Technology in Society 68 (2022) 101879

Contents lists available at ScienceDirect

Technology in Society

journal homepage: www.elsevier.com/locate/techsoc

Determining the human to AI workforce ratio – Exploring future organisational scenarios and the implications for anticipatory workforce planning

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ARTICLE INFO

Keywords:
Artificial intelligence
Futures wheel
Adaptation
Workforce design
Operating models
Scenarios

ABSTRACT

There are waves of organisational adaptation challenges facing decision makers due to current time societal, systemic and pandemic implications. It is difficult to plan strategically and then act decisively towards a future that is uncertain - the cause and effect offering many scenarios, some plausible and some outliers. In this research 110 participants from 36 different organisations were invited to explore the implications of different ratios of human and artificial intelligence (AI) in future organisational operating models. Five operating models were explored using the Futures Wheel (Glenn, 1972) [1]. The Futures Wheel is a methodology to causally link the future implications of a scenarios and change. Operating models explored varied from a fully human workforce with no AI to those which had a changed ratio of AI and human workers and leaders with the outlier being an AI lead (no human) model. Three participatory workshops generated 20 futures wheels, four for each of the five organisational scenarios. This article will present the results, personally prioritised by participants, to identify which implications they thought in an anticipatory 2040 organisational context would be best avoided (stop happening) or amplified (make happen). These findings then are analysed to produce macro themes that form part of a proposed anticipatory workforce design approach (5As) for organisations strategising on what the ideal Human to AI ratio (Human:AI) ratio is within an organisational context.

1. Introduction

Contemporaneous societal, systemic and pandemic implications bring waves of organisational adaptation challenges for decision makers. It is difficult to plan strategically and then act decisively towards a future that is uncertain, with cause and effect offering many scenarios; some plausible, and some outliers. The old ways of working, leading and adapting are being questioned, the COVID-19 pandemic has increased the consideration of AI in organisational settings to enable the safety of workers as well as the ability to speed up the rate of complex global problem solving. Given this complexity and opportunities, what will the operating models and organisational structures of the future be? Who or what are the "workers" in these future organisational ecologies? What are the implications on our future of decisions made today, in relation to technologies like Artificial Intelligence (AI) platforms and automation that can augment or replace human workers?

The introduction of automation or augmentation technologies, and the associated ensuing adaptation, is not new. Humans have been using forms of enabling technology to bring advantage to their communities and organisations for thousands of years [25]. Organisations and whole industries have disappeared, adapted or emerged since the first trading operational models were formalised. Often, organisational design strategy setting tools are decided on a narrow range of parameters that ignore the range of creative and futuristic consequences, either within or outside the walls of the organisation [2,26,27]. Current organisational design strategies tend to focus on delivering tangible economic benefits, and increased profit, for shareholders linked to market growth or efficiency dividends. These strategies also seem to lead to more reactive forms of organisational structure and operating model realignment that is neither anticipatory in nature, nor consciously connected to deeper values or causal loops [3].

Enter the futurist and foresight practitioner who, in bringing to the table a futures mindset and a toolbox of valid methodologies, can broaden an organisation's process and help determine the causality of today's decisions on the longer term outcome [27]. The anticipatory approach selected for this research is the "Futures Wheel". The Futures

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https://doi.org/10.1016/j.techsoc.2022.101879
Received 9 August 2021; Received in revised form 5 January 2022; Accepted 6 January 2022
Available online 10 January 2022
0160-791X/

Wheel was originally designed by Jerome Glenn [1] to assist organisations in understanding the multifaceted implications of scenarios. The approach moves beyond first order implications and in an accessible, visible process demonstrates the "far reaching" consequences that have a causal link to another.

This research has demonstrated that anticipatory approaches are relevant to understanding future trajectories of AI. In this research 110 participants from 36 different organisations to answer the question, what are the implications of differing human to AI worker ratios in five future organisational operating model scenarios. In order to explore the question the operating models varied from those that exist in a 2020s context, including fully human workforces with no AI, to those that could plausibly be in existence in the year 2040, such as organisations that are fully AI with no human involvement. Three workshops generated 20 Futures Wheels and required participants to anticipate future implications. Futrues research offered a unique approach to unwind participants current thinking and lift perception to the threats and opportunities in the future. This article will present the results, personally generated and prioritised by participants, where they identified which implications would be best avoided (stop happening) or amplified (make happen). These findings have unique implications for organisations strategising on what the ideal Human to AI workforce ratio (Human:AI) is within an organisational context. The research offers a novel approach to how industries and organisations may consider the long-term planning of AI and identifies the virtuous and unwanted aspects of AI in the workplace.

2. Methodology - participatory futures research and the futures wheel

Futures research has grown in prominence since formal recognition as a research paradigm in the early 1970s [4,5]. Ramos ([6]; p. 825) has identified "five major stages of futures research: Predictive, Systemic, Critical, Participatory, and Action oriented", which evolved from the practical application and evaluative processes of a wide range of future philosophers, theorists and practitioners. The participatory and action oriented futures modalities formed the underpinning theoretical model used in this research. Participatory futures were demonstrated through qualitative data gathering, with a diverse range of people in a workshop process exploring futures through the lens of creative thinking and personalised experience. For the action oriented modality, participants actively prioritised and determined which Futures Wheel consequence they would then choose to amplify or avoid. Action oriented futures approaches are linked to co-design and co-developing the future.

According to Stevenson ([7]; p. xxi):

[F]utures studies is less about prophecy and more about anticipating the way in which we will pass on the world to those who will live … in the future. It is also about taking responsibility for the consequences of the choices and decisions we make today.

A tool that met the two prioritised domains (Participatory and Action), was Glenn's [1] "Futures Wheel". The generation of a Futures Wheel is best completed as a participatory method that uses a qualitative narrative-producing process, with the aim of generating insight and inspiring action. According to Bengston ([8]; p. 374) "… the Futures Wheel uncovers multiple levels of consequences resulting from all types of change". The workshop approach utilised in this approach had participants able to offer perspectives on the heart of the wheel (in this case organisational scenarios).

2.1. Participants

To explore the implications of organisational scenarios of the future requires the generosity of people willing to creatively explore and participate in diverse groups. Three workshops, in three different Australian locations, were designed with the core themes of learning, collaboration, narrative sharing, creative exploration and qualitative data documentation. In total across the workshops, there were 110 workshop participants from 36 different organisational backgrounds (Table 1), and each individual participant's voice and perspective was honoured through group-based processes. Each person was randomly allocated to a sub-group of five to eight people and had the "power of the pen" to note their own insight. A strength of the workshop approach and where possible individual comments have been kept whole. All ideas were accepted in the first pass of data collection. Both Glenn [1] and Bengston [8] suggest Futures Wheel processes should include a "diversity of cultural and ethnic perspectives, knowledge, experiences, gender and age …". This diversity was achieved through the mix of organisation, ages, work experience, gender and professional backgrounds of the volunteer participants, and the combination of perspectives across the three workshops.

All workshop participants volunteered to participate in the process and signed relevant ethical approval documentation. Workshop one had 70 participants and was conducted within a single local government organisation, through a community of practice of mainly project and technology delivery and change managers. All participants were employees or contractors who worked across different divisions and teams within the local government organisation. Ten smaller discussion groups were utilised, which generated 10 Futures Wheels (two for each of the five operating models). Workshop two had 25 people from 20 different organisations in attendance. Most of the participants were technology, project and delivery managers (particularly) those who utilise Agile, iterative or incremental deployment methodologies in both community service and profit-based organisations. Five smaller discussion groups were utilised that generated five Futures Wheels. Workshop three comprised 15 people from 15 different organisations and was conducted at a conference promoted to women working in technology. Participants were from a range of service and profit-based organisations, and self-nominated prior to workshop attendance. Five smaller discussion groups were utilised, generating five Futures Wheels. The gender difference in participant voice on implications will be explored as part of a separate publication.

In total across the three workshops, 75% of participants had direct involvement with AI in their workplace, either as a programmer, end user or transformation team leader. All participants had some exposure or use of AI or AI augmented solutions as a user in, or outside, their workplace setting. This occurred either in social forms of interaction with interfaces—including SIRI or customer chatbot algorithms—or via predictive analytics, deep learning or natural language processing tools etc. To meet ethical guidelines for conducting the workshops, participant names, ethnicity and organisation name were not included on individual consequence data items. Where possible, direct quotations generated from each workshop were maintained in "*italics*" to honour

Table 1
Participant/category breakdown by workshop.

Participant/Category	Workshop 1 N =	Workshop 2 N =	Workshop 3 N =	TOTALS N =
Total Participants	70	25	15	110
Gender:				
Male	43	15	1	59
Female	25	10	14	49
Prefer not to say	2	0	0	2
Age:				
20–39	30	15	9	54
40–64	35	9	6	50
65-upwards	5	1	0	6
Category:				
Government	70	8	3	81
Academia	0	2	1	3
Private/Commercial	0	12	8	20
Non-Profit	0	3	2	5
Other	0	0	1	1

Table 2
Base numbers of data elements by scenario.

Human Centric (No AI)		Human Lead (AI Augment)		Human and AI Cooperative		AI Lead (Human Augment)		AI Centric No Human	
Consequences to Avoid (n:23)	Consequences to Amplify (n:16)	Consequences to Avoid (n10)	Consequences to Amplify (n:7)	Consequences to Avoid (n:13)	Consequences to Amplify (n:11)	Consequences to Avoid (n:15)	Consequences to Amplify (n:8)	Consequences to Avoid (n:19)	Consequences to Amplify (n:11)

the voice of the participant, in line with participatory and anticipatory action learning futures research methodologies [7].

2.2. Time context and workshop process

Futures research extends the thought process beyond typical planning horizons. The participatory workshop process (Fig. 1) was framed in a futures context of 2040. The year 2040 was chosen for the scenario because it commonly features in reported research about the impact of AI on the workforce [9–11]. A longer term horizon also lifted the anticipatory and creative thinking requirement of participants. Anticipating and consciously making steps towards futures is a central feature of action oriented futures methodologies (traditionally beyond the limitation of a typical three to five year organisational strategy horizon) [5,6,12].

The 90 min workshop process commenced with an educational component delivered by the researcher to set framing for the creative process. This included preliminary information on the genealogy of AI technologies and AI sub-disciplines, including machine learning, robotics, computer vision, automated reasoning, machine perception and knowledge representation [13,14,25]. The workshops did not limit AI to a particular programming field or language. The framing enabled participants to utilise AI as a story telling concept and self-define it from what they thought "AI" would be like in 2040. The main definition participants worked to was:

> AI is a collection of programming languages and algorithms that can learn and adapt. AI can fulfil the function of a human (or "super" human) in a workplace setting (including but not limited to administration, teaching, processing, customer service, manufacturing). AI could also be the operating engine of a robotic "worker" of the future and have complete sentience by 2040.

Once the core concepts of futures research were shared, participants were invited to commence the first group discussion - making meaning of and validating the five organisational operating model scenarios and thus confirm the centre of the Futures Wheel.

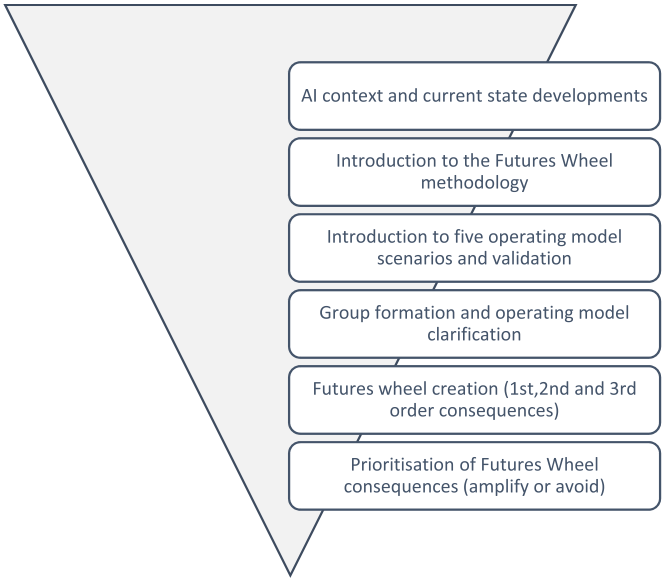

Fig. 1. Process of data collection workshop.

3. Introducing the five future organisational operating model scenarios

Organisations are complex arrangements of diversity, incorporating people, ethnicity, gender, personality, roles, processes, policies, relationships, systems, politics, history and spirit. AI and automation technologies' broadening application scale and sphere of influence adds additional layers to existing organisational complexity. One of the key challenges to the current state is the design of human positional power and centrality in the work context [25]. Complexity theory examines how order and patterns arise from apparently chaotic systems and, conversely, how complex behaviour and relational structures emerge from underlying rules [15]. To explore organisational operating model scenarios of the future using the Futures Wheel methodology, a careful description of the centre of the wheel—the "organisational scenarios"—is key [8]. To confirm the centre of each wheel to participants, the researcher outlined the five high level organisational operating model scenarios (Fig. 2), and then validated this centre definition via group discussion processes.

Validation of "the centre" starting point was a key commencement process to activate participant agency in the research and to shift the energy from theory to "future making". At each workshop, the boundaries of each scenario for data collection were questioned and then confirmed by participants, with little change. The researcher previously generated the original draft five organisational scenarios based on insights gained from earlier research [26], and a literature scan to reveal operating models that either will exist, or could plausibly be in existence, in the 2040 futures context. Some of the scenarios in which AI held power or an authoritative position over human workers were at the time considered as outliers, so participants were invited to consciously explore new domains of possibility using a creative, almost "science fiction", lens.

In workshop discussions the participants agreed on the organisational scenarios, with the base assumption that these operating models could exist, either singularly or in combination, in corporate organisational settings of the future. The Human to AI ratio would be adjusted based on functional complexity. The organisational scenario definitions through workshop process evolved to the following:

- **Human Centric** (No AI) - Humans offer a unique value add that machines cannot or "will not" provide due to boundary decisions made by humans. This operating model could be seen as human boutique, niche or an individualised personal service offering (a human would provide a deeply personalised or unique human service). Humans are self-managing and self-directing, there is a no tech or low tech culture. In some cases, this model may be a result of global environmental or energy shortages, impacts and disasters, where humans are placed to provide "all labour and face-to-face forms of service once again" ([16]; 11)
- **Human Led** (AI Augment) - Humans lead and set direction for the organisation and work priorities. AI is the equivalent to the "transactional worker" or subservient to the human leader. AI is considered a tool, a machine that has no form of agency. Humans have the legal authority and make the decisions on the AI architecture, including evolution or archive. Lower skilled or former process human staff are

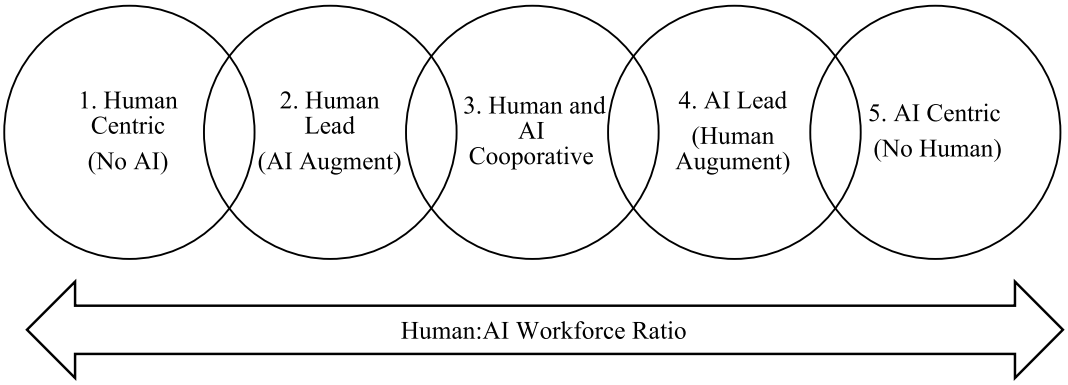

Fig. 2. High-level organisational scenarios of future organisations in 2040.

either upskilled in other functions or let go from the organisation (worse case).

- **Human and AI Cooperative** - A cooperative organisational structure with both human and AI recognised equally for their agency. Both recognise one another's importance and worth. There are times in work where either AI or Human take the lead on decisions and process elements when they are best suited. Mutual respect exists and this is the primary difference to scenario two and four where either AI or Human are in the power position (master-servant).
- **AI Led** (Human Augment) - AI provides the organisation strategy and the leadership and direction/vetoing of ideas to human teams who fulfil defined functions. Humans may support AI to fulfil the AI purpose and function. "The human becomes the laptop" [26] or the human is the programmer/mechanic with AI establishing the design and control parameters. AI may transact with other AI leaders to formulate new connections, opportunities and learnings. The human is there to validate and enact duties that AI cannot do.
- **AI Centric** (No Human) - AI lead and run operating models providing service without human intervention. AI has legal agency and is considered to have rights. AI could be the organisational owner and self-managing and self-rejuvenating. AI may have a hierarchy of sentient evolved AI over more functional basic AI. Humans' role will shift outside the organisational setting to activities more philosophical, creative, ecological or of spiritual importance. Different models of income support and economy exchange for humans and community resources would be in place to keep community peace and order.

The five validated organisational scenarios were explored four times using the Futures Wheel. This provided a rich source of qualitative data, whilst reducing the risk of bias from any one group's perspective picture, noting a large percentage of participants came from a local government setting where two rounds of the five operating models were examined. The 20 Futures Wheels generated 353 categorised first, second and third order consequences. This broader detail will be subject of future publication.

This article focuses on the secondary level analysis completed by participants within the workshop setting, where the twenty groups prioritised first, second and third order consequences on their Futures Wheel and agreed collectively on what implications to prioritise to actively avoid or amplify. *Avoid* is defined in the context workshop as "to conduct a proactive foresight driven response to reduce or remove completely the likelihood and negative flow on impact that would result if the consequence was to occur". The definition of *amplify* within the context of the workshop was "to conduct a proactive foresight-driven response to improve or guarantee the likelihood and positive flow on impact that would result if the consequence were to occur". Groups had full agency to determine their secondary level analysis approach, and most settled on a voting process of agreement before the decision on "what to amplify" (total n:53) or "what to avoid" (total n:80) were indicated on their poster. Each participant had an equal contribution and a conscious role in making an agreement on the future of each operating model. These were identified on each map by participants via words, ticks or crosses. Image 1 shows three actual examples of the twenty maps created.

There was a statistically relevant range of results prioritised by participants of what consequence of AI they deemed in their small group to Augment or Amplify. The numbers are listed below:

This article will now outline the key insights generated by participants for each scenario, combining data from the three workshops that detailed the implications the participants prioritised to either amplify or avoid. The full list of prioritised implications by organisational scenario is at Appendix A.

4. The results: prioritised consequence findings by organisational scenario

Much of the insight in the following section uses words directly from participants. Keeping the participant voice in the Futures Wheel, and indeed any form of anticipatory research, is a key ontological value position [1,8]. This section will go through each of the scenarios and a summary of what was observed in participant responses.

4.1. Human Centric (No AI)

The Human Centric (No AI) operational model was observed as an easier concept for people to explore. This may have been due to the participants having longer life and employment experience; each participant having a point of reference and example of a non-AI world from their own personalised experience. The challenge to participants came with the time context overlay of being based in 2040. Most expressed that the published developments in AI, combined with their own organisational strategy, suggested that by 2040, AI would be having a "*potentially massive impact*" on all corporate sectors and "anything" could plausibly be augmented or automated. Having a deliberately framed discussion about the implications of being selective in the Human to AI ratio change was something most participants anecdotally had not considered. Participants identified the largest number of consequences (n:101) for this scenario. The groups then completed their secondary level analysis to prioritise a total of n:23 consequences to avoid and n:16 consequences to amplify.

What is first observed from participant response is that the primary consequence to avoid in the Human Centric (no AI) scenario related to the traditional economic themes of avoiding cost, efficiency and/or "*performance lag*". The broader themes included avoiding impact on the environment or people (mental health impacts, less work-life balance and reduced creative opportunities) because of the model selected. A different dynamic that would affect decision making was the possibility

that organisations with a heavier Human to AI ratio would experience "*difficulty in attracting staff",* especially if staff were still tasked with more transactional or "*process heavy"* activities, versus organisations who can attract humans due to creative incentives and opportunities on offer.

The consequences to amplify were more humanistic, value laden and emotional in theme. There are also references to the definition of place. A human centred (No AI) scenario could be linked to "*growing the localised economy*" and capability as well as growing a sense of community or equality. Keeping choice for the customer and human worker to transact with another human without inequity was a theme. Ethical control of the organisations' operations was also a theme, along with references acknowledging the place of work in human intelligence evolution and spiritual actualisation.

The common themes in "avoid" and "amplify" related to organisational reputation, in particular the "value" of maintaining a human only service offering. The "*organisational brand"* needed to be protected and one way of doing this was to amplify the "*humanness"* of the service offered; or a richer personalised experience. Another more consistent theme was that of learning and creativity, "*avoiding the loss and stagnation"* of innovation, balanced with the need to amplify the collective and individual learning than could be present in this scenario.

4.2. Human Led (AI augment)

Human Led with AI augmenting service was referred to by participants as the most possible of the operating models to exist in 2040. Anecdotally, participants found this discussion easier, as many had exposure to AI augmented services and products, including a role in implementing them (as pilot or low risk applications) in their organisations. Some of the exposure examples included: an AI and customer facing chatbot triage in a call centre environment; AI for data mining and analysis of marketing and customer information to target sales; identifying changes in ecosystems due to longitudinal analysis of flood and fire maps; and, providing efficiency in recruitment and selection processes due to AI providing a "prioritisation" of resumes and job description prior to interview.

Participants identified 73 consequences for this scenario across the Futures Wheels generated. The groups then completed a secondary level analysis to prioritise a total of n:10 consequences to avoid and n:7 consequences to amplify. Consequences to avoid in the Human Led (AI Augment) scenario related predominantly to ensuring mechanisms (both technical and non-technical) were in place to mitigate possible "*bias in decision making"*. Participants prioritised the need to avoid "*human workers displacement"*. Priority was also given to ensuring the value from the ratio of human workers (empathy, heart, nuance, reading the grey) was not lost to a narrower decision-making focus on financial return due to efficiency savings of employee expenses. This operating model scenario suggested a possible effect on human workers' intelligence from being too reliant on AI and becoming "*lazy thinkers"*.

The primary consequences prioritised to amplify for Human Led (AI Augment) were smaller in number but specific in targeting the newfound efficiency time savings, permitting space for humans to expand reflections and "lessons learned" processes. There was also a specific consequence to amplify which related to "*safety nets"* and ensuring "*humans made the final call on key decisions"* that have deeply personal human impacts. Human Led (AI Augment) operating models also suggested a cultural amplification was required to focus on *"error reduction"* and a *"mitigation mentality*" via review and formal assurance processes. Interestingly, the amplification suggested it was worth more to invest in designing AI solutions that were "*scalable to other areas of business*". This has implications for the adaptation approach as efficiencies are gained, and learnings made.

The common themes across "avoid" and "amplify" were in relation to ensuring the flow on effect of human replacement was considered in decision making, and that time was factored into an organisation's ecosystem to reflect and review the real value from AI incorporation. Participants wanted to maintain decision making processes with humans and "*keep AI in a controlled space*", even if the capacity of AI was more advanced than that of humans.

4.3. Human and AI cooperative

Human and AI having an equal place and power in organisational settings was an operating model scenario that proved a challenging concept for participants. In many organisations in the current state, machines are valued due to their functionality and not given any form of agency. However, in future organisational models, advancements in AI and humanoid robotics may lead to a positional change for the non-human in the work context [17,18]. What this would mean for organisations prompted the third operating model that expands the notion of "who" or "what" the key workers and leaders in this organisation are that are responsible and accountable for direction, growth and service delivery. In this scenario, additional framing was provided to participants in the form that:

- The human cannot complete their full function and role without AI.
- AI cannot complete their full function without the human.
- There is a degree of "dependency" for the fulfilment of a task.

The working relationship is based on equal power and respect for both AI and the human, each acknowledging the place of the other in the context and concept of work.

Participants identified 51 consequences for this scenario across the generated Futures Wheels. The groups then completed a secondary level analysis to prioritise a total of n:13 consequences to avoid, and n:11 consequences to amplify. The consequences to avoid that were prioritised for the Human and AI Cooperative scenario included not losing natural decision making and avoiding humans having a "*blind reliance"* on AI. Moral responsibility as a dimension of decision making that should not be eroded was important for participants. In a Human and AI Cooperative scenario, each entity has a specific role and function to play, but are equal in agency, thus participants expressed concern as to who to blame if things go wrong and who is the leader. "*Am I jointly accountable for the mistakes of AI; is AI accountable for the mistakes of the human*?" There was a strong theme of transparency and the need to avoid bias in input and output. There were also logistical issues to be avoided (as is the case in human-centred models), i.e., if we are more rigid in our Human to AI ratio, "*how can we manage unplanned personal leave (or unplanned maintenance) ?*".

The primary "amplify prioritised" consequences for the "Human and AI Cooperative" scenario related to the need for specific clarity on function, place and the value proposition each worker (AI or human) would bring. Participants wished to prioritise "*better balance in decision making",* as both perspectives would be considered equally. Priority consequences to amplify also related to the cooperative model leading to a "*reduction of stress and better balance in work and life"* (for humans). Other amplifications related to the ability to progress greater quantities of work and amplify "*customer satisfaction*" for those looking for their needs to be met effectively whilst retaining a "*human connection"*.

The common themes across avoid and amplify were less obvious in the post workshop analysis of this scenario. Decision and being clear on who, where, what and how decisions would be made was important in this cooperative model, as opposed to the ratio, which suggests clear decision-making, and authority and rectification processes, would need to be in place.

4.4. AI led (Human augment)

In this scenario there is a swap of traditional roles, where AI is now leader and human workers the supporters, the maintainers and the service deliverers, based on AI priorities. A challenging model to some

participants, given it suggests humans would give agency to AI and then follow what AI instructed, based on the predictive and prioritisation power it provides. Participants identified 55 consequences for this scenario across the Futures Wheels generated. The groups then completed a secondary level analysis to prioritise a total of n:15 consequences to avoid and n:8 consequences to amplify.

What was unveiled as part of the "avoid prioritised consequences" for AI Led (Human Augment) is a more pessimistic concern that AI would be the "*bully boss*", dictating direction, with power being placed in the hands of only a few. The avoid consequences related to avoiding limited or incorrect decisions being made and the negative harm to humans. There was a strong theme of caution, the introduction of language like "*let's avoid the lack of a legal framework*". There was the suggestion that the loss of the more "grey" judgement call was not to be eroded. One group identified that in this scenario it was important to prevent the possibility of "*chaos if AI was unchecked*". Interestingly these groups also prioritised the avoidance of "*loss of human skills*" and the emergence of discriminatory practices in humans based on digital intelligence. This scenario also included some of the practical social aspects of work that humans appreciate such as desire not to lose the social interaction that comes through informal work connections, i.e., "*the bake off*".

The primary themes from the "amplify prioritised consequences" for AI Led (Human Augment) related to amplifying the typical efficiency attributes sought via AI investment, such as faster decisions due to targeted AI deployment. Participants wished to amplify the "*safety and improvements for human life*" as well as human "*job satisfaction*". Participants also prioritised the consideration of different tiers of service where "*customers could opt out of using AI*" and use the decision making power of AI to speed up and inform those decisions.

The common themes across the "avoid" and "amplify" categories were in relation to human safety (physical and psychological). The other theme was that of risk and return of this scenario (the need for validation) and consequences from decisions from AI that go unchecked.

4.5. AI-centric (No human)

Visualise a whole organisation or function of a larger organisation in 2040 that has no human involvement. Difficult to imagine without Kurzweil's [18] notion of singularity or full legal agency for AI [17,26]. The AI-centric, no human operating model was accepted by groups to work with, with some initial observed objections about the reality of this model existing without some form of human ownership or ultimate control.

Given this research used a participant-generated definition of AI that gave participants full latitude to be creative, the group had to consciously remove initial barriers that blocked the ability to see the human completely absent in an organisational setting. In the current day, AI cannot be an owner of an organisation: given AI does not have a legal status, a human will still have some form of legal ownership, even if the AI completes 90% of the work (such as in some manufacturing settings). This may not be the case in 2040. The group realised that AI-centric organisations or organisational functions could also service other AI organisations as a new form of virtual organisation (i.e. robots service the robots).

Participants identified 73 consequences for this scenario across the Futures Wheels generated. The groups then completed a secondary level analysis to prioritise a total of n:19 consequences to avoid and n:11 consequences to amplify. The consequences to avoid in an AI-Centric (No Human) scenario are the direct effects from human job displacement that may lead to social disruption or social discrimination. Participants prioritised some deeper philosophical points including the need to avoid having a more pessimistic AI-dominant ratio that "*caused any confusion about what is human*". Participants wanted to avoid any consequences that lead to loss of empathy or emotion in service and decision. Participants did not want to lose their "*humanness or have a robotic or brainwashed existence*" because of an AI centric organisational structure. Participants also wanted to avoid any encoded bias and technical errors that would go unchecked.

The primary themes from the amplify prioritised consequences for AI-Centric (No Human) scenario related to the creation of human opportunities such as increased "*safety for humans*", and the policies and governance needed to provide space for this operating model. Some participants felt this model could exist in contexts considered dangerous or unsafe for humans. Dimensions to amplify were also within the theme of enriching the human condition by improving costs of living through "*efficiencies passed onto consumers*". The creation of new structures, policies and regulation were supported by participants to "*provide a safety net*" so humans could be free to gain a broader role and balance, and move to "*self-actualisation*" [19].

The common themes across "avoid" and "amplify" is the relationship to protect humans from broader societal consequences. This model promoted the idea that an AI-Centric (No Human) model, if managed well and with the more negative consequences mitigated, could lead to "*greater evolutionary possibilities*" for humans.

5. Discussion - implications for making organisations of the future

The level of disruption a changed Human to AI workforce ratio will have on an organisation (regardless of type), will require decision makers to prioritise particular implications over others. The aim of this research was to demonstrate the value of taking an anticipatory longer term perspective in designing and adapting to the organisation of the future. A conscious foresight-driven process, including even the simple addition of tools like the Futures Wheel, unveiled existential risks that could destroy or uplift, not just the organisation's reputation, but the employee and civil society those employees (and employers) are part of. To consider how to use the findings from this research will require understanding of the macro implications, a shift in the "human as leadership" mindset, and the institutionalised value sets that drive decisions and adaptation approaches.

5.1. Macro themes as an impact analysis extension in workforce design scenarios

The five organisational scenarios validated by participants contained a caveat that each scenario could exist singularly, such as the case of an aged care service provider who commits to a Human-Centric (No AI) model where a human care-giver provides a personalised service directly to a resident in the aged care space. Equally, we may see decisions made where there is a co-existing set of the five scenarios in place, such as where the same aged care provider may have a personalised resident care model involving humans only, but the logistics and ordering of medications and supplies is done via an AI-led (Human Augment) structure, with the delivery of medications to support staff handled by an AI-Centric (No Human) approach, as is the case in modern hospital settings where AI-managed robots deliver key supplies to various areas of the organisation, or AI assists with health record analysis [13].

Thus analysing the macro themes (Fig. 3) from both the "avoid" and "amplify" listings across the five scenarios provides a set of decision criteria that can assist organisations to determine their position when prioritising AI or augmentation technologies that materially change the Human to AI ratio. The themes came from across each of the scenarios where they were reflected most consistently across each of the five scenarios.

The base question relates to the concept: will this change to the Human to AI ratio in this function/organisation negatively impact, or positively enhance, the following macro themes:

These macro implications (noting they were established with a 2040 time context) would mean the current, often disconnected, workforce

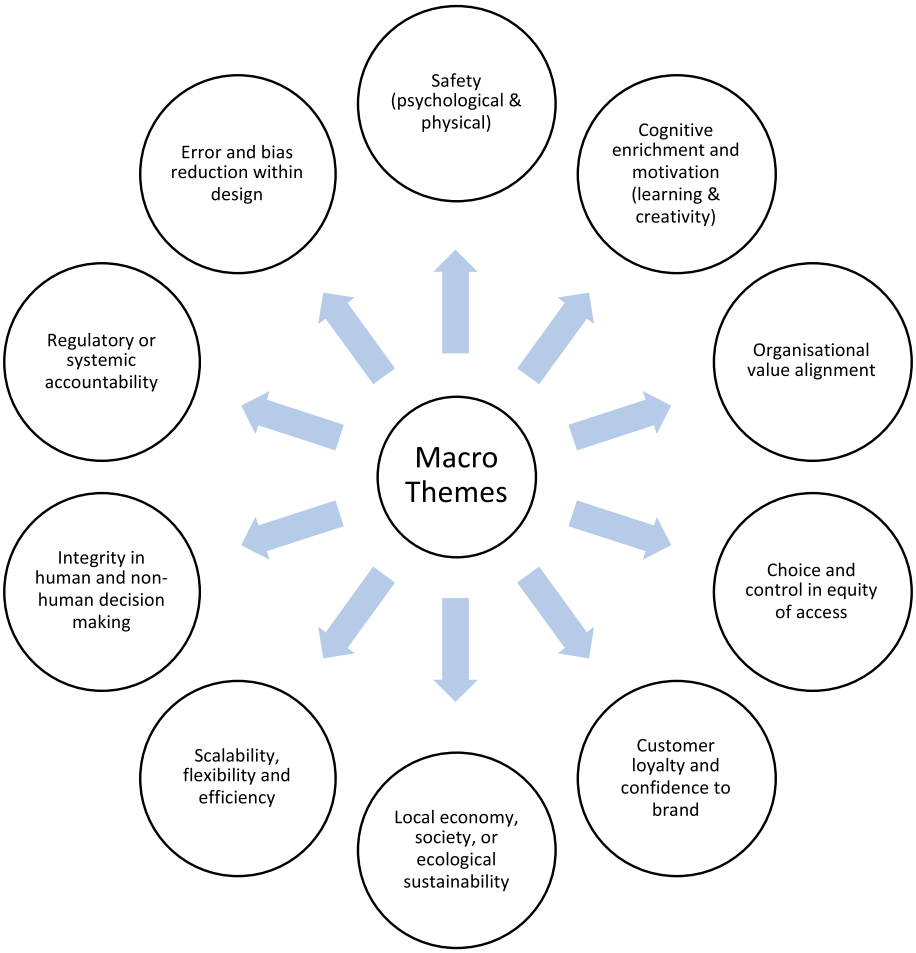

Fig. 3. Macro themes to inform an organisational adaptation strategy.

design approaches and subsequent AI investment and adaptation need to be more principle-led and anticipatory in nature, considering the far reaching impacts of decisions made in the shorter term.

5.2. *Anticipatory workforce strategy – determining the human to AI ratio*

Participants throughout the workshop process expressed a challenge in current processes to define a workforce of the future, when the causal effects of the future are uncertain and developments in emerging technology, including AI, are rapid and emerging. The macro themes (Fig. 3) identified a frame of different themes that decisions can be filtered through. A more anticipatory approach to workforce design is required in environments where there is greater complexity (both technical, behavioural and relational) [3]. An approach that is centred around core commitments that are longer term-focused (beyond the traditional planning horizon of three to five years), and that can be adjusted as new insight from technological innovations, comes to light.

When organisational leadership agrees to an anticipatory approach to workforce strategy, there firstly needs to be the acknowledgement and preparedness for the systemic and institutionalised components of an organisation to be challenged (perhaps for the first time). To consciously consider a foresight-driven approach to workforce strategy, agreement is needed for a leadership commitment and a mindset shift around the concept of the power, or place, AI has in organisational leadership.

Traditionally, AI and other augmenting technologies is seen to be the servant or tool to the "worker", and the plausibility of AI being leader or director existent only in the realm of science fiction [26]. With AI having more processing power and broader scalability to many more applications and industries, there is a legitimate scenario—validated by participants in this research—wherein human leaders can choose to take a subservient role to the A-Led (i.e., the "no human", "human cooperative (shared leadership)" or "human augment" scenario approaches). This reality of AI lead will be possible only when confidence is reached in AI programming, and error detection is robust, or the evolution of AI reaches a tested and trusted level of sentience [18].

Workforce strategies in organisations are typically developed separately from digital strategies. They are often reactive in nature and bounded by shorter term planning horizons. There may be a detailed and more mature architectural blueprint for digitisation, automation, AI and process aspirations, but not a corresponding workforce strategy overlay that maps against technological architectural shifts and the corresponding workforce shifts this may enable over time. It is like the strategic target operating model and roadmap for the organisation has "*blind spots*" and is not collectively conscious to the now or the future possibility [27]. A generic statement about ethical use of AI by leadership may be in place, but an economic driver linked to a profit value chain is often still the heavier weight in decisions, rather than a wholistic, ethical, environmental, socio-cultural or humanitarian driver [11,17]. It is the space "between" these domains and human experience where the energy and key to adaptation lies [2,20,28].

The other key component to anticipatory workforce design process is how to determine the ideal Human to AI workforce ratio, using a broader definition of complexity rating for function/process. Common organisational approaches to workforce design typically are either linked to industry-recognised ratios [20–22], or a reference class of organisational data based on previous models and performance levels [23]. What is anecdotally understood from practice is that often,

financial limitations and an overlay of technical competency required are the main drivers, rather than relational, governance or behavioural complexity. Workforce design teams then use either quantitative or qualitative methods that vary in formality, participation and subjectivity. Functionally, with the inclusion of AI, it is likely that there will be a smaller ratio of Human to AI, as targeted AI utilisation manages more of the less complex transactional process. This will allow the human worker ratio to either shift in scope to take on and be upskilled in new functions in innovative or high personalised areas of service offer; to "manage or maintain" the AI transactional worker; or be displaced from the organisation.

The five core scenarios explored via the Futures Wheel employed in this research were set in the future. In 2040 there would be different decision criteria and workforce design approaches to match the evolving conditions. Ideally, an approach would aim in reaching the best value balance of "leader" versus "transactional" worker (either human or AI) to honour core commitments such as the sociological, economic, environmental, ethical and humanistic macro themes that were highlighted in this research. Regardless of the human AI ratio, there are broader ethical issues decisions makers need to consider, including real or perceived discriminatory practices, personal harm as a result of unchecked changes and broader economic ramifications (positive or negative). One example of a developing anticipatory workforce design process that uses key trends, or macro, is outlined in Fig. 4:

This model was created as a result of this research, and creating a way to extend the macro themes as a form of impact analysis. The model was also informed from the lived experience and ontology of the researcher, who through reflective practice has determined a new model for anticipatory strategy making. The model is intended to be used as an alternative to automation strategy processes that typically don't have a blend of adaptation and futures knowledge domains. It would be perfectly suited as part of future focussed strategic planning workshops and as an augmentation to portfolio prioritisation processes. Early indication of the use of this model in government and non-government contexts by the author is showing promising results confirming not only the integrity of the approach, but it's flexibility in different industry and project complexities. The key is the preparation of the base information, and then an open "futures mindset" in a broad set of participants (including leader, manager, worker, AI specialist, industry subject matter expert, change agent and user representatives). A circular model of learnings that flow both up and around the model (more of a circle than the linear process identified in Fig. 4 for descriptive purposes).

This research has already identified that user preferences of what AI "will not" be applied to assist in the scoping of incremental experimentation and deployment [28]. Further work is being investigated to unpack the operational model changes required to build broader definitions of diversity that would underpin an "AI and Human Cooperative" scenario.

6. Conclusion

During the course of writing this article the COVID-19 pandemic forced a shift in consciousness and culture within many organisations. This pandemic and the flow-on effects have created, not only a global crisis that has far reaching implications, but a global opportunity to consider what the future scenarios for human safety, work and income support could look like. AI is a vital driver of the next wave of automatisation of Industry 4.0. This global crisis has made original outliers such as the scenario of "AI-Led (no human)" a more plausible option for the shorter term, given the need to keep humans safe from harm and possible life-threatening exposure. Consider the challenges faced by front line medical staff, vaccine developers racing for a feasible solution, age care workers, schoolteachers and even the meat packing industry, with the pandemic spreading among its workers. On the one hand, workers risk their own and their family's health by continuing in front-line roles, since they do so in proximity with others, while their very existence depends on the money they earn and, in some countries, for their employer-provided health insurance.

Many organisations during the pandemic, including those in which the participants involved in this research were employed, have had to rapidly implement virtual home working arrangements, or have lost employment due to changing priorities, or needed to navigate new online systems. All these factors are now a prime data source for AI domains, including natural language processing, machine learning and predictive intelligence. It is likely many surviving organisations—and therefore employers—will seize the opportunity afforded by the pandemic to change the Human to AI ratio, seeking to maintain productivity through reductions in at-risk labour when things return to some measure of "normality".

It is acknowledged that not every possible consequence could be identified within the time restrictions in the workshop setting. This article explored the implications of potential futures organisational scenarios looking forward to 2040, using five Human to AI ratio balances. The article used highly participatory futures research/futures thinking as its basis and covered areas of work related to adaptation, organisational and—more generally—societal contexts, working life

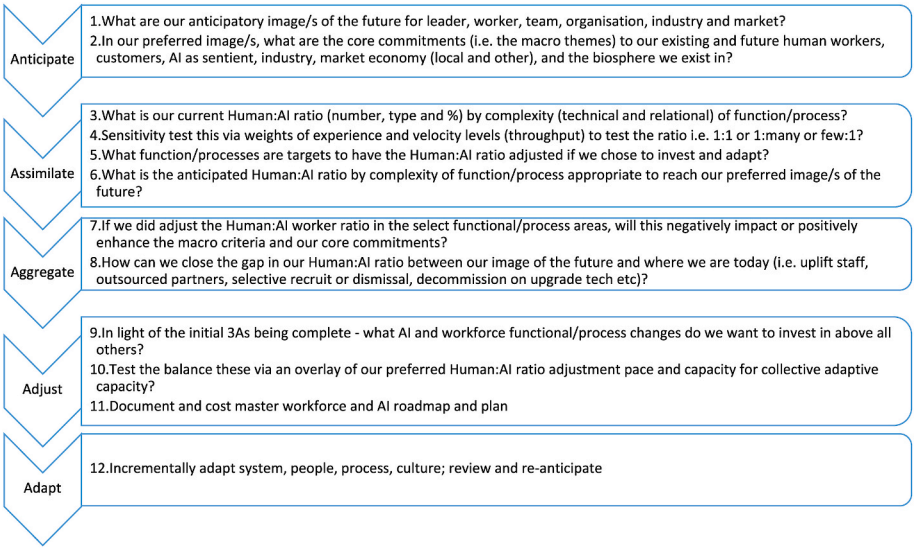

Fig. 4. 5As *Model - Anticipatory Workforce Design Process.*

Image 1. Examples of original futures Wheel's generated (AI centric (no human)).

and people's well-being. It has expanded a discussion of its exploration of the findings of a series of scenarios of future AI use to consider possible existential risks. The findings revealed a number of negative aspects to AI across the five scenarios and these are important for organisations to consider in not prior their prioritisation of AI investments, but also during the course of the implementation and adaptation approach. The negatives identified can be managed out through a deliberate and active risk management approach.

As in all qualitative research processes, there are limitations within the research to be outlined that can focus areas for future research in the organisational AI application space. Firstly, the research was based on gathering information from participants who were from varied organisational environments. Thus, some unique organisational cultural norms, power structures and possible bias from previous exposure to AI may have influenced individual perspectives. Given a large proportion of participants were from local government settings and the remainder predominantly from academic and private sector organisations, there may have been a bias in response to those from local government and/or public policy settings.

Through this research, the Futures Wheel proved to be a flexible methodology that could be applied in a time-boxed, agile manner to generate concepts typically missed in generic, current-state impact analysis processes. There are opportunities for the AI workforce and corporate strategists to take a longer-term view of organisational design, rather than a project-by-project impact; a wholistic approach to foresight-driven strategy that becomes an embedded cultural and conscious process which includes:

- space to deliberately discuss the effects of AI on organisational operating models and agree on the positional power of human and AI (neutral, led, augment or cooperative);
- futures mindset and the ability to determine the appropriate Human to AI ratio for specific functions and process lines;
- opportunities to enhance the connection between internal and external aspects of an organisation's ecology; and
- models of organisation needed to keep a place for the warm, relational and social interaction, communication and empathy humans enjoy.

Enabling people to consciously participate in a future-making process was a key epistemological orientation of this research. Organisations defining their future strategy can ensure positive adaptation via building a culture where diverse involvement, creative space for scenario analysis and a fully-conscious adaptation strategy is the normal and ubiquitous part of organisational futures making.

Appendix A

Actual Prioritised Consequences to Avoid and Amplify by Operating Model Scenario.

Human Centric (No AI)		Human Lead (AI Augment)		Human and AI Cooperative	AI Lead (Human Augment)	AI Centric No Human
Consequences to Avoid (n:23)	Consequences to Amplify (n:16)	Consequences to Avoid (n10)	Consequences to Amplify (n:7)	Consequences to Avoid (n:13)	Consequences to Avoid (n:15)	Consequences to Avoid (n:19)

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(*continued*)

Human Centric (No AI)		Human Lead (AI Augment)		Human and AI Cooperative		AI Lead (Human Augment)		AI Centric No Human	
Consequences to Avoid (n:23)	Consequences to Amplify (n:16)	Consequences to Avoid (n10)	Consequences to Amplify (n:7)	Consequences to Avoid (n:13)	Consequences to Amplify (n:11)	Consequences to Avoid (n:15)	Consequences to Amplify (n:8)	Consequences to Avoid (n:19)	Consequences to Amplify (n:11)
					Consequences to Amplify (n:11)		Consequences to Amplify (n:8)		Consequences to Amplify (n:11)
• High monetary cost per transaction (7)	• Grow the localised economy and capability (3)	• Bias in decision making and data that comes from emotion over logic or algorithm errors (2).	• The expansion of reflection time on lessons learned	• Blind reliance on AI (2)	• Reduced stress leading to better quality of life (2)	• Limited and wrong decisions being made (2)	• Different tiers of service	• Loss of emotional or empathy in service or decision (3)	• Better use of data driven tactics in decision making
• The annihilation of mental health (3)	• Greater learning opportunities in cross disciplinary areas (3)	• Displaced employment groups with broader impact (2)	• The decisions made in consideration of human impacts	• Errors and unknown mistakes (2)	• The place and value of each agent's contribution (3)	• AI dictating direction	• Improved efficiency	• Technical errors (3)	• Greater technical possibilities
• The stagnation or loss of innovation that leads to companies being out of step with industry partners (2)	• Choice for the customer being maintained during transition – you can be served by a human (2)	• Lack of diversity in perspective if AI is given too much credibility over human sense making (2)	• An extended and greater accountability	• Moral responsibility forgotten (2)	• More free time due to better balance (2)	• Power is placed in the hands of only a few.	• Faster and informed decisions	• Broader social consequences – no jobs, crime and poverty (3)	• Increased/ improved life balance
• The impact on maintaining wages due to the more labour intensive nature of these services (2)	• The push towards full employment for all those who wanted work, with choice, dignity and control for those who did not want to work or were unable to.	• The reduction of human connection and disadvantages this brings compared to greater financial results e.g. health care	• AI gives a set of choices, but human makes the final call	• Harder to identify leaders	• Better balance in decision making (2)	• Different effect than intended	• Cost Saving	• Loss of personal interaction (2)	• New industry of workers
• Over bureaucracy and the reduction of employee engagement (2)	• Acknowledge humans need connection for deeper spiritual purpose	• Laziness of humans relying too much on AI	• The ability to scale widely due to efficiencies gained	• Human memory impacted	• Customer satisfaction increased	• A reduction in human skills	• Logical decisions	• Confusion about what is human (2)	• Safety for humans
• Lagging of performance leading due to reduction in agility leading to reputational damage (2)	• Boutique Human centric operational models	• Lack of time to reflect, test and validate	• An error reduction mentality	• The loss of innovation	• Able to progress a greater quantity of work	• The loss of the judgement call	• Safety for humans	• No money or income stream for humans	• Improved cost of living
• Cost of service making service more inequitable and not meeting diverse community needs	• The ethical control required to maintain human centred service	• Unhappy customers	• Mechanisms for peer review and assure quality	• Lack of natural decision making		• Bad data consequences	• Job satisfaction	• Bias encoded	• Process and cost efficiency (cheaper)
• A reduction in creative opportunities for human workers due to heavier	• More room for human creativity and learning opportunities (either			• Questions on who to blame		• Chaos	• AI reduces risk/ improves human life	• Loss of market	• Uniform and faster decision making

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(*continued*)

Human Centric (No AI)		Human Lead (AI Augment)		Human and AI Cooperative		AI Lead (Human Augment)		AI Centric No Human	
Consequences to Avoid (n:23)	Consequences to Amplify (n:16)	Consequences to Avoid (n10)	Consequences to Amplify (n:7)	Consequences to Avoid (n:13)	Consequences to Amplify (n:11)	Consequences to Avoid (n:15)	Consequences to Amplify (n:8)	Consequences to Avoid (n:19)	Consequences to Amplify (n:11)
transactional activities	individually or in collective groups)								
• Challenges to attract staff compared to other organisations where humans do more value adding work	• Company reputation of maintaining a human only service offering			• Increased risk of bias, skewed input output		• No bake off (social interactions at work)		• Artificial governance	• New structures needed - governance could be global
• Operational models that bring negative effects to the environment including additional waste	• Better decision making based on ability to read nuance			• How to handle unplanned leave		• Less human collaboration		• Robotic existence	• Policies to ensure improved role for emotion
• Impacts on human workers due to limits of rest and vacation or time with family.	• More face to face interactions with worker and customer satisfaction and happiness as a core to the value chain					• Breaks dependencies - what happens with AI failure		• Brainwashing outcome voting	• Humans become self-actualised
						• Risk to human life • Legal framework may be unclear • Greater class distinction based on Digital Intelligence			

Note - The list includes 133 *actual* participant worded responses with a number indicating where matching items have been amalgamated (these are indicated with a number in brackets of times identified).

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