University Alliance
Doctoral Training Alliance

DTA3/COFUND Programme Research Project Proforma

Page 1 – General Information

Project Code	TSEN05
Partner University	Teesside University
Faculty/School/Department/Research Centres	School of Science, Engineering and Design, Engineering Department
First supervisor Please provide name weblink	Dr Vladimir Vukovic https://research.tees.ac.uk/en/persons/vladimir-vukovic
Second supervisor Please provide name and weblink	Prof Nashwan Dawood https://research.tees.ac.uk/en/persons/nashwan-dawood
Third supervisor Please provide name and weblink	Dr Ezri Hayat https://research.tees.ac.uk/en/persons/ezri-hayat
Fourth (external) supervisor	Dr Mohammad Abdur Razzaque https://research.tees.ac.uk/en/persons/mohammad-abdur-razzaque
External/industrial supervisor	Peter Hall, Phusion IM, UK https://www.phusionim.com/
Which of the supervisors listed above is an early-career-researcher	Dr Ezri Hayat (PhD 2015)
Contact details for project for informal applicant queries	v.vukovic@tees.ac.uk
DTA Programme	DTA Energy
Project title	Local Infrastructure Health and Safety System

Co-funded by the Horizon 2020 programme of the European Union

This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No 801604.

Page 2 – Project Description

Scientific Excellence (500 words)	Housing Health and Safety Rating System (HHSRS) is developed by the UK government as part of the Housing Act 2004 in order to evaluate potential health and safety risks in dwellings (ODPM, 2006). In HHSRS hazards with a score above 1000 are marked as Category 1 hazards that present immediate and serious risk to health and safety, whereas those with a score between 500 and 999 are Category 2 (Nicol et al., 2015). While HHSRS is used for housing, no evidence was found of its application to infrastructure, e.g. roads. Standard classification systems (e.g. Uniclass2015) in accordance with ISO12006 are used for various sectors of the UK construction industry in order to organise information about construction works (NBS, 2015; ISO, 2015). Additionally, ISO22301 and ISO22313 define requirements and guidance for business continuity management to ensure operation of critical infrastructure with minimum disruption in case of emergencies (ISO, 2012a; 2012b). Local authorities use Geographic Information Systems (GIS) to manage a variety of assets, e.g. roads, drainage, buildings, parks, other outdoor facilities (Lennox, 2012). Development and integration of a maintenance / refurbishment prioritisation system based on HHSRS and mentioned ISO standard principles within the existing GIS may present valuable contribution to state of the art and lead towards the optimal use of limited resources in local communities, including energy. References: Cabinet Office. (2011). Keeping the Country Running: Natural Hazards and Infrastructure – A Guide to improving the resilience of critical infrastructure and essential services, UK ISO. (2012a). Societal security – Business continuity management systems – Requirements, International Organization for Standardization ISO. (2012b). Societal security – Business continuity management systems – Guidance, International Organization for Standardization

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	ISO. (2015). Building construction – Organization of information about construction works, International Organization for Standardization Lennox, P. (2012). GIS is an important tool for local government, https://www.geospatialworld.net/article/gis-is-an-important-tool-for-local-government/, accessed Jan 28, 2019 NBS. (2015). Uniclass 2015 - a universal classification system for the construction industry, https://www.thenbs.com/news/uniclass-2015-a-universal-classification-system-for-the-construction-industry, accessed Jan 28, 2019 Nicol, S., Roys, M. and Garrett, H. (2015). Briefing Paper - The cost of poor housing to the NHS, BRE ODPM. (2006). Housing Health and Safety Rating System – Operating Guidance. Office of the Deputy Prime Minister (ODPM), UK
Aim (400 words) You may wish to include headings – Hypothesis, Methodology and Innovations	Aim of the research is to develop Local Infrastructure Health and Safety System (LIHASS) that will consider different risks/hazards and energy/environmental footprint implications related to roads, pathways and other infrastructure of interest to local authorities, classified according to the standard classification systems (e.g. Uniclass2015). The main research hypothesis is that LIHASS maintenance / refurbishment prioritisation system based on HHSRS and relevant standards used with the existing GIS, contributes to the optimal use of energy resources in local communities. Initially, the project will identify different categories of risks/hazards and specify types of hazards within each category (e.g. roads: damage - potholes, missing elements - gutter covers, surface obstacles - shuttered glass, etc.). The project will further provide methodology for rating risk/hazard levels similarly to the HHSRS in order to evaluate potential health and safety risks. The rating will consider likelihood and impacts on health and safety, energy demand, as well as the following aspects in accordance with the Guide to improving the resilience of critical infrastructure and essential services (Cabinet

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	Office, 2011): a) Loss of primary transport routes; b) Reduced staff availability; c) Impaired site access; d) Loss of power supplies; and lack of availability of alternative power supply; e) Loss of water supplies; and lack of availability of alternative water supplies; f) Closure of local businesses; g) Increased demand for health, emergency services, products and services of local authorities and stakeholder organisations; h) Supply chain disruption. Redundancy and disruption due to repair works, including service restoration time, will be taken into account, in order to evaluate the consequences of repair vs. non-repair. Subsequently, all hazards will be classified into prioritisation categories, depending on the rating score, e.g. Category 1 - hazards that should be immediately mitigated/repaired; Category 2 - lower priority hazards. Provisions will be made for integration of the developed LIHASS within the GIS that may be in use by the local authorities. During development of LIHASS, relevant standards will be reviewed to incorporate standardised principles and processes. The following procedure will be followed: 1. Produce Community Risk Register to identify local risks and essential services / critical infrastructure, 2. Understand business continuity management by the providers of essential local services, 3. Use information on critical infrastructure to review disruption response plans and local planning assumptions, 4. Provide suggestions how LIHASS could fit into and improve local disruption and business continuity plans and investment decisions.
Strategic Relevance (300 words)	The project will aim to understand existing practices within the local authorities to identify, assess and manage the changing risks associated with the infrastructure of interest. It will outline the aspirations of the local authority for delivering improvements in their existing practices; determine what success, in terms of managing infrastructure risks/hazards, looks like for the local authority; identify specific priorities over the short, medium and long term; understand the risk "appetite" of the local authority and discuss with key stakeholders and emergency responders for the local authority. The purpose of such interaction will be to produce an action plan for LIHASS to

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	facilitate achievement of the desired improvements in existing practices at the local authorities, being positioned at the core of its prospective governance processes. Therefore, LIHASS development will be strategically relevant for improvement of local authority operations, as well as for the relevant local Category 1 responders, to advise on business continuity planning and have an understanding of response and continuity activities during a disruption of services of interest.
Interdisciplinarity and fit with DTA3	Interdisciplinary nature of this research is inevitable as it includes knowledge and understanding of a variety of existing underlying principles, e.g. emergency response, continuity of operation, classification, health and safety, energy demand, information management, GIS. The aim is to address a number of potential stakeholders form local authorities to first responders and technology developers, requiring inputs from diverse fields of knowledge and application ranging from sociological and engineering analyses of stakeholder requirements, through information modelling, to optimisation and policy development. Its fit within the DTA Energy programme is mostly related to the smart city design targets: optimised design, operations and resilience. Tangible and quantifiable benefits within the domain of energy studies will be based on ISO 17742 Energy efficiency and savings calculation for countries, regions and cities.
Industrial Relevance (300 words) Detail external placement opportunities or	A number of large industry players aim to take a share of the emerging digital city markets. Platforms such as ET City Brain by Alibaba[1], Car2X technology demonstration by Volkswagen and Siemens[2], SAP HANA, Leonardo, Vehicles Network and Cloud platforms[3], IBM Intelligent Operations Center for Emergency

[1] Alibaba Cloud ET City Brain, Cities Empowered to Think, https://www.alibabacloud.com/et/city, 2019

[2] Volkswagen and Siemens make crossroads safer, https://www.volkswagenag.com/en/news/2018/10/volkswagen-and-siemens-make-crossroads-safer.html, 2018

[3] Smart Cities World Forum, http://www.smartcitiesworldforums.com/news/smart-cities-middle-east/5g-iot-me/802-sap-announces-partnerships-designed-to-propel-smart-city-innovation-in-me, 2019

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collaborations available as part of the project	Management[4], Atos MyCity[5] are only some of the existing solutions available on the market. Teesside University already discussed collaboration on this project with Phusion Information Management, local SME with whom we had a small consultancy project to advise on the prospective technology developments. Furthermore, TU had previous successful collaboration with Siemens, IBM and Atos. Such collaborations open possibilities for placement within the remits of the proposed DTA3 research. Additionally, TU team recently finished a consultancy project for Darlington Borough Council, advising about prospective town planning and investment priorities. The council was very interested in continued collaboration, which the proposed project could further facilitate.
Economic and Societal Impact (300 words)	Economic and societal impacts of the proposed project are part of the overall business opportunities created through smart city developments, as presented in Figure 1. The resulting total revenue opportunity amounts to approximately $4 trillion by 2020, connecting 4 billion people via more than 25 billion smart systems. As the intention is to make the proposed development within this project invaluable for prospective city operations, taking even a small portion of the overall market (e.g. 1%) would amount to $40 billion in potential revenues. At the same time citizens can expect better maintenance of critical urban infrastructure, lower levels of disruption, leading to (estimated 10%) higher degrees of satisfaction as the main societal benefits. As indirect benefits, local businesses can also expect higher revenues leading to higher levels of taxable income.

[4] IBM, Intelligent Operations Center for Emergency Management Overview, https://www.ibm.com/us-en/marketplace/emergency-management, 2019
[5] Atos, MyCity https://atos.net/en/industries/local-government-cities/mycity, 2019

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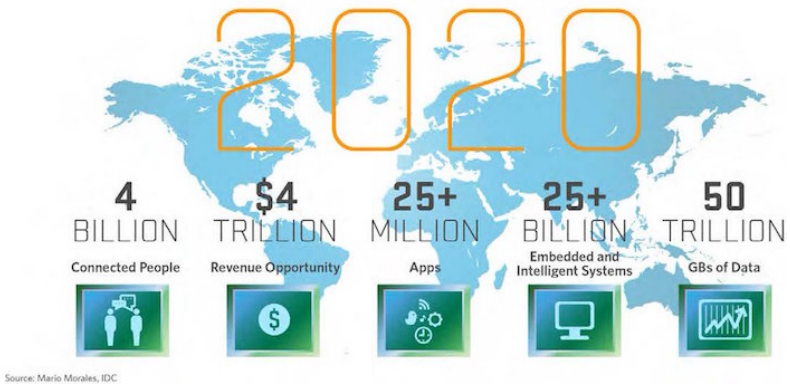

Figure 1 Some of the smart city opportunities

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Page 3 – Admission Requirements

Specific Admission Requirements Detail any subject specific degree qualifications or disciplines, relevant skills, experience	Master degree in architectural engineering, mechanical engineering, electrical engineering, computer science or related area, with a GPA above 60%.
Minimum IELTS score	6.5

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