert users with experience in Urban Resilience are able to contribute to the adoption of new tools and approaches and to in effect ‘mentor’ other users, via the HARMONISE Community VCE. This adds an extra dimension to the existing repository of excellence and search functionality of the platform and tool kit, helps the underpinning platform ‘outperform’ other repositories and helps to build use of and trust in the system.

3 Conclusions

The capacity of the HARMONISE Platform to have a useful life after the end of the Project will be dependent upon the intentions and co-operation of the consortium Partners. It is intended that this will be achieved under the auspices of the HARMONISE Community Virtual Centre of Excellence. The intention is to build upon existing relationships formed under the Project to build a vibrant HARMONISE Community VCE, accessing the Platform, utilising the Tools and building a resilience community linking countries, institutions, discipline groups and commercial entities.

Partners who have developed technical Tools are committed to seeking opportunities to deploy the tools, either as part of a HARMONISE package, as standalone deployments or as integrated extensions of existing client planning, design, operational asset management and business intelligence systems.

HARMONISE partners, particularly the academic partners, are planning to use the knowledge gained during HARMONISE project for teaching and further research.

The consortium proved to be an effective working group and the partners are open to developing further cooperative projects together, including participation in the Horizon 2020 programme, with some success having been achieved to date with collaborative projects including some consortium members.

This firm foundation has been showcased via the website, the regular newsletter which has circulated to over 80 recipients and has recently been launched successfully at the HARMONISE Conference in Genova which launched Genova Smart Week, exposing the HARMONISE Concept and Community VCE to a wide and high level audience of potential participants. This has indeed laid the foundation for a robust and sustainable Virtual Centre of Excellence moving forward and which will link organisations of many types, spanning many disciplines and cities with a wide range of challenges, experience and expertise and which will, via the technology and tools developed in the HARMONISE Project and via the ‘virtual mentoring’ designed in to the Community VCE, help to promote urban resilience best practice and help to build safer places and more secure communities.