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Technology Boom(ers): How US Multinational Technology Companies Are Preparing for an Ageing Workforce

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Abstract: This study addresses a lack of knowledge of how US multinational organizations are preparing for an ageing workforce. The study took the form of a qualitative multiple-case study, comprising in depth semi-structured interviews of senior managers in target companies selected through purposive sampling. The study used institutional theory and dynamic capabilities theory as theoretical frameworks. The findings of the study imply that there are still no rigorous processes in place to support the contribution of older workers to the success of the organization, that legislative compliance is a key current focus, and that considerations of intersectionality between age and other aspects of diversity are emerging. These findings suggest recommendations for practice that are related to the transparency of age-related data, implementation of considered recruitment and retention strategies for older workers, and the direct involvement of older workers in technological product and service development.

Keywords: ageing workforce; diversity; information technology; multinational

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1. Introduction

The proportion of the world's population over the age of 65 will increase from nine percent in 2019 to 16% by 2050 (United Nations 2019). Policy makers (Organisation for Economic Cooperation and Development 2006, 2019) are focused primarily on enabling people to live and work for longer to maximize the economic benefits. While research is emerging regarding the impact of working longer on society (Taneva et al. 2016), it is generally focused on managing the negative implications of individual ageing (Henkens et al. 2018) or the economy (Nagarajan et al. 2017). There are relatively positive perceptions of older workers (Munnell and Wettstein 2020).

Regulatory approaches to the age-diverse workforce vary widely according to social and cultural norms (Cebulla and Wilkinson 2019). Discussions on ageing in the literature focus on traditional industrial and manufacturing industries, with some implications for the technology sector emerging (Giakoumis et al. 2019). Predominantly, research on technology-related workforce issues has focused on the impact of process automation (Berger and Engzell 2020; Morgan 2019).

Definitions of ageing and the "older" worker vary. Chronological age is most often used, with "older" defined variously as anything from over 45 years of age to 65 or older. Intersectional research is emerging and takes into account multiple factors that contribute to the complex issue of ageing (Spedale 2019).

A meta-analysis of the rankings of innovative companies identifies information technology companies headquartered in the United States of America (USA) as leaders in innovation (Lichtenthaler 2018). There is a mismatch between the perception of technology companies as sources of innovation and the demographics of innovators. Innovators are at their peak between the ages of 46 and 50 years of age, with rates of innovation remaining high through to the age of 55 years (Nager et al. 2016). The median age of technology employees ranges from 29 to 35 years of age (Statista 2016).

The purpose of this qualitative, multiple-case study was to answer the research question, "Why are large information technology companies headquartered in USA and trading internationally missing the opportunity to capitalize on the potential and performance capabilities of older workers?" For the purposes of this research the OECD definitions of an older worker as someone over the age of 50 was used (Organisation for Economic Cooperation and Development 2006).

This study was framed by institutional theory (Meyer and Rowan 1977) and dynamic capabilities theory (Teece et al. 1997). Institutional theory frames how information technology organizations are structuring to accommodate the evolving ageing demographic, and was examined in questions related to policy and practice, while dynamic capabilities theory offers the opportunity to complement the organizational view with a perspective focused on the individual resource level, which was examined in questions related to perceptions of capability and productivity. These frameworks enable a holistic view of opportunities presented by the potential and performance of older workers, as is summarized in Figure 1.

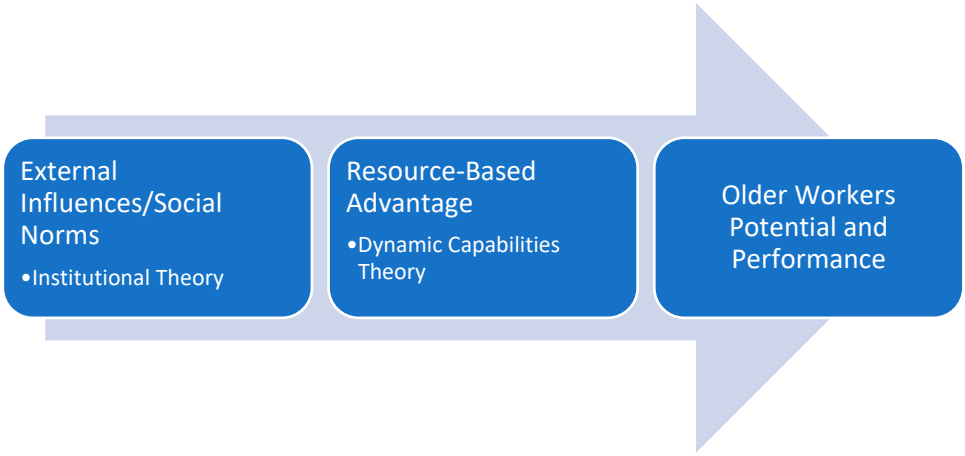

Figure 1. Conceptual framework.

By 2050, the proportion of the world's population over the age of 65 will be 16%, compared to nine percent in 2019 (United Nations 2019). A quarter of the people in Europe and North America will have reached 65, and the number of people above 80 years of age will have tripled to some 426 million (United Nations 2019). The selection of 65 as a key age for conversations about societal aging is in itself arbitrary given the heterogeneity of life experience as people grow older (Bal and Jansen 2015). Many countries are increasing the pensionable retirement age to mitigate the economic and fiscal impact of this shift in demographics (Krekula and Vickerstaff 2020).

The economic costs are significant, with pension liabilities for a selection of OECD countries estimated to be almost twice their combined national debt (Hanif et al. 2016). The multidimensional nature of the issue has driven disconnected and contradictory governmental responses (Blackham 2017). Similar approaches in different national contexts, even within an economic bloc such as the European Union, have resulted in different outcomes (Schilling 2016). Whilst not generalizable, longitudinal studies of the impact of Japan's ageing population indicate that developed countries can expect a three-percentage point reduction in the fiscal account balance (relative to GDP) for each standard deviation in the growth of the elderly population (Goh and McNown 2020).

Technology's centrality to global lived experiences is disrupting both business and society, leading to a fourth industrial revolution (Schwab 2017). The transformation to digital production leads to technologies that leverage big data such as the "Internet of Things" and artificial intelligence (Oztemel and Gursev 2020). The pace of change in processes and business requires employers and employees alike to focus on upskilling and reskilling (Man and Man 2019), yet there is less understanding of the importance of

knowledge and skills to individual employability in this emerging paradigm (Safrankova et al. 2020).

While multinational enterprises may be slightly better positioned to embrace changes, there are very real opportunities for smaller companies to benefit (Horváth and Szabó 2019). Overall, the inter-relationship between commerce, technology, and society raises questions regarding the relative importance of technology in driving change at the workplace and societal level (Caruso 2018), or to parse the impact of technology from social change generally (Hughes and Southern 2019; Trauth-Goik 2021).

Artificial intelligence (AI) is a key technological trend impacting employment, generally, and in matters of diversity and inclusion. Framing, collecting and analyzing data is imperfect and it is difficult to resolve introduced bias (Hao 2019). The deployment of AI in social services has disproportionately impacted the marginalized (Eubanks 2018). Considering intuitive decision making, AI can be seen as complementary rather than in competition with humans (Jarrahi 2018). While there is some discourse within the discipline of data science on improving inclusion (Geiger et al. 2019) further progress is required.

Most multinational technology companies focus on diversity and inclusion, although evidence is mixed as to the impact of this focus (Velinov 2019). There is little peer reviewed research regarding the impact of ageing within technology organizations, with industry publications (ITPro 2019; CWJobs 2019) using content analysis of public discourse as a proxy. Age has not been included in the contents or results of surveys such as the "Stack Overflow Developers' Survey" (Stack Overflow 2018), although this research does reinforce the importance of initiatives that reduce bias (Kohl et al. 2019). Analyses tend to have limitations including focusing on perceptions of ageism related to specific roles or geographies. Nevertheless, they offer a reasonable starting point to understand practical perception (Visier 2017).

Terminology such as "digital native" differentiates generations and implies competence, acting as an age qualifier that restricts the ability of older people to compete for work in this sector (Sink and Bales 2016). The lack of focus on age in the technology industry stands in stark contrast to the leadership position these companies have taken regarding other aspects of diversity and inclusion (Amazon 2020; Microsoft 2020). A focus on neurodiversity, for example, demonstrates how these organizations can have a very real impact. This example is particularly relevant as organizations are advocating using a social, rather than medical, perspective (Loiacono and Ren 2018).

Recent research indicates that software developers are considered old at age 40+, with a maximum age of 50+—considerably below the typical retirement age. Worry about being too old to work in the software industry was found to be common across age groups (Baltes et al. 2020). A multinational study of IT employees found that employees faced age-related assumptions that prevented them imagining a career that extended past their fifties (Brooke 2009).

Age bias in the software industry begins at recruitment, where a focus on code-writing capabilities drives bias towards youth while neglecting the value of real-world experience (Behroozi et al. 2019). The latest coding trends trump experience in software development (Baltes and Diehl 2018). The disconnect between those building technology experiences and those using them has real world consequences. It is posited, for example, that the relatively low usage of digital public services by older people is down to the mismatch with what younger designers assume older people want and need (Jarke 2021). The use of AI to automate hiring may help eliminate bias if not perpetuated in code (Ozkazanc-Pan 2019). Nevertheless, it seems that demographics will win out in the end, with the number of developers aged above 55 years in the USA doubling in the decade after 2010 (U.S. Bureau of Labor Statistics 2020).

Outside of engineering, there are indications that the move to the fourth industrial revolution is driving a shift to increased consultancy/human interactive type roles (Eberhard et al. 2017). There is little literature on the lived experiences of older workers using technology in workplaces where information technology is key (Francis-Pettway 2019).

A number of methodologies to assess the age friendliness of workplaces have been posited. A recent example, the "Workplace Age-Friendliness Measure", uses a 24-item scale. The authors acknowledge that a current limitation of such scales is that they are only developed effectively when the workplace already has a significantly age-diverse employee base (Eppler-Hattab et al. 2020). While age-related data for major technology organizations is difficult to find, it seems that Amazon, Apple, and Google, for example, skew noticeably young in their workforce compared to longer established companies like Microsoft (StatSocial 2020).

2. Materials and Methods

Case-study research is indicated where there is a "why" research question related to uncontrollable contemporary events (Yin 2017). Case studies have proven valuable in research focused on practice (Starman 2013) and has the ability to deliver strong conceptual validity and examine causal mechanisms (George and Bennett 2005). As there is limited, fragmented research on successful ageing at work (Kooij et al. 2019), a multiple-case study design was chosen to enable analysis across and within settings (Baxter and Jack 2008). This design is considered to produce robust, compelling results (Herriott and Firestone 1983) with substantial analytic benefits (Yin 2017). Deciding an appropriate sample size in qualitative research can come down to the judgement of the researcher (Malterud et al. 2016). In this study, sampling continued until saturation was achieved (Boddy 2016; Calder 1977; Guest et al. 2006), which was after eight interviews.

Managers in USA-headquartered global technology companies with more than 3000 employees comprised the target population. Convenience sampling, specifically snowball sampling was the selected approach. The inclusion criteria for this study were organizations (i) whose main purpose is the creation and provision of technology-based services; (ii) headquartered in the USA and trading internationally; and (iii) with more than 3000 employees. The inclusion criteria for employees considered for interview as proxies for the organization were individuals (i) holding senior manager positions, such as team leaders or heads of department and (ii) holding a role with specific accountability for employee experience, such as HR leads, or diversity leads. Candidates who did not meet at least one of the criteria specified were excluded.

Research participants were recruited from the researchers' professional network and subsequent referrals. Semi-structured interviews were used in the expectation that preset open-ended questions would enable valuable dialogue with the interviewee (DiCicco-Bloom and Crabtree 2006). An interview protocol was the instrument of data collection, and it was designed and implemented in a manner that satisfied the eight "big tent" quality criteria for qualitative research (worthy topic, rich rigor, sincerity, credibility, resonance, significant contribution, ethics, meaningful coherence) (Tracy 2010). There were two parts to the protocol: the demographic section was designed to capture information about the participants and their organizations, including individual gender, age group, education level, role, tenure and organizational size, geographic scale, and (where available) the proportion of employees over 50 years of age. These data were captured to validate participant suitability for the research and to evaluate any potential for bias. The second section consisted of six primary open-ended interview questions together with six probes, which allowed the respondent to discuss topics including their organization's awareness of the context of the ageing workforce, the challenges and opportunities this may present, perceptions of the capabilities of older workers, policies and practices in place to maintain productivity, and the impact of the regulatory environment.

Sources of data, including company records and diversity reports were reviewed in conjunction with the interviews to clarify meaning and context. Methodological triangulation involved observing facial expressions and body language in interviews where video was used to help interpret strength of feeling. The combination of these practices increased our confidence that perspectives had been rendered accurately (Yin 2017). Transcripts of interviews together with field notes were coded and organized using NVivo12.

Word frequency analysis and node matrices contributed to thematic analysis. This analysis generated meaning across the entire data set, whilst still enabling an in-depth examination of key phenomena (Braun et al. 2014). A detailed description of the research process, the triangulation of data with existing sources, and member checking contributed to the credibility and dependability of the research findings (Curtin and Fossey 2007). Transferability was enhanced by leveraging theory to broaden the context (Kuper et al. 2008).

Qualitative research assumes that reality is subjective and contextual (Velez 2008), and on this basis, the researcher assumed that the methodology used was appropriate to the purpose of the study. A supplementary assumption was that the design and implementation of the chosen methodology, the research instrument, together with the analysis process undertaken enabled an effective exploration of the results relevant to the research question. Based on the interview results, it was assumed that the sample size was appropriate to reach saturation (Boddy 2016). It was also assumed that respondents were suitably qualified, and provided an honest and accurate representation of how their organizations were preparing for an ageing workforce.

Replication of this study would be difficult due to the specific setting (in person virtual setting), and the fact that the researcher had access to a limited number of people and incomplete data (Bloomberg and Volpe 2018). The method employed did not rule out alternative explanations or produce causality, and so findings were not generalizable (Goes and Simon 2017). This study did not seek to reflect the individual participant's impact on the research topic concerning itself with the organization as the unit of analysis. The study did not attempt to include representatives of all employees and stakeholders of these organizations but focused on participants who could reflect their companies' positions on the topic. The study did not attempt to present a global perspective, focusing only on US-headquartered technology organizations.

3. Results

Interviews were scheduled and performed as planned. All interviewees were fluent in English. Saturation was reached at the eighth interview as from then on, no new information was revealed. To protect anonymity, a unique identifier was issued, sequenced from P1 to P8. The demographic information is captured in Table 1.

Table 1. Participant and company demographics.

ID	Gender	Age Group	Education Level	Role	Years in Role	Number of Employees	Countries
P1	Male	40–50	Graduate Degree	Director Global D&I	6	175,000	100+
P2	Female	40–50	Master's Degree	HR Lead	3	200,000	50+
P3	Female	30–40	Graduate Degree	Communications Director	3	130,000	100+
P4	Female	40–50	Graduate Degree	Executive Recruitment	2	3000	11
P5	Female	50–60	Master's Degree	DEI Program Manager	6	50,000	80
P6	Female	40–50	High School Diploma	Infrastructure Lead	2	45,000	21
P7	Male	40–50	Doctorate	Partner Development Lead	15	100,000	30+
P8	Male	70–80	Doctorate	Principal Technology PM	18	150,000	10

Five people identifying as female were interviewed, together with three people identifying as male. This gender bias was not considered influential to the conclusions of the study. The youngest respondent was 32 years of age, while the eldest was 72. The majority of respondents were in the 40–50 age category, with one in the 50–60 age category. Overall, this depth of experience qualified respondents to participate in the research. Educational qualifications ranged from high school diploma to multiple doctoral degrees.

Half of the respondents held roles that were directly related to organizational people strategy ("Diversity and Inclusion Director", "HR Lead", "Executive Recruiter", "Diver-

sity", "Global Equity and Inclusion Program Manager"). The remainder held positions with people management accountability in their organizations, with most of these participating directly in regional or global diversity initiatives within their organization. The range of accountabilities indicates that the findings of the research capture a number of differing perspectives. All participants met the required inclusion criteria for this study, and were qualified to knowledgeably represent how their organizations are preparing for an ageing workforce.

Participants' tenure in their current role ranged from two to 18 years, but all respondents had a significantly longer time in their career. All organizations met the inclusion criteria and were sizeable, with a minimum employee base of 3000 and a maximum of 200,000. The average employee count of the organizations was 106,625 people, thus meeting the expectations of a representative population. Only one of the respondents knew or could share the proportion of employees above the age of 50, indicating that discussion of age diversity by the target organizations is less mature than other aspects.

Count and weighted percentages of the top 20 words containing five or more characters were analyzed. "People" was the most used term with 145 occurrences and a weighted percentage of 1.73%. "Organization" and "older" were the second and third most frequently used terms. The primacy of these terms and other top ten terms such as "workforce" and "different" give the researcher confidence that the input from participants was well aligned with the intent and execution of the interview protocol, and that these inputs are relevant to the research question.

Code aggregation produced four themes. These were: "Awareness", "Capabilities", "Policies and Practices", and "Talent Management". These themes were the parent codes, with child codes and references aggregated accordingly. The four themes were present in each of the eight interviews, as can be seen from Table 2.

Table 2. Aggregated code list.

Name	Files	References
Awareness	8	55
Capabilities	8	141
Policies Practices	8	164
Talent Management	8	80

A tree map was generated to visualize the coding patterns and hierarchy. The hierarchy chart shown in Figure 2 represents data presented previously in Table 3 in a more intuitive manner. "Policies and Practices" comprises seven significant coding references, representing 164 text references. The theme of capabilities is more concentrated, with 141 references captured within four different codes.

Cluster analysis offered a means of visualizing the grouping of frequently used words with shared meaning or attributes, which helped the researcher to assess and validate potential themes. Figure 3 shows the high-level output from the cluster analysis.

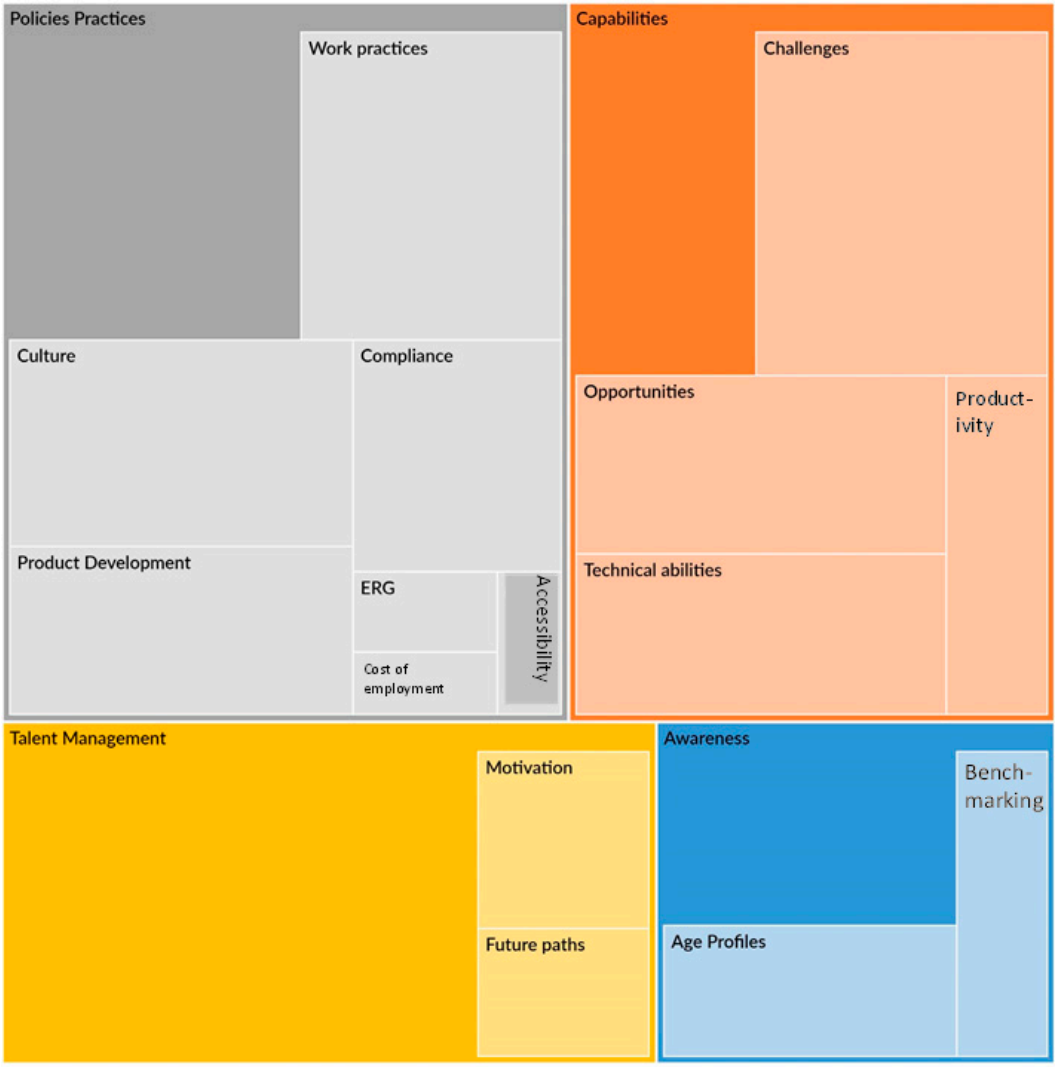

Figure 2. Hierarchy chart—codes and coding references.

Table 3. Expanded codebook.

Name	Description	Files	References
Awareness	**Emerging Theme—Awareness**	8	55
Age Profiles	Knowledge/context of age profile	7	18
Awareness	Organizational consciousness of relevance of ageing	8	24
benchmarking	Awareness, usage of age related industry benchmarking	8	13
Capabilities	**Emerging Theme—Capabilities**	8	141
Challenges	Challenges presented by ageing workforce	7	44
Capabilities	Capabilities of older workers	8	27
Opportunities	Opportunities presented by ageing workforce	7	29
Productivity	Productivity of older workers	7	15
Technical abilities	Technical abilities of older workers	7	26
Policies Practices	**Emerging Theme—Policies**	8	164
Accessibility	Relevance of accessibility efforts	3	4
Policies Practices	Organizational practices relevant to ageing	8	39
Compliance	Age-related organizational compliance	7	21
Cost of Employment	Organizational cost of older workers	1	4
Culture	Organizational culture	8	31
ERG	Employee Resource Groups	4	5
Product Development	Product Development practices	8	25
Work practices	Work-related practices	8	35
Talent Management	**Emerging Theme—Talent**	8	80
Talent Management	Managing older talent	8	66
Motivation	Motivating older talent	5	14

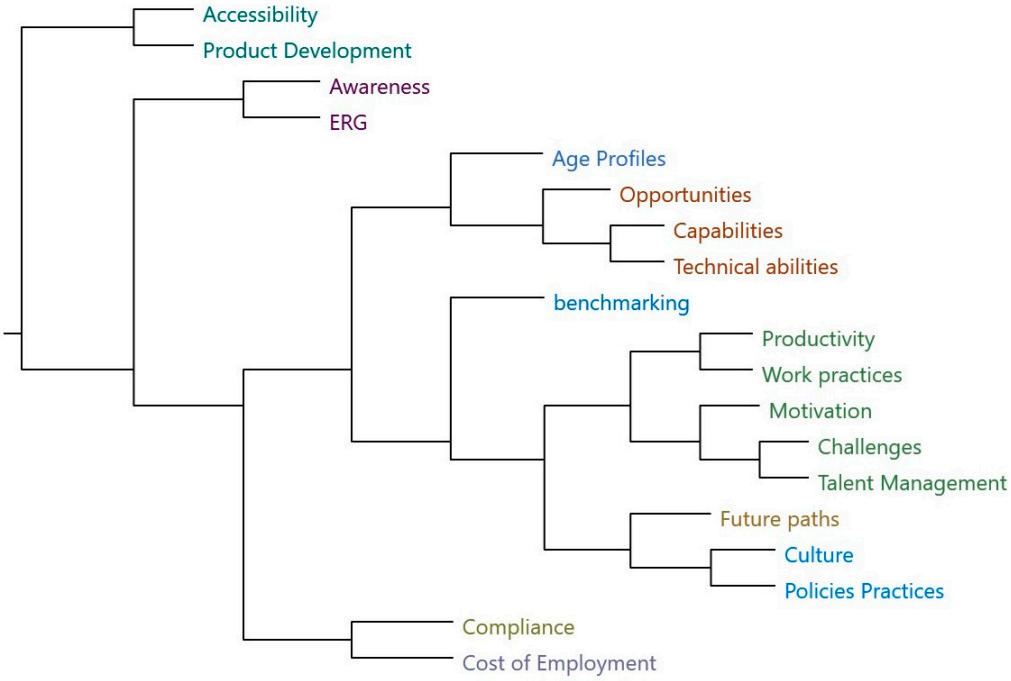

Figure 3. Word cluster analysis.

"Policies and Practices" was the most referenced theme with 164 text references. "Capabilities" was referenced 141 times, with "Talent Management" and "Awareness" referenced 80 and 55 times, respectively. The overall codebook (Table 3) illustrates the components of each theme and taken together, they provide an effective framework within which to evaluate findings.

Identified Themes

- *Awareness:* Generally, participating organizations were aware of the issues presented by an ageing workforce. P7 mentioned "a tremendous awareness, there is a conscious buildup of culture" while P6 spoke of a recent "survey to ask what priorities (the company) would like to see out of inclusion, diversity, and equity initiatives, and last year generational diversity grew from 5% to 35%." P5 identified the impact of location, saying "some of our countries are very young and may be less aware." In contrast, P4 said that age "has never been a conversation . . . there is such a focus on ethnic diversity" while P2 took a broader view and touched on "the dimension of intersectionality," using the example of "older women with families" to illustrate the multiplier effect of different aspects of diversity. P2 had a narrower perspective of age awareness, saying "we do think about it a lot particularly when we think about career development." P8 pointed to a lack of outcome, saying of the organization "they are aware but not actively involved." This was generally indicated by a lack of specific data around age profiles, with only P2 in a position to make an estimate, "about five % of our population is above 50." "Don't know, it's a young company" was a more typical response from P7. P1 said his organization would not "share (the proportion over 50), and I doubt if anyone else will share." P3 said the "numbers of employees who are 50 (are) something I don't have a hard number (for), but I know that a lot of the senior leaders are around that mark," while "the leadership of the engineering teams are younger." P6 mentioned that "a lot of our most senior distinguished engineers would definitely be over 50."
- *Capabilities:* Perspectives varied on the technical abilities of older workers. Organizations "over-index on early-stage talent for technical hiring" (P6). P2 felt that "employees who are less tech savvy . . . tends to be in a certain age demographic." P4 said older workers are "viewed as overqualified" and would have to "unlearn

some things versus somebody younger coming in and we can mold them." P3 lauded younger talent, saying "we celebrate younger engineers for the energy and fire they bring to the practice" whilst acknowledging "the knowledge and experience of the more senior engineers in setting structure and strategic direction." P5's view was that "sometimes we overvalue experience to the point where our younger population feel like they're the ones undervalued." P6 shared that "we hire early-stage high performers, we also hire people with more history that might have been pivotal parts of creating technology." P6 also mentioned "it's not about age, it's about their passion for learning. If you're a passionate technical person, you'll keep learning forever." P5 highlighted that older workers "bring in more diversity of thought" and "promote and contribute to greater innovation."

- *Policies and Practices:* The majority of organizations in this study do not have any specific age-based policies. P7 talked about the organization making "conscious efforts . . . not to do something to any cohort as that's where diversity and inclusion get challenged . . . the benefits are flat and consistent," while P6 spoke about "a very self-service culture." P5 was direct: "We don't have any age-based policies," a view echoed by P4, who said that age-based policy was "not part of the education that I'm receiving." P1 however spoke about the general applicability of "nondiscrimination, bullying, and harassment" policies, and wondered about where the line between "compliance and are we doing the legal thing" is. The culture of technology organizations was seen to be an essential factor in the ageing conversation. P8 observed that "individuals forget about your age and look at your expertise." P6 echoed this thought, talking about the depth of technical expertise of older people, "We have hired people in that age group as distinguished engineers." P6 also mentioned the importance in technology organizations of "seeing around corners (which) is what experience brings." P3 talked about the value of older workers' innovation, citing their importance in "setting structure and strategic direction for where we go in product development," whilst also celebrating "younger engineers more as they have fresh ideas and have their fingers on the pulse of . . . where the world is heading." P8 placed the discussion in a wider context, describing the tension involved in "constant reference to increasing market share amongst millennials . . . they don't think older people have anything compelling to add to that." P8 described a "consensus that the older a customer is the more likely they are to stay with us. There is implied resistance to change." P1 discussed service mismatches in customer service, "people who use retail stores are more my generation, and I'd prefer to speak with someone . . . who doesn't look down on me". Taking an opposite view, P5 said "Our challenge is how do we persuade younger people to use our products even though the population is older." Not all organizations are thinking deeply about the issue, with P6 not having "seen anything specific in how we develop products . . . " while P2 opined that "we can't keep having this notion that there is a one-size-fits-all approach."
- *Talent Management:* Respondents set their thoughts about the talent management of older workers in a broad context. P7 pointed out the impact of the COVID-19 pandemic on organizations' level of workplace flexibility, pointing to "moving away from a mindset of any person can't do the role for any reason, including age." P3 reflected on the personal impacts of COVID-19, talking about the "great resignation . . . especially for older employees . . . there is a lot of reflection that goes on." P6 felt that COVID-19 had led to "people later in career . . . looking for more meaning", something supported by P1 who referred to "a societal moment-in-time change". P3 talked about competitive recruitment strategies, and "competing with startups who are attracting younger talent, so naturally we know that if we're competing for younger talent then older workers look to big tech for opportunities." An organizational focus on ageing may not make a difference to individual decisions: "if we have applicants who are 30 and 57, a manager might make decisions based on trajectory and time left to work in the company." P4 echoed this, saying that older workers "are going to be sunsetting"

and age is "something that's generally not seen as a positive". P1 introduced the issue of cost, whereby the organization could have "two people doing exactly the same job but somebody who is 50 versus somebody who is 18, you have to pay differently for."

4. Discussion

The research question addressed by this study is "Why are large information technology companies headquartered in USA and trading internationally missing the opportunity to capitalize on the potential and performance capabilities of older workers?" The results of the study indicate that older workers are simply less of a priority for these companies than other employee groups. P8's comment that the organization is "aware but not actively involved" fittingly summarizes the situation. This lack of prioritization causes a split focus whereby organizations struggle with career enablement for older workers but have not implemented focused reskilling, and consider age-related policy making solely in terms of compliance.

Organizational confusion about how to capitalize on the capabilities of older workers is clear from study results that indicate this cohort is both too over- and under-qualified to be successful in the modern technology space. There is a belief that age does not impact productivity, and yet there is doubt as to whether older workers can keep up with change. This makes the absence of focused talent management notable, whether in regard to internal career movement or the fact that age is seen as a negative for external job candidates.

Inclusion and engagement of the older cohort is seen as less important than other cohorts, as expressed by P4, age "has never been a conversation" due to the "focus on ethnic diversity." Most organizations in the study did not have meaningful age-related statistics to share, and were not actively benchmarking against industry peers—this is dramatically different to measures of gender or ethnicity for example, which are actively managed and published industry-wide. It is also possible that a focus on age is assumed due to intersectionality with issues such as gender.

The findings of this research support previous findings that age and life course do not receive the same focus that issues of gender, race, or class do (Amis et al. 2018; Holman and Walker 2021). Technology organizations delegate career planning and personal development to the individual regardless of age, creating a risk that older workers fall behind as the pace of technological progress increases. While the need for structured career planning for older technology workers is recognized, few organizations have taken steps to implement it. USA-headquartered technology organizations view age primarily as a compliance issue, in line with the expectations of institutional theory (Meyer and Rowan 1977) and are reluctant to publish age-related data outside of what is demanded by legislation. While respondents offered mixed perspectives on the technical abilities of older workers, organizations are exploring opportunities to use experienced employees for strategic product planning and mentoring across generations. Organizations are missing the chance to optimize product development capabilities by consistently involving older workers, which previous research has demonstrated to be suboptimal (O'Connor 2008).

From a practical perspective, gathering available and meaningful data may help move organizations towards actively enabling and empowering the older workforce. The majority of respondents did not have meaningful age-related statistics to share (P1, P3, P4, P5, P6, P7, P8), nor did most organizations actively benchmark age against similar companies (P1, P2, P4, P5, P8). It is therefore not surprising that organizations do not have specific age-related internal practices. The clarity on the need to comply with external regulations, even given the complexity of meeting different regulatory benchmarks around the world, implies that the issue of ageing is managed in line with legislation rather than an opportunity for competitive advantage.

Organizations should remove age bias at the recruitment stage in the technology industry, particularly for engineering resources, as shown by a tendency to "over-index on early-stage talent for technical hiring" while older workers are "viewed as overqualified." P3 celebrated "younger engineers for their energy" while P7 spoke of the need to

harvest information from older workers before they leave. This implies that the technology industry experiences a level of similarity bias towards younger people, despite the overall demographic shift towards ageing. P1 and P5 both identified gaps in service and product development due to a generational mismatch between provider and customer.

Recommendations for practice would be for organizations to measure, report, and subject issues related to older workers to the same standards applied to other aspects of inclusion. Most respondents pointed to a lack of internal or benchmarking data related to older workers, and diversity reporting in major organizations continues to neglect issues related to age. Additionally, the talent management functions of technology organizations should define and implement recruitment and retention strategies for older workers. Creating an environment where "individuals forget about your age and look at your expertise," (P8) while enabling a more transparent view of the skills profile and career pathways for older workers, would begin a process of removing negative stereotypes. Enabling people to "explore second or subsequent careers" (P3) may address worries that "we have less paths as people get older." (P6)

The limitations of this research include the difficulty of replicating the study due to the specific setting (in person, virtual setting), and the fact that the researcher had access to a limited number of people and incomplete data (Bloomberg and Volpe 2018). Not all of those identified as qualified respondents were willing to participate in the research, with company confidentiality being the main reason cited. Assurances around individual and corporate confidentiality enabled some to participate. Complete methodological triangulation (Bell et al. 2018) was not possible as some respondents did not wish to use video during the interviews. The multiple-case study method employed did not rule out alternative explanations or produce causality, and so findings were not generalizable (Goes and Simon 2017). The potential sensitivity of the research topic created a potential limitation related to socially acceptable response bias, but the researcher considered this a minor limitation as the questions and conversation were targeted at the organizational policy rather than personal competence level (Van de Mortel 2008).

Future research would address the lack of generalizability inherent in the case-study method through a quantitative follow-up research effort. A broad survey aimed at a greater range of technology organizations worldwide would enable the generation of a standardized view of the individual and organizational impacts of an ageing workforce. This would allow for generalization to a larger population. An understanding of the impact of the intersectionality of age with other dimensions of diversity would be highly beneficial in developing relevant policy recommendations. An additional avenue for the future would be to broaden the research to include the technology-startup environment and identify whether early-stage technology innovation benefits from the involvement of more experienced workers, as suggested by previous research (Nager et al. 2016). Such research would also complement previous research in providing data on the pervasiveness of age discrimination within technology recruitment (Behroozi et al. 2019; Kulik et al. 2016).

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