Institution: Cardiff Metropolitan University		
Unit of Assessment: UOA32: Art and Design: History, Practice and Theory		
Title of case study: The impact of user centred design research on health, wealth and innovation culture.		
Period when the underpinning research was undertaken: 2002 - 2020		
Details of staff conducting the underpinning research from the submitting unit:		
Name(s):	**Role(s) (e.g. job title):**	**Period(s) employed by submitting HEI:**
Jarred Evans	Director of PDR	Dec 2003 – present
Prof Steve Gill	Professor	Jan 1997 – present
Bethan Gordon	Deputy Dean, CSAD	Sept 2001 – present
Prof Gareth Loudon	Professor	Sept 2002 – present
Prof Andy Walters	Director of Research, PDR	July 2000 – present
Dr Clara Watkins	Senior Lecturer	Jan 2013 – present
Period when the claimed impact occurred: August 2013 – December 2020		
Is this case study continued from a case study submitted in 2014? No		

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

Cardiff Met's User Centred Design (UCD) research has influenced strategies, working practices and product ranges in **1,023** companies in sectors including engineering, medical devices and banking in the UK, Germany, Greece, Barbados, Ukraine and USA. For two companies, **Kenwood** and **Allergan**, it led to an additional **£69 million**[1] in sales with a further **£950 million** projected in the next 4 years. Service design changes for Principality Building Society and a public sector banking organisation (PSB) resulted in **3,000** new customer accounts and the transformation of the PSB's organisational approach to innovation. Two KTPs generated **growth** of **£1.2 million** per annum turnover, with a further **£2.5 million** growth projected by the industry partners.

2. Underpinning research (indicative maximum 500 words)

Cardiff Met's User Centred Design (UCD) research dates back to 2002, when **Gill** and **Loudon** began investigating methods to enable early, low cost testing in the design of computer-embedded products such as mobile phones, cameras, washing machines and electronic medical devices [R1] [R2]. These products can be challenging to develop, as they require a range of skills including electronic engineering, computer programming, human-computer interaction and product design. This makes development time-consuming and costly, with the investment meaning companies are often reluctant to alter designs during the final stages of the design development process - typically the point at which user testing is employed. As a result, many potentially good products fail for want of in-depth understanding of product or service users. To address this short-coming, Gill and Loudon focussed on developing appropriate tools to allow computer-embedded products to be prototyped and trialled earlier and quicker during the design development process, at relatively lower cost, and using prototypes at appropriate fidelity levels to the stage of testing. Between 2002 and 2015, along with some of their PhD students and

[1] Calculated on 23/1/21 at the then exchange rates of $1 = £0.73 and €1 = £0.89

Research Assistants (Woolley, Culverhouse, Hare, Zampelis and Andrews) they developed a series of novel tools for product designers developing computer-embedded products by removing technical barriers and allowing them to build and test prototypes early in the design process. Over the years this research focus broadened towards a general exploration of the role of physical and virtual testing in UCD tools and processes. This included **Watkins's** exploration of the prototype's role in participatory design in developing world contexts [R3] and **Gordon's** investigation into fidelity requirements of mixed reality 'context of use' user testing scenarios [R4].

In 2009, Cardiff Met's International Centre for Design and Research (PDR) began their own exploration of the UCD research space, with **Walters** and **Evans** focussing on research into how to effectively implement user-centred design within a range of organisations and sectors [R5]. Concurrently, PDR began to employ UCD researchers within their commercial operations, including Woolley, Hare, Culverhouse and Andrews, bringing the University's two UCD research streams together and collectively enabling the impacts described here. PDR research on accessible approaches highlighted the importance of scalability in addressing the differing needs and resource availability within a range of organisations. By 2011, a framework [R6] developed to meet these needs had been used both to assist manufacturing companies utilise a UCD development approach for their support services, and to build a network of organisations across Europe to understand how service design is implemented in the public sector. Our UCD researchers have since translated learning from that research into practical models for the private sector. This programme of research into methods of applying user centred design-led approaches in various contexts continues, for example in Cardiff Met's Co-Investigator role (which includes Gill, Loudon, Evans and Walters) in the current £5.4m AHRC-funded Creative Clusters project, within which they work with the Creative Industries to stimulate R&D activity in the Cardiff Region.

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

Two of the outputs below were returned in REF 2014 [R1], [R2]. Half are published in recognised double-blind peer-reviewed journals [R1], [R2] and [R6] and another is a UK patent [R3]. Research grants in the period of **~£7.8 million** include major awards from the **AHRC**, **EPSRC**, **MRC** and **H2020**. A further **~£7.3 million** in knowledge transfer grants and **11 design awards** including 3 iF Awards, 2 Red Dot Awards, a Good Design Award and UCD research-rooted consultancy income of **£3,132,061** provide further evidence of quality.

[R1]. **Gill, S.** (2009) Six challenges facing user-oriented industrial design, *The Design Journal*, 12(1), pp. 41-67, DOI: 10.2752/175630609X391569.

[R2]. **Gill, S.**, **Loudon, G.**, Walker, D. (2008) Designing a design tool: working with industry to create an information appliance design methodology, *Journal of Design Research*, 7(2), pp. 120-135, DOI: 10.1504/JDR.2008.020851

[R3]. Hall, J. **Gill, S.**, **Loudon, G.** and **Watkins, C.** (2018) 'Brace' UK Patent GB2556418 http://hdl.handle.net/10369/10220

[R4]. **Gordon, B.**, **Loudon, G.**, **Gill, S.** and Baldwin, J. (2019) Product user testing: the void between Laboratory testing and Field testing, in the proceedings of International Association of Societies of Design Research Conference 2nd – 5th September, 2019, Manchester, UK http://hdl.handle.net/10369/10865

[R5]. **Walters A.T**, Thurston P., Cawood G. (2013) User Centred Service Innovation: Are commercial interests preventing clients from maximising the value they get from service design research? *Service Design with Theory*, Miettinen S. & Valtonen A. (Eds.), Lapland University Press, Finland, ISBN 978-952-484-551-9, pp. 125 – 130

[R6] Wilkinson, C., **Walters, A.** & **Evans, J.**, (2016), Creating and testing a model-driven framework for accessible user-centric design, *The Design Journal*, 19(1), pp. 69-91, DOI: 10.1080/14606925.2016.1109209

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

Cardiff Met UCD research has engaged with **over 1,000** [E1] companies and transformed practice in public and private sector organisations, increasing sales and revenue and leading to impacts around the world. For example, they have resulted in: increased product sales of **tens of thousands of units** [E2, E3]; increased sales revenue of at least **£68,876,350** with forecast revenue of **£950,332,500** over four years [E2, E3]; **new banking services** across **20** countries [E4, E5, E6]; **63,000** app downloads [E4, E3]; and **1023** Small and Medium-sized Enterprises (SMEs) introduced to UCD approaches [E1, E7, E8]. These impacts are now explained, evidenced and situated within 4 different areas.

Example 1: Medical products. UCD research underpinned work for Allergan's CoolSculpting division in California, which develops products employing an FDA-approved process for the non-surgical removal of body fat. Allergan expended **£2.9m** on PDR services, resulting in two major new product lines: 'Cooltone' in December 2019 and the 'Coolsculpting Elite' in January 2021. *"These are the first of a series of products developed through our R&D and collaborative design work with PDR. To date we have seen sales of 900 units of Cooltone generating more than $70 million in revenue. Coolsculpting Elite and Cooltone are anticipated to generate sales in excess of $1.3 billion over the next 4 years" -* ***Senior Vice President, Product Development, Allergan*** [E2]. Meanwhile, Cardiff School of Art & Design in collaboration with Cardiff University Medical School developed a trauma pack for rural Zambia capable of deployment by untrained, illiterate users. Zambia was chosen because trauma caused by road traffic incidents cost up to 5% of the country's GDP. Our pack is **80% cheaper** than existing solutions with no drop in performance. Prototypes have been used to **treat victims** of a multi-car road traffic accident in Zambia [E9] and derivatives have been deployed by **Namibian police** [E10]. A **patent** was granted in 2016 [R2] and a manufacturing license signed [E11].

Example 2: Financial services. Since 2015 PDR has used UCD methods rooted in research on **27 new service** development projects for Principality Building Society. *"PDR's User Centred Design research has changed the way we think about our internal and external stakeholder engagement and product offering. Thanks to the insights PDR were able to bring we have developed two particular products in our Children's proposition category, Dylan's Saving Squad and Learner Earner. These have been a significant success, creating over 3,000 new children's savings accounts and enabling many thousands of children to access a range of resources to learn about money and saving whilst having fun. In addition, the products and services have attracted thousands of supporting adults to engage with the Principality brand and become customers themselves or with potential to become customers of the future." -* ***Head of Customer Development, Principality Building Society*** [E4]. As a result of the successful product development projects with the Principality, PDR won a **€300K** tender with a proposal to provide User Centred Design Thinking services based on UCD tools and expertise for a Public Sector Banking Organisation (PSB). A further 12 contracts with the PSB embedded UCD approaches to changing the PSB's internal organisation and the co-creation of new internet enabled communication processes [E5]. *"PDR's Design Thinking Services have been influential in changing how we at [PSB] approach innovation, assisting redevelopment of internal processes and communication/engagement with external and internal shareholders through contributions made to the development of the new portals."* ***Anonymous, Public Sector Banking Orgainsation*** [E6]

Example 3: Consumer products. UCD research has underpinned the development of consumer products in several companies. In 2015 **Kenwood** paid PDR **£87,850** to develop a 10-year consumer product strategy. *"PDR's User Centred Design research gave Kenwood consumer insights we'd never had before, inspiring an entirely new direction in our product range and helping to ensure our products are relevant and desirable for consumers today and into the future."* ***Innovation Manager, Kenwood*** [E3]. PDR's commercial opportunities report identified 24 significant top-level trends across 7 themes, providing in-depth insights into how people approach the contemporary cooking experience. This changed Kenwood's **product development strategy**, leading them to embrace embedded computation for the first time. As a result of PDR's recommendations, in 2018, the company launched the *kCook Multi Smart Cooking Food Processor,* an 'Internet of Things' computational cooking device controlled

through the *Kenwood World app*. To date Kenwood has sold **28,000** *kCook*s at a value of **€20 million.** The Kenwood World app has been downloaded **63,000** times [E3].

Example 4: Knowledge transfer. UCD researchers have engaged in knowledge transfer activities with **1023** companies in the period, winning **5 awards.** Activities include a **£5.4 million AHRC Creative Industries Cluster, 8 Knowledge Transfer Partnerships (KTPs), 2 Knowledge Transfer Centres** and **4 other** knowledge transfer projects. A KTP with 'Window Cleaning Warehouse' involved embedding UCD expertise to develop an aircraft cleaning product that would maintain a 3% aerodynamic performance gain without the environmental damage of existing systems which flush heavy metals from altitude into the airport's groundwater. A **new branch, 4 jobs and 60% growth** (**£1 million** *per annum* turnover) were attributed to the KTP. *"Since embarking on KTP, we have seen substantial growth which would never have taken place without the scheme. The KTP has been vital in developing our business for future growth."* ***Owner, Window Cleaning Warehouse*** [E7]. In another KTP, UCD methods were embedded in 'Odoni-Elwell' (a cycle storage modular building manufacturer) to improve their product range and productivity. The company directly attributed growth of **£180,000** *per annum* turnover. *"The KTP fundamentally changed our business, bolstering existing capabilities and adding new ones. We're now both equipped and confident in our ability to meet the challenges of the 21st century head on."* ***Operations Management, Odoni-Elwell*** [E8].

In summary, Cardiff Met's UCD research has underpinned significant impact for thousands of companies, creating jobs, £ millions of turnover in companies of all sizes and driven culture change in organisations as diverse as manufacturing and banking. It has also resulted in a manufacturing license for a revolutionary trauma pack, prototypes of which have already been deployed in sub-Saharan Africa.

5. Sources to corroborate the impact (indicative maximum of 10 references)

[E1] Corroborating evidence of engagement with 1,021 companies.

[E2] Testimonial from Senior VP, Product Development, Allergan about PDR's impact on their business.

[E3] Testimonial from Innovation Manager, Kenwood about the business impact of PDR's input.

[E4] Testimonial from Head of Customer Development, Principality about the business impact of PDR's input.

[E5] Confidential Report showing PDR's impact on public sector banking.

[E6] Testimonial from Anonymous, Public Sector Banking Organisation detailing PDR's impact on their internal processes and communication / engagement with external and internal shareholders.

[E7] Partners Final KTP Report: Window Cleaning Warehouse detailing impact of the project on their business.

[E8] Partners Final KTP Report: Odoni Elwell detailing impact of the project on their business.

[E9] Testimonial evidence of use of Cardiff Trauma Pack being used in Zambia.

[E10] Paper showing Namibian police being trained to use Cardiff Trauma Pack.

[E11] Manufacturing agreement for manufacture and distribution of Cardiff Trauma Pack.