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Build Back Brainier: Base Policies on Brain Science

This chapter presents a conceptual asset, Brain Capital, to inform novel policies. The concept builds on previous work, the Brain Capital Grand Strategy, that considers Brain Capital in all policies and offers a comprehensive investment plan and the development of an index or a dashboard. The premise, enablers, and barriers towards a Brain Capital Building Policy Agenda are outlined. Engagement with communities is proposed, and approaches for educating policymakers are described. Brain Capital building policies should be considered in sectors such as human development, migration, gender issues, social justice, multi-cultural affairs, economics, protections, and international relations. Novel approaches for public investment including brain bonds and social impact investing are considered.

Introduction

Five of the top ten causes of disability in the Western world are brain disorders resulting in mental suffering (Economist, 2018; Whiteford et al., 2013; AARP, 2021). Additionally, 75-95 % of people with mental disorders in low- and middle-income countries are unable to access mental health services. (UnitedGMH, 2021; Vigo et al., 2019; Liu et al., 2020; Rehm and Shield, 2019). These types of brain-based issues are not actively considered in our modern economy and have seen very little policy development and investment (Eyre, Ayadi, et al., 2021; Ellsworth et al., 2021). In contrast, they are often major drivers of governmental spending to ameliorate their societal impacts (e.g. the costs of dementia care or substance use disorders). Moreover, they are critical to unlocking latent workforce capacity and skills, such as creativity (Glaveanu, 2020). Many current approaches are siloed within individual fields. Technologists are building new solutions without clinical inputs; clinical stakeholder groups have overlapping and sometimes competing agendas (e.g. psychology, psychiatry, neurology); economists have not considered how brain health issues can reduce productivity; and new care solutions are not effectively translated between high-, middle- and low-income settings. Integrated and harmonised public policy solutions are needed to ensure that otherwise unconnected stakeholder groups are moving in the same direction. A Brain Capital Building Policy Agenda aims to address and remedy these issues.

Brain Capital prioritises brain health and brain skills in the economy (Smith, Ali, et al., 2021; Smith et al., 2021; Eyre, Ayadi, et al., 2021). It is a reflection of a country's wealth; it affects a person's quality of life and the way they are able to contribute to their society. The 21st century "brain economy" is predicated on the increasing demand for advanced cognitive skills (Eyre, Hynes, and al., 2021). It is an economy where innovation is a tangible deliverable of employee productivity (Smith and al, 2021). However, this is also an economy where brain-based issues (e.g. spread of misinformation, psychiatric and cognitive disorders) are increasingly impacting on productivity and wellbeing and the stigma of these disorders persist in far too many communities. This brain economy is currently impeded by the widespread impacts of Covid-19 on our central nervous system (CNS) (i.e. chronic stress and the known neuropsychiatric and cognitive issues associated with long haul Covid-19), which creates mood changes and brain fog (Mendez et al., 2021; Rogers et al., 2021). Such an impediment of a brain economy will likely be magnitudes higher with accelerating likelihood of "systemic shocks" e.g. viral, climate, and financial.

In the brain economy, despite the challenges outlined, neuroscience discoveries and insights are accelerating and opening new opportunities for understanding and remedies. Brain health as a life-long, multidimensional, dynamic state consisting of cognitive, emotional and motor domains underpinned by physiological processes can be objectively measured and subjectively experienced (Eyre, Berk, Cummings, et al., 2021; WHO, 2021; Chapman, 2013). It is influenced by eco-biopsychosocial determinants. Brain health is also defined by minimised risk and disability due to psychiatric and cognitive disorders. Brain skills incorporate not only logical but also emotional, social, cultural and spiritual intelligences. They are the underpinnings of resilience and adaptability, which are critical in our societies where economic and societal shocks are expected to increase in the future (be they financial, pandemic-induced or climate-related) (NAEC, 2019, 2020; Klasa et al., 2021). Other key brain skills include literacy, numeracy, and different forms of intelligence.

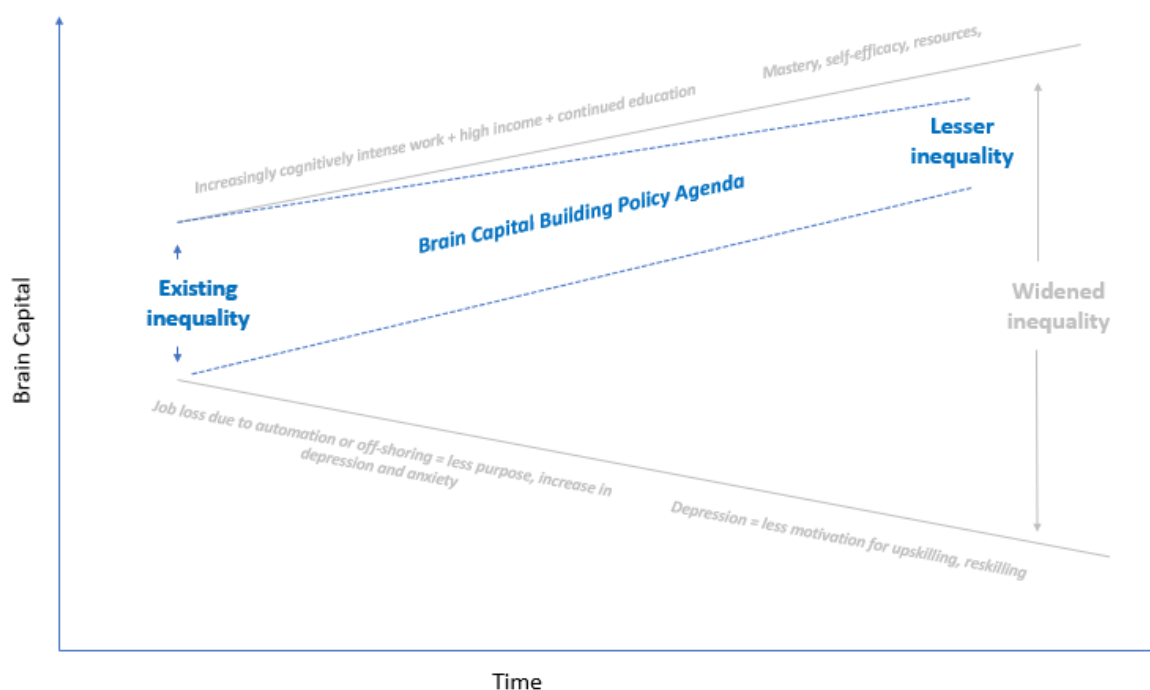
If we build Brain Capital, then other social and economic factors will potentially improve. The relationship between social factors and brain changes is bidirectional and an ongoing and active conversation amongst public health scholars, health care professionals, and scientists (The, 2021). Brain Capital is intertwined with overall health, longevity, and economics. Recent research has highlighted the importance of social determinants of health such as social isolation and loneliness versus social connectedness and compassion (Allen et al., 2014; UN, 2021). As articulated by the United States (US) Surgeon General, Dr. Vivek Murthy, and others, loneliness and social isolation impact physical and mental health as well as brain function as much as, if not more than, traditionally recognised risk conditions including smoking, obesity, substance use, hypertension, and sedentary behaviour (Murthy, 2020; Bzdok and Dunbar, 2020; Torrente

et al., 2021). Social connection is crucial to human development, health, and survival. There are perhaps no other factors that can have such a large impact on both the length and quality of life, from the birth to end of life (Holt-Lunstad, Robles, and Sbarra, 2017). Loneliness increases the risk of dementia and dementia increases loneliness, highlighting a pernicious relationship between brain health and social factors (Jeste, Lee, and Cacioppo, 2020; Blazer, 2020). The economic impact of loneliness was illustrated by United Kingdom (UK) Prime Minister Theresa May's decision in, 2018 to appoint a new "Minister for Loneliness" in order to assess and reduce business losses resulting from loneliness among workers (Gov.UK, 2021). Japan also appointed a similar minister in, 2021.

Our cognitive capacities are not a given and can be shaped in the course of our lifetime, in particular during childhood when brain plasticity is at its peak. During infancy, vulnerability and poverty compromise several aspects of neurocognitive development and language, two important predictors of later success in school and the labor market. Therefore, we are buoyed by US President Biden's planned human infrastructure agenda, which will boost childhood brain-based skills (Behrmann, 2021). This is aligned with our proposed Brain Capital Building Policy Agenda. US-based investments are proposed in childhood poverty reduction, universal pre-kindergarten, and a national paid leave program. If funded and executed well, these large-scale programs will facilitate early childhood brain development (Noble et al., 2021). Several governments have already invested heavily in research to explore the promise of such programmes, like the Neurons to Neighborhoods project and Baby's First Years (Council, 2012; Noble et al., 2021), so we hope policy influencers around the world take note of these approaches (Smith, Hynes, et al., 2021).

We suggest there is a current "Brain Capital Gap" occurring at different levels: within populations and between populations and society. Current inequalities will be exacerbated with the status quo. That is, individuals with lower Brain Capital are at higher risk of job loss, which creates a negative spiral of loss of purpose, economic hardship, depression, and anxiety. Taken together, these make upskilling and reskilling more difficult. In Figure 6.1, we outline the ultimate goal of the Brain Capital Building Policy Agenda, to reduce the current Brain Capital Gap by raising up all individuals and societies over time.

Figure 6.1. Reducing the Brain Capital Gap



In figure 6.2, we outline the key components of a Brain Capital Building Policy Agenda, including policy sectors which can be targeted as well as investment approaches. Scientists are a key interest group and partner – it is important to engage neuroscientists and scientists from various brain-related fields (e.g. neuroimmunology, neuroplasticity, neuroepidemiology, etc). Health care providers, of course, are manifold and include psychiatrists, neurologists, psychologists, social workers, primary care providers, etc. It is key to engage the main professional organisations associated with scientists and health care providers.

Figure 6.2. Components of a Brain Capital Building Policy Agenda.

Components of the Brain Capital Policy Action Agenda

Opportunities for implementation	Policy Sectors	Interest groups and partners	Regulatory approaches	Investment approaches	Tactical considerations	Targets of policy influence
Local	National security					
	Economic development	Scientists	ESG standards and guidelines	Venture capital	Establish a Council of Brain Advisors	Elected officials
State	Women's issues	Consumers and caregivers		Social impact investing	Field organizing and outreach	Executives overseeing policy portfolios such as education, health, innovation, climate, multiculturalism etc
Federal	Early childhood	Health care providers	Taxation and accounting reforms	Public-private partnerships	Meet community leaders and influencers	Public servants
Global	Youth	Unions		<u>Megafunds</u>		
	Late-life	Foundations and philanthropies		Philanthropy	Understand voter issues	Think tanks
	Infrastructure and transportation	SMEs		Policy Labs		Non-profit entities
	Aerospace	Large businesses				Standards setting bodies (e.g., SASB, PRI)
	Multi-culturalism	Educators				Ethicists
	Minorities	Governments				Digital health designers
	Environment	International organizations (e.g., OECD, ILO, APEC)				
	Education					

Facilitators of a Brain Capital building policy agenda

Brain Capital building approaches must be intensely multidisciplinary, and hence need to pull in diverse stakeholders, including those from economics, patient advocacy, early childhood and ageing interest groups, investors, educators, health care providers, arts, media, ethicists, and social services providers (Smith, Ali, et al., 2021; Eyre, Berk, Lavretsky, et al., 2021a; Eyre, Berk, Lavretsky, et al., 2021b). When one stakeholder group advances Brain Capital, it encourages and reinforces interest in other groups, therefore all stakeholders are allies of each other. Such dynamic interactions will be crucial to advance policy that is often fragmented, rigid, static, and ineffective to an adaptive, integral and dynamic approach that may guarantee efficacy.

Neuroscience discoveries are accelerating (Eyre, Berk, Cummings, et al., 2021), helped by new technologies to study the brain, from imaging to modelling and simulation. Stigma surrounding brain-based disorders is declining in many areas, meaning more open conversations are being held in communities about their impact and need for support. Globally, the SARS-CoV-2 pandemic highlighted the stressors and consequences of conjoint mental health crises, including concerns related to self-harm, suicide, and overall attestations of despair amidst a crisis – all of which contribute to diminished individual and household resilience to disrupted health, finances, and security (Ontiveros et al., 2021).

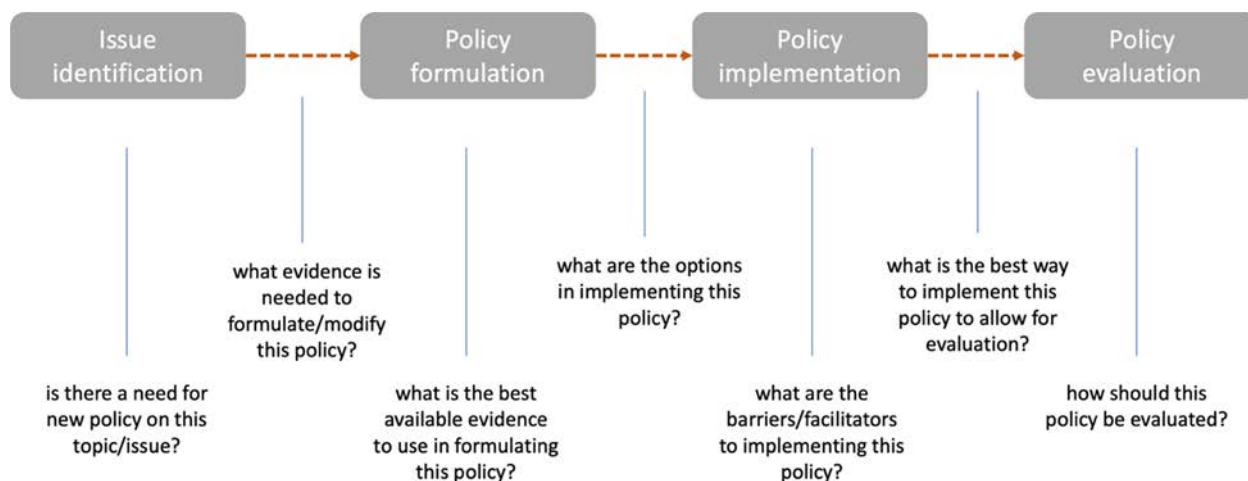
Levels of venture capital investment in brain health technology companies are rising (Shah and Berry, 2020). There is an increasing recognition that skills gaps are causing inequality, and these inequalities

create a negative spiral of despair, disenfranchisement, and depression (UN, 2020; Brookings, 2021; Case and Deaton, 2020). The pandemic has created the space for systemic changes to the way we approach and organise our societies, including the necessity of building individual and community resilience to shocks and stressors, as well as a focus on well-being and flourishing (Palma-Oliveira, Trump, and Linkov, 2021). Indeed, the Covid-19 pandemic has become an inflection point for substantive policy change (Bavel et al., 2020). An increased recognition and understanding of the principles of neuroscience and how these apply to individuals and society can and should be at the forefront of a world re-imagined after Covid-19.

A Brain Capital building Policy Lab

While robust evidence is an important ingredient in the development of good policy, it is by no means the only one. Engaging with policymakers and the policymaking process requires collaborative working models, navigating through the experiences, values and perspectives of policymakers and other stakeholders, as well as communicating evidence in an accessible manner. As a response to these requirements, in recent years there has been proliferation of activities that engage producers of evidence (specifically, academics), policymakers, practitioners, and the general public in policy formulation, implementation and evaluation. One engagement approach for facilitating research evidence uptake into policy and practice is an activity called a 'Policy Lab'. Analysis by The Policy Institute of King's College London suggested the following values of policy labs: providing a forum for open, honest conversations around a policy topic; creating new networks, collaborations and partnerships between academics and policymakers; synthesising available evidence on a policy topic in a robust and accessible format; and providing timely access to evidence relevant to a policy issue (Hinrichs-Krapels et al., 2020). Figure 6.3 provides sample Policy Lab questions which should be considered in the context of the Brain Capital Building Policy Agenda.

Figure 6.3. Sample Policy Lab questions

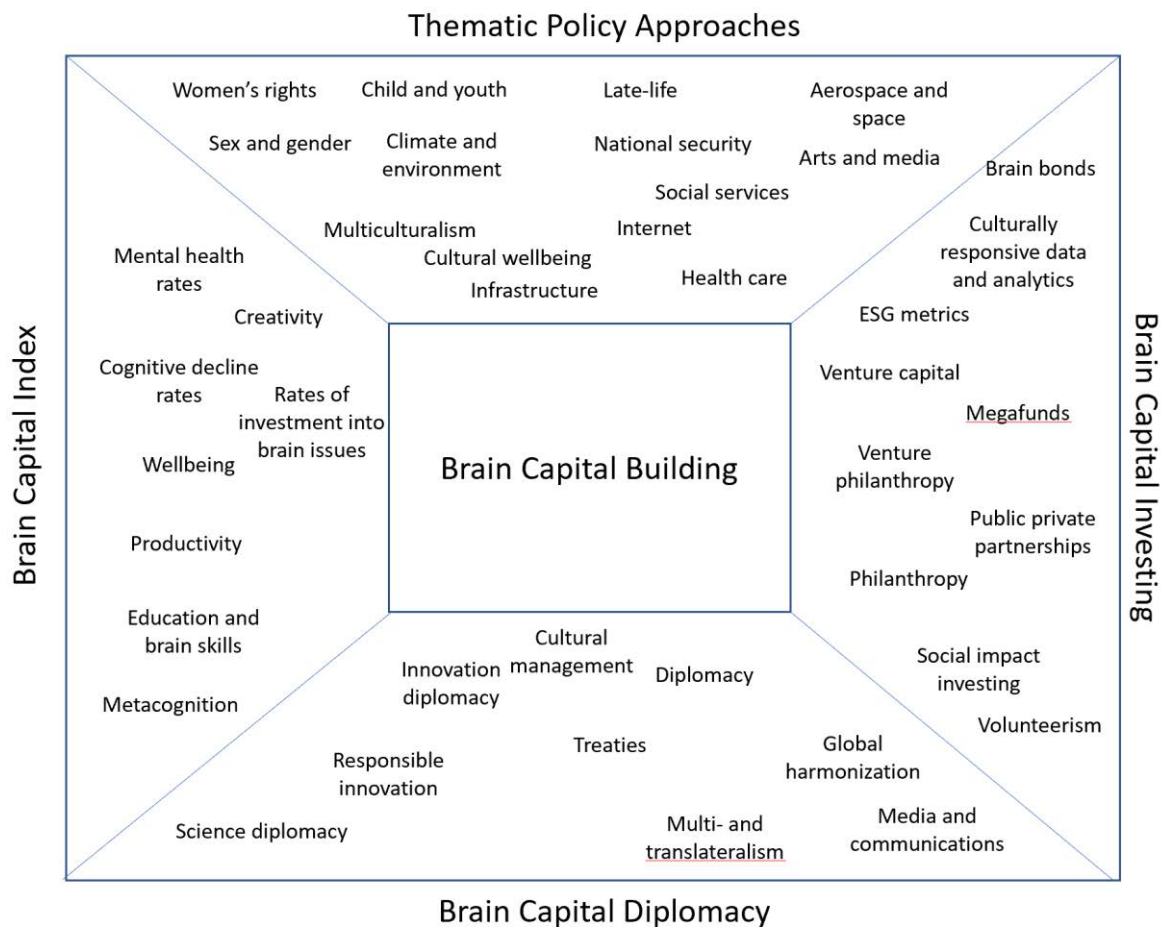


Source: Hinrichs-Krapels et al., 2020.

The OECD's New Approaches to Economic Challenges Unit (NAEC) created the Neuroscience-inspired Policy Initiative (OECD, 2021). This Initiative has many features of a Policy Lab. The Initiative seeks to reconceptualise and revitalise the world's economy and the way it operates, establishing the groundwork to identify relevant metrics while building a transdisciplinary network of global stakeholders (Council, 2014; Smith et al., 2020; Smith et al., 2021). The Initiative draws on experts from a broad array of fields such as neuroscience, medicine, gender analysis, economics, philanthropy, arts, media, industry and enterprise. The Initiative also seeks to sharpen and advance the concept of Brain Capital through research projects,

surveys, data collection, economic modelling, seminars, and policy analyses and recommendations. Dedicated working groups have been established on the four key elements listed in Figure 6.4, Brain Capital investing, Brain Capital diplomacy, Brain Capital thematic policy approaches and the Brain Capital index or dashboard.

Figure 6.4. Key Elements of the Neuroscience-inspired Policy Initiative



Brain Capital building policy sectors and recommendations

Brain Capital building should be considered in all policies to ensure that resources are optimised by leveraging science in service to effective, efficient and equitable solution finding for improved health, social good and economic growth. Perhaps the most robust Brain Capital building policy focuses on equitable access to high quality early childhood education, as well as social policies that reduce the likelihood of childhood and adult trauma, both physical and psychological (CDC, 2021).

In the case of poverty, for example, empirical evidence suggests that being poor is not only related to a lack of material resources but also to chronic scarcity and instability that impose great demands on a person's time and attention — such as having access to food and shelter. These findings illustrate that poverty is not associated with particular motives, skills, character or behavioural inclinations. Rather, they show that anyone living in a psychological environment of chronic scarcity would begin to display the same biases in planning and problem solving. As a result, behavioural science can help on a wide array of issues

intended to reduce poverty, including streamlining administrative procedures to reduce their burden on time, attention and the cognition needed to access social welfare programmes; providing widespread access to financial institutions to improve household savings; and reframing and empowering people living in poverty to counteract stereotypes and discrimination. Another protective policy is to achieve vaccine-based herd immunity to prevent or attenuate neuro-Covid presenting with substantial behavioural and cognitive symptoms and disabilities (GCBH, 2021). Table 1 outlines the most impactful examples of how Brain Capital can be built in various policy areas. There are other more speculative policy areas which could be influenced to build Brain Capital (such as transportation and the internet).

Brain Capital has implications for almost every policy domain. We note a helpful predicate from the 2008 UK Government Office for Science Foresight Report on Mental Capital and Wellbeing that generated the first neuroscience-inspired policy recommendations (Beddington et al., 2008). For example, investments in early childhood education facilitate brain development and offer the potential for significant enhancements of population-level health outcomes (Heckmann, 2021). A better educated citizenry may be more likely to reduce modifiable risk factors for dementia in late life (Larson, Yaffe, and Langa, 2013; Livingston et al., 2020) and less susceptibility to ‘fake news’ (Ternes et al., 2020; Miller, 2020). Additionally, as economies transition to the Fourth Industrial Revolution, economic growth and resilience will depend upon innovation that unlocks the latent capacity of workforce creativity in meaningful ways (Amabile and Pratt, 2016; Lister et al., 2021).

An aspiring Brain Capital leader or advocate can use these policy areas to raise awareness and/or build a political platform. These of course will be tailored to the geographic location and political subdivision (local, regional, or national) where the campaign is embedded. Policies need to be determined and prioritised based on local context or industry sector focus.

Table 6.1. Brain Capital Building Policy Areas, Approaches, and Examples

Policy area	Policy approaches and examples
Early childhood	The size of a child’s brain reaches 90% of an adult’s by the age of five. Early childhood is a time of rapid change – particularly for the development of the brain. These early years are critical for lifelong learning and well-being. We note the Minderoo Foundation’s Thrive by Five program (https://thrivebyfive.org.au/), which will engage with government, research institutes and other stakeholders to advocate for effective policy and investment in early learning. This programme has initial activities in Australia, with global ambitions. Creating an optimal environment for healthy brain development starts prior to conception with adherence to healthy physical and mental preparation for parenthood. Therefore, focusing on young people prior to becoming parents by educating them about the importance of a healthy brain in giving their future children the best shot in life should be a cornerstone for optimal early childhood brain development. Given the importance of the caregiver to early relational health, better prevention, identification, and treatment of postpartum depression is key to boosting early childhood brain health and development. Not doing so is costly both economically and individually. A study found that the state of Texas is losing \$2.2 billion by not treating mothers’ mental health from pregnancy through their child’s first five years of life (Villalpando, 2021). Postpartum depression has also been found to have both maternal and infant consequences, including negatively affecting physical health, sleep, motor, cognitive, language, emotional, social, and behavioural development in the infant (Slomian et al., 2019). Exemplary models for early childhood brain health include the Thriving Queensland Kids Partnership (https://www.aracy.org.au/the-nest-in-action/thriving-queensland-kids-partnership-tqkp).
Women’s health	There is a clear sex and gender gap in outcomes for brain health disorders across the lifespan, with strikingly negative outcomes for women. This calls for a more systematic way of approaching this issue of inequality. The Brain Health Gap highlights and frames inequalities in all areas across the translational spectrum from bench-to-bedside and from boardroom-to-policy and economics (Smith, 2021). The WHAM Report (Women’s Health Access Matters) shows that high-income countries cannot afford inaction (WHAM, 2021). The report studies the impact of accelerating sex- and gender-based health research on women, their families, and the economy across diseases, like Alzheimer’s disease and related dementias, that impact women differently and differentially. The Women’s Brain Project (WBP) is an international, non-profit organisation studying sex and gender determinants to brain and mental health. Founded in, 2016, the WBP is a group of scientists from disciplines including medicine, neuroscience, psychology, pharmacology, and communication who work together with caregivers, patients and their relatives, policymakers, and other stakeholders. The WBP identifies

	how sex and gender factors impact diseases, diagnostics, drug and novel technologies development, to achieve precision medicine for sustainable and inclusive healthcare. www.womensbrainproject.com .
Social science	Emotion and social processes are hot topics in neuroscience and psychology, but the “visceral” nature of politics remains weakly assessed. Visceral politics (Tsakiris, Vehar, and Tucciarelli, 2021; Zmigrod and Tsakiris, 2021) highlight the non-rational nature of politics, as well as how the physiological engagement with the social world impacts on our decisions and political behaviour. Body experience, emotions and socio-cultural context are all impacting on neurophysiological process. Academic-governmental initiatives such as the Centre for the Politics of Feelings in UK (UL, 2021) are creating novel interdisciplinary understanding of how brain, emotions and feelings can be active causes but also targets of political behaviour in diverse socio-political contexts.
Education	Develop ways to increase equitable educational engagement and attainment to improve brain health. Innovative strategies are especially needed to rethink ageing and promote learning and engagement across the lifespan, beginning in early childhood. Education is key to flourishing and longevity (OECD, 2017). In the Age of Accelerations, with converging accelerations in technology, globalisation and climate, lifelong learning is no longer desirable, it is essential (Friedman, 2017). The ‘OECD Skills Outlook, 2021: Learning for Life’ (2021) noted that lifelong learning starts in childhood and youth, continuing throughout adulthood and old age. It encompasses formal learning in settings such as schools and training centres, informal and non-formal learning derived from colleagues and workplace trainers, and unintentional learning stemming from spontaneous social interactions.
Psychological and cognitive resilience	Resilience is an important quality during challenging times of pandemic and climate change that allows human beings to adapt to an uncertain and unpredictable future (Masten, 2016). Resilience can be developed across the lifespan and lead to the ability to self-regulate and adapt in the face of acute trauma and chronic stress. Building cognitive resilience can help build cognitive reserve and promote healthy cognitive ageing, but also off-set negative effects of stress and Covid-19 related cognitive issues (Killgore et al., 2020; Linkov et al., 2021).
Despair	Despair in society is a barrier to reviving labour markets and productivity, jeopardising well-being, health, longevity, families, and communities, and even national security. The Covid-19 pandemic exacerbated an already growing problem of despair. In the US, this despair in part results from the decline of working class, white Americans. It contributes to decreasing geographic mobility and has political spillovers, such as the increase in far-right radicalisation. Other population groups are also suffering, for different reasons. Over past few years, for instance, suicides increased among minority youth and overdoses increased among Black urban males (starting from a lower level than white Americans but now exceeding it). Policy responses have been fragmented, with much focus on interdiction or ex-post treatment rather than on the root causes of despair. There are local efforts to boost the well-being of vulnerable population cohorts, but there is no federal level entity to provide vulnerable populations with financial or logistical support, nor is there a system that can disseminate relevant information to other communities seeking solutions. While federal agencies - such as the Centers for Disease Control (CDC) - track mortality trends, no system tracks the underlying causes of these deaths. In contrast, many countries, such as the UK and New Zealand, track trends in well-being and ill-being as part of their routine national statistics collection and have key leadership positions focused exclusively on these issues. A Brookings Institution task force report (Brookings, 2021) highlights the increasing levels of despair in the US and the need for a new federal interagency task force to address the nation’s crisis of despair as a critical first step to sustainable economic recovery.
Ageing	Key challenges that older adults face, including the decline of cognitive and physical health, social isolation, and psychiatric disorders, must be better understood and overcome to unlock and capitalise on the value of an increasingly aged society (Bishop, Lu, and Yankner, 2010). The challenges associated with caregiving is a brain-based issue directly impacting older adults. A major downstream benefit of reducing dementia and other brain-based disorder impacts would be to caregivers, in particular women, whose brain function is impacted by stress, depression, and the high economic costs (e.g. income loss and reduced employment) associated with caregiving. Brain Capital encompasses individual, societal, and global-level strategies for the promotion and protection of brain health in late-life.
Mind-body practices for stress reduction	Mind-body practices such as yoga and meditation, as well as tai chi or qi gong are increasingly utilised for self-regulation and for promoting psychological resilience in stress-based disorders (Laird et al., 2018). They are also found to have direct neuroplastic effects on the brain and may be used in the prevention of cognitive decline in older adults (Laird et al., 2018). They can serve as easy to learn and affordable tools to promote stress reduction and brain health across the lifespan.
Environment	There is a pressing need to fund research into the risks, impacts, and priority actions related to climate change and brain health. By increasing our understanding of the dynamics between the brain and environmental changes, innovative solutions and strategies can be developed. Air pollution and noise have been linked to cardiovascular conditions and cognitive decline in older adults, along with being associated with accelerated

	brain ageing and neurodegeneration. Likewise, the presence of pollutants such as heavy metals can yield generational health challenges and even permanent disruption in cognitive function (Palma-Oliveira et al., 2018). Reduction in pollution is a risk reduction strategy for dementia and key to protecting and building late-life Brain Capital.
Productivity	The labour market appears to be healing slower from Covid-19 pandemic-induced shocks than the wider economy (Greene, 2021). Explanations include behaviour changes related to concerns of contracting Covid-19, enhanced caregiving needs, changing personal preferences about the nature of work, or a desire to take an earlier retirement. Another explanation is that brain health has suffered during the pandemic. By boosting brain health, it may not only be possible to heal the labour market at a faster pace, but also unlock higher productivity growth and help people retool for jobs in an economy that has been reshaped by the pandemic. One Mind at Work (onemindatwork.org) and The Global Business Collaboration for Better Workplace Mental Health (https://unitedgmh.org/unitedgmh-and-workplace-global-business-collaboration) are providing extensive resources, return on investment calculators, education, and networking to major global employers to help them navigate the new, post-pandemic economic environment.
LGBT+ (Lesbian, Gay, Bisexual and Transgender)	Members of the LGBT+ community report higher levels of mental health issues, different levels of access to mental health services with equity of access varying widely between different regions across the lifespan (Russell and Fish, 2016; Roe et al., 2020). LGBT+ people also tend to experience higher rates of substance use disorders, which needs to be addressed in relation to brain health. Research with LGBT+ youth show that earlier mental health support and boosting protective factors can improve the brain health of LGBT+ youth and adults.
Physical activity	It appears that regular physical activity provides benefits to the brain. Studies show that people who are physically active and not sedentary are less likely to experience a decline in their mental function and have a lower risk of developing Alzheimer's disease. Indeed, physical activity is one of the known modifiable risk factors for dementia. Regular exercise and avoiding a sedentary lifestyle may also help combat other risk factors for dementia, such as depression and obesity.
First Nations people	Addressing the factors recognised as contributing to mental health challenges faced by First Nations people. Taking a lifespan approach recognises that mental health disadvantages start before birth, including intergenerational trauma (IGT), often from residential or native "schools" and other legacies of colonisation. This coincides with barriers to accessing health services for pregnant women, which is compounded in remote and rural communities. A community mental health approach can help address the historical background factors that have led to increased mental health problems among First Nations people. Understanding the life expectancy, physical and brain health gaps between First Nations people and the rest of society should consider an explanatory framework which emphasises the role of toxic stress, trauma and allostatic load (multisystem dysregulation due to the wear and tear of the body and the brain) across the lifespan (Ketheesan et al., 2020). In Australia, Yiliyapinya Indigenous Corporation (https://www.yiliyapinya.org.au/) is responding to this decrease in brain health by working together with First Nation communities, schools, government organisations such as child protection, youth justice, and law enforcement, to improve brain health across the lifespan in a culturally responsive and contextualised way using tailored neuroplasticity impact programmes within multiple systems.
National security	Susceptibility to populist and extremist political messages can be studied using neuroscience-based approaches (Decety, Pape and Workman, 2018). People's political opinions emerge based on incoming information, and the learning of new information changes fundamental beliefs and political associations. Populism and extremist ideologies reach people in the form of oversimplified information and/or extreme solutions to crises, often while ignoring contextual nuance. Human responsiveness to these oversimplified political messages, such as propaganda and populist rhetoric, could be responsible for polarisation and radicalisation, which opens up the possibility of increasing political control by populist leaders. Therefore, brain science should investigate the causes and mechanisms of this phenomenon.
Criminal justice reform	Policymakers who focus on criminal justice struggle to develop and implement policies to balance justice, punishment, and rehabilitation (Bower et al., 2018). However, many of the issues that criminal justice policy is asked to manage involve the interactions of people and the modification of behaviour. Neuroscience researchers are actively mapping circuits and the changes involved in substance use, violence, and mental illness. They are developing neurological devices to help those living with mental illness or substance use disorders when traditional pharmaceutical therapeutic methods do not work.
Chemical pollution and brain health	Chemical pollution takes many forms with far-reaching direct and indirect impacts on human brain health (Grandjean and Landrigan, 2014). Examples include climate change (green-house gas pollution) and hyperthermia-induced CNS dysfunction such as delirium, seizures, coma, as well as increased incidence of depression (Ruszkiewicz et al., 2019). Concerningly, many of the damaging effects of chemical exposure are seen in children. Exposure to heavy metals has significant impacts with lead being linked to Attention Deficit

	<p>Hyperactivity Disorder (ADHD) (Froehlich et al., 2009) and lead and methylmercury to loss of IQ points (Boyle et al., 2021; Gaylord et al., 2020). Other chemical exposures include those associated with the use of plastics including flame retardants (e.g. polybrominated brominated diphenyl ethers and per- and poly fluorinated alkyl substances) which are linked to loss of IQ points and ADHD (Lam et al., 2017; Fornis et al., 2020) as well as plasticisers (phthalates) which are linked to loss of IQ points as well as impaired cognitive development and fine motor control (Lee et al., 2018). The economic impacts of chemical exposure are substantial and skewed towards the disadvantaged. For example, childhood exposure to lead in low and middle income countries was estimated to cost 1.2% of world GDP in 2011 (Attina and Trasande, 2013). Even when exposure to chemicals, for example the organophosphate pesticide Chlorpyrifos, is incontrovertibly linked to loss of IQ points in children, regulatory bans have not been implemented. The cost of this specific policy failure is estimated to be in the billions of dollars in the US (Trasande, 2017). Targeted reduction strategies such as reducing children's lead levels have resulted in intelligence gain as well as cost savings at a societal-level (Remy et al., 2019).</p>
<p>Arts and Media</p>	<p>Arts and media spur innovation across the economy, as well as contributing to numerous channels for positive social impact. They influence local economic development and entrepreneurial activity (NASAA, 2021) and have proven to be effective tools for improved population health (WHO, 2019). Even so, Covid-19 has induced potentially devastating job losses in the field (Florida and Seman, 2020) which may hinder the capacity of the creative workforce to continue its positive impact. On the other hand, consumption continues to grow. Gaming media alone is predicted to rise to nearly \$200bn in 2021 (Upstart, 2019). As Gen Z, who embrace interactive media, is set to become 27% of the workforce by 2025 (Koop, 2021) the potential for disruption, either positive or negative, to existing systems is significant (Deloitte, 2021). Targeted investments in transdisciplinary approaches for developing the creative workforce in targeted ways related to the science of creativity, cognitive flexibility, as well as other critical skill-sets could yield significant gains that will better prepare economies for the future of work.</p>

Quantification of Brain Capital

To be truly successful, Brain Capital will need to be quantified and tracked. Hence the development of an index or other forms of measuring brain capital capacity and comparative evaluation of managing alternatives is key, as we have previously outlined (Smith, et al., 2021). This way policy agenda setting can be more precise, and the impact of policy changes can be more accurately measured. More comprehensive tools that capture broader categories of metrics (e.g. multi criteria decision analysis), can be better suited to developing policy alternatives (Linkov et al., 2020). Standardised approaches to the quantification of Brain Capital will be needed to minimise subjectivity in comparisons of performance in different sociocultural and economic contexts. Through standardisation, fostering objective interpretation is facilitated and policy implementation will ultimately be well-informed and likely fairer.

Regulatory and legislative approaches

Financial investments in environment, social and governance (ESG) issues have grown tremendously over recent years. Regulatory and legislative approaches to policy may help promote Brain Capital building within this domain.

The Sustainability Accounting Standards board recently included mental health and wellbeing in its proposed updated human capital standards (SASB, 2020). International Organization for Standardization ISO standard 45003 gives guidance on managing psychological health and safety risks within an occupational health and safety management system (ISO, 2021). The Business Roundtable recently noted the generation of a healthy environment is a key purpose of a corporation (BR, 2021). The signatories of the Principles of Responsible Investing recently listed mental health as one of the top four social issue priorities in the future (PRI, 2020). This is promising given the \$40.5 trillion currently allocated to Environment, Sustainability and Governance (ESG) investing around the world (Baker, 2020). The restructuring of taxation and accounting arrangements may support Brain Capital. For example, financial incentives to invest in Brain Capital may be achieved by re-designating business expenditures on

employee payroll, health, re-skilling, re-training, innovation, and human productive capacity to insurable capital investments. Treating expenditures on the employment, development, health, and productive capacity of people as capital investment may stimulate productivity. An exemplar of these approaches can be seen in the Human Capital Accounting Framework from the World Economic Forum and Willis Towers Watson (WEF, 2020).

Other opportunities for the building of Brain Capital could come from certified B Corporations. These are businesses certified as meeting certain standards of social and environmental performance, transparency, and accountability while balancing profit and purpose. Further, these entities seek to support a change in global culture that reconceives what defines business success and cultivates a more inclusive and sustainable economy. This model could be used to support Brain Capital priorities (www.bcorporation.net).

Classic regulatory tools (e.g. regulation and taxation) have demonstrated limited abilities to change behaviours related to brain health (e.g. eating habits, physical activity, information processing or technology use). The use of nudging may have an impact on Brain Capital by promoting behaviour change and may be a useful complement to classical policy regulations (Ledderer et al., 2020; Pennycook et al., 2020).

Regulating neurotoxic chemicals to protect Brain Capital

Governments can incentivise innovation in safe chemistry to create chemicals and products which protect Brain Capital rather than harm it. There are currently few chemicals restricted globally and little market incentive to switch to safe chemicals. By using a combination of positive and negative incentives, governments can push industry to phase out substances which are linked with reduced IQ, impaired cognitive development and neurological disorders. Restricting the use or prohibiting outright the use of chemicals which harm brain health forces consideration of the utility of that chemical and whether its functions are important (e.g. the colour, flexibility, or UV resistant properties it provides a product). If the functionality is important, manufacturers can seek alternatives. Alternatively, companies may be required to include data specific to brain health impacts of their products, and hence are incentivised to proactively move away from neurotoxic compounds/elements. With Brain Capital centralised as a pillar of chemical regulation, the search for alternatives will be shaped by needing brain-safe chemistry, lest the new alternative also be restricted from the market. Using non-legal levers, governments can also shape chemistry regulation. Criteria to assess safety claims (e.g. that a product is ‘green’ or ‘free from harmful chemicals’) are needed, along with establishing research and development hubs on safe chemistry, and guiding safe and sustainable design of products.

Public investment opportunities

Brain Capital should be considered as an investable asset. This means novel approaches can be considered for investing in it, and Brain Capital benefits need to be factored into the cost-benefit equation of diverse policies from education to social services. These investment mechanisms can be supported and refined by effective and thoughtful policy making (Vigo et al., 2019). Table 6.2 outlines examples of public policies through which Brain Capital can be invested in.

Table 6.2. Brain Capital Building Public Investment Opportunities

Investment mechanism	Description and examples
Brain bonds	Social bonds are offered by municipal and sovereign issuers to fund research as well as clinical care (Initiative, 2018). They typically focus on economic impact in a region or an area of interest. The Healthy Brains Global Initiative is an example of an initiative seeking to develop innovative financing mechanisms through a collaboration of global leaders in neuroscience, policy, and finance who are developing an overarching set of financing mechanisms to fuel an

	increase in brain science breakthroughs (HGBI, 2020). The HGBI has a particular focus on cutting \$3 trillion in costs that are borne by low, middle, and high-income countries. The feasibility of a healthy brain bond is of significant global importance, then procuring a large amount of resources from bond capital is essential. The HGBI focuses on scaling up fundamental clinical services in low- and middle-income countries and breakthrough neuroscience research, conducted through networks of researchers around the globe.
Public-private partnerships	The Davos Alzheimer's Collaborative (DAC) is a public-private partnership with a commitment to a collective global response to the challenges Alzheimer's disease presents to millions of families worldwide. The DAC aims to raise \$700 million for a six-year plan to accelerate and diversify innovation in Alzheimer's research. The three main components of DAC include a global cohort developed to identify new targets for potential treatments; a global clinical trial support platform to reduce the cost and time to test new treatments in trials and bring them to market; and promote health care systems to be better prepared to new treatments to patients. The DAC project seeks to enable novel biomarker development, connect global researchers using the data platform of the AD Data Initiative, and to keep the lived experience of Alzheimer's at the centre of its efforts.
Social impact investing	Funding strategies that take an outcomes-based approach lets public-sector entities pay only for what works, to the extent that it works; simultaneously, they can create pathways for the most impactful providers and interventions to flourish if they are able to achieve important public policy priorities. This approach to funding could be of particular value for addressing the social determinants of health and behavioural health. For example, Capital Impact Partners focuses on financing and scaling age-friendly communities in the United States, including expanding the scope and integration of the medical, social, and practical needs of older adults as they evolve. Increasingly, organisations such as Capital Impact Partners are establishing a new norm for investing impact metrics. Environmental, social and governance (ESG) factors are being weighed not only as indicators of corporate competitiveness, but also to minimise long-term risks to investors' portfolios (https://www.capitalimpact.org/).
Early-stage technology investing	There are record levels of venture capital investment into the brain health technology space, along with a number of companies now considered <i>unicorns</i> (valued at over \$1 billion) (Shah and Berry, 2020). A Venture Capital firm, Primetime Partners, launched with a focus on early-stage investments in experiences, products and services for older adults. The firm's interests include care management, longevity health services, financial security for retirees, and enriching consumer experiences. Additionally, Primetime Partners invests in older adults who found new companies, building on their earlier career experiences. Other thematic funds include Telosity for youth (https://www.telosity.co/) as well as the Women's Venture Fund (https://womensventurefund.org/). Governments can engage in the venture capital sector. For example, the MRCF is the largest life science investment fund in Australia and New Zealand (www.mrcf.com.au). It is a unique collaboration between major Australian superannuation funds, the Australian and New Zealand governments, Australian state governments and over 50 leading medical research institutes and research hospitals.
Philanthropy	Philanthropy may have objectives for specific diseases, institutions, or populations that will benefit from research. It can be driven by research efficacy and research outputs (e.g. patents, economic impact, and patient outcomes, not monetary returns.) One notable model is the Alzheimer's Drug Discovery Foundation, which uses a venture philanthropy model to fund breakthrough research in academia and the biotech industry with promise to prevent and treat Alzheimer's disease (Alzdiscovery, 2020).
Megafund	A public-private partnership that takes a portfolio-based approach to drug and device development in which multiple projects are undertaken simultaneously for the purposes of developing Brain Health therapeutics. Although a greater upfront investment is required by this approach, the probability of at least one success should be higher, accelerating the search for cures to brain-based disorders and increasing the probability of successes within the next decade.

Engaging with the Brain Capital community

After covering the potential policy and investment approaches for Brain Capital building, it is important to consider the Brain Capital community. As outlined in Figure 1, this community is broad and may function at local, state, national and/or global levels. The community may include many stakeholder groups such as patient and caregiver groups, healthcare workers, scientists, thinktanks, non-profits, unions, SMEs, corporations and other elements of civil society. In table 6.3 we outline approaches for engaging with the Brain Capital community.

Table 6.3. Approaches for Engaging with the Brain Capital community

Component	Description	Refinement for Brain Capital Policy Agenda
Voter issues	Capture voter issues from early on with petition drives, canvassing and online surveys.	Be sure to monitor and correctly frame emerging Brain Capital-related issues, e.g. concerns over science denialism, Covid-mental health issues, misinformation propagation, political divisiveness.
Strategic communications	Be sure to correctly frame problems and then solutions. Consider these questions: <ul style="list-style-type: none"> • What is the issue? • What is the solution? • How does this solution solve the problem? • Who benefits from the solution and how? • How much will it cost? 	There are of course myriad 'problems' relevant to brain-based issues which need to be addressed. These may differ depending on the region and country. Key issues include: <ul style="list-style-type: none"> • Rising rates of depression, anxiety and suicide • Lack of effective treatments for most brain disorders • Rising inequality resulting from brain skills gaps • Disparities in outcomes based on sex and gender
Field organising and outreach	Connect your field outreach work or 'ground game' to your voter database, email and media operations for maximum efficiency.	Consider all relevant and aligned interest groups, spanning neuroscience, mental health, dementia, new economics, patient advocacy, caregiving, etc. Bring in and organise the key stakeholders outside of those areas who are less familiar with 'brain issues' such as unions, business and industry associations (trade associations), etc.
Meet community leaders and influencers	Connect and explore collaboration with opinion leaders.	Consider those at local, state, federal and global level. Consider Brain Capital interested celebrities, public figures, local union sections, active and retired individuals, philanthropists, business figures, humanitarians. Online communities tend to form around shared interests or identities. Specific people tend to attract large followings of people interested in physical and/or mental health, education, or specific skill development. Ask these influencers about the specific language, buzzwords, interests and platforms where their audiences are active and open to learning new information.
Messaging	Each issue area needs a stance. Connect your message to your organisation's brand. Be distinctive, the same message can be delivered differently.	A Brain Capital-based campaign will be unique. Always be 'on message' in public appearances, media, and social media. Be careful of a biological reductionist approach – brain issues of course are linked to mind, body, spiritual, place and planetary dynamics.

We note that female empowerment may be the most simple, cross-cutting theme to boost Brain Capital at scale (Smith, 2021). We have previously noted the "Brain Health Gap" to frame inequalities in all areas across the translational spectrum from bench-to-bedside and from boardroom-to-policy and economics (Smith, 2021). Therefore, female empowerment has profound benefits for Brain Capital across the lifespan and needs to be multifactorial. For example, reducing social media-related distress for teenage girls, to supportive maternity policies, to supportive caregiver policies, and improved sex and gender tailoring of clinical neuroscience research, clinical care and innovation. Female empowerment can engage a large proportion of the population.

Engaging partners aligned with the agenda

The envisaged impact on the policy agenda amounts to a paradigm shift in the way the challenge of the brain is perceived and addressed. In order to build the basis for such a significant recalibration, a comprehensive effort is required, involving multiple levels of government. Coalition building with various stakeholders is key to policy advancement. Engagement may vary in type and depth – from mutual advocacy, sharing resources, convenings, through to public-private partnerships and more formal activities. Pledges in agreement with a proposed policy agenda are a simple first step for building partners and a coalition. Activities should be pursued in parallel at the local, state/regional, national and international levels, given the significant feedback loops that need to be created. Anchoring the Brain Capital Policy Agenda within strong engagement of communities lies at the heart of its future success.

This process can and should be assisted by the provision of targeted expertise, customised to address the specific situation and requirements of each community. We recommend that entities considering a Brain Capital policy agenda establish the Brain Capital Network of Expertise to support and enhance parallel actions. The Network would provide a platform for the exchange of best practices and for seeking support in policy engagement. At the state (or regional) and national level, advisory groupings could be formed, such as 'Council of Brain Capital Advisors', akin to the US Council of Economic Advisors (www.whitehouse.gov/cea/). This approach may be useful particularly for executive-level elected positions (presidents, governors, mayors, etc.). An advisory council with expertise in brain issues would advise the brain agenda and help with the refinement of policies that advance this agenda.

The Brain Capital policy agenda would need to be taken up and crafted at the political level. Therefore, the emergence of potential political champions of this agenda would need to be encouraged and supported by means of active advocacy and provision of expertise. Links between political groups committed to the Brain Capital agenda would need to be built to facilitate the exchange of experience. Political parties should receive comprehensive information about the significant policy implications that the Brain Capital agenda would bring.

The key constituency for the paradigm shift towards centrality of the Brain Capital agenda is already in place. These are the thousands of people actively involved in improving education, promoting efforts at prevention of brain disorders or simply caring about cognitive development. It is this constituency that needs to receive guidance how to orient their actions to create collective value added. This is where the Brain Capital movement will be necessary, firmly based on evidence and action-oriented. Activities undertaken at different levels will be mutually-reinforcing and should usher in the Brain Capital Policy Agenda becoming one of the points of orientation for countries and communities globally before the end of the decade.

Studying human conduct can be an additional tool in the policymaking process and it has become a cost-effective way to change behaviour in ways that can be both subtle and beneficial for wider society.

Conclusion: Overcoming barriers to a Brain Capital building Policy Agenda

When progressing this Policy Agenda, it is critical to anticipate potential barriers. Below we outline several key barriers and approaches to overcoming them.

Inertia: Perhaps the greatest barrier is that unless Brain Capital gets onto the policy agenda and support is built, any attempt to move this forward may face headwinds in gaining traction. Therefore, broad based coalitions, evidence-based proposals, and proactive public communications programs are key to advancing this agenda.

Institutional barriers: The institutions which include the political architecture of a nation can be a barrier to policy change and the implementation of innovative policies. In the US, for example, federalism (individual

states vs. federal government) and the separation of powers between different branches of government disperse power and has been an impediment to major change in social policies (Huberfeld, Gordon, and Jones, 2020). This may be less of a barrier in countries with unitary governments such as New Zealand or the United Kingdom. Nonetheless, institutional structures remain a potential barrier in every country. Entrenched bureaucracies and administrative hurdles may pose additional institutional barriers to a Brain Capital Building Policy Agenda in many countries.

A sense this is already being done: In some ways, Western economies are moving in this direction. As a result of globalisation and labouring/manufacturing jobs being outsourced overseas, university attendance is increasing, people are choosing courses that are more innovation-focused, etc. Many people will believe we are already moving that way – to an economy that is more focused on cognitive ability. It is therefore key to outline the failures of the current policy approaches and how this proposed Brain Capital Building Policy Agenda is unique and additive.

Lack of large-scale evidence to prove ‘value’ over and above existing policies and efforts: Some may feel policies that appear to be building Brain Capital already exist, and may not accept that our proposed Policy Agenda will add additional value. Large-scale, randomised controlled studies may be useful to demonstrate impact (as has been achieved by the field of public health-behavioural economics (Ledderer et al., 2020)).

Complexity of neuroscience: It is important to work extensively on strategic communications to make these potentially complex topics relatable to a broad, non-specialised audience.

Brain Capital Index scoring is challenging: We must recognise that indices in general, and specifically of morbidity and mortality, may provide a limited reflection of the actual situation and may not necessarily reflect policy efforts. For example, Deaths of Despair in the US are increasing and recently spread from being a primarily working class, white American phenomenon to reaching increasing numbers of African Americans and Hispanics, and rates of teenage anxiety and suicide are increasing in many countries (Racine et al., 2021; Brookings, 2021; Luby and Kertz, 2019). If such indices (and the issues they track) worsen over time, they may not be politically viable.

As our “brains are indispensable drivers of human progress - why not invest more in them?” (Smith et al., 2021) And why not develop a novel policy agenda around building our brains? To adapt as a society to the challenges of the “Brain Capital Age”, we need to direct attention to optimising human decision making; to ensure it is scientific, consistent, collective, and long-term focused; and we need political leadership to make this happen. Increased Brain Capital means better lives for citizens. We look forward to seeing these types of Brain Capital policies actioned at local, state, federal and international levels. Imagine a long-term policy agenda in which the whole society is expected to be involved, including civil society organisations, private sector stakeholders, and agencies from different levels of local, national, and international governments. Much work is needed to prioritise and advance the top policy approaches for each region of the world.

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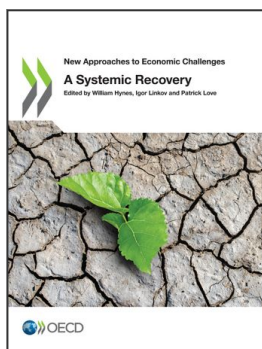
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From:
A Systemic Recovery

Access the complete publication at:
<https://doi.org/10.1787/62830370-en>

Please cite this chapter as:

Hynes, William, Igor Linkov and Patrick Love (eds.) (2022), “Build Back Brainier: Base Policies on Brain Science”, in *A Systemic Recovery*, OECD Publishing, Paris.

DOI: <https://doi.org/10.1787/1e893170-en>

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