How can impact strategies be developed that better support Universities to address 21st Century challenges?

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Abstract

As research funders and governments around the world seek to demonstrate societal impact from investments in research, Universities are re-organising to better address 21st century challenges. Alongside this, organisations often develop and publish institutional research impact strategies to organise activities and initiatives, but as a tool, impact strategies are poorly understood. This study therefore provides the first formal analysis of impact strategies from around the world. A total of 77 strategies were analysed from Higher Education Institutions, programmes and units in the UK, Canada, Australia, Hong Kong China, Denmark, New Zealand and from independent research institutes. Two types of strategy emerged from the analysis. First, “achieving impact” strategies had a strong emphasis on partnerships and engagement, but were more likely to target specific beneficiaries with structured implementation plans, enable the organisation to operate as a boundary organisation to co-produce research and impact, support and facilitate best practice at the scale of individual research projects or teams, and recognise impact with less reliance on extrinsic incentives. Second, “enabling impact” strategies tended to be developed by universities and research institutes to build impact capacity and culture across an institution, faculty or centre. They also had a strong focus on partnerships and engagement, often including a focus on industry or local communities, and they invested in dedicated impact teams and academic impact roles supported by extrinsic incentives including promotion criteria. The typology offers a new way to categorise, analyse and understand research impact strategies, alongside insights that may be used by practitioners to guide the design of future strategies. More broadly, it discusses the potential for different strategic approaches to transform how researchers engage with stakeholders and societal challenges, considering the limitations of both top-down, incentive-driven approaches versus more bottom-up, co-productive approaches.

Keywords: Research impact, impact strategy, valorisation, knowledge exchange, knowledge transfer, KMb

1 Introduction

As the world faces many new and complex challenges, research funders and governments are increasingly seeking evidence that public investment in research leads to wider societal impacts. For higher education and research institutions, the rise of this 'impact agenda' has generally been incorporated in formal systems and policies designed to assess the quality of research. In the UK, for example, impact is assessed retrospectively via the Research Excellence Framework (REF), and similar systems exist in Australia, Hong Kong, the United States, Sweden, Italy, Spain and elsewhere (Geuna and Piolatto, 2017; Chubb and Reed, 2018; Heyeres et al., 2019; Reichard et al., 2020; Reed et al., 2021). Although formal evaluation of impact has received criticisms related to negative unintended consequences for individual researchers and research priorities (Chubb and Watermeyer, 2017; Watermeyer, 2019; Reed and Fazey, 2021), incentivising research impact generally leads to increased public funding, as well as more accountable research that has long-term benefits for society (Hill, 2016; Chubb and Reed, 2017; Reichard et al., 2020; Reed et al., 2021).

Research impact policy is part of a broader trend of seeing universities at the heart of a knowledge economy (Chubb et al., 2017), and higher education and research institutions are responding through increased investment in impact and the associated capacity required (Oancea, 2019; Watermeyer, 2019). Strategic institutional responses to the impact agenda have varied. Some have developed new and innovative institutional structures to enhance the use of science in policy and practice (e.g. Bruce and O'Callaghan, 2016; Cvitanovic et al., 2018), while others have created new organisational roles such as 'knowledge brokers' to improve knowledge exchange between scientists and policy makers (Meyer, 2010; Cvitanovic et al., 2018). However, a common response has been the integration of impact strategies (or similar) into university-wide policy and practice, reflecting the growing trend for accountability within the university system to research funders and users (Penfield et al., 2014). As a result, impact is now widely seen as an important part of an institution's research culture (Leeuwis et al., 2018), and a small but growing body of literature is beginning to understand how the impact agenda is shaping organisational cultures across the sector (e.g. Moran et al., 2020; Rickards et al., 2020; Reed and Fazey, 2021). There is also increasing recognition that an institution's impact culture needs to go beyond simply monitoring and evaluating impact (MacGregor et al., 2020; MacGregor and Phipps, 2020). Instead, an institution needs to develop conditions at both individual and organisational levels for generating impact, including the skills and capability to conduct action-oriented and robust research to underpin impact, and the generation of social capital within stakeholder networks and partnerships to address societal challenges (MacGregor et al., 2020; Reed and Fazey, 2021).

Although there is a wealth of literature that has explored the process of research impact assessment in different countries and in different disciplines (e.g. Penfield et al., 2014; Cook et al., 2017; Joly and Matt, 2017; Adam et al., 2018; Weisshuhn et al. 2018; Tsey et al., 2019), there has been no international study to date that systematically analyses higher education and research institutions' own impact strategies. As a result, impact strategies are poorly understood and there is no formal understanding of the different approaches that institutions are taking to developing their impact culture. There is also a lack of any critical appraisal of the strengths and weaknesses of current strategic planning and practice. There are no existing publications that set out the range of practices proposed under current institutional impact strategies, and this limits the ability of higher education and research institutions to learn about the diversity of approaches taken elsewhere. Given the potential for well-designed impact strategies to enable institutions and their researchers to address

the complex challenges that we face in the 21st century, it is important to address this knowledge gap.

In response, this study explores what types of impact strategies higher education and research organisations are adopting to drive impact from research. The work provides the first formal analysis of impact strategies from around the world, informing a typology of strategies that can be used to guide the development of future institutional impact strategies. In considering how future strategies might build institutional impact capacity and impact culture more effectively, the findings suggest which mechanisms might offer the most potential to transform how institutions operate in this space and enable researchers to address 21st century challenges.

2 Methods

A total of 77 impact strategies were analysed including 38 from the UK, 9 from Canada, 8 from Australia, 8 from Hong Kong, 7 from Denmark, 2 from New Zealand and 5 independent research organisations (Table 1). The majority (66 strategies) were for Higher Education Institutions (mainly Universities); the sample included 19%, 9%, 19%, 100%, 88% and 25% of Higher Education Institutions in the UK, Canada, Australia, Hong Kong, Denmark, New Zealand respectively (however note, the different approach to identifying impact strategies for Hong Kong, China, and Denmark below, which may account for the higher proportion found in these jurisdictions). Two strategies were found representing sub-units within UK Universities (a college and research institute operating within Universities), four were cross-institutional research programmes or centres (N8 AgriFood, ClimateXChange Centre of Expertise, WISERD and Third Sector Research Centre), and five were independent research institutes (Institute for Development Studies, Plymouth Marine Laboratory, Stockholm Environment Institute, CGIAR and CERN).

Impact strategies were identified in four ways. First, as non-peer-reviewed texts, a non-academic Internet search engine (Google) was used to identify impact strategies by combining search terms including “impact”, “knowledge exchange”, “knowledge mobilisation”, “knowledge transfer” with “strategy”, “strategic plan” and “university”, “higher education”, “research”, “research centre” and “research institute”. Second, strategic documents were sourced via international email lists including the JISCMail International Impact Network (which has a bias towards Australia), and the Association for Research Administrators and Managers (exclusive to the UK) and Fast Track Impact mailing lists (with global coverage but a bias towards UK, Australia and New Zealand). Third, additional strategies known to the authors (including two unpublished strategies that were made available for the analysis) were included in the sample.

Finally, to evaluate whether strategies might have been missed because searches were conducted only in English, University strategies were systematically assessed for all Universities in two non-English speaking countries, Denmark and Hong Kong, China. These were selected on the basis of one author’s in-depth knowledge of the Danish Higher Education system and the well-developed impact evaluation system in Hong Kong (and translated to English for the analysis where necessary). Of the higher education institutions in both jurisdictions, all but one (which did not have a publicly available detailed strategy) included substantive impact goals and activities in their institutional strategies, and were brought into the sample.

Inclusion criteria were that strategies: a) were for a unit or institution that conducts its own research (strategies by networks e.g. Research Impact Canada and funding organisations were excluded); b) were in use at the time of the analysis, or the time horizon over which

impacts were planned was recent; and c) had dedicated section(s) and/or substantive goals and activities about (rather than just passing references to) research impact strategy. Four strategies were excluded from the analysis on the basis of these criteria. Where a dedicated impact strategy was available, this was analysed instead of the wider research or institutional strategy (e.g. University of West of England, Bristol), unless impact strategies for that institution were designed for a single unit within it (e.g. University of Glasgow's Knowledge Exchange and Innovation Strategy 2017-2021 was analysed in addition to the Public Engagement and Knowledge Exchange Strategy of the University of Glasgow's Institute of Health and Wellbeing). One of the documents analysed was a report making recommendations for University strategy to enhance impact (The University of British Columbia), and two were draft strategies (The University of Auckland and Plymouth Marine Laboratory).

Only text pertaining to research impact was extracted and analysed from the strategies. This therefore excluded for example, information about sustainability initiatives (e.g. in estates) not linked to research, and impact from teaching where it was not explicitly linked to research e.g. widening participation initiatives. All searches and requests were done in English and all the documents found were in English. Although this is likely to have led to a bias towards institutions in English-speaking countries, this was deemed to be a minor limitation given the widespread use of English in the higher education sector and the specific inclusion (and translation to English where necessary) of strategies from two non-English speaking jurisdictions, Denmark and China (Hong Kong).

The thematic analysis approach outlined by Braun and Clarke (2006) was used to undertake in-depth analysis of strategies, using Microsoft Excel to manage the data. All qualitative analysis was conducted by the lead author to maintain consistency across the sample. Themes were developed *a posteriori* during an initial open coding phase, as described in Braun et al. (2015), with themes being sub-divided and integrated when sub-themes or repeating themes emerged during the analysis. Axial coding (grouping and abstracting data into categories) was then used to organize themes into theoretical constructs that informed the development of the typology in the next section. Points have been illustrated with quotes to provide examples of the themes that emerged. As the sample consists mainly of publicly available texts, these are not anonymised, unless the strategy was provided for analysis on the condition of confidentiality.

In addition, frequently occurring words were identified using the Wordle desktop application (Viegas et al., 2009), visualised into word clouds excluding the most common English words and tables of the most frequently occurring words excluding common words, synonyms, institution names and the words "research", "researchers", "impact" which occurred frequently across all strategies sampled. Note that these frequencies are based on extracts from strategies where they discuss impact, not the full text of each strategy. Given the limitations of methods based on word frequency (e.g. Williams et al., 2013), these results are provided to supplement the qualitative analysis, which provides the context within which these findings are interpreted.

All publicly available strategies analysed in this paper are available as part of a database of impact strategies, available at: www.fasttrackimpact.com/impactstrategies.

Table 1: Strategies included in the sample

Name	**Organisational Unit**	**Document name**	**Date** where stated	**Dedicated impact strategy**	**Part of a wider strategy**
UK academic institutions, programmes and units					
Aberystwyth University	University	Towards the next 150 years: Aberystwyth University Strategic Plan 2018-2023	2018	✓	
Anglia Ruskin University	University	Research and Innovation Strategy 2018-2022	2018		✓
Brunel University London	University	Brunel 2030: A university for a changing world	Not given		✓
Climate XChange Centre of Expertise	Cross-University Research Programme	A Knowledge Exchange Model for research, policy and practice	2016	✓	
Climate XChange Centre of Expertise	Cross-University Research Programme	A Knowledge Exchange Model for research, policy and practice	2016	✓	
College of Arts, Humanities and Social Sciences, The University of Edinburgh	College within a University	Strategy for Research and Knowledge Exchange	2016		✓
De Montfort University	University	Research Strategy 2018-2023	2018		✓
Durham University	University	Durham University Strategy 2017-2027	2017		✓
Goldsmiths University of London	University	Goldsmiths' Strategy 2018-2023	2018		✓
Imperial College London	University	Pathways to Societal Impact	2016		✓
Institute of Health and Wellbeing, University of Glasgow	Research Institute within a University	Public Engagement and Knowledge Exchange Strategy April 2012	2012	✓	
Keele University	University	Keele Research Strategy	2020		✓
King's College London	University	King's Strategic Vision 2029	Not given		✓
Leeds Trinity University	University	Research Strategy 2018-21	2018		✓
London Metropolitan University	University	Strategy 2019/20 – 2024/25	2019		✓
Manchester Metropolitan University	University	Research and Knowledge Exchange Strategy	2017		✓

N8 AgriFood	Cross-University Research Programme	N8 Agrifood Theory of Change and Logic Model	2017	✓	
N8 AgriFood	Cross-University Research Programme	N8 Agrifood Theory of Change and Logic Model	2017	✓	
Norwich University of the Arts	University	Research Strategy 2015-2020	2015		✓
Queen Mary University of London	University	Strategy 2030	Not given		✓
Sheffield Hallam University	University	Impact Strategy For Research And Knowledge Exchange	Not given	✓	
SOAS University of London	University	SOAS Vision and Strategy 2016-2020	2016		✓
The London School of Economics and Political Science	University	LSE 2030 Strategy	2019		✓
Third Sector Research Centre	Cross-University Research Centre	Knowledge Exchange, Communication & Impact Strategy	2010	✓	
University of Bath	University	Looking Further University Strategy 2016-2021	2016		✓
University of Brighton	University	Research and Enterprise Strategic Plan 2017-2021	2017		✓
University of Exeter	University	Research and Impact Strategy 2015-20	2015		✓
University of Glasgow	University	Knowledge Exchange and Innovation Strategy 2017-2021: Changing the world through Engagement – Innovation – Impact	2017	✓	
University of Lincoln	University	Thinking Ahead 2016-2021: University of Lincoln Strategic Plan	2016		✓
University of Liverpool	University	Our Strategy 2026	2016		✓
University of Oxford	University	Strategic Plan 2018-23	2018		✓
University of Portsmouth	University	Research and Innovation Strategy 2015-2020	2015		✓
University of South Wales	University	Research Strategy 2018-2028	2018		✓
University of Sunderland	University	Impact Strategy	Not given	✓	
University of the Highlands & Islands	University	Research, Impact and Knowledge Exchange Strategic Plan 2018-2023	2018		✓
University of the West of England	University	Research Impact Strategy	2015	✓	
University of Warwick	University	Our Research Strategy	Not given		✓

Ulster University	University	Research & Impact Strategy 2017-2022	2017		✓
Wales Institute of Social and Economic Research and Data (WISERD)	Cross-University Research Centre	Engaging for Impact – WISERD's Knowledge Exchange Strategy 2012-2015	2012	✓	
Australian Universities					
Charles Darwin University	University	Connect Discover Grow	2015		✓
La Trobe University	University	Research Impact Strategy 2019-2022	2019	✓	
Queen's University	University	Our Future is You: a strategic plan for our shared future 2019-2023	2019		✓
Monash University	University	Research Agenda 2020	2019		✓
The University of Queensland	University	Strategic Plan 2018-2021	2018		✓
University of Melbourne	University	Research at Melbourne: Ensuring Excellence and Impact to 2025	Not given		✓
University of Wollongong	University	Research Impact Strategy: White Paper	2019	✓	
Victoria University	University	Strategic Plan 2016-2020	2016		✓
New Zealand Universities					
Massey University	University	Research Strategy 2018-2022	2018		✓
The University of Auckland	University	Research Impact Strategy	2019	✓	
Canadian Universities					
Athabasca University	University	Strategic Research Plan 2018-2022	2018		✓
Memorial University of Newfoundland	University	Public Engagement Framework	2012	✓	
Queen's University	University	Strategic Research Plan 2018-2023	2017		✓
The University of British Columbia	University	Enhancing KMb@UBC: Mobilizing UBC Research in The Policy Realm	2017	✓	
University of Calgary	University	2018-23 Research Plan	2018		✓
University of Manitoba	University	Strategic Research Plan 2015-2020	2015		✓
University of Ottawa	University	Research with Impact Knowledge Mobilization Institutional Strategy 2019-2021	2019	✓	
University of Regina	University	All Our Relations Strategic Plan 2020-2025	2020		✓
University of Waterloo	University	Connecting Imagination with Impact	2020		✓
Hong Kong Higher Education Institutes					
The Chinese University of Hong Kong	University	CUHK Strategic Plan 2016-2020	2016		✓

City University of Hong Kong	University	Strategic Plan 2020-2025: World-Class Research and Education	2020		✓
The Education University of Hong Kong	University	Strategic Plan 2016-2025	2016		✓
The University of Hong Kong	University	Asia's Global University: The Next Decade – Our Vision for 2016-2025	2016		✓
The Hong Kong Polytechnic University	University	Shaping the Future: Strategic Plan 2019/20-2024/25	2019		✓
Hong Kong Baptist University	University	Strategic Plan 2018-2028: Climb High, Gaze Far	2018		✓
The Hong Kong University of Science and Technology	University	HKUST 5 Year Strategic Plan 2020: Innovating Today, Imagining Tomorrow	2020		✓
Lingnan University	University	Stronger, Higher: 2019-2025 Strategic Plan	2019		✓
Danish Higher Education Institutes					
University of Copenhagen	University	Talent and Collaboration: Strategy 2023	2017		✓
Copenhagen Business School	Higher Education Institute	CBS Strategy	2020		✓
Aarhus University	University	Aarhus University Strategy 2025	2020		✓
Syddansk Universitet	University	SDU's fundamental narrative: 'Our SDGs'	Not given		✓
Aalborg University	University	Knowledge for the world. Aalborg University Strategy 2016-2021	2016		✓
Roskilde University	University	Strategy RUC 2030: Interconnected	Not given		✓
Technical University of Denmark	University	Strategy 2020-2025: Technology for People	2020		✓
IT University of Denmark	University	ITU Strategy 2022-2025	2021		✓
Independent research institutes					
CERN	Independent Research Institute	2020 Update of the European Strategy for Particle Physics by the European Strategy Group	2020		✓
CGIAR	Independent Research Institute	Research Strategy 2030: Ending hunger by 2030 through science to transform food, land and water systems in a climate crisis	Not given		✓
Institute of Development Studies	Independent Research Institute	Engaged Excellence for Global Development Strategy 2015-20	2015	✓	
Plymouth Marine Laboratory	Independent Research Institute	PML Research Impact Plan 2020-2025	2020	✓	
Stockholm Environment Institute	Independent Research Institute	Strategy 2020-2024	2020		✓

3 Results

Figure 1 provides an overview of the strategies reviewed from each jurisdiction, including lists of the most frequently used words. Excluding common words, synonyms, institution names and the words “research”, “researchers”, “impact” and “university” (which occurred frequently across the sample), the word “partnerships” (and related words e.g., partners, partnering etc.) appeared in the top ten most frequently used words in all seven jurisdictions included in the sample. The word “development” was used frequently in six out of seven jurisdictions, “support” and “engagement” were used frequently in five out of seven jurisdictions, and “knowledge” and “community” were used frequently in four out of seven jurisdictions. Some words were specifically associated with certain jurisdictions, for example “Indigenous” appeared frequently in Australian and Canadian strategies. The following words only appeared frequently in a single jurisdiction:

- UK: “exchange”
- Australia: “training”, “industry” and “evaluation”
- New Zealand: “Pasifika”, “focus”, “new” and “local”
- Canada: KMb (the abbreviation for Knowledge Mobilisation)
- Hong Kong, China: “strategic”, “transfer”, “world”, “entrepreneurship”
- Denmark: “sustainable”, “challenges”, “collaboration”, “contribute”, “technologies”
- Independent research institutes: “project”, “stakeholders”, “work” and “tools”.

In part, these differences reflect differences in terminology between jurisdictions in the words used to describe impact generation processes: knowledge “exchange” in the UK; knowledge mobilization (“KMb”) in Canada; and knowledge “transfer” in Hong Kong. However, these differences also go deeper, as will be discussed using qualitative data analysis later in this section.

Of the 77 strategies reviewed, 19 of these (25%) were dedicated impact strategies, and the rest integrated impact into wider institutional strategies and plans. Based on word frequency data, there were a number of differences between the content of dedicated impact strategies compared to sections about impact in wider institutional documents. Six out of the ten most frequently used words were shared between both types of strategy (“public”, “partnerships”, “development”, “support”, “engagement” and “knowledge”). Dedicated strategies were more likely to use the words “activities”, “KMb”, “policy”, “public” and “opportunities”, and where impact was embedded in a wider strategic plan, sections dedicated to impact were more likely to use the words “community”, “innovation”, “society”, “world” and “global”.

Although the sample was dominated by University strategies, 11 out of 77 represented more specialised sub-units within Universities, cross-institutional research programmes and independent research institutions, and these strategies appeared to be significantly different to the University strategies on the basis of word frequency (Figure 2) and qualitative data analysis. Both types shared a focus on “engagement”, “development”, “partnerships” and “support” for “activities” based on “knowledge” from research. However, Universities were more likely to focus on the “public” and “communities”, link to “innovation” (typically in the context of industry links) and have a stronger focus on “society”. On the other hand, strategies for more specialised units were more likely to emphasise “policy” and “project” “work” with “stakeholders”. Sub-units within Universities, cross-institutional research programmes and independent research institutions were more likely to have dedicated impact strategies, which may explain the similarity between the words used frequently in each. This was indicative of a stronger focus on specific activities and projects across strategies for the more specialised units, to benefit specific sectors (e.g. the pharmaceutical and creative industries, or third sector) and beneficiaries (e.g. clinicians, creative practitioners and non-governmental organisations) and based on the focus of the unit (e.g.

University of Glasgow's Institute for Health and Wellbeing or The University of Edinburgh's College of Arts, Humanities and Social Sciences).

To draw out comparisons and lessons from these findings we identified six themes that occurred across all strategies; engagement and partnerships, co-production and boundary organisations, resourcing for impact, impact training, monitoring and evaluation and impact culture and analysed findings on each.

UK		**Frequency**
	Knowledge	118
	Develop	172
	Policy	170
	Partnerships	141
	Support	130
	Innovation	129
	Engagement	129
	Public	99
	Activities	98
	Exchange	83
Australia		
	Engagement	62
	Community	55
	Development	47
	Partners	46
	Support	42
	Training	37
	Indigenous	36
	Industry	31
	Evaluation	28
	Evidence	26
New Zealand		
	Support	21
	Development	21
	Society	18
	Communities	15
	Partnerships	15
	Pasifika	9
	Knowledge	8
	Engagement	8
	Focus	7
	New	7
	Local	7

Canada		
	KMb	102
	Community	73
	Knowledge	72
	Engagement	50
	Support	47
	Activities	41
	Partnerships	38
	Public	33
	Indigenous	33
	Innovation	33
Hong Kong		
	Knowledge	40
	Development	37
	Community	25
	Partnerships	24
	Innovation	24
	Strategic	23
	Transfer	22
	World	21
	Entrepreneurship	21
	Education	20
Denmark		
	Society	48
	Sustainable	37
	Collaboration	36
	Development	35
	Contribute	30
	Education	28
	Challenges	27
	Knowledge	25
	Partners	23
	Technologies	21

Independent research institutes		
	Development	96
	Partners	60
	Project	58
	Stakeholders	45
	Support	41
	Work	40
	Engagement	38
	Tools	38
	Policy	38
	Evidence	36

Figure 1: Most frequently used words in text written about impact in institutional strategies from the UK (n = 38), Australia (n = 8), New Zealand (n = 2), Canada (n = 9), Hong Kong (n = 8), Denmark (n=7) and independent research institutes (n = 5), visualised in word clouds (excluding common English words) and listed by frequency (excluding common words, synonyms, institution names and the words “research”, “researchers”, “impact” which occurred frequently across all strategies sampled). Where synonyms were combined, the most frequent synonym is reported in the table.

University impact strategies		Frequency
	Development	322
	Partnerships	275
	Community	262
	Engagement	251
	Support	241
	Knowledge	225
	Innovation	216
	Society	151
	Activities	142
	Public	139
Impact strategies for specialised units, programmes and institutions		
	Development	108
	Knowledge	98
	Policy	85
	Activities	73
	Project	70
	Partners	66
	Support	63
	Work	56
	Stakeholders	55
	Engagement	54

Figure 2: Most frequently used words in text written about impact in University strategies (n = 66) and strategies for specialised units, programmes and institutions (n = 11), visualised in word clouds (excluding common English words) and listed by frequency (excluding common words, synonyms, institution names and the words “research”, “researchers”, “impact” which occurred frequently across all strategies sampled). Where synonyms were combined, the most frequent synonym is report in the table.

3.1 Engagement and partnerships

Building and maintaining relationships is established as one of the most valuable precursors to achieving research impact (Stanley, 2016) and so it is not surprising that the most prevalent theme across all the strategies reviewed was partnerships and stakeholder and public engagement (it was a key theme in 51 out of 77 strategies). However, approaches to engagement and partnerships varied widely across the strategies reviewed. This can be dictated by considerations of place or impact types and while most contained descriptions of planned activities some addressed the importance of needs analysis or planning to improve the nature of relationships on an ongoing basis.

University strategies identified partnerships with organisations across the local region and at national and international scales. Engagement within the University's city and region was a common theme, and was particularly prevalent in London-based Universities. For example, the strategy for King's College London aspired by 2029 to "*be regarded throughout the world as London's leading civic university… making a valuable contribution to the capital's health and success through a wide range of collaborations that both draw London into King's and put King's expertise to work in productive ways that have meaning for London*."

Partnerships with business and industry partners featured in strategies across the sample. Research and innovation clusters (also named 'precincts') were mentioned in strategies for Monash University and University of Melbourne. University of Oxford was engaging in expansion of innovation districts in and around Oxford, a number of Universities collaborated in science parks (e.g. the Universities of Lincoln, Exeter and Durham were investing in Lincoln Science Park, Exeter Science Park and NETPark respectively and City University of Hong Kong was running an incubation programme at Shatin Science Park), and Anglia Ruskin University was one of many Universities that ran shared spaces for the co-location of start-ups and applied research groups. These are geographical areas, typically in the same city or state as the University, where Universities and companies cluster (often including co-location in dedicated buildings), pool facilities and expertise and connect with start-ups and business incubators, facilitating economic and social development. In the UK, similar proposals were made for engaging with Local Enterprise Partnerships to establish collaborative spaces where researchers and business could drive the local economy, or the creation of 'Catapults' and incubators to drive innovation in collaboration with local industry. The University of Melbourne strategy explained how this works:

"To foster productive research collaborations, a key starting point is the development of strong clusters of research activity which bring together people and infrastructure in productive ecosystems. … With appropriate settings, these clusters can become 'research precincts' – a powerful means of harnessing collaborations and boosting innovation effectiveness. … Precincts offer a way to reach across and beyond organisational boundaries to generate far greater impact on challenging problems than the University could achieve alone. They can have a physical centre and be linked to nodes in different geographical locations."

In some cases, generation of new income streams motivated the development of partnerships for example La Trobe University explained how "*existing and new partners will actively seek out our researchers because of their proven track-record… [and this] strategic engagement will increase our end-user (Category 2-4) income stream*." Imperial College London's strategy includes a goal to "*diversify funding by engaging with new public and third sector collaborators*." Danish strategies were less specific about business engagement, for example Syddansk University simply sought to "*promote research areas that match positions of strength in the regional business community*", and Aalborg University's "*carefully selected knowledge-sharing partnerships are based on mutuality and a shared focus*".

University strategies were also more likely to include civic and/or public engagement. The majority of public engagement in the strategies aimed to provide benefits to society, but often articulated one-way knowledge transfer and communication methods. For example, Goldsmiths University of London offered a "*range of short courses, our public lectures and events programme and our library and archives*" to make knowledge widely accessible to their publics. Similarly, Sheffield Hallam and Ulster University proposed "*marketing*" their research to the public via social media, driving engagement with events and archives. University of Copenhagen emphasised the importance of schools as key stakeholders, and sought to develop teaching materials and contribute toward curriculum development. Similarly Lingnan University sought to support STEAM education in primary and secondary schools.

Some strategies framed public engagement as capacity building, including more two-way knowledge exchange mechanisms. For example, Memorial University of Newfoundland aimed to "*[build] greater capacity for our external partners and collaborators through public engagement activities*". University of Calgary described how community engagement actually shapes their research, as they have a "*responsibility to engage our communities that we serve and lead in discussions about important issues where evidence is required to better understand those issues or even resolve them. Our community engagement significantly influences our research directions*".

Strategies also aimed for international partnerships, and these were wide-ranging, including with: business and industry; governments and agencies; UN organisations and other international institutions and convention bodies; cultural organisations; community organisations and other civil society organisations; practitioners; experts and researchers in think tanks and academia; not-for-profit organisations and philanthropic groups. It was common for strategies to identify partnerships with other Universities internationally, but few linked this to impact. Stockholm Environment Institute did, however, and they explained why: "*We partner with other knowledge-providers for multiple reasons: to access expertise, to ensure our research is firmly grounded by consulting with local and regional research partners, and to create alliances for achieving greater impact on policy and practice.*"

More rarely strategies referenced partnerships with funders (e.g. Research England, which co-ordinates the UK's Research Excellence Framework). Stockholm Environment Institute explained their reason for including their funders as partners, to help them to identify "*knowledge frontiers, [provide] scientific approaches to their problems, and [deliver] outputs and results that are accessible and actionable*", but emphasised the need to "*operate at arm's length*" to avoid conflicts of interest.

There was not always a specific strategy to develop partnerships with particular sectors or types of organisation; for example University of Wollongong proposed a needs analysis to prioritise future partnerships in relation to University strengths and stakeholder needs. Similarly, University of Exeter proposed systematically mapping industry needs on a sector-by-sector basis "*against current expertise and academic hires*" to provide "*introductions, facilitate initial meetings…and build industrial interactions and engagement*". University of Auckland proposed hosting industry/stakeholder days to identify stakeholder needs, which they argued would "*provide opportunities for our local communities and other stakeholders to share with us what impact means to them*". Although partnerships were sometimes focussed on seeking funding from external organisations to create new infrastructure or capacity within the University, they were more often focussed on delivering benefits to collaborating groups and those they served in society, in some cases referencing the achievement of Sustainable Development Goals.

Strategies referenced a number of mechanisms for maintaining and deepening partnerships. For example, University of Ottawa emphasised networking events, with a KMb hub to

facilitate networking and identify networking events and consultations run by their stakeholders that researchers could participate in, alongside the provision of tools and services to facilitate networking. The University of Queensland had a Special Studies Program to encourage researchers to engage with industry, government and the wider community, and funded industry placements for research students. University of Lincoln funds "*staff placements in, and exchanges with, industry to ensure that our…research is relevant and up-to-date*". University of Glasgow had "outcome agreements" with the Scottish Government "*to support their ambitions in maximising the opportunities afforded to the economy through the exploitation of research undertaken by our world-renowned academics and scientists*". King's College London proposed "*a civic engagement programme that will deliver a coordinated approach to student volunteering, credit-bearing modules in partnership with local community organisations, and an annual Civic Challenge*." The University of Portsmouth strategy talked about its "*portfolio of CPD programmes for government, industry and third- sector partners in response to emerging workforce needs*". The WISERD project used an annual conference and "*evidence symposia across key themes of policy and academic interest*". The Calgary University suggested "*pitch competitions on thematic problems [to] exchange information with external partners*." Hong Kong University of Science and Technology aims to "*promote community service: by raising civic awareness and social entrepreneurship and setting up an ecosystem to support social enterprise start-ups*" and by reaching out "*to more students and faculty and encourage them to actively participate in community service programs*". Similarly, Roskilde University and Technical University of Denmark taught their students to become "*change agents*", develop businesses and "*take leadership of sustainable change*". Aalborg University used "*problem-based learning as a valuable means to establish successful collaboration relationships between our surrounding community and our students. This approach enables the students to gain practical knowledge while the business community gains an insight in the most recent theoretical knowledge*".

Finally, there was a strong emphasis on partnerships with Indigenous populations and their representative bodies across the Australian, New Zealand and Canadian strategies, with commitments often positioned prominently. In many cases, these were framed as acknowledgements, "paying respects" to Indigenous elders, knowledge and land, and they were not all linked to research impact. Where impacts were identified, they tended to focus on "Indigenous advancement", "providing opportunities", "reconciliation" and "empowering" Indigenous staff and students. Some however made explicit links to research and impact, for example University of Wollongong included "*embedding Indigenous principles and practice…into our research processes. A holistic and inclusive institutional view of impact along with academic leadership will also safeguard against instrumentalising university research (directing research solely towards utilisation or political priorities)*". Massey University provided "*support for and facilitation of mentoring networks designed to support researchers working in Pasifika research and development, especially those working in partnership with external stakeholders and Pasifika communities*". Queens University "*support the diversity of perspectives across First Nations, Métis and Inuit communities, while working with the Indigenous research community to examine how Indigenous ways of knowing impact research across the university*". They did this through a Principal's Implementation Committee on Racism, Diversity and Inclusion, community-based participatory research partnerships with Indigenous groups to examine issues of mutual interest and recruiting more Indigenous scholars through initiatives such as the Queen's National Scholar program and the Canada Research Chairs Program. Similarly, University of Regina University aimed to "*build and strengthen our relationships with urban, rural, and remote Indigenous communities with an aim of accountable and reciprocal research; enhance Indigenous engagement in the research enterprise…; [and] enhance professional development opportunities and supports for units and faculties to learn to Indigenize and decolonize pedagogy, curricula, policies, procedures, and processes*".

3.2 Co-production and boundary organisations

Although co-production and boundary organisations are closely related to engagement and partnerships, some strategies took a distinct approach that moved beyond engagement. Many of the strategies discussed more interactive co-construction of knowledge with partners and stakeholders (Campbell and Vanderhoven et al., 2016), where researchers work in partnership with knowledge users. Co-production has been embraced 'because of its potential to improve the quality and relevance of research and its effect on policy and practice' (Redman, 2021) and this was a stronger theme across more specialist units. Given their focus, they tended to provide more detail about specific groups and organisations linked to the organisation's strategic impact goals and scale of operation. For example, The Institute for Development Studies focused on learning partnerships which enable them to learn from their stakeholders to better understand the contexts in which they produce knowledge, so they could co-produce more relevant findings:

"Learning partnerships enable us to better understand the environment in which development happens and map out desired changes, key stakeholders and policy processes. Achieving impact means not just producing evidence, but engaging with the politics of knowledge – who it is produced by and for, and whose voice counts… "

Stockholm Environment Institute went on to describe some of the co-production methods they used: "*We often build engagement into research, through methods such as citizen science or participatory scenario development, co-production processes and workshops and dialogues of different types, as well as through tools and platforms that users can work with independently*". The Plymouth Marine Laboratory strategy provided support to researchers to identify stakeholders early in the research process so that they can co-develop proposals together. CGIAR took this a step further to propose work to get "*greater strategic clarity on where CGIAR lies in the development landscape*", in order to match stakeholder partnerships to challenges, building in "*greater diversity in the range of research and scaling partners*". They went on to specify three types of partnership they wished to target: i) "*partnerships along the impact pathway…to co-deliver on innovations in technology, institutions and policy*"; ii) "*partnerships with the private sector*"; and iii) "*multi-stakeholder platforms*", which they describe as "*structured alliances of stakeholders from public, private and civil society convened in the international development community to address complex global problems enshrined in the SDGs, with CGIAR participating in those whose architecture and activities are best designed to link global policy and local action, and whose actions are informed by research*".

Some of the University strategies also emphasised co-production of knowledge, but rarely considered how this would be done. One exception was University of Glasgow, which in addition to providing training for community and public engagement, sought to "*identify innovative and effective models of community engagement and co-creation from within the institution and provide mechanisms through which these models can be shared, adapted and adopted*".

Universities did however regularly work with boundary organisations, brokers, intermediaries and boundary spanners (see Neal et al., 2021) for definitions). The most common approaches were focussed on interfaces with industry via innovation precincts/districts, science parks and co-location facilities (see above). In the creative sector, Norwich University of the Arts positioned its East GalleryNUA as a boundary organisation designed "*to develop a formal network of partner galleries across the UK and Europe with the potential to host collaborative exhibitions, it becomes a key resource for NUA academic staff and PGRs as well as external colleagues as a forum through which research activity can be organised and disseminated*". The University of British Columbia's KMb Unit employed

brokers to operate "*as a gateway of access between UBC and other communities/ general public… [It] brokers partnerships between communities at UBC and communities outside UBC and operates as a connector for currently existing knowledge mobilization groups and personnel, enhancing cross-pollination, synergy and innovation*". Some strategies mentioned working with organisations and networks that could connect them with other Universities working on impact or public engagement as well as stakeholders, for example Research Impact Canada and the UK's National Co-ordinating Centre for Public Engagement.

In contrast, specialist units were more likely to position themselves as boundary organisations. For example, the ClimateXChange Centre of Expertise was designed to act "*both as a knowledge broker between researchers and policy, and as a research provider*". It operates in two modes. First, it ran a research programme that is co-produced with Scottish Government and its agencies "*to respond to questions and requests for evidence, identify upcoming evidence needs, and then independently plan our research and analysis to meet policy timelines*". Second, it provided a knowledge brokerage service to "*facilitate conversations and broker knowledge across sectors, disciplines and institutions to provide new insights for policy.*". Similarly, CGIAR engaged in "innovation systems", which they described in an early draft of their strategy as follows: "*The concept of an innovation system stresses that the exchange of technology, information and other inputs among people, enterprises, and institutions is key to an innovative process. Within innovation systems, there are no hard boundaries where CGIAR stops and starts*".

3.3 Resourcing for impact

Alongside the externally focussed engagement and co-production strategies was a set of more inward-looking activities designed to support researchers from inside the organisations and improve capacity and capability for delivering impact. The majority of University strategies included resources for dedicated professional services impact staff to provide this support. These teams were typically separate from commercialisation teams or other Knowledge Exchange departments which may have a more external focus (Ward, 2017) , though both clearly worked closely together. Although implicit in most strategies, it was clear that commercialisation teams and organisations like "Warwick Ventures" and "Oxford University Innovation" focussed on industry engagement and economic impacts, while broader impact teams focussed on other sectors and types of impact. These teams provided a range of functions, including:

- Helping researchers develop pathways to impact (including for funding applications)
- Running events including stakeholder workshops and networking events
- Administering impact funding (see below)
- Administering systems and providing training in impact monitoring and evaluation
- Regularly reviewing impact capabilities in relation to their strategy
- Monitoring evolving external agendas to recommend appropriate responses
- Sharing good practice in impact generation
- Co-ordinating impact generation related activities across the institution
- Co-ordinating and delivering training
- Providing or facilitating specialist support for engaging with industry and policy
- Identifying and managing impact case studies
- Providing impact stories to communications teams and press offices
- Creating and managing online resources for researchers to generate impact, in particular impact toolkits, guides, training resources and case studies.

Some activities which crossed over more directly with the commercialisation or knowledge exchange teams include:

- Managing relationships with stakeholders and alumni (in some cases using Client Relationship Management systems)

- Providing a gateway and/or clearly identified contact points for external organisations

Another common approach was to appoint "impact champions" (these featured in strategies from University of Wollongong, La Trobe University, The University of Auckland, University of the West of England, London Metropolitan University, Ulster University, The Chinese University of Hong Kong and the Glasgow Institute of Health and Wellbeing). The champion role included: helping build skills and approaches to impact relevant to the discipline or unit; sharing the knowledge of how to translate and communicate research impact within the discipline or unit; helping prioritise effort and resources for impact; recognise and celebrate impacts occurring in their area; sharing good practice with other champions across the University; and in the case of London Metropolitan University, they were responsible for actually generating impact for research centres. Champions were responsible for these tasks at the scale of departments, schools or faculties, with the goal of providing insights into the unique challenges and opportunities faced by colleagues in their disciplinary area. With the exception of The University of Auckland, which specified both academic and professional services champions, the role was either academic or not specified in the strategy.

A number of Universities ran internal impact funding schemes to generate new impacts or extend existing impacts, and in the UK and Australia in particular, to also facilitate evidence collection activities. The scope of the Warwick Impact Fund (University of Warwick) was particularly broad: "*Internal investment will be available to support a range of innovation activities, from industry- University secondments, industrial fellowships in areas of relevance to the Government's Industrial Strategy, collaborative research projects with practitioners in the public and private sector and with creative industries, 'industry engagement days', and 'proof of concept' and commercialisation funding*". Funds in other Universities were more specialised, for example The University of Edinburgh's College of Arts Humanities and Social Sciences ran "*a venture fund for investment in commercial exploitation of research (through external partnership with Arthurian Life Sciences), [with] strong links to the SET Squared innovation and business incubator, of which we are a member*". In the UK, availability of these funds may depend on an institution's eligibility for government funding from UK Research and Innovation via the Higher Education Innovation Fund, or Impact Acceleration Accounts from the UK's disciplinary research councils.

Many Universities had internal structures to provide accountability and link the activities of impact teams to wider activity in the institution e.g. University of Wollongong's strategy recommended the creation of an "*impact and engagement steering committee reporting to the University Research Committee… compris[ing] senior research staff, relevant support staff and impact champions*". University of the West of England had a similar structure designed to provide "*clear reporting lines for research impact within faculties and between faculties and the university*." This was often operationalised through networks of academic and professional services staff with specific responsibilities for impact, including departmental or school impact officers and facilitators from professional services, and academic co-ordinators and directors of impact or impact champions.

In contrast to the emphasis of University strategies on impact teams, roles, organisational structures and internal funding schemes, impact strategies from more specialised units were more likely to provide training and support and facilitate best practice at the scale of individual research projects or teams, or integrate across projects thematically to achieve economies of scale in specific impact domains. For example, CGIAR's strategy included a mechanism to "*build a shared portfolio of research for development based on pooled funding… [to] achieve the levels of partnership required to scale impact, and attract the best minds to the challenges facing our food, land and water systems*". There was limited information on resourcing and structures for impact in Danish and Hong Kong strategies.

3.4 Impact training

Training was the main alternative (or supplement) to impact support in the strategies reviewed, aiming to build "impact literacy" (as The University of Auckland called it), presumably referring to Bayley and Phipps' (2019) framework for understanding: what impacts happen, for whom, and how researchers can demonstrate it; how research can be mobilised into action; and who is needed, with what skills, to make that happen. In addition to the necessary knowledge and skills to underpin an impact culture, some strategies mentioned the need to change perceptions of impact, for example "s*ocialis[ing] the importance of KMb for research impact among graduate students and faculty*" (The University of British Columbia), "*promot[ing] the benefits of designing research to enhance impact*" (The University of Auckland) and providing opportunities to connect with researchers already engaged with impact via "*networks to connect those who are interested in impact or who are engaging in impact activities already*" (University of Auckland). University of the West of England and University of Calgary proposed going beyond a network to establishing an impact "*community of practice*", presumably referring to Lave and Wenger's (1991) concept of a group of people who "share a concern or a passion for something they do and learn how to do it better as they interact regularly".

As a comparatively new research skill, building capacity for research impact through training is a standard approach, so it is perhaps surprising that impact training was only explicitly included in a minority of strategies (17 out of 77 reviewed). In some cases, these were passing mentions or restricted to certain skills or group, for example The University of Queensland highlighted communications training for graduate researchers. University of Wollongong, La Trobe University, Manchester Metropolitan University, Memorial University of Newfoundland, Plymouth Marine Laboratory and the WISERD project included mentoring or coaching programmes. Although few strategies provided details, topics and skills covered in training programmes included:

- Foundations and principles;
- Planning and designing research for impact;
- Building and maintaining stakeholder relationships;
- Tracking impact pathways;
- Measuring impact success and evidencing impact;
- Communication and dissemination, including media and online engagement skills;
- Public engagement;
- Public policy impact;
- Ethics of research and impact;
- Entrepreneurial skills for researchers and commercialisation routes; and
- Co-production skills.

University of Wollongong's training on co-production sought to "*understand and recognise relevant forms of evidence (including those outside traditional forms valued solely by academics)*". They also emphasised the need to take a co-ordinated approach to training, revisiting a "*researcher development needs analysis*" and identifying training priorities at school and faculty levels. A number of strategies included the development of online toolkits, guides, training resources and case studies, including definitions, templates and signposting to specialist sources of support. As might be expected, there were often links between the content of these published resources, training and the functions for which impact teams were responsible (see previous section) e.g. all three covered monitoring and evaluation of impact.

The independent research institutes tended to take a different approach to impact training compared to the other organisations and units in the sample. While recognising the

importance of building capacity in their research community, their focus was on training and building capacity among stakeholder communities, for example training them in the use of decision-support or analytic tools arising from research or in the use of collaborative data platforms (Stockholm Environment Institute), and "*targeted capacity development…ranging from training-of-trainers at the farmer level through to ongoing institutional support to national partners…and technical advice to policy-makers at global level*" (CGIAR). The only parallel to this in the University strategies was Memorial University of Newfoundland which sought to build stakeholder capacity for engaging with researchers and The University of British Columbia "*trains and builds capacity for research utilization in partnerships with different stakeholders*".

3.5 Monitoring and evaluation

Few of the strategies included key performance indicators or success measures (16 out of 77) or any more detailed information about monitoring and evaluation of impact (15 out of 77). Of all the jurisdictions analysed, Australian strategies were most likely to mention the word "evaluation", but only three strategies from this country contained substantive monitoring and evaluation activities (described below). However, five out of the 12 specialised units, programmes and institutions had a strong focus on monitoring and evaluation, and these were most likely to use impact planning tools such as Theory of Change and logic models.

Strategy implementation was included in some strategies via a Theory of Change (5 out of 77) or logic model (or similar) (4 out of 77) to visualise or tabulate actions, assigning responsibilities and deadlines. For example, University of South Wales used a simple logic model while N8 AgriFood drew on logical framework analysis to plan and track progress towards their impact goals (Figure 4). The N8 AgriFood logic model included assumptions, where risks might be identified. Generally, however, there was limited consideration of risks across the strategies reviewed. Notable exceptions were Norwich University of the Arts and the Third Sector Research Centre, which both considered a range of risks in their strategies. Both focussed primarily on non-delivery risks, while The University of Auckland and The University of British Columbia reported on staff surveys which also highlighted risks of negative unintended consequences arising from impact generation activities (incidentally, The University of British Columbia was the only strategy to mention the need for more research on impact). Plymouth Marine Lab included an implementation timeline with milestones linked to a Theory of Change (Figure 5). In others, reference was made to committees responsible for overseeing progress towards strategy goals (for example see the committee structure proposed by University of Wollongong in the "resourcing for impact" section above).

Table 2 shows the most common indicators used to track progress towards strategic impact goals. The most frequently cited indicator was income from consultancy and industry (used in ten strategies). These mainly came from the UK and Australia, which might reflect the inclusion of industry funding as an indicator in Australia's Engagement and Impact Assessment and in the UK's Knowledge Exchange Framework. There were some nuances in the indicators included in this category, for example, University of Liverpool aimed to achieve specific numbers of new funded strategic partnerships with industry and The University of Queensland aimed to "*rank first in Australia for attracting research income from industry*". Whereas this indicator focussed specifically on funding from industry, three strategies also included indicators based on funding for impact from any source.

Table 2: Key performance indicators and success measures used to track progress towards strategic impact goals, ranked by the frequency with which they appeared in strategies.

Impact indicator	Frequency
Income from consultancy and industry	11
Numbers and/or proportion of high scoring impact case studies (including changes in impact rankings based on case studies)	6
Attendance figures for training events and evaluations of training and impact resources	5
Number of funded impact projects (including impact funding from Government e.g. Higher Education Innovation Fund in UK)	4
Number of press releases and/or media stories featuring research impacts	4
Impact KPIs in appraisals met and promotions due to impact	2
Applications for internal impact awards	2
Impact monitoring established with database	2
Changes in government policy (or citations in policy documents) resulting from research	2
Number of stakeholder engagement activities delivered	2
Number of requests for impact support received	2
Positive researcher attitudes towards impact and support services	2
Changes in audience awareness and/or attitudes resulting from research	2
Proportion of publications co-authored with non-academic partners	1
Number of staff engaged with staff placements in and exchanges with industry	1
Presence and representation on relevant boards and bodies	1
Number of spin-out companies	1
Number of impact opportunities identified, planned and realised	1
Customer Relationship Management system established	1
Scholarly publications arising from institutional support for impact	1

Although only two impact strategies included monitoring and evaluation in their success measures, fifteen strategies included material on this topic elsewhere in the document. In many cases this pertained to the investigation of options for monitoring systems (e.g. La Trobe University and The University of Auckland) or aspirations to "*[develop] processes to capture, collate and celebrate our impact*" (Sheffield Hallam University). Investment in impact monitoring and evaluation was often linked to research assessments and the generation of case studies in the UK and Australia, and in other cases was sometimes linked to the generation of annual reports on impact. Some mentioned specific tools, like Vertigo Ventures Impact Tracker (University of Wollongong) and aimed to increase the use of these tools by researchers. However, it was recognised that impact evaluation was likely to require additional input. For example, University of Wollongong suggested that despite their investment in the impact tracking software, "*without appropriate support mechanisms in place, researchers will be unable to adequately capture or quantify impact. Some of this could be achieved through evidence gathering support from research assistants or professional staff, but in some cases specific expertise (e.g. interviews or surveys) or analytics support (e.g. website demographic analysis) may be required*". As a result, some strategies also aimed to increase capacity for impact evaluation among researchers, for example developing and promoting the use of specific evaluation tools (University of Ottawa). Independent research institutes were the only organisations who employed independent external impact evaluators, partly in response to requirements from their funders. Stockholm Environment Institute had a strong culture of learning around monitoring and evaluation:

"SEI has a scheme of learning activities to ensure that the monitoring and reporting on outputs and outcomes from research activities are fed back into the organization... We

regularly assess our effectiveness in achieving outcomes, capturing key success factors and the dos and don'ts of, for example, stakeholder engagement."

Plymouth Marine Laboratory's approach to monitoring and evaluation was also particularly comprehensive, including: the identification of information gathering points at key project stages, reporting structures, identification of impact indicators at project proposal stage, monthly science area reports providing updates on impact and potential case studies, annual impact reporting for all projects, systems to review all new publications for their impact potential, training for staff on monitoring and evaluation, maintenance of an impact database, timely requests for testimonials from research users, proactive case study monitoring and support, and regular monitoring against the organisation's Theory of Change (Figure 5) and impact performance indicators. There was limited attention given to monitoring and evaluation in New Zealand, Hong Kong and Danish strategies compared to the other jurisdictions in the sample.

3.6 Impact culture

Pressure on research productivity from assessment, precarious contracts, increased competition for research funding and a focus on outputs at the cost of all else has led to a recent rise in interest in 'research culture' or as the Royal Society defines it 'the behaviours, values, expectations, attitudes and norms of our research communities'. Work by Wellcome Trust (2020) and ARMA in the UK (2020) considers factors in research activity that can give rise to 'disruption' of research and how this is manifested in 'poor' research culture. Wellcome deduced that 'Factors identified as disruptive to research culture included chasing impact, increased competition, proliferation of metrics, job insecurity and rigid career pathways.' The UK Government released an 'R&D People and Culture Strategy' in summer 2021 which aims to ensure: 'everyone's contribution is valued, and the UK has an outstanding research culture that truly supports discovery, diversity and innovation, and offers varied and diverse careers that bring excitement and recognition', although most actions are currently reviews and consultations.

Many of the institutional strategies we examined explicitly considered research culture, and as a sub-category within this, much of this content could be implied to apply to impact culture. For example, much of the content in strategies about research ethics, Responsible Research and Innovation, open access policies, equality, diversity and inclusion, and staff health and wellbeing would apply to impact. For the purposes of this study however, only material pertaining specifically to impact culture was analysed.

First, it should be noted that many references to culture were non-specific and ill-defined, and in reality were probably referring to an "approach" rather than a culture, if culture is understood in relation to how people "*find meaning as individuals (on the basis of their own perceptions), collectively (on the basis of social norms and shared perceptions) and through their relationship with objects*" or if impact culture specifically is understood as "*communities of people with complementary purpose who have the capacity to use their research to benefit society*" (Reed and Fazey, 2021). For example, La Trobe University aimed to "*develop a culture that values and generates impact from research through industry engagement*"; Queen's University state that their "*culture of sustainability will be underpinned by our commitment to the United Nations Sustainable Development Goals*"; University of Lincoln aimed "*to promote a culture of enterprise and innovation across our communities*"; Anglia Ruskin University aimed to "*deliver a culture and working environment in which collaborative and multi-disciplinary research and innovation thrive*"; and London Metropolitan University aimed to "*embed impact and knowledge exchange within our research culture*." Very rarely did these and other strategies like them define what they mean by culture or explain how they would achieve their cultural goals.

Implementation Plan

The following table summarizes, at a glance, the objectives and who is responsible for implementing these objectives.

	Responsibility	Timeline	Excellence	Staff and students	ERI and Infrastructure	Connections	Breadth and depth	Enterprise and KT
1	Individuals, Colleges		✓	✓		✓	✓	
2	Colleges, RO, Individuals		✓		✓	✓	✓	
3	RO, Colleges, PVCs, Individuals		✓	✓		✓	✓	
4	Colleges, PVCs, AVCRAE		✓	✓	✓	✓	✓	✓
5	Colleges, PVCs, RO, AVCRAE		✓	✓			✓	
6	RO, PVCs, Colleges, Individuals		✓	✓	✓	✓		
7	AVCRAE, RO, Colleges, Individuals		✓	✓	✓	✓	✓	
8	RO, Colleges, Individuals, PVCs, AVCRAE		✓	✓	✓			✓
9	RO, Colleges, AVCRAE		✓		✓	✓		
10	RO, Colleges, AVCRAE, AVCSFITCO		✓	✓	✓	✓		✓
11	RO, Colleges, AVCRAE, AVCSFITCO, AVCOIUR		✓	✓	✓			
12	RO, Colleges		✓	✓		✓		✓
13	AVCRAE, RO		✓	✓		✓	✓	✓
14	RO, Colleges, AVCMP		✓					
15	RO, Colleges, AVCMP		✓	✓		✓	✓	
16	PVCs, Colleges, AVCRAE		✓			✓		✓

Timeline key:

- Annual
- Annual measure (Year on year through to 2022)
- Annual measure (based on three-yearly IRP's)
- Annual increase (by 2022)
- Short term (by 2019)
- Long term (with annual review)

PVCs – Pro Vice Chancellors

AVCRAE – Assistant Vice Chancellor, Research, Academic and Enterprise

AVCSFITCO – Assistant Vice Chancellor, Strategy, Finance, IT and Commercial Operations

AVCMP – Assistant Vice Chancellor, Māori and Pasifika

AVCOIUR – Assistant Vice-Chancellor, Operations, International and University Registrar

RO – Research Operations

Figure 3: Implementation plan for Massey University's strategic plan including enterprise and knowledge transfer (KT) in the far-right column

Objective	We will achieve this by:	Baseline 2018	Success Measure 2021	Success Measure 2027	Lead person
Nurture and sustain research with impact that crosses disciplinary boundaries and addresses societal challenges	1. Stimulate multidisciplinary research by funding and supporting pan-university networks focussed on global societal challenges; incentivise linkages between research groups and participation in national and international networks to create critical mass	49% of our impact case studies scoring 3/4* in REF2014 with 4*:3* split 30:70	60% of our impact case studies scoring 3/4* with 4*:3* split 40:60	75% of our impact case studies scoring 3/4* with 4*:3* split 50:50	Pro Vice-Chancellor Research
	2. Continuing professional development on: the importance of and how to develop impact from research; entrepreneurship and routes to commercialisation	Not available	50 participants having completed Impact Leadership development programme and/or Impact Awards	200 participants having completed Impact Leadership development programme and/or Impact Awards	Director of Research & Business Engagement
Building multi-touch relationships and long-term partnerships to provide routes to impact	3. Exploit existing links with regional and national industry for internships, placements, graduate employment and staff secondments to build consultancy and contract research income and vice-versa. Facilitate strategic partnerships with university-level support and key (academic) account managers.	No B2B CRM for information sharing.	B2B CRM operational, all internships, placements, graduate employment, consultancy and contract research captured. 6 university-wide strategic partnerships; adding one new per year	10 university-wide strategic partnerships	Director of IT Services; Pro Vice-Chancellor Research

OUTCOME 1	**Outcome Indicator 1.1**		**Baseline 01/05/18**	**Milestone 1 31/12/18**	**Milestone 2 30/08/19**	**Target 31/03/20**	**Assumptions/notes**
N8 AF influencing changes in agrifood and environmental policy and practice	N8 has influenced post BREXIT policy	**Planned**		Key messages identified	Reccommendations for future policy made	Policy brief and reccommendations	O.I 1.1 - will know likely influence here by Nov 2018. *change = forming lasting collaborations, applications for funding etc. O.I 1.2 Clusters currently being decided
		Achieved					
			Source				
	Outcome Indicator 1.2		**Baseline 01/05/18**	**Milestone 1 31/12/18**	**Milestone 2 30/08/19**	**Target 31/03/20**	
	Clusters generating change* in the north of England	**Planned**		a), b), c)	a), b), c)	a), b), c)	
		Achieved					
			Source				
			KEFs, Reports				

OUTPUT 1.1	**Output Indicator 1.1a***		**Baseline 01/05/18**	**Milestone 1 31/12/18**	**Milestone 2 30/08/19**	**Target 31/03/20**	**Assumption/notes**
N8 AgriFood community influencing the policy landscape	Number of policy forums/meetings	**Planned**	0	5	8	12	
		Achieved					
			Source				
			Policy audit and planned events/meetings. Reporting				
	Output Indicator 1.1b*		**Baseline 01/05/18**	**Milestone 1 31/12/18**	**Milestone 2 30/08/19**	**Target 31/03/20**	
	Instances of influence on a) policy, b) practice.	**Planned**		a)17, b)	a)30, b)	a)40, b)	
		Achieved					
			Source				
			Policy audit and planned events/meetings. Reporting				

Figure 4: Examples of logic models from University of South Wales (top) and N8 AgriFood (bottom)

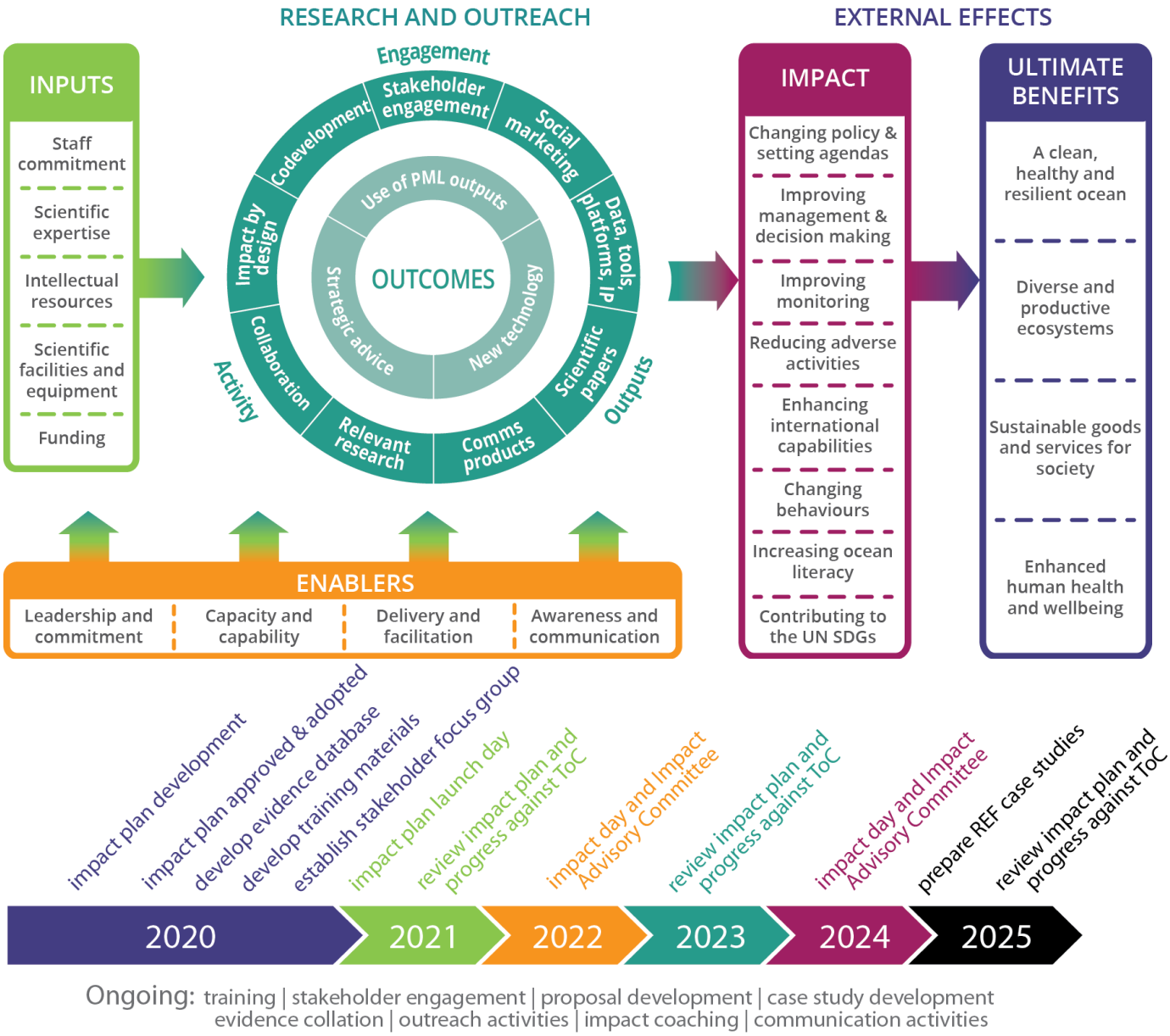

Figure 5: Theory of change (top) and implementation plan (bottom) from Plymouth Marine Lab.

Impact culture was often associated with values, for example, the Hong Kong Polytechnic University aimed to "*align departmental and individual performance measures to better reflect a congruent value system that properly addresses the balance among education, research and community impact through KT and entrepreneurship*". The Brunel University strategy described a "*culture of mutual respect and equality of opportunity, placing the health and welfare of individuals at the heart of our ethos*". The University of Edinburgh described "*a shared culture that values people and provides leadership within a supportive working environment built upon collaboration, communication and coordination*". Queen Mary University of London sought to "*build on our core values to further embed a culture of engaged research practice*". Stockholm Environment Institute provided one of the richest descriptions of an impact culture rooted in clearly articulated values and principles:

"Our organizational culture lays the foundation for the way we work with partners and with each other. Our culture is grounded in our development ethos and commitment to resolving sustainability challenges, from local to global. It stands for transparent and inclusive decision making, for building and maintaining trust, for empowering our partners, for giving space to diverse voices, and for delivery of the highest quality. It holds us to ethical standards of integrity, collegiality and respect in all our professional interactions."

Hong Kong University's strategy sought transformational change in its culture, to deliver impact: "*We will make a paradigm shift to focus on and reward…research innovations that benefit communities and transform global technologies…There will be a shift from activity to value, from output to outcome, and from strength to leadership*." To do this they proposed to: "*provide more opportunities for outcomes-driven translational and transformational research; support research that transcends intellectual output to meeting an innovative outcome that has value and impact, and driven by societal needs or enterprise; [and] deliver demonstrable and significant outcomes to our social communities and the technological world through research, innovation and enterprise development.*"

Aligned with research culture and values is the issue of intrinsic and extrinsic drivers of behaviours. Extrinsic drivers are those where external demands or incentives provide motivation for researchers and organisations while intrinsic builds on personal values and a fundamental self-motivated desire to meet the needs of society (Ryan & Edward, 2000). These drivers are the building blocks of research and impact culture.

UK strategies were more likely than strategies from other countries to make explicit links between impact and formal assessments of research and impact (16 strategies, compared to two in Australia, one each in New Zealand and Canada and none in Denmark; two of the Hong Kong strategies referenced the Research Assessment Exercise, with one referencing the UK's system as a benchmark). Although these represent a minority of UK strategies, links to REF were particularly prominent in some of these. For example, REF was mentioned in the first point in the first main section of Manchester Metropolitan University's strategy, with the document later implying that investment in research for impact was typically dependent on a return on investment via quality-rated (QR) funds from REF: "*Internal resources will be directed at research that meets our ethical standards and usually: a. Generates academic outputs of sufficiently high quality to attract external income… and b. Generates beneficial social, economic, environmental or cultural impact (sufficient to attract QR funding)*." Similarly, two out of six criteria for the establishment of new Research and Knowledge Exchange Centres were linked to REF performance, Key Performance Indicators were due to be linked to REF (similar to a number of other institutions – see Table 2) and workload allocations across the institution were linked to REF: "*Faculties will set a specific target for the proportion of workload allocation directed at 3* and 4* work and measure against it as a lead indicator of progress with the research strategy*".

A total of 17 out of the 77 strategies reviewed included various kinds of extrinsic incentives designed to increase researcher engagement with impact (Table 3). These were largely absent from the five independent research institute strategies and not present in Danish strategies. There were examples of impact being included in promotions exercises in the UK, Canada, Australia and New Zealand (note that this includes The University of Auckland where inclusion in promotions was under consideration only). The need to "recognise" impact generation activities was noted in two of the Hong Kong strategies, but no mechanisms were proposed (for example, Hong Kong Polytechnic University aims to, "*enhance the benefit-sharing policy and recognition mechanism to encourage academic staff to identify and pursue high-impact KT endeavours*"). Impact was only included in annual appraisals in four strategies (two each from the UK and Australia) and was only included in recruitment criteria in two strategies (both from Australia). Although there were general comments about the need to recognise and celebrate impact across all six jurisdictions and the independent research institutes, formal impact award ceremonies were only mentioned in one Australian and one Canadian strategy.

In two Universities that did not yet offer formal rewards for impact, strategies included findings from staff surveys that highlighted issues arising from the lack of incentives. For example, The University of Auckland strategy noted that, "*Many of our researchers are already conducting impactful research but are often not recognised or rewarded for this, or their work is perceived negatively*", and The University of British Columbia highlighted a number of issues linked to a lack of incentives for impact, including the recognition that impact is "*something Professors do off the side of their desk*" and "*not yet part of the tenure and promotion discussions [or] recognized in most faculties*".

There was limited consideration of the potential negative unintended consequences of providing extrinsic incentives for impact. One notable exception to this was La Trobe University's strategy, which emphasised the need to reward impact without disadvantaging non-applied researchers, recognising "*that there are researchers undertaking pure or fundamental research that may not yield 'real-world' change in the immediate future but will profoundly influence the course of knowledge and the ability of other researchers to achieve future impact*".

Table 3: Extrinsic incentives designed to increase researcher engagement with impact, ranked by the frequency with which they appeared in strategies.

Incentive	**Frequency**
Inclusion of impact in promotion criteria	9
Less formal recognition and/or celebrations of impact (including impact showcase events)	7
Inclusion of impact in annual appraisal criteria	5
Inclusion of impact in recruitment criteria	2
Research impact awards	2
Inclusion of impact in workload allocation models	2
Financial bonuses	1

In contrast to these extrinsic incentives to promote engagement with and reward impact, strategies also sought to engage with the intrinsic motivations of researchers. In an oblique reference to the limitations of incentivising impact via research assessments, University of West of England was "*keen to ensure that a research impact culture extends beyond the REF and that as much of our research as possible is focused on being of value to society*". Connecting with the intrinsic motives of their researchers to innovate to tackle real-world challenges, Stockholm Environment Institute describes itself as a "*a trust-based organizational culture, and our people breathe life into and carry out our mission. We put*

high levels of confidence in our colleagues around the world, which enables SEI researchers to innovate, take initiative, and engage with key arenas of decision making. SEI is innovative and adaptive in order to respond to new challenges".

4 Discussion

The findings from our analysis showed a degree of consensus about the activities and approaches required to develop research impact although there were notable distinctions between strategy documents from the Universities and more specialised institutions or sub-units. Specifically, two broad types of impact strategy emerged from the thematic analysis; those that were focussed primarily on: a) enabling impact; or b) achieving impact (Table 4).

Enabling impact strategies:

- Tended to be developed by universities and research institutes to build impact capacity and culture across the institution. They were often integrated as part of a wider research or university strategy which would include values and a mission or set of goals that included impact. Very few of these strategies included an implementation plan.
- They had a strong focus on partnerships with organisations within their local region, often with an emphasis on industry (for example via innovation precincts, districts, science parks and co-location spaces) and community connections (e.g. via civic and public engagement initiatives, and with a strong emphasis on engaging with and benefiting Indigenous groups in Australia, New Zealand and Canada). These strategies also prioritised partnerships at national and international scales, for example with government bodies and international organisations. To do this, they sometimes collaborated with boundary organisations to engage effectively across particular sectors or populations at scale.
- Enabling strategies were more likely to include investment in professional services staff dedicated to impact, (whether located centrally or locally in departments, schools and faculties), and create academic roles to champion or direct impact within different disciplinary fields, linked to organisational structures to provide lines of accountability and reporting to central committees or leaders.
- In addition to building skills and capacity for impact through training programmes, these strategies often sought to motivate researchers not naturally aligned with impact, for example via opinion leaders (e.g. impact champions) and incentives (e.g. inclusion of impact in academic promotions criteria).
- They were also more likely to run internal funding schemes to support the generation of impact (and in the UK and Australia in particular) the collection of evidence to support impact claims for research assessment purposes.
- Linked to this, enabling strategies were more likely to include key performance indicators or success measures, especially linked to income targets and performance in research assessment exercises.

Achieving impact strategies:

- Also had a strong emphasis on partnerships and engagement, but were more likely to target specific stakeholder groups and organisations linked to the organisation's strategic impact goals (e.g. a profession or sector aligned with the organisation's

discipline(s) or mission) and scale of operation (e.g. within the country or region of the world that the organisation is based in).

- These strategies often included methods and approaches designed to enable the organisation to operate as (or become) a boundary organisation, enabling researchers to co-produce research and impact with trusted networks of stakeholders, and respond to changing needs and contexts adaptively. This included for example: the creation of knowledge brokerage roles within the organisation to connect researchers with specific sectors or communities; stakeholder advisory panels (operating at both institutional and project scales) to provide strategic direction and feedback to researchers; the facilitation of shared learning and innovation spaces, including facilitated workshops, unconferences and other fora, to enable co-production of research and impact; and the use of participatory and co-productive research methods such as citizen science or participatory scenario development.
- Achieving impact strategies were more likely to provide support and facilitate best practice at the scale of individual research projects or teams, with advice and resources tailored to their specific operational contexts. They also integrated across projects thematically to achieve economies of scale in specific impact domains for example developing scaling pathways to design, test and pilot initiatives that could generate impact across projects tackling related issues, or building on pilot work to generate impacts at broader scales through joint working.
- In addition to providing training for researchers, achieving impact strategies sometimes also prioritised capacity building for stakeholders to enable them to work more effectively in teams with researchers to achieve impact together.
- Achieving impact strategies were more likely to include implementation plans, often using Theory of Change or logic models to visualise and plan for impacts, including in some cases assessments of risks and assumptions, and monitoring against baselines.
- These strategies recognised and celebrated impact but were less reliant on extrinsic incentives like promotions and awards, drawing more on the intrinsic motivation of researchers who already align with the mission and values of the organisation.

Enabling impact strategies may be supported by frameworks such as the 5Cs institutional impact health checklist (Bayley and Phipps, 2017) or NCCPE's EDGE tool, which works from similar principles and has a focus on public engagement (NCCPE, 2010). The Knowledge Exchange Concordat (McMillan, 2020) offers '8 Principles', all of which aim to engender an environment conducive to stronger knowledge exchange activity in research organisations. All of these frameworks use a maturity model to allow organisations to assess their stage of development and introduce improved strategies and plans against that benchmarking process. When comparing the themes that emerged from our analysis with these models, it is possible to see significant overlap in some areas (e.g. engagement, resourcing and capacity building) but the role of leadership was emphasised less in the strategies we reviewed than it is emphasised in these frameworks. Achieving impact strategies may be supported by frameworks such as Theory of Change (Mayne 2016), outcome mapping (Earl et al., 2001), logic models or the 7Cs of impact (Sreenan et al., 2019), as these frameworks support more change-oriented planning and focus more on purpose and mission.

Many of the University Strategies drew heavily on familiar notions of one-way research communication to a generalised public and the potential for commercialisation of new 'ideas' through business adoption or spin-offs, although newer forms of more synergistic relationships are being developed through investment in research precincts, co-location and incubators. In Canada, Australia and New Zealand the focus on their indigenous

communities reflects a coming of age of decolonising research and knowledge that is only just being addressed in the UK. The Australian and New Zealand Standard Research Classification Review (2020) generated new divisions in two classification fields for Indigenous Research with a subset of codes for Aboriginal and Torres Strait Islander, Māori, Pacific Peoples and other Indigenous peoples that will continue to drive an explicit focus on engagement with Indigenous communities.

Beyond the Indigenous focus, the more traditional modes of external engagement miss much of the messy complexity of generating impact from research, which could explain the lack of detailed implementation, monitoring and evaluation in most University strategies. The strategies from the specialist institutes, programmes and sub-units tended to be situated in a more specific context related to their mission, and so were able to reflect a deeper understanding of the multitude of ways in which engaging others in shaping, conducting and applying research can lead to greater impact.

As Table 4 shows, the themes that emerged from across the analysis are common in both types of strategy in our typology, and the potential for combining types could be delivered through a nested approach across the scales of the organisation. For example, a research programme may apply an achieving strategy with targeted stakeholder partnerships, clearly identified spaces for shared learning and methods of engagement, and potentially a ToC or logic model for impact. This programme strategy may be nested within a wider School strategy that could combine approaches that enable (academic champions, communications support) and achieve (celebrating impact, integrating research across themes, building stakeholder capacity to engage) and which itself is nested within a broader University wide enabling strategy (providing professional support and training, access to impact funds, internal accountability mechanisms, impact-aligned mission/vision).

Drawing on our analysis, we propose the following lessons for developing an impact strategy:

- Decide what type of impact strategy best meets the goals and context of your organisation, considering whether elements of both types might enrich your strategy overall, or for specific sub-units, sectors, beneficiary groups or other contexts
- Consider how far a nested approach might enable you to meet the needs of different levels of the organisation
- Identify the external frameworks that might help you develop this sort of strategy or provide benchmarking
- If carrying out benchmarking, consider networking with others in a similar position to sanity check your benchmarking or maturity model
- Systematically map stakeholder needs to organisational (or sub-unit) strengths and capabilities, supplementing existing partnerships with programmes of work driven with new stakeholders that emerge from this analysis
- Invest in keeping engagement with partners active (e.g. via thematic or networking events, relationship managers and/or working with boundary organisations), and ensure it is two-way by building capacity for them to engage effectively with researchers where necessary, integrating partners into research via advisory roles and supporting placements for partner staff and for researchers in partner organisations
- Consider whether to invest in becoming a boundary organisation in particular sectors or disciplinary areas, with knowledge brokers proactively reaching out to and becoming embedded within stakeholder networks, or if there are existing boundary

Table 4: Themes from the qualitative analysis that tended to be associated with strategies that primarily sought to enable versus achieve impact (both types had similar approaches to training)

Theme	Enabling impact strategies	Achieving impact strategies
Partnerships and engagement	Partnerships with organisations within the local region and at national and international scales, more likely to include civic and/or public engagement and mechanisms for working with Indigenous groups	Partnerships and engagement with specific groups and organisations linked to the organisation's strategic impact goals and scale of operation
Co-production and boundary organisations	Work with boundary organisations to co-produce research for impact	Often are (or aspire to be) boundary organisations, responsible for driving co-production with specific methods or approaches adapted to their stakeholders
Resourcing for impact	More likely to have dedicated impact teams, roles, organisational structures and internal funding schemes operating at institutional scales	More likely to provide support and facilitate best practice at the scale of individual research projects or teams, or integrate across projects thematically to achieve economies of scale in specific impact domains
Impact training	Impact training appeared in both types of strategy, with skills adapted to the disciplinary contexts of researchers e.g. policy engagement skills for researchers working in policy-relevant fields, and the operational context of the organisation e.g. international development researchers and those working in civic society were more likely to train and empower stakeholders	
Implementation, monitoring and evaluation	More likely to include key performance indicators or success measures	More likely to link monitoring and evaluation to logic models and Theories of Change to assess progress towards specific impact goals
Extrinsic/intrinsic impact culture	More likely to seek improvements in research assessment rankings and link promotions to impact performance, and seek to motivate researchers not naturally aligned with impact	More likely to recognise and celebrate impact less formally, drawing more on the intrinsic motivation of researchers who already align with the mission and values of the organisation

organisations that could more effectively connect and build trust across relevant networks

- Consider the roles and responsibilities needed to achieve the goals of your strategy. Where resources are limited, consider providing, or drawing on, core services accessible to all researchers including training, monitoring and evaluation tools, event organisation, or communications support. Then, invest more proactively and co-productively in strategic areas based on your needs analysis (above), rather than spreading resources so thinly that the depth and sustainability of your engagement suffers.

- Consider the type of strategy you are developing and create appropriate implementation and monitoring and evaluation plans. For enabling strategies, be clear about how the organisation will resource and deliver the strategy and identify relevant indicators, baselines and measures of progress that enable impact-oriented research. For achieving strategies more detailed implementation plans should be included. Implementation plans may include indicators of both activity and impact, and if possible, baselines from which progress can be assessed, with individuals and teams given responsibility for managing impacts as they evolve, accountable to others in the organisation. Consider co-producing a Theory of Change and/or logic model with stakeholders in target sectors or programmes to identify detailed and flexible pathways to impact and share responsibilities and resources with external organisations where possible
- Beware of how far you rely on extrinsic incentives. A strategy that does not include mechanisms to formally recognise and reward impact is likely to send a message that you do not actually value impact as an institution. However, too much focus on extrinsic incentives, especially if explicitly linked to funding and research assessment targets, is likely to instrumentalise impact and drive game-playing behaviours that could be counterproductive and demotivate staff.

Whilst this last point draws in parts on warnings contained in strategies, there were few concrete actions proposed to create impact cultures that drew on the intrinsic motivations of researchers to facilitate their engagement. While impact champions may be effective in some groups, their effectiveness is likely to be strongly determined by the attitudes of the post-holder and the extent which colleagues consider them to be opinion leaders (impact champions with no respect or influence are likely to be ineffective and influential post holders who have negative attitudes towards impact may do more harm than good). The majority of training is focussed on knowledge and skills (e.g. impact literacy), but to create a "third generation" impact culture (Rickards et al., 2020) that drives systemic change in the way researchers co-produce impact, training needs to create communities of practice where conversations can develop over time to challenge the ontological and epistemological assumptions underpinning both research and impact.

Based on Reed and Fazey's (2021) impact culture typology, the majority of University strategies reviewed for this paper were designed to perpetuate corporate impact cultures or research "and impact" cultures. To move towards a more co-productive impact culture (as defined by Reed and Fazey, 2021), it will be necessary to pay more attention in future impact strategies to:

- How research is conducted, considering discipline-specific mechanisms to increase the rigour and ethical basis of "responsible research and innovation", and encouraging researchers to move beyond studying problems to start researching solutions in more action-oriented and co-produced programmes of research;
- How impact interacts with the intrinsic motivations of different researchers, shaping their individual sense of purpose, and the meaning they derive from work, and the emergence of groups with shared purposes that can be deepened through engagement with impact, even if generating impact is not itself part of their purpose (e.g. considering how impact generation opportunities might combine with new research opportunities to facilitate curiosity-driven enquiry along pathways to impact)
- Strategic approaches that enable bottom-up culture change, driven by researchers with their stakeholders, enabling multiple impact sub-cultures to develop among complementary communities of researchers and stakeholders, which are porous and dynamic, enabling these communities to work together where their needs and interests intersect, as they build trust and connection and attend to the role of social norms and power; and

- The kinds of capacity that are needed to enable action-oriented research, discovery of shared purpose and community building around impact, including skills, resources, leadership, strategic and learning capacity.

Although there were many excellent examples of impact strategies in our sample, we have identified four exemplar strategies to illustrate good practice in "achieving impact" and "enabling impact" strategies. The full title of each strategy is in Table 1 and the full text of these and the other strategies we analysed can be found in a database at www.fasttrackimpact.com/impactstrategies:

- Achieving impact examples of good practice:
    - Dedicated impact strategy: Plymouth Marine Lab
    - Whole institute strategy: CGIAR
- Enabling impact examples of good practice:
    - Dedicated impact strategy: University of Wollongong Australia
    - Whole University strategy: Kings College London

The impact strategies we assessed may well already be under review or revision and new documents are produced regularly. A productive area of further research would be how these strategies have or have not been implemented and the changes they have effected so far, bearing in mind the inevitable 'implementation gap' (Derrick, & Nickson, 2014) that will be seen. Alongside implementation assessment and evaluation there is also an opportunity for organisations to move beyond the standard enabling approaches towards putting in place mission, purpose and leadership that can achieve more effective impact outcomes.

5 Conclusion

Our methodology only found strategic documents from universities with substantive goals and activities relating to impact in six jurisdictions, in addition to a number of independent research institutes from around the world. To test for a bias towards English speaking jurisdictions in our sample, strategies were identified for all Universities in Denmark and Hong Kong, China, and all but one included substantive goals and activities relating to impact. This may indicate that there are missing impact strategies in the other jurisdictions included in the sample, which could be identified in future research via the systematic collection of strategies for all universities in each jurisdiction.

It is clear that more research is needed, but by showing for the first time how different types of institutions and countries are strategizing impact, we have provided evidence to underpin the development of a novel impact strategy typology. This is the first time that such a typology has been proposed, and this is significant for two reasons. First, it provides a fine-grained understanding of the components of impact strategies, providing research managers with a wealth of options for consideration as they develop and enhance their own impact strategies. Our analysis provides insights into a new and rapidly evolving field of professional practice across the international higher education and research sectors, showing the very different approaches that are being taken by research organisations to build capacity and plan for impact in response to research funders and assessments.

Second, this snapshot of impact strategies around the world may also provide insights into the ways in which research organisations are re-orienting and in some cases re-purposing themselves to deliver impact as their core mission. The two types of strategy described in this paper are not mutually exclusive, and some strategies contained elements of both enabling and achieving impact. Each type of strategy has unique strengths, and by defining these clearly, we hope that our analysis will be used to increasingly combine best practice from each approach. In so doing, future impact strategies may be able to provide clear

structures, roles and accountability for impact across large organisations whilst facilitating more co-productive approaches to research and impact within and between projects. It may be possible to establish more specific and measurable impact goals and targets, whilst creating credible implementation plans that consider assumptions and risks, both to the delivery of impact and unintended consequences. They may be able to harness the intrinsic motivation of some researchers around mission-focussed engagement whilst incentivising and rewarding engagement more widely, and paying attention to the potential negative outcomes sometimes associated with extrinsic incentives for impact.

Universities have a critical role in shaping society and the world. More and more higher education institutions are recognising the need for altering research praxis and impact that is inclusive, emancipatory and transformative. There was a strong emphasis on Indigenous rights and the need to embed research principles and practice with indigenous ethos, to safeguard against instrumentalizing university research in Australian, Canadian and New Zealand strategies. However, the commitment for a more inclusive and transformative approach, in other words *decolonial praxis* at all levels, was largely absent from strategies in the UK, despite its colonial history. The more progressive strategies – both enabling and achieving - recognised that research is not conducted or applied in a void. They acknowledged that through building two-way relationships with external stakeholders – public, industry, policy makers etc. – research may be co-produced to fill knowledge gaps while delivering outcomes that are needed and prioritised by local/civic communities, the public and stakeholders.

Impact strategies have the potential to articulate goals and implement activities to enable research to develop credible and relevant solutions to problems, increase effectiveness or efficiency of existing systems and processes and develop tangible new approaches to societal and planetary health and wellbeing. However, they also have the potential to communicate aspirations without meaningful follow-through, or play into existing instrumental narratives of impact as a way of generating new income streams or climbing league tables. Whether an enabling or an achieving impact strategy, the power of these documents is in the specificity of the activities and accountability mechanisms that will enable aspirations for impact to be translated into the kinds of cultures that drive real, transformational change to meet 21st Century challenges.

Competing interests

Mark Reed is the Chief Executive Officer of Fast Track Impact Ltd and Saskia Gent is Director of Insights for Impact. Mark Reed and Saskia Gent provided consultancy support to Plymouth Marine Laboratory in the development of their impact strategy and have previously advised University of Hong Kong on their development of impact case studies.

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