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Social Licence in Design: Constructive technology assessment within a mineral research and development institution

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A R T I C L E I N F O

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A B S T R A C T

Technological innovation in the minerals industry must be driven by the need to improve performance according to social, as well as environmental, safety, efficiency and production criteria. This paper outlines the possibilities and rationale for incorporating constructive technology assessment (CTA) into technology research and development within the Australian Commonwealth Scientific and Industrial Research Organisation (CSIRO) Minerals Down Under National Research Flagship (MDU). MDU represents an $80 million per year investment in transformational mineral technology. The paper reports on the development of a process called Social Licence in Design to address the future social challenges and opportunities of the technologies that may arise during implementation. Social Licence in Design utilises social research techniques to account for the perspectives and values of decision makers and likely stakeholders. Interviews with senior technologists and social scientists within MDU reveal the institutional context into which the Social Licence in Design process is to be situated and highlight key factors that may inhibit or enhance its uptake. Despite the long history of CTA the paper is the first to report on the incorporation of a CTA process to address the social implications of technology development within a mineral R&D institution.

1. Introduction

Social issues are receiving greater emphasis and prioritisation within the extractive resource industries. Through approaches such as social impact assessment, ISO 26000,[1] community development programmes and trusts, community engagement and consultation, and the employment of social and communication specialists within community relations teams, some companies within the sector are seeking to improve the conduct of their operations and better respond to the social context in which they operate [1–5]. The industry has adopted the term Social Licence to Operate to signify the importance of social acceptance for the continuing operation of mineral extraction and processing activities.

The social performance of a mineral operation is profoundly influenced by the design traits of the technologies employed to extract and process mineral resources and the interplay between these traits and their environmental and social contexts. At one extreme inappropriate technology can lead to considerable harm to the public, mine employees as well as the environment and lead to tangible and intangible costs to industry including reputational loss, costly retro-fitting, disruption to production and even the closure of an operation due to a loss of Social Licence to Operate [6,7]. Changes in extractive resource technologies may also precipitate social and economic change such as shifts in employment and skill requirements, or reduction in the economic

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[1] International Organization for Standardization (ISO); Commonwealth Scientific and Industrial Research Organisation (CSIRO); CSIRO Minerals Down Under National Research Flagship (MDU); Research and Development (R&D); Sustainable Operations (SUSOP); Scientific and Technological Options Assessment (STOA); Environmental Impact Assessment (EIA); Social Impact Assessment (SIA).

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return to communities. These changes may not necessarily lead to social conflict but will shape mine-community relationships to varying extents.

In this paper we outline the potential of constructive technology assessment (CTA) to improve the social performance of technologies under development within the CSIRO Minerals Down Under National Research Flagship (MDU) an initiative of the Australian Government that aims to unlock Australia's future mineral wealth through transformational exploration, extraction and processing technologies. The Flagship currently represents an $80 million per year investment into strategic research and development.

This paper reports on interviews conducted with senior MDU staff which explored opportunities and constraints to the practical implementation of CTA within the flagship. The paper draws on the theoretical developments in CTA and the field of science and technology studies [8–14] to develop an applied CTA process called Social Licence in Design. Social Licence in Design seeks to address the future social challenges and opportunities of technologies under development by considering the potential performance of the technology in its future operational context and accounting for the perspectives and values of potential stakeholders and decision makers. Social Licence in Design has been shaped by the institutional context illustrated through the interview process and makes explicit reference to the currently under-recognised role that R&D organisations have for shaping mineral operations' Social Licence to Operate.

The paper is structured as follows. Section two explores literature on constructive technology assessment and Social Licence to Operate arguing that CTA can play an important role in addressing social performance within mineral industry R&D. In sections three and four we outline the method and interview results, and describe the institutional context and key factors that could influence the uptake of CTA within MDU. Section five develops a CTA process called Social Licence in Design that accounts for the factors identified through the interviews. The paper concludes with a summary of the findings and their future application.

2. Theoretical framework

Technology assessment has a long history as a method to inform research, development and decision-making. Constructive technology assessment (CTA) refers to a particular form of technology assessment that seeks to influence the design process of technology through dialogue and interaction with and between technology developers [9]. Guston and Sarewitz [13] define CTA to include three particular analytical components these being socio-technical mapping, early and controlled experimentation and identification of unanticipated impacts, and communication between technology proponents and the public. These components allow social aspects to become additional design criteria of technologies [10]. In practical terms CTA can illicit information on the values, perspectives and background of potential stakeholders and anticipate likely stakeholder responses to the change that a new technology may bring and in so doing, reduce the uncertainty associated with novel or emerging technologies [14].

CTA seeks to affect technological developments by considering values and ideas that may exist outside of the concerns of narrowly defined technological trajectories and shaping technologies in response to these values. Drawing on Beck's notion of reflexive modernisation [15,16] Voß and Kemp [17] argue that to avoid unintended consequences and second-order problems the isolated perspectives in which problems are often addressed must be widened to include external filters of relevance. They argue that CTA is a way of creating interaction between various rationalities and taking into account the complexity of social, technological and ecological interrelationships [17]. In this way technology (and technologists) can become reflexive as social rationalities are reflected in technological outcomes and technologies (and technologists) reflect inwardly on, and hopefully transcend, the factors (structures) that shape technological pathways (see Rip [18] and Stirling [19]). As many have argued this bringing together of insights needs to happen at the outset of technology design whilst technologies are still in the innovative stages and are thus malleable to new possibilities and potentialities [13,14,20]. Early intervention can potentially address the gap that often exists between technologically driven prototypes and various adaptations suggested by investors based on people oriented market research or critical business drivers such as health and safety [20].

The process in which differing rationalities are brought together impacts greatly on the success of any CTA project [14]. Van Merkerk and Smits [14] describe managing the convergence of different actors and their values systems in CTA projects as a *facilitation of interfaces*. They argue that a carefully managed interface needs to account for the differences between various actors and should, in enabling a constructive environment for dialogue, broaden each actor's knowledge and perspectives in regards to the sociotechnical dynamics of the technology at hand.

The *facilitation of interfaces* in the minerals sector must therefore be embedded within the unique features of mineral technology development and cognisant of the landscape changes that are invoked by mineral extraction. Mining and community interactions are best viewed as a set of technological, economic, political and cultural relationships [21]. Mining interacts with and shapes environments, economies and individuals in complex ways. How people experience and situate change influences how they react to such change. As Bridge [21] argues: ‘to understand contemporary debates over mining and the environment … it is necessary to recognise how mineral development is unavoidably situated within a moral landscape.’

The future environmental, social, economic and safety outcomes of a mining operation are, to a certain extent, built into technologies during their design phase. These traits, and the societal reactions that they manifest, are thus embedded within technologies. The technologies in turn become embedded in the physical and social landscape and once they are sunk into that landscape they become difficult and costly to retrofit [6]. The likelihood that these traits manifest into conflict, support, or other social responses, depends on the social and environmental contexts of the landscape in which they are sunk. This technological aspect of social performance shifts the domain of focus from mining companies who implement technology to also include the R&D institutions involved in technology development (see Fig. 1).