

Innovation in Crisis: an examination of the interoperation of Triple Helix actors in response to Covid-19 pandemic

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1. Research background

The Covid-19 pandemic has resulted in huge disruption to the healthcare sector. In response to this crisis, there have been collaborative effort among universities and industry for production and service innovation. On a regional level, Triple helix, referred as the interaction among university, industry, and government demonstrate a non-linear way of innovation (Etzkowitz, 2003) through dynamic interaction. Practically it has used as a model for economic development in the South Wales. The need for cooperation between the three actors within the triple helix models has been understood in the region for the best part of a century, at least. The relationship between each actor is diffuse. Indeed, the categorising of entities and individuals themselves can be challenging, with many belonging to academia, government and industry simultaneously. Government healthcare is provided through university health boards with close ties to academia and teaching hospitals in which employees may be defined as either of these actors. The nature of relationships can change depending on context. Whilst an individual would naturally take a different role when undertaking their different responsibilities, they remain the same person and their personality and social relationships remain the same.

This paper reports upon a study of the innovation activities that arose in response to the Covid-19 pandemic in 2020. Adopting a Triple Helix perspective, it aims to understand the primogenitors of three medical innovations.

2. Literature review

Our review of the Covid-19 literature in the field of business and management identified only four empirical studies. Two of these were made upon the previous SARS-CoV-2 type coronavirus and are therefore of limited value to the current situation (Petcu and David-Sobolevschi, 2020; Raghav and Dhavachelvan, 2020). The other studies examined the stock price of companies in response to Covid-19 (Ding et al., 2020) finding those with stronger

balance sheets fared best, and an examination of social media feeds of companies (Sharma et al., 2020) to reveal that supply chain issues were organizations' main concerns.

3. Research methodology

In order to explore the origins of Covid-19 motivated innovations and the micro-relations between collaborators this study adopts an interpretive approach. Three cases were chosen, based on university innovation projects in the South Wales region. Case One is the development of oximetre. Case Two is the project of 3D printed visors. Case Three is the project of rapid diagnostic testing technology. Semi-structured interviews were used to gather rich data (Denscombe, 2010) with the project leaders. The interviews, each of around one-hour duration, were conducted and transcribed by the researchers in order to minimise misinterpretation (Opdenakker, 2006). The interview questions were initially operationalized from the literature, taking the form 'How did the project arise', 'How did this project differ from the work you normally do' and 'What other individuals and organizations did you collaborate with' (Halcomb and Davidson, 2006). These were followed by open questions.

Data collection and analysis followed five steps of thematic analysis (Braun and Clarke, 2006). The transcripts were coded (Step 1) and thematically analysed (Step 2) by all four researchers following each interview. In step 3 of the research process the Values of Kappa, linking to the research robustness (Castano et al., 2019) indicated a 'good' level of agreement of the primary themes that each researcher identified in the data sets. Step 4 consisted of the collective identification and naming of the dominant themes that were identified by each researcher, and are identified as the consensus of themes. Finally, Stage 5 comprised the merging and reduction of the dominant themes that resulted in the compilation of the 'Final Themes'.

4. Expected findings and discussion

Data analysis suggested six final themes of Triple Helix innovation in response to Covid-19 pandemic: 1) supply chain, 2) pull vs. push innovation, 3) medical certification, 4) IP and patent, 5) Team, trust, serendipitous and open communication, 6) University support. In-depth analysis is then conducted regarding each of the theme, highlighting the context and changes of the theme across the cases. For example, in terms of the first theme, the issue of the shortage of supply at a global level was a partial impetus for the need to develop bespoke supply chain structures to support innovation. Additionally, the international travel restrictions, there was growing need for local supplies. The cases highlighted a short-term perspective on the development of the supply chain, without explicit focus on the long-term structure and scope of the supply chain. Nonetheless, the long-term opportunities emerged.

Findings of this paper contributes to the contributes to the understanding of how the triple helix functions in response to the Covid-19 crisis. It also contributes to the limited literature that examines the operation of systems of innovation in response to current crises, and does so through study of the events *in acta*. Furthermore, the study contributes to the few empirical examinations of the effects of Covid-19 in the business and management literature.

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