‘At the round earth’s imagined corners’: the power of Science Fiction to enrich ethical knowledge creation for responsible innovation.

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Abstract
Knowledge Management (KM) can reflect an aspirational vision of how human knowledge, identity, and technology should interact. As innovations emerge, our view and expectations of the future evolve. Innovation is part of the KM process and requires the ability to imagine these mutable futures before they materialise.

The imagined worlds of Science Fiction (SF) offer one way to explore possible futures and future possibilities. Indeed, some classic SF literature is strikingly prescient. These imagined worlds provide a landscape of inspirations and warnings that can support our understanding of the ethical and social impacts of working with and managing knowledge. Often presenting an extreme vector or ‘ideal type’ of how technology is shaped by, and in turn shapes, human life, SF provides a rich repertoire of imagined futures that enable us to support a Precautionary Principle in how we develop and implement technology.

Drawing on classical and contemporary SF literature, this paper explores a number of SF visions of the future. It categorises the major themes of the roles played by human knowledge and technology, as portrayed in the selected texts. It then discusses how these imagined futures currently influence our discourse about knowledge, and how they might inform current and further ethical concerns on KM and technology development. Finally, it offers some new insights for how SF might inspire and influence KM, particularly with respect to the social and ethical impact of managing knowledge. We conclude that SF literature provides a repertoire of imagined future possibilities and possible futures that could inform and improve KM’s ability to ethically plan for innovation.

Keywords: Knowledge management, science fiction, innovation, ethics, education, knowledge creation, Information Communication Technology (ICT), technology, story-telling, knowledge

1. Introduction

“To say you have no choice is a failure of imagination” Jean Luc Picard circa 2399 AD (Picard, 2399)

Within the Knowledge Management (KM) field, there is tendency to understand knowledge as something real and true about the past or present (Alavi & Leidner, 2001). Effective KM is thus framed as successfully establishing, organising and applying knowledge to inform current and future action. This is a very reasonable approach in many contexts, where change is at a manageable level. However, it becomes more difficult in fast-moving fields of high concept innovation, change, and risk, such as in cutting-edge research and its application (Schwartzman & Carlone, 2008).

The field of Information Communication Technology (ICT) is making tremendous advances at great speed, particularly in comparison to historical rates of development. Recent developments include Cyber Physical

Systems, Blockchain, Nanotechnology, Artificial Intelligence, and Virtual Reality. Creating knowledge about commercially exploiting their capabilities is usually the primary concern. Ensuring adequate knowledge creation and its valorisation to address their disruptive and transformative societal and ethical implications is, however, more challenging. The ethical risks of ICT primarily concern how ICT enables the creation, storage, use, and communication of data, information, and knowledge, including its control and interface with humans and their environments. As such, we need to gain a better understanding of KM in the context of fast technological changes. With much current concern and research (Bryson, 2017; Burmeister, 2017; European Commission, 2021) being technology-focused rather than knowledge-focused, we aim to address that gap through a focus on the knowledge perspective.

The 'imagined worlds' of Science Fiction (SF) works offer a valuable reservoir of non-scientifically produced knowledge (Gendron et al., 2017). SF, as the term suggests, is 'make believe' and normally has a future-focused or other-worldly context. The term suggests an imagined conception of science, such as technological capabilities not feasible when writing the fiction. Importantly, SF can support both creative thought and scientific reasoning for knowledge creation about managing ethical risks of emerging ICTs. For example, SF often offers allegories, imagined scenarios, vectors to extremes, or 'ideal types'; in signifying how technology and human life may interact. Some classical SF in particular are strikingly prescient, providing a landscape of both inspirations and warnings to consider in how we should work with knowledge and technology. SF thus offers imagined reference points to orientate our understanding of the past, present, and potential future. Such an approach has been discussed in both academic (So et al., 2021) and professional (Finch, 2021) literature for considering future scenarios, as well as SF's role in shaping public sentiment, such as public expectations and concerns about technology (Azagra-Caro et al., 2020).

In this paper, we explore the ways in which knowledge and technology are cast in the imagined worlds of a selection of Science Fiction stories. This can help shed light and nuance to some of the current and future ethical risks of technology. The research question guiding our exploration of the texts is: *How do science fiction works represent ethical issues concerning knowledge and technology in their imagined worlds?*

In the discussion, we explore how answering this question may inform our understanding of ethical risks and impacts. We discuss how these imagined worlds may provide new ways to engage the public and professionals to become more aware of risk and the ethical nuances of how we use, manage, and communicate knowledge. The next section discusses the current literature on the key concepts of this paper: ICT and knowledge; ICT and ethics; Science Fiction, Knowledge and ethics.

2. Literature Review

This section reviews literature on key topics covered in this paper. It then illuminates a research gap; a) connecting the impact of ICT on knowledge, and b) in current efforts guiding ethically responsible innovation. The approach of Science Fiction is then introduced to provide context to the Method section.

2.1 ICT and knowledge

Much, if not all, of ICT changes how data, information, and even complex knowledge, are stored, controlled, and communicated in some way. For example, digital transformation, its pace, and societal impetus for its momentum, has shifted the relationship between data, information, and knowledge (Thornley et al., 2016; Tuomi, 1999). This hierarchy was once 'a truth universally acknowledged' within KM (Alavi & Leidner, 2001). It is now possible to mine and analyse unstructured data to identify structured themes and insights that looks like information and even knowledge. There is an increasing awareness that our knowledge perspective, or 'ways of seeing' and 'ways of doing', shape and inform how we collect and interpret data (Kennedy, 2020). This can have serious effects on equality, for example, the ignoring or interpreting in certain ways data on women has negative effects on women's lives (Criado Perez, 2019).

Our understanding of who or what can 'have' knowledge is beginning to shift with the growth of the suite of technologies labelled as 'Artificial Intelligence', even though a comparatively small number of these at present have deep learning or autonomous capabilities. Similarly, 'smart' systems and the personalisation of knowledge sources may challenge the classical distinction between tacit (generally human) and explicit knowledge (codified

and communicable) (Nonaka, 1994). ICT has a complex and largely unknown effect on how humans interpret, learn, use, and communicate knowledge, which has ethical and social implications. But how can we find out what these impacts might be, especially when the technology is still under development, or their effects unknown or difficult to capture empirically?

2.2 ICT and ethics

The academic literature connecting ICT and ethics suggests the greatest focus is on technology, with a nascent discussion of how ICT may change how humans use knowledge. For example, Floridi (2014) discusses ethical issues concerning ICT 'enveloping' our world, cautioning that limitations in technological capability can mean human practice reshapes to accommodate these limitations. It should be noted that knowledge, as a central aspect of what humans are, know, and relate to the world; is never ethically neutral (Evans & McKinley, 2011; Rechberg & Syed, 2013). If technology changes how we learn, store, understand, or communicate knowledge then it is changing us.

Multiple ethical guidelines and models exist for professionals working within the research environment. The 'Precautionary Principle' (Reber, 2018), for example, advocates thoughtful and careful progress in research with a high potential for negative impact, and the 'Responsible Research and Innovation' framework (Delgado & Åm, 2018; Zwart et al., 2014) provides a check list for risk assessment and other tools. In the context of private business, oversight is more difficult due to proprietary systems, the drive for competitive differentiation and advantage, and the quest for profit. Though some distinctions are possible based on establishing the core values and principles guiding the conduct of a commercial entity. There are numerous national, global, and EU policy documents on ethics and ICT, most recently for example, the EU guide to AI (European Commission, 2019) developed in collaboration by governments, think tanks, research projects, and professional societies.

The very need for such a number and range of reports and guidance should itself be a cause for some alarm. Such guidance on AI ethics indicate informed concern with some suggestions for improvement but there is, so far, no comprehensive legislative framework to enforce many of the suggested safeguards. Compounding this weakness at the macro legislative level, there is limited public or professional engagement around understanding the ethical impact of either currently available or forthcoming technologies. There is increasing concern amongst ICT professionals in practice, as opposed to research, as evidenced by the increased focus on ethics by a number of ICT professional societies (Gotterbarn et al., 2018; IFIP, 2021) and Bodies of Knowledge (Thornley et al., 2020). This focus is useful but, with some exceptions (IEEE, 2019), does not often deal with cutting edge technologies. Further, the careful and consensus-led approach to developing such guidelines, whilst necessary to gain engagement and 'buy in', can prevent early detection of potential difficulties or impending risks.

2.3 Knowledge, Science Fiction and Ethics

The power of storytelling as a tool, and its pros and cons, are addressed extensively within the KM literature (Andrews et al., 2020). Stories are powerful because they persuade but also dangerous because they persuade. There is some mention of Science Fiction (SF) within this literature (Ruggles, 2002) and, less formally, potential lessons for KM from SF are discussed in a blog (McAlister, 2015). In terms of the knowledge process of innovation, the use of fiction to consider ethical issues has also been raised such as in genetic biology (Chan, 2009). Chan argues that *'the usefulness of fiction and imagination in bioethical discourse is evident when one considers that hypothetical scenarios, thought experiments and case studies are also a form of fiction'* (Chan, 2009, p.398). Thus, SF can also play a role in communicating scenarios, vectors to extremes, and thought experiments in a more engaging and entertaining way that complements academic literature and teaching. As the risks of technology are societal, not just for specialists working in the field, it is also important to have tools and methods for ethical engagement that are accessible and compelling for all members of society. Correspondingly, 'metaphors' have a long tradition for propagating scientific knowledge (Rothbart, 1997).

There is a legacy of using stories (Abram, 2017) to present and persuade people about positive and negative alternatives of future worlds and to reveal unseen contradictions in our current world. As humans we seem to be unique, at least on this planet, in terms of our ability to imagine 'what might be' and generate complex visions of other realities and worlds. In the 17th century poem, Holy Sonnet no.7, quoted in this paper's title, the poet, John Donne already knows the world is round. He explores, however, the impact of the vision in scripture that

angels will be at the four corners of the earth on judgement day. He knows the world is not square but the imagined world where it is, still holds sway, until he concludes that the correct approach is to live his best life on *'this lowly ground'*. Religious beliefs and ancient myths reveal that humans are clearly influenced by stories that are some ways different from the world they see around them. Humans have long been concerned for the future, while also being aware that the future remains unknown. As Burns observes, when he accidently ruins a mouse's nest, they are both the victim of fate but, unlike the mouse, he also worries about what may come next:

'An' forward tho' I canna see,
I guess an' fear!'
To a Mouse: on Turning her up in her Nest, with the Plough., Burns, Robert. 1785

Although awareness of these imagined worlds may not qualify as knowledge under the strict criteria of 'justified true belief', it does potentially change how people think and act. Awareness of and fear for the future are based on predictive data that may transpire to be mistaken. Given the future is unknown, the use of imagined worlds to inform it seems one reasonable approach to identify, envisage, and discuss potential risk. This is not to suggest that rigorous empirical data collection and analysis is not also critical.

3. Method

This section describes and explains our criteria for selecting the books examined for this paper, and approach to extracting themes, which was guided by our research question. The approach of thematically analysing Science Fiction has been used in similar works, including a recent study which extracted archetypes from films rather than books (Fergnani & Song, 2020). As this paper is in the realm of KM, we focused on themes more directly concerned with knowledge.

3.1 Choice of Science Fiction literature

The SF genre is vast and encompasses many variations of imagined worlds, with technology playing a variously central or more peripheral role to themes of each work. We selected representative works based on a general fit with our thematic concerns, such that technology and the treatment of knowledge are central to the story. For the most part, we chose acknowledged masterworks – seminal texts – well established in SF canon. The six works, a mixture of novels, novellas, and short stories, span almost a century of publication. See in Table 1.

Table 1: Books

Year of first publication	Author	Title	Key/Central Themes		
			Technology	Knowledge/ Information	Nature of personhood
1932	Aldous Huxley	Brave New World	x	x	x
1949	George Orwell	1984		x	
1956	Philip K Dick	The Minority Report	x	x	x
1969	Ursula Le Guin	The Left Hand of Darkness		x	x
1984	William Gibson	Neuromancer	x	x	x
2013	Ted Chiang	The Truth of Fact, the Truth of Feeling	x	x	

3.2 How we analysed the books

At least two researchers read and analysed each text to extract themes. Our RQ guided our interpretation of texts. Each researcher, whilst reading, took notes and selected quotes relevant to the focal themes. We then met to share notes and agree on a subset of key content most relevant to answering the RQ.

Three significant themes are discussed. Ethical perspectives, either implicit or explicit, on how (a) knowledge and (b) technology were envisioned within the imagined worlds. On exploring these themes, the (c) nature of personhood also emerged as a central theme, as it incorporated the impact on people.

In the next section, we explore how the books represent each theme. This provides context for discussing how abstracting and synthesising these insights may be useful for KM and responsible innovation. Under the heading for each theme, we describe the books that made the most prominent contribution to that theme, though recognising some thematic overlap.

4. Findings

This section discusses the themes, then provides a summary synthesising them in terms of KM and ethical innovation.

4.1 Theme A: Knowledge and Information

This is a theme in all the books, though varying in intensity and centrality to the world described. In *Brave New World* knowledge and learning are strictly controlled at the level of biology through technology. Before birth, babies are given hypnotic repetitive messages about their social status and the risks of books and learning. This is facilitated as babies come to gestation in artificial wombs. Learning and knowledge creation are hindered using aversion techniques, such as associating books with painful sensations. Imagination is prohibited and the worst crime is unorthodoxy. Only reference books are allowed in libraries and though there is an awareness amongst elites that historical knowledge exists it isn't accessible. The aim is to ensure people are always in the present, aided by the use of a drug, soma, to promote contentment and satisfaction. Silence is seen as the best option and people should be in a mental state where *'it does not occur to them to ask'.*

"Not philosophers but fretsawyers and stamp collectors compose the backbone of society." Brave New World (p. 4)

In *1984*, there are similar constraints on heresy and efforts to control thinking through the regulation of language, and the manipulation of news and record keeping. Hence, control of knowledge is both external and internal. The libraries in *1984* only contain indispensable technical manuals, demonstrating this external control. The term 'science' is banned, and general knowledge or abstract ideas are strongly discouraged. This is a macro-expression of the far more insidious and manipulative internal control of knowledge, inhibiting the human capabilities of thought and expression by reducing the power of language to 'newspeak', a functional naming system. Taken together, these limits on big ideas and imagination are designed to keep people at the small discrete level of knowledge so they are unable to critique the larger context:

'being without general ideas, they could only form petty specific grievances, the larger evils invariably escaped their notice' 1984 (chapter 8)

Historical records in *1984* are continuously 'updated' as people and allegiances come in and out of favour. Thus, similar to *Brave New World,* there is no way for people to analyse their current state with reference to the past, nor to surmount the limits put on their ability to envisage the future. This rewriting of history (or future-story, in the case of *Minority Report*) by authoritative powers is often taken for granted within each book. Whether or not this is presented as a positive attribute (as in *The Truth of Fact the Truth of Feeling* and *The Left Hand of Darkness*) or a malign distortion (as in *1984* and also *The Left Hand of Darkness*) is largely dependent on how authority is portrayed in that world.

In *Minority Report*, data is collected from three people, known as 'pre-cogs', via a Cyber Physical System which statistically analyses their visions of the future, to produce actionable predictions, i.e. 'majority reports'. Thus, technology is used to interpret their knowledge of the future. Pre-cogs are physically and mentally weakened as all their energy is utilised to create knowledge, e.g. reports of future crimes. Individuals are dehumanised and held in abject captivity for an assumed greater good. Absolute faith in the accuracy of the system offers a moral shield to pre-cog's inhuman treatment and the detention of 'guilty' people. As it is assumed that majority reports are true, the nature and an understanding of minority pre-cog reports is known to very few, until a Precrime

Commissioner is implicated in a future crime and uncovers the inherent flaws in the system. As the title signifies, the book focuses on the legitimising of knowledge from minority positions in committee-led decisions. The book also reveals the dangers of a disconnect between those exploiting 'knowledge', and those who understand and/or enable knowledge creation. In strong contrast to both *1984* and *Brave New World,* the knowledge focused on in *Minority Report* is about the future, with the thematic final reveal that the future may have many possibilities. In *Minority Report*, blindly following the system has negative ethical implications but the system offers no space to even consider ethical arguments or possibilities.

'"There were three minority reports," he told Witwer, enjoying the young man's confusion. Someday, Witwer would learn not to wade into situations he didn't fully understand"' Minority Report (Chapter 10)

Finally, *The Left Hand of Darkness* portrays an intriguing perspective on knowledge and ignorance. This book contains a group, 'the Fastnesses', who have the power to predict the future. This knowledge is not used to find out what will happen next, but rather to *'learn what questions not to ask'* (p.176). The relationship between life, knowledge, and action is described in a way counter-intuitive to our common understanding of knowledge:

'The unknown… the unforetold, the unproven, that is what life is based on. Ignorance is the ground of thought. Unproof is the ground of action' The Left Hand of Darkness (p.58)

4.2 Theme B: Technology

The Truth of Fact and the Truth of Feeling describes a fascinating imagined world only marginally different from our own, where knowledge and memory is facilitated and mediated by technology in different ways. Firstly, and unusually, this book identifies writing as a technology that fundamentally changes how humans view, use, and access knowledge and memory. One of the communities, the Tiv culture, relies on their oral tradition to propagate their history and there is no writing. When a missionary comes with writing, there is a strong concern that record keeping will only cause disputes. Communal decisions are not based on an accurate record of what actually happened in the past but what is best for the community right now. There are two different types of truth in Tiv culture: 'Vough' is the exact and pure truth whilst 'Mimi' is what is right for the community and something that 'only the elders could understand'.

This is juxtaposed with a new technology being introduced in a more futuristic society. 'Remem' is a small recording device that stores all your memories accurately in the context in which they happened so you can have perfect full recall of the exact situation. The narrator expresses concern about this new technology but recognises that it will probably 'catch on' anyway. When he uses this technology to recall memories of his arguments with his daughter he is mortified to see he mis-remembered them and now knows he behaved far less well than he previously believed. Accurate memories are seen to simultaneously pose risks for relationships as well as offer a foundation to repair or strengthen them.

In *The Left Hand of Darkness,* technology as a means of communicating information, is seen as high risk if it can control thought as well as action;

'Here, the government can check not only act but thought. Surely no men should have such power over others' The Left Hand of Darkness (p.127).

The risk posed by technologies that store and communicate knowledge to potentially change how people think, and by extension allow others to influence people's thoughts and actions, is a common theme throughout all the books.

4.3 Theme C: Nature of personhood

This is a particularly strong theme in *Neuromancer,* with its imagined world of virtual realities and artificially intelligent creatures. There are themes of antipathy towards the human body, often referred to as 'meat', and addictions are vividly portrayed, such as the need for constant new informational stimulation. Cyberspace, often used with mind-altering chemicals offer escapism, ephemeral freedom, and in some cases afford the convenient reconstruction of one's identity to deal with difficult experiences or trauma. The realities of illness and physical pain are very present in this book and there are many effective and/or addictive means to escape different types

of pain. The widespread use of drugs to render compliance and contentment is similar to the use of 'soma' in *Brave New World.* Case describes the bodily escape that cyberspace offers:

'who'd lived for the bodiless exultation of cyberspace…In the bars he'd frequented as a cowboy hotshot…Case fell into the prison of his own flesh.' Neuromancer (p.6)

One key concern with personhood in *Neuromancer* is identifying the line between Artificial Intelligence and a human being, and discerning what is real and what it not. The AI creatures discuss this openly with humans:

'"Well, it feels like I am, kid, but I'm really just a bunch of ROM. It's one of them, ah, philosophical questions, I guess." The ugly laughter sensation rattled down Case's spine. "But I ain't likely to write you no poem, if you follow me. Your AI, it just might. But it ain't no way human."' Neuromancer (p.145)

The moral hazard is clear as AIs have superior strength and power to humans yet an unknown consciousness and morality. The book also provokes questions about technological companies, framed as resilient creatures you cannot kill, as they always have more people to fill vacancies. Thus, the distinction between what is living, what is immortal, and what is technology is strangely blurred. A company is seen as living and resilient in terms of the impossibility of removing their existence or control. This resonates with current concerns about the hidden power of technological multinationals.

''Zaibatsus', the multinationals that shaped the course of human history, had transcended old barriers. Viewed as organisms, they had attained a kind of immortality. You couldn't kill a 'zaibatsu' by assassinating a dozen key executives; there were others waiting to step up the ladder' Neuromancer (p.224)

The Left Hand of Darkness provides a vivid description of the experiences of a human Envoy, Genly Ai, from earth to another planet called 'Winter'. On Winter, the inhabitants seem similar to humans in most ways though they have no fixed gender and at most times have no sexual desire. This only changes when they are fertile or in 'kemmer' and during this time they can arbitrarily end up female or male. So anyone can become pregnant and the book includes the line, *'The King was Pregnant'*. This conceit shapes the whole book and in one scene the human becomes annoyed by what's seen as a feminine approach to knowledge by one Winter's inhabitants. The human finds it difficult not to use categories of male and female in their interpretation and understanding of communication and knowledge. Forced hormone treatments suppress the sexual cycle in prison camps to render them docile and unquestioning. The human observes this as a disturbing vulnerability in terms of the chemical control of mental states but does not seem to realize that it is one which humans share.

The nature of culture and how individuals relate to wider society is also a key theme. Knowledge is communicated using complex traditions and norms that the Envoy consistently mis-interprets with serious consequences. He is particularly perplexed by the concept of 'shifgrethor', which is never fully explained but seems to connote a face-saving desire not to reveal a lack of knowing or a lack of power. In the *Truth of Fact and the Truth of Feeling* the impact of technologies (including writing) on human's sense of identity and memory is explored. It demonstrates the impact of different technologies, both positive and negative, as individuals' relationships with family, community, and society.

4.4 Summary on value of themes for ethical innovation

As is evident, technology is cast as playing an instrumental role in the control, manipulation, hindering, corruption, prohibition, (de)legitimization or even interpretation of knowledge, its creation, access and use. Whereby, these books illuminate both intentional and unintentional motives/effects at play. All these books discuss the nature of knowledge, with particular emphasis on the importance of asking the right questions and the risks entailed by losing the capability of broad holistic knowledge. This provides an interesting perspective on the mainly uncritical welcome and adoption of technology use across many spheres of life. Their widespread introduction in the teaching and learning domain, is one example where greater discussion of how this affects creative thinking and wider reading is needed. The biggest threat in these books is not AI or even institutional control of knowledge, but rather any threat that undermines the essentially human embodied nature of knowledge, self-knowing, perception, and threats that makes humans less capable of 'big picture', creative, and

critical thinking. In particular, it is the internal locus of change that makes institutional control possible, with equally detrimental consequences for the arts and sciences.

Based on these findings, a focus on the capacity for human knowledge embodiment and holistic thinking could usefully be prioritised as themes for further exploration, and inclusion in innovation risk assessment processes. Bad things can happen when technology shapes how we learn, remember, think and reproduce. The greatest risk is not necessarily the increasing dependence of ICT as a knowledge creation, storage and communication device, it's the potential of technology to detrimentally interfere with human biology. This emphasises the significance of human knowledge embodiment, thinking and perception. As long as the mind-body is not compromised, there remains hope for self-knowing, freedom, original and independent thought. This is in contrast to most ethical debates on AI which tends to focus on the risks of AI becoming too 'autonomous' or 'human' rather than how technology use may damage the human capacity for resilient knowledge, identity and expression. For example, when technology mediates (self) perception, and blurs one's ability to discern what is 'living', and what is not.

5. Implications for KM and ethical innovation

What does this analysis of the identified themes suggest in terms of the usefulness of the insights gained from Science Fiction (SF) as knowledge that can be used in the innovation process? The best way to address this question is to review what one can find in SF that is not a large part of current debate but also a definitively informative insight. What new knowledge does SF potentially provide? In summary, whereas different lighting technologies in turn shape how we see in the dark, it would appear that what SF crucially conveys (rarely seen in academic literature) is how ICTs can shape human's capability for thinking and knowledge. It would appear SF does provide useful and new sources of knowledge to be considered for informing knowledge management in the innovation process.

SF also adds nuance to the debate about the ethical implications of how technology may be shaping knowledge. An exploration of the themes in the SF analysed for this paper did reveal some unexpected and 'bigger picture' themes than those that are evidenced in most of the research and policy literature. It shows that these insights are often more focused on human knowledge than technology and perhaps that those are the ones that should cause the greatest concern. Technology, and how it used to manipulate, store, and communicate knowledge, increasingly has the power to shape human biology and thoughts. These impacts also have alarming multiplier effects in terms of biological and intellectual 'reproduction' of our 'ways of thinking' in the learning process.

This can shift the focus of the debate more to the nature of human knowledge rather than the details of particular technologies. It can also add to the debate about how we think about particular technologies, such as the immutable and distributed data records of blockchain for protecting and accessing knowledge etc. In terms of KM, this is an argument for wider use of KM expertise and processes in managing ethical innovation. If knowledge is more important than is currently acknowledged, then KM should be more engaged in improving ethical innovation capabilities.

6. Future work

Future work could include further examining SF as a potential source of knowledge to draw on in decision making processes around innovation. The method introduced of extracting knowledge themes from fictional literature is one way to expand the theoretical depth and practical application of KM. It could be developed for different contexts of research, education, and wider public engagement of the ethical risks and potential of innovation. As with any story-based approach it can be subjective and partial, but when it is combined with other methods of risk analysis it has useful potential. As it uses fiction it can also offer a free exploration of ideas, unrestrained by established facts. This can challenge both the increasingly contentious 'cancel culture' of current ethical and political debate and the silencing power of technological multi-nationals.

Future investigation could include a wider perspective on SF literature, and develop methods for engaging audiences on issues of ethical impact across the innovation process. The ability of SF to attract and resonate with large audiences makes it worthwhile to identify, extract, and organise their embodied knowledge themes. Presenting extremes of technological impact may also enable comparison with our current state more

accurately. Finally, future work could study ICT professionals from different domains to understand how they interpret and apply SF ethical knowledge in their professional work and identity. New approaches to meaningfully engage people are important for both those performing risk assessments of innovation and the wider public in terms of engagement in this important issue.

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