Impact case study (REF3)

Institution: Nottingham Trent University (NTU)

Unit of Assessment: C13 - Architecture, Built Environment and Planning

Title of case study: Smart Preservation of Middle Eastern Urban and Cultural Heritage: Shaping Policy and Practice

Period when the underpinning research was undertaken: 2004-2020
Details of staff conducting the underpinning research from the submitting unit:

Names:	**Roles:**	**Periods employed by submitting HEI:**
Gamal Abdelmonem	Professor	2016-present
Soumyen Bandyopadhyay	Professor	2008–2014

Period when the claimed impact occurred: 2016-2020
Is this case study continued from a case study submitted in 2014? N

1. Summary of the impact

NTU has pioneered a novel heritage management framework for integrating smart laser scans, historical narratives, community heritage, and virtual modelling of endangered heritage sites in the conflict-prone Middle East and North Africa (MENA) region. It conjoined multi-layered history, narratives and archival records of social, cultural and architectural heritage into publicly accessible virtual platforms that maximise public engagement and provide a roadmap for heritage management capacity building. NTU research has: (1) influenced national policy on preserving heritage sites in Egypt by establishing a standardised process of managing digital heritage records, leading to Egypt's first virtual tours of heritage sites, generating over 30k online viewings, and 7 private-public partnerships; (2) advised the Mayoralty of Baghdad on virtual heritage technology and informed the city's heritage preservation Roadmap Policy; (3) created the first interactive model of a heritage site in Jordan, which integrates local accounts and stories of community memory; (4) delivered training for 7 SMEs, over 100 government officials and heritage professionals, building capacity and effective private-public partnerships throughout the region; finally (5) instigated five start-ups in the new creative virtual heritage industry in Egypt.

2. Underpinning research

Iconic heritage throughout the world is threatened by conflict, climate change, rampant commercialisation, overexploitation by tourism, and significant disinvestment. With the increasing rate of destruction of heritage sites across the MENA region, the need for digital preservation of historic artefacts and cultural heritage is urgent; success relies on effective collaboration between governments, the private sector, civil society organisations and local communities. Digitisation of heritage from the recording of customs, photo archives, film footage through to oral histories has become indispensable for the engagement of public audiences and local stakeholders in the common goal of preservation (**G1**). The use of online platforms, digital exhibitions and virtual reality models of historic sites has offered novel ways to increase audience engagement with remote heritage locations (**R1**). This is particularly critical to heritage-dependent economies, industries and communities in the conflict-prone MENA region, like Egypt, Jordan and Iraq.

At the Centre for Architecture, Urbanism and Global Heritage (CAUGH), the research focus goes beyond the physical remains of historic sites and seeks to understand human experience, rituals and social history that add meaningful narratives to physical fabric, structures and artefacts. To achieve virtual fidelity and accurate reproductions of historic environments, Bandyopadhyay and Abdelmonem sought to develop novel platforms for conservation of heritage sites in the MENA region, incorporating a series of socio-cultural studies and historic narratives, in Oman, Egypt, Iraq and Jordan. Bandyopadhyay criticised the traditional approach of studying architecture and urban development, such as forts, castles and dwellings of significance in Oman, as decontextualised exotic objects. He explored the interplay between the evolution of the built environment and its historical social context, using Manah, a strategically important oasis settlement in central Oman, as a case study (**R2**). Abdelmonem's

research on the *Hawari* (alleyways) of historic Cairo (**R3**), *Mahallas (neighbourhoods)* in historic Baghdad (**R4**), historic urban squares in Tripoli and Erbil's Castle developed in-depth understanding of historic socio-spatial patterns and everyday lives in heritage environments. This allowed him to create records of cultural memory comprising digital databases and archives of historic houses, streets and everyday lives (**R3, R5**).

Abdelmonem subsequently developed a novel heritage management framework as a co-production and community-led preservation tool, which utilises novel virtual heritage technologies to explore the theoretical and philosophical disposition of cultural heritage as a democratised record of historic environments (**R1, G1**). Working on three levels – recording archaeological sites, tracing historic lives and archives, and recording communities' stories, the framework encompasses technical procedures, community engagement, and policy advocacy aspects to reframe heritage preservation as an enabler of digital heritage economy and remote tourism. The framework includes: (a) protocols for laser scanning, recording, digitising and preserving heritage sites and monuments through contextualised point-cloud and navigable virtual environments; (b) procedures for analysing archaeological artefacts and material culture; (c) advice for developing crowd-sourced community narratives and oral histories; and (d) the practice of compiling digital archives of archaeological heritage artefacts through working with museums. This work assembles unique and publicly accessible virtual displays, in which history, archaeology and community records are integrated and visible.

Abdelmonem has had a regional leadership role through a network of active research initiatives and strong, sustainable partnerships with SMEs, communities and government entities. Key projects include a grant from the British Academy's Global Challenges Research Fund to record and map the disappearing intangible heritage of historic markets, trades, crafts and traditions in largely destroyed Old Mosul (**G3**). AHRC (Newton) grants enabled socio-cultural research to feed into the creation of virtual reality models of historic cities, building capacity within local SMEs and government departments (**G1**). They facilitated the investigation of historic everyday lives, public memory and community heritage as part of the conservation and reconstruction of heritage sites of Hawara Pyramid and Labyrinth in Egypt, working with the Ministry of Tourism and Antiquities (**G2**), and the Greco-Roman heritage site of Gedara (Umm Qais) in Jordan, working with Department of Antiquities (**G4**). Another AHRC (GCRF) grant funded the study, analysis and recording of neglected and disappearing community heritage and lack of economic opportunities for vulnerable and displaced communities in conflict-prone zones in Iraq, working with the Department of Antiquities and the Mayoralty of Baghdad (**G5**).

3. References to the research

The quality of the underpinning research has been evidenced by externally peer reviewed grants and outputs.

R1. Abdelmonem, M.G., Selim, G., Mushatat, S., AlMogren, A., 2017, *"Virtual Platforms for heritage preservation in the Middle East: The Case of Medieval Cairo"*, Archnet-IJAR, 11(3), pp.28-41.
https://archnet.org/publications/12717

R2. Bandyopadhyay, S., 2011, "Manah: Omani Oasis, Arabian Legacy: Architecture and Social History of an Omani Oasis settlement", Liverpool University Press, 312pp, ISBN: 978-1-846-31121-5.

R3. Abdelmonem, M.G., 2017, "The Architecture of Home in Cairo: Socio-spatial practice of the Hawari's Everyday Life", London: Routledge, 368pp, ISBN: 978-1138567320

R4. Al-Thahab, A.A. and Abdelmonem, M.G. (2019), "*Changing socio-spatial systems of urban living in twentieth century Iraq*", Archnet-IJAR, 13(3), pp. 595-611.
https://doi.org/10.1108/ARCH-01-2019-0011

R5. Abdelmonem, M.G., 2017, "*Architectural and Urban Heritage in the Digital Age: Dilemmas of Originality, Authenticity and Reproduction*", Archnet-IJAR,11(3), pp5-15.
https://archnet.org/publications/12715

The following **grants** provided important impetus to underpinning research:

G1. Abdelmonem, MG. (PI); AHRC (£66,024, 2016-2017): "Virtual Heritage of Medieval Culture"; partners: University of Birmingham, National Research Institute of Astronomy &

Geophysics, Egypt, and Ministry of Tourism and Antiquities in Egypt.

G2. Abdelmonem, MG. (PI); AHRC (£230K-UK+£85K-EGY; 2018-2021): "*LABYRINTH: Conservation, Analysis and Virtual Reconstruction of Archaeological site of Hawara Pyramid and Labyrinth*". partners: Leeds Uni, Durham Uni, National Research Institute of Archaeology & Geophysics (NRIAG) and Ministry Tourism and Antiquities in Egypt.

G3. Abdelmonem, MG. (PI); British Academy (£299K; 2019-2021): "*Preserving the disappearing Cultural Heritage of Post-War Mosul*". partners: NTU, University of Leeds, Durham University, Department of Antiquities and Heritage – Iraq, University of Mosul, University of Wasit, Iraq.

G4. Abdelmonem, MG. (Co-I); AHRC (£200K; 2019-2021): "The Living Museum of Umm Qais: Sustainable preservation, analysis and virtual reconstruction of Gadara's ancient site and village". Partners: Leeds University, Department of Antiquities (Jordan) & Jordan University of Science & Technology.

G5. Abdelmonem, MG. (PI); AHRC-GCRF Development Award (£56,622; 2019-2020): "Heritage Borders of Engagement Network" (ENGAGE). Partners: Wasit University (Iraq); Sousse University (Tunisia) and Praxis (India); and 24 others partners.

4. Details of the impact

Egypt, Jordan and Iraq have a long list of world heritage sites with limited digital records or necessary resources needed for effective conservation or reconstruction. Since 2017 damage to 57 heritage sites in Mosul was reported by the American Schools of Oriental Research (ASOR) Cultural Heritage Initiatives; Jordan has very limited digital outputs for its diverse Greco-Roman heritage; and Egypt is embarking on digitising its vast Pharaonic, Greco-Roman and Islamic collections and heritage sites. In response, NTU collaborated with governments to develop digital platforms for heritage preservation to address the increasing vulnerability of heritage sites and create alternative mediums for community-led income generation and growth of the heritage economy in light of a sustained decline in international travel to the region. These research-led collaborations have influenced government policy and decision making, and built capacity within SMEs and government departments by embedding digitally enabled heritage preservation practice. NTU's training programme directly resulted in five start-ups (Escape-HD/VRTEEK, AVRST, MOSAIC, Hexel labs, OMvr) in virtual heritage technologies and contributed to building a strong creative virtual heritage industry in Egypt (page 9, **S4**).

Impact on Government Policy and Decision Making:

NTU worked with the Ministry of Tourism and Antiquities (MoTA) and the National Research Institute for Astronomy and Geophysics (NRIAG) as a three-way partnership in Egypt for five years (2016-2020), firstly to develop and embed a governmental approach to laser scanning and virtual heritage applications as a model for the rest of the country's heritage sites; and secondly to apply that approach to six heritage sites in Medieval Cairo (Islamic) and Hawara Pyramid (Pharaonic). This resulted in the policy document: "Managing Cultural Heritage in the Digital Age*" (2018),* to inform the government's approach to devising regulations and practice in managing virtual and digital heritage applications in Egypt (**S1**). It recommended: *adopting digital strategy as a conservation practice*; *opening heritage sites for virtual tours through public-private partnerships*; *offering systematic training to young generations and officials*; and *developing regulations and authority for managing digital heritage records*. It was issued to the Minister of Tourism of Antiquities and the Minister of Higher Education and Scientific Research. This document was accompanied by a number of policy engagement events with the Executive Office of the Minister of Antiquities (27 Dec 2016), at the Academy of Scientific Research & Technology (27th July 2017) and an MoTA-hosted and sponsored Conference with 100-participants in Cairo (**S8**); and training 18 of the Ministry's staff and heritage professionals on laser scanning, digital modelling and photogrammetry-generated models of archaeological sites in Fayoum (May 2018). As a result, the policy document, and the associated best practice manual, "*has become integral to the future planning of heritage sites in Egypt. … It is used by MoTA as a roadmap for encouraging private sector participation, whilst managing standardized process of registration and managing digital and virtual heritage records.*" (**S2**). Between 2018 and 2020, further interdisciplinary and scientific innovation was developed through projects on Hawaray Pyramid (Pharaonic) and *Bayt El-Qady (Islamic)* using our laser scanning technology to map non-

intrusive geophysical detection systems, as "*ground-breaking and critical to preserve nationally important heritage sites*" (**S2**), that are used "*to protect, preserve and develop [many] Egyptian heritage sites, such as Bayt El-Qady, Qaitbay citadel Historical Cairo among others.*" (**S3**).

This engagement resulted in the appointment of Abdelmonem and NRIAG-Egypt (**S2**) for the laser scanning and virtual models of two substantial heritage sites in Egypt: Bayt Al-Qadi Historic Site in Medieval Cairo in 2019 and Hawara Pyramid site in 2018 (**G2**). MoTA followed the recommendations and action plan set out in **S1** for adopting a virtual heritage strategy on public engagement and digital economy, and assigned contracts to NTU-trained and supported SMEs (including VRTEEK, **S9**). As a result, in April 2020 it launched the Ministry's Virtual Tours Programme: "Egyptian Heritage from Home" for 16 archaeological and heritage sites, coinciding with COVID-19 travel restrictions. Having received global media coverage, it generated 30,000 online visits from around the world for a six-month period to November 2020. As a direct result, NTU's research project (**G1**) was shortlisted for the prestigious Newton Prize 2020 "*for its high quality research and impact*" (**S4**), for which the Ministry of Antiquities in Egypt provided a supporting letter (**S3**) and highlighted the establishment of the first British-Egyptian Centre of Virtual Heritage Technologies (BECAVE).

NTU's research has informed the Mayoralty of Baghdad (MoB) in designing a heritage preservation strategy for its historic core and Al-Rasheed Street following widespread destruction during the Iraq war and ISIS conflict since 2014. Abdelmonem was appointed as Consultant and Advisor to the Mayoralty (**S5**) and authored the Al-Rasheed Street Laser Scanning Report, which included a comprehensive strategy for the preservation of the City's most historic street. This was key to the Baghdad Heritage Preservation Roadmap, which sets priority actions and preservation projects (**S6, S7**).

Through a collaboration with the Department of Antiquities (DoA) in Jordan and University of Leeds (**G3**), the NTU team introduced the use of laser scanning at Gedara Archaeological Site and Hara Fouqa (the Ottoman Village). This delivered "*a material change in the manner with which the Department of Antiquities manage, record and promote the preservation [of these two heritage sites] … The interactive model of the site is the first to be produced in Jordan and integrate local accounts and stories of community memory*" (**S11**).

Impact on Heritage Sector Capacity Building:

NTU directly engaged with over 200 practitioners in three countries through funded research projects, through workshops organised with governmental entities in Egypt (MoTA), Jordan (DoA) and Iraq (MoB). These activities delivered six training programmes to officials, heritage professionals and start-ups, building critical sectorial capacity. The effort directly resulted in five Start-Ups (Escape-HD/VRTEEK, AVRST, MOSAIC, Hexel labs, OMvr) in Egypt (**S4**) that developed their creative industry and business models based on NTU's training programme of the *Virtual Reality of Medieval Culture* Network's (**S10**).

These newly established SMEs worked on recording, preserving and developing virtual heritage applications under the NTU Mentoring Scheme. A successful example is Escape HD (later VERTEEK), whose Executive Manager acknowledged that the firm "*acquired valuable novel skills and distinct experiences on the application of virtual reality to historic buildings in real and practical projects. [Training by NTU] have given us an edge in local and regional markets and helped to secure a flow of income stream and projects in this unique business field*" (**S9**). The firm received the national innovation award for the most downloadable App by Samsung Egypt in 2017 (Award Value: 100,000 Egyptian Pounds; £5K) for 'Shari's Al-Muizz Virtual Tour' Mobile Application, which was developed as part of NTU's project (**G1**), and went on to lead and deliver many of the Ministry's Virtual Tours of heritage sites (**S9**). In those projects, a series of digital recordings, 360-degree interactive photographs, digital modelling and narratives were designed to enable the virtual navigation of heritage sites, places, rooms and stories either through virtual/augmented reality applications or through online access, maximising engagement and generating income.

Another company (AVRST), which developed The Orient Virtual Museum, received national recognition from the Egyptian Government and its Scientific Academy as a Pioneering Innovation project (March 2018). Two SMEs in Jordan, AL-Mutaz & MARS Robotics, have led

Terrestrial Laser Scanning and Aerial Point-Cloud scanning and modelling for the Umm Qais Heritage Site in Jordan, adding capacity to both SMEs for digital modelling of historic and complex structures, leading to other projects (**G4, S11**).

The NTU research led to the establishment of the Virtual Heritage Unit at NRIAG in Egypt in 2019. The NRIAG team now leads a growing portfolio of laser scanning activities at archaeological sites in Egypt and have '*become leaders in this field*' (**S2**).

5. Sources to corroborate the impact

S1: "Managing Cultural Heritage in the Digital Age: Research Policy Document on the Development of Virtual Heritage for Egypt and the Middle East". AHRC-Virtual Heritage Cairo. Cairo: Ministry of Higher Education & Ministry of Antiquities. Nottingham: NTU.

S2: Testimonial Letter from the National Research Institute for Astronomy and Geophysics (NRIAG) in Egypt on our impact on changing governmental attitudes.

S3: Supporting letter from Ministry of Tourist and Antiquities for Newton Prize 2020 application.

S4: Newton Prize 2020 announcement booklet. Out of 450 eligible UK-Egypt partnership grants, 27 applications were received. NTU's project (on page 9) is one of five shortlisted (not the final winner) for 2020 prize award. Shortlist announce can be found at: https://www.newtonfund.ac.uk/news/latest-news/newton-prize-2020-shortlist-announced/

S5: Testimonial Letter on advisory role of Professor Abdelmonem to the Mayoralty of Baghdad on guiding Al-Rasheed Street heritage preservation.

S6: Co-authored Report with the Mayoralty of Baghdad on the 3D Laser Scanning of Al-Rasheed Street using NTU's Smart technologies as preparation for the strategic policy and Road map for preserving Baghdad Architectural Heritage (2018-2020).

S7: Policy Engagement - International Seminar on the Preservation of Architectural and Urban Heritage of Post-war Iraq, co-sponsored by the Office Iraqi Prime Minister, Iraqi Embassy-UK, the Cultural Attaché in London, and Baghdad Mayoralty.

S8: Programme & Participants of the First International Conference: "*Sustaining Heritage in the Digital Age: Towards Virtual Environments for Middle East's Cultural Heritage*", the first ever international conference on Virtual Heritage in the MENA Region.

S9: Testimonial from Award-winning Start-Up Escape HD (VRTEEK), established by Virtual Heritage Cairo Project (Samsung's National Innovation Award winner 2017 on 'Shari's Al-Muizz Virtual Tour) & 2020 Contract with MoTA for Baron Imban Virtual Tour (Arabic).

S10: Training Workshops for 200 officials and heritage professionals on Laser Scanning and digital modelling: Fayoum-Egypt (3-8 May 2018), Baghdad-Iraq (21-26 May 2018); Umm Qais-Jordan (Jun 2019); Nottingham (5th Feb 2018 & 2-5 Jul 2019).

S11: Testimonial Letter from the Department of Antiquities (DoA) in Jordan on our impact on Introducing first virtual heritage record and technology acquisition for SMEs.