Section A

Institution: Leeds Beckett University

Unit of Assessment: Unit 11

Title of case study: Improving Policing of Cybercrime

Period when the underpinning research was undertaken: July 2015 to 31 December 2020

Details of staff conducting the underpinning research from the submitting unit:

Name(s):	**Role(s) (e.g. job title):**
Dr Z. Cliffe Schreuders	Reader in Computer Security
Dr Tom Cockcroft	Reader in Criminology
Dr Pip Trevorrow	Course Director Digital Forensics and Cyber Security
Dr Mark Dixon	Senior Lecturer in Computer Science
Dr Akbar Sheikh Akbari	Reader in Data Science

All members of staff listed above were employed for the full length of the project and continue to be employed by Leeds Beckett University.

Period when the impact occurred: January 2016 to July 2020

Is this case study continued from a case study submitted in 2014? No

Section B

1. Summary of the impact (indicative maximum 100 words)

The Leeds Beckett University Cyber Security Innovation Centre led on the CARI Project, working with West Yorkshire Police (WYP), the fourth largest police force, to understand and improve policing of cybercrime. This has had lasting impact by 1) informing and influencing planning and policing practice: informing a rethinking of the way police handle cybercrime investigations, including the role of the Digital Media Investigator becoming a more prominent role within investigations; 2) increasing awareness and understanding of cybercrime within the force: our research triggered local and national discussion around

strategic planning and police roles and their relation to cybercrime, and provided training and skills for participating police; 3) providing new technical capabilities to the police: including grooming chat log parsing, and photo image processing.

2. Underpinning research (indicative maximum 500 words)

The Police Knowledge Fund **CARI Project** was a large-scale collaboration between the Cybercrime and Security Innovation Centre (CSI Centre) at Leeds Beckett University (LBU) and West Yorkshire Police (WYP). The CARI Project was designed to improve and incorporate an evidence-based approach into the policing of digital forensics and cybercrime investigations. The academic lead for the CARI Project was Dr Z. Cliffe Schreuders, CSI Centre Director, working closely with DI Vanessa Smith, Head of Cybercrime at WYP. The CARI Project was funded **£640,000** by the Police Knowledge Fund (PKF), from The College of Policing, the Higher Education Funding Council for England and the Home Office, and took place from 2015 to 2017.

An extensive needs assessment of UK policing and cybercrime and digital evidence was conducted to understand the current situation, and to identify needs across the force. The needs assessment was conducted within West Yorkshire Police, the fourth largest force in England and Wales, involving focus groups and interviews with police staff and strategic leads across key units and roles, in the largest study of its kind to date. This work identified and provided key insights into issues facing policing of cybercrime, across the force and in specific units and roles.

We produced a detailed report for internal police use, and published an academic paper "Needs Assessment of Cybercrime and Digital Evidence in a UK Police Force" in the International Journal of Cyber Criminology (IJCC).

The CARI Project also involved implementing a training and research programme. We provided training in research methods, to the entire Digital Forensics Unit, and the Cyber Crime Team within WYP. This needs assessment and research training led to the development of a set of research proposals, which were scored and selected with an emphasis on impact for policing. Subsequently, 12 LBU academics and 5 WYP police staff co-produced nine research and development workstreams. Each of these collaborative projects was designed to address needs within law enforcement (with pathways to impact designed in). Outputs included evidence-based procedures, new capabilities such as software/algorithms, and actionable intelligence. All of these workstreams included research findings and outputs targeted at addressing police needs, some of which were the basis for academic publications.

"Police Cybercrime Training: Perceptions, Pedagogy and Policy," presents our examination of the cyber training that police receive, published in Policing: A Journal of Policy and Practice, Oxford University Press. "Understanding Cybercrime Victimisation: Modelling The Local Area Variations in Routinely Collected Cybercrime Police Data Using Latent Class Analysis" presents statistical analysis profiling of victims of cybercrime in Yorkshire. "Reinforced Source Camera Identification Using Non-decimated Wavelet Transform" and "Source Camera Identification using Non-decimated Wavelet Transform" proposes and evaluates a novel technique for identifying the digital camera used to take a photograph. Each of these papers describe findings and outputs that were provided to police.

3. References to the research (indicative maximum of six references)

M. Shan-A-Khuda and Z. C. Schreuders "Understanding Cybercrime Victimisation: Modelling The Local Area Variations in Routinely Collected Cybercrime Police Data Using Latent Class Analysis," International Journal of Cyber Criminology (IJCC), Vol. 13 Issue 2, 2019.

Z. C. Schreuders, T. Cockcroft, E. Butterfield, J. Elliott, R. Soobhany, and M. Shan-A-Khuda "Needs Assessment of Cybercrime and Digital Evidence in a UK Police Force," International Journal of Cyber Criminology (IJCC), Vol. 14 Issue 1, 2020.

T. Cockcroft, M. Shan-A-Khuda, P. Trevorrow, and Z. C. Schreuders "Police Cybercrime Training: Perceptions, Pedagogy and Policy," Policing: A Journal of Policy and Practice, Oxford University Press, 2018.

R. Soobhany, A.S. Akbari, and Z.C. Schreuders, "Reinforced Source Camera Identification Using Non-decimated Wavelet Transform," IET International Conference on Biomedical Image and Signal Processing, Wuhan, China, 2017.

R Soobhany, A.S. Akbari, and Z.C. Schreuders, "Source Camera Identification using Non-decimated Wavelet Transform" in 11th International Conference on Global Security, Safety & Sustainability, London, 2016.

4. Details of the impact (indicative maximum 750 words)

The **CARI Project** has resulted in many practical impacts on UK policing of cybercrime. As described in Section 2, the project was specifically **designed to produce impact** by starting the project with an extensive needs assessment to determine the police's institutional requirements and areas of interest and concern, both operational and strategic, in relation to cybercrime. Arising from this, and following a prioritisation and selection process based on impact, research workstreams worked to provide solutions to identified needs.

Working collaboratively, research projects were conducted to **co-produce new knowledge and technical solutions**. Produced knowledge and software has been tested by, presented to, and reviewed by police at operational and strategic levels, informing strategic planning and decisions, and integrating tools and techniques into the available tool-set for operational policing.

Our *first claim of impact*, is that the new knowledge has provided police in strategic positions with information that has **informed and influenced planning and policing practice**. The effect of which is observed in WYP, the fourth largest police force with over 17,000 police officers, and 5 districts covering 2,029 km^2. The needs assessment highlighted many issues, many of which have been subsequently addressed or have active action plans in West Yorkshire Police's strategic plans. As detailed in the testimony of the then Head of Cybercrime, Vanessa Smith, our research "has provided evidence that informed strategic decision making, including approaches we subsequently took to restructure our staffing around providing cyber support (such as expanding the role of Digital Media Investigators and creating a national call takers flow chart)".

Based on the results from the needs assessment and a follow up workstream which

conducted an evaluation of the Digital Media Investigator (DMI) role, an internal police paper was issued, resulting in direct action from the PCC to redefine how this role is now implemented within West Yorkshire Police, resulting in a restructuring of the policing roles within WYP. Based on these recommendations DMIs are now full-time dedicated staff that take a much more prominent role within investigations, guiding and information digital aspects. DS Vanessa Smith has stated in testimony that "investigations are significantly improved by the additional capacity to make use of cyber elements".

We presented statistical profiles on victims of types of cybercrime to leads within WYP to inform proactive policing (including the identification of vulnerable geographical areas and hotspots that were identified), and to benefit awareness raising work (for example, young females were found to be particularly vulnerable to particular kinds of cybercrime, which can inform the messaging targeted at this demographic).

The training team now has further insight into training methods that were perceived to be more effective for teaching cyber policing, and this has informed future training plans. Our results informed a Police Transformational Fund bid to reform the training provided by the police; although the bid was unsuccessful, this demonstrates that police partners are proactive in actioning the findings.

Updates and results from all the workstreams have been *disseminated at the highest strategic levels within the police force nationally*, including at the WYP Strategic Board on Cybercrime, chaired by Assistant Chief Constable Russ Foster, and attended by Police and Crime Commissioner (PCC) for West Yorkshire Mark Burns-Williamson. The *invite-only* CARI Project showcase conference event was well attended, with 70 delegates from law enforcement and academia, including senior decision makers and strategic leads from a variety of police forces. 100% of attendees reported finding the event useful, and all law enforcement in attendance reported that they were "interested in using any of the CARI project outputs within their own force/unit". Senior representatives from the UK Police digital investigation and intelligence (DII) discussed taking results forward nationally. Subsequent meetings have taken place to discuss our findings and outputs with Detective Superintendent Andrew Gould, the National Cybercrime Programme Lead for the National Police Chiefs' Council responsible for developing the police response to cybercrime at the national, regional and local level, and with Giles Herdale, the then Head of Digital Intelligence & Investigation Strategy.

Our *second claim of impact* is that our work resulted in **increased awareness and understanding within the force** across police units of the police roles, the importance of digital evidence in investigations, and use of research and evidence-based practice. As Vanessa Smith stated in testimony: "Participating in the needs assessment exercise impacted on the way as a force we were considering cyber crime. It raised discussions at strategic level and locally within police teams [...] as a consequence there was an impact that made a lot of people think about their own role and their connected roles to other departments". The CARI Project demonstrably increased capability amongst officers and staff to understand, and conduct research: having successfully co-produced research projects related to their police roles. Many police officers and staff (all members of WYP's digital forensic unit (DFU) and cyber crime team (CCT) staff) received research training, and were involved in the design of research projects, enabling them to understand and critically

evaluate research. Specialist police staff engaged fully in conducting research projects, gaining experience working on research and development. As described in the PKF review conducted by the College of Policing: “Academics at Leeds Beckett University related the content of their one-day research methods programme delivered to West Yorkshire Police’s Digital Forensics and Cybercrime teams to the context of their specific projects, helping attendees to understand how the benefits of the research could be directly applied in their operational roles.” Stephen Miller, who leads the Regional Digital Forensics Unit (RDFU), within the Yorkshire & Humber Regional Organised Crime Unit (ROCU), in his testimony states that “involvement in CARI informed our thinking, and has led to an overall change in mindset”, and that as a result they now “investigate the research behind approaches we take, looking into background information, and how we can use this information to inform our decision making and problem solving.”

Our *third claim* is that impact has included new knowledge and understanding that has provided **new technical capabilities to the police**. The police now have a new tool, EWT, for quickly triaging chat logs to identify log files that include grooming behaviour, including the production of chat profiles of participants and filtering chats for messages of interest. Five UK police forces have been provided EWT, enabling them to more effectively investigate cases of child sexual exploitation (CSE). Amongst the forces that have requested the software, Dyfed-Powys Police produced an independent evaluation report, which states “The software is very effective in processing mobile phone downloads in that all of the conversations that were previously detected through the manual process have been identified and highlighted. Additional conversations were also detected and these were able to be checked manually”. DFU also now has access to new tools and procedures to store and make use of SPN fingerprints of cameras, providing a new investigative technique for connecting cases of CSE, by linking new photo images to camera fingerprints. These new capabilities are all now available for police to use to progress and improve investigations.

5. Sources to corroborate the impact (indicative maximum of ten references)

Testimony by Detective Superintendent Vanessa Smith – clearly supports all three claims.

Testimony by Stephen T. Miller, Senior Digital Forensic Investigator – clearly supports all three claims.

Evaluation Report of “EWT: Chat Log Grooming Detection” by Dyfed Powys Police – supports claim three.

PKF Fund Review (funding overview) – general support of success of the project.