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A COMPARATIVE READING OF 11
COUNTRIES' STRATEGIES

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Towards a new vision of innovation through COVID-19?

A comparative reading of 11 countries' strategies

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This paper discusses how countries' vision for science, technology and innovation (STI) priorities has evolved through COVID-19. The analysis was conducted on a sample of 171 STI strategy documents from 11 countries that were released between 2013 and 2021. Depending on the context, these documents seek to build consensus, manage actors, communicate or signal directions for policy, or achieve internal organisational motives. Most of the documents that have emerged since the COVID-19 crisis focus on a dominant ambitious societal goal and specific technologies to implement that goal. For example, environmental sustainability is a shared goal across different countries' STI strategies, but its specific meaning differs. Most countries' STI strategies also identify digitalisation as an important tool to achieve other socio-economic goals. Inclusivity is prominent in agendas reflecting country-specific circumstance. Improving resilience is a shared priority and increased in prominence with the COVID-19 experience.

Keywords: STI policy, innovation, resilience, digitalization, inclusivity, sustainability, green transition, digital transition, technology, COVID-19

JEL: D63, I18, Q01, Q55, O38

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Executive summary

Faced with the COVID-19 pandemic, governments have provided support for science, technology and innovation (STI) to provide solutions to exit the crisis (Paunov & Planes-Satorra, 2021; OECD, 2021). Beyond overcoming the pandemic, STI can contribute to many societal goals, such as designing environmentally sustainable modes of production or building more inclusive societies by offering opportunities across socio-economic groups. Governments' goals for STI are set out in national strategy documents, which are "coherent action (plans), guided by a longer-term sense of direction, to transform value-generated processes, undertaken by (a network of) actors, backed by an argument" (Wauters, 2019). The COVID-19 experience has potentially affected those goals and objectives. What are the major characteristics of national STI strategies in the context of the COVID-19 crisis? How do they deal with the topics of environmental sustainability, digitalisation, resilience and inclusivity?

This study reviews the STI strategy documents of 11 OECD countries: Australia, Austria, Canada, Chile, Finland, Italy, Germany, Japan, the Slovak Republic, Sweden, and the United States. Its results are based on an examination of 171 documents across these 11 countries, ranging from 8 and 25 per country and generally written between 2013 and 2021 (thus capturing both the pre-COVID-19 period and the intra-COVID-19 period). The analysis involved a comparative qualitative assessment along four core topics (environmental sustainability, digitalisation, resilience and inclusivity), interviews with national policy makers to contextualise and enrich initial findings from the assessment, and a review of the structure and function of STI strategy documents in national innovation systems.

Six findings emerge from the analysis:

1. Governments produce STI strategy documents that are adapted to national needs and governance practices. Depending on the national environment, STI strategy documents may seek to build consensus, manage actors, communicate or signal directions for policy, or achieve internal organisational motives.
2. Most national STI strategy documents are organised around a dominant societal goal, often emphasising strongly social and ecological objectives in addition to economic goals. More ambitious societal goals and specific technologies to implement those goals have emerged since the COVID-19 crisis.
3. Environmental sustainability is a shared goal across STI strategies, but its meaning differs between countries. The specific priority targets for the green transition and the proposed technologies to build green transitions differ.
4. Most countries' national STI strategies identify digitalization as an important tool for achieving other socio-economic goals.
5. Inclusivity explicitly reflects country-specific circumstances and social priorities.
6. Protecting STI ecosystems and using STI to build more resilience is a shared priority across countries following the COVID-19 shock.

Going forward, a complementary paper will explore STI strategies from an expanded sample of countries using natural language processing (NLP) tools.

The remainder of the paper is structured as follows: Section 1 lays out the theoretical basis of this study and outlines the methodology, and Section 2 describes the key findings of national STI strategies.

Chapter 1. Conceptual framework and methodology

1.1. Rationale for focusing on strategies

This analysis focuses on strategy documents that specify plans for STI policy. Strategy documents were chosen for their contents, which indicate a government's priorities, goals, and its understanding of key technologies and transitions. Strategy documents are by their nature forward-looking and concerned with visions of the future, especially of future technological, economic, and social transitions. The plans laid out in STI strategy documents are a point of departure to compare countries' perspectives and to better understand the ways in which policy makers understand the role of STI in transitions. By their nature as strategic visions, they describe governments' vision of the future and the role that STI should play in it. To the extent that policy making is responsive to citizens, they should also reflect societal priorities and goals.

Strategy is an important element of the policy making process, but remains challenging to define. A number of modern definitions relevant to strategies in public policy have been put forward. Mintzberg (1978), defined strategy as the combination of a goal or guiding principle, be it explicit or implicit, and the means that are taken to get there. Wauters (2019) notes in particular the work by Mintzberg (1978), Poister and Streib (1999), and Rumelt (2011) when defining strategy as: *“coherent action, guided by a longer-term sense of direction, to transform value-generating processes, undertaken by (a network of) actors, backed by an argument.”*

Wauters' definition has several operative components: (1) strategy is inextricably related to action; (2) action must be coherent with respect to a long-term objective; (3) strategy is related to organising the foundational questions of what an organisation should do – “value-generating processes” – and not to managing the minutiae of regular activity, which Ruegg-Sturm (2005) distinguishes as mere “tactics”; (4) strategy concerns a clearly specified actor or group of actors deliberately working together; and (5) strategy is backed by an argument in favour of how and why it occurs. The argument for “why” suggests that a strategy requires an articulation of why the issues it targets are important. The argument for “how” related to what Weiser et al. (2020) call a “theory of change”, which is an understanding of how the actions in a strategy cause the desired outcomes.

This definition is useful for the analysis with the important difference that the “strategy documents” investigated are statements of priorities and plans of action, but are not in themselves actions. In this sense, strategy documents are best understood as pledges to implement a strategy. Mintzberg calls these “intended strategies” which may either become “unrealised strategy” if they fail to be implemented or “deliberate strategy” if they are implemented as planned (Mintzberg, 1978).

1.2. Selection of strategy documents and analytical approach

This study includes documents from 11 countries as a sample of the broader OECD. The selection of countries was intended to be broadly representative of the OECD – including countries from each of the regions of Europe as well as from the Americas and Asia-Pacific – in order to better understand trends across countries. There is a trade-off in this exercise between the diversity of countries included and the feasibility of conducting the study. A sample of 11 countries was judged to appropriately balance inclusion and feasibility.

Strategy documents were selected to cover both the period before the start of the COVID-19 pandemic and the period during the COVID-19 pandemic. Documents issued before the start of the crisis, but which were in effect at the time the crisis began, or which were principally drafted before the start of the crisis, are qualified as “pre-COVID-19”, and all others, which were therefore drafted in substance after the start of the pandemic, as “intra-COVID-19”. The COVID-19 pandemic, at the time of writing, has not concluded. Efforts were made to collect an approximately equal number of strategy documents in each period from each country, and the overall corpus is almost exactly balanced between pre- and intra-COVID-19 documents. The periodisation of documents was verified through consultations with national policy experts.

Strategy documents were only considered if they were developed and published by a national government. Documents written by non-governmental institutions were excluded, as were documents written by sub-, supra-, or inter-national institutions. A publication was only considered to be a strategy document if it explicitly discussed a forward-looking plan for future policy actions and priorities.

The goal of the identification process, which ran from 2021 through the first half of 2022, was to gather all relevant STI strategy documents representing countries’ STI strategy in both periods. This selection was performed jointly with STI policy makers in each country. Following an initial identification of documents based on the EC-OECD STIP Compass database and other data sources, policy makers from the governments in question validated the selection, identified documents that were erroneously included, and provided additional relevant documents.

After consultations with relevant policy makers, some strategy documents issued after the start of the COVID-19 pandemic in March 2020 were treated as representative of the period before the crisis if they were produced before the pandemic. This reflects the fact that some STI strategy documents are the process of long consultation, drafting, and review processes that can stretch over months or years.

A wide set of strategy documents was used in order to capture the full scope of national STI policy objectives, resulting in a database of 171 strategies for the 11 countries. Table 1 provides representative examples of these strategy documents. These documents included national STI strategy documents, sector-specific strategy documents which clearly and explicitly referenced STI, individual agency or ministry strategy documents where the mandate of that agency or ministry principally concerned STI (for example, a research ministry), and legislation that explicitly concerned STI policy (relevant in countries where legislative documents played a role in setting STI objectives).

Documents with an official English translation issued by governments were collected in English; otherwise, they were collected in their original language and translated to English in cases where the team could not review them in their original language.

Table 1. Representative examples of strategy documents included in this study

	Example of core STI strategy documents	Example of other STI strategy documents considered	Example of a broader national strategy considered
Australia	Technology Investment Roadmap (2020, Department of Industry, Science, Energy and Resources)	Digital Economy Strategy 2030 (2021, Australian Government) National Hydrogen Strategy (2019, COAG Energy Council)	Budget 2020-2021 (2020, Australian Government)
Austria	STI Strategy 2030 (2020, Federal Government) [FTI-Strategie 2030]	STI Strategy for Mobility (2020, Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology) [FTI-Strategie Mobilität] Bioeconomy: A Strategy for Austria (2019, Ministry for Sustainability and Tourism) [Bioökonomie-FTI-Strategie für Österreich]	Austrian Reconstruction and Resilience Plan 2020-2026 (2021, Ministry of Finance) [Österreichischer Aufbau- und Resilienzplan 2020-2026]
Canada	Canada's Science Vision (2019, Innovation, Science and Economic Development Canada)	A Healthy Environment and a Healthy Economy (2020, Environment and Climate Change Canada) Intellectual Property Strategy (2021, Innovation, Science and Economic Development Canada)	Supporting Canadians and Fighting COVID-19: Fall Economic Statement (2020, Government of Canada)
Chile	National Policy on Science, Technology, Knowledge and Innovation (2020, Ministry of Science, Technology and Innovation) [Política nacional de ciencia, tecnología, conocimiento e innovación]	National Policy for Gender Equality in STI (2021, Ministry of Science, Technology and Innovation) [Política Nacional de Igualdad de Género en CTCI] National Policy on Artificial Intelligence (2019, Ministry of Science, Technology and Innovation) [Política Nacional de Inteligencia Artificial]	
Finland	Solutions for a sustainable and developing society (2020, State Council) [Kestävän ja kehittyvän yhteiskunnan ratkaisuja tuottava Suomi]	The regional development decision 2020–2023: Sustainable and vital regions (2020, Ministry of Economic Affairs and Employment) [Aluekehittämispäätös 2020-2023 : Kestävät ja elinvoimaiset alueet] Inclusive and Competent Finland – a socially, economically and ecologically sustainable society (2019, Finnish Government) [Osallistava ja osaava Suomi – sosiaalisesti, taloudellisesti ja ekologisesti kestävä yhteiskunta]	Sustainable Growth Programme for Finland – Recovery and Resilience Plan (2021, Finnish Government) [Suomen kestävä kasvun ohjelma : Elpymis- ja palautumissuunnitelma]
Germany	Federal report on science and innovation (2020, BMBF) [Bundesbericht Forschung und Innovation]	German AI Strategy Update (2020, Federal government) [Strategie Künstliche Intelligenz – Fortschreibung] Strategy for automated and connected driving (2015, Bundesregierung) [Strategie automatisiertes und vernetztes Fahren]	German Recovery and Resilience Plan (2021, Federal Ministry of Finance) [Deutscher Aufbau- und Resilienzplan]

Italy	National Program for Research 2021-2027 (2020, Ministry of university and research) [Programma Nazionale per la Ricerca 2021-2027]	Proposals for an Italian Strategy on Artificial Intelligence (2020, Ministry of economic development) [Proposte per una Strategia italiana per l'intelligenza artificiale] National Program for Research Infrastructures 2014-2020 (2016, Ministry of university and research) [Programma Nazionale per le Infrastrutture di Ricerca 2014-2020]	National Plan for Recovery and Resilience (2021, Council of Ministers) [Piano Nazionale di Ripresa e Resilienza]
Japan	6th Science, Technology, and Innovation Basic Plan (2021, Cabinet Office) [第6期科学技術]	Green Growth Strategy Through Achieving Carbon Neutrality in 2050 (2020, Ministry of Economy, Trade and Industry) [2050年カーボンニュートラルに伴うグリーン成長戦略] Basic Policy on Reform for The Realization of a Digital Society (2020, Prime Minister's Office) [デジタル社会の実現に向けた改革の基本方針]	Emergency Economic Measures to Cope with the Novel Coronavirus (COVID-19) (2020, Cabinet Office) [コロナ克服・新時代開拓のための経済対策]
Slovak Republic	Strategy of the Digital Transformation of Slovak Republic 2030 (2019, Office of the Deputy Prime Minister for Investments and Information) [Stratégia digitálnej transformácie Slovenska 2030]	National Energy and Climate Plan 2021-2030 (2021, Ministry for the Economy) [Integrovaný národný energetický a klimatický plán na roky 2021-2030] Low-Carbon Development Strategy of the Slovak Republic until 2030 with a View to 2050 (2017, Ministry of the Environment) [Nízkouhlíková stratégia rozvoja Slovenskej republiky do roku 2030 s výhľadom do roku 2050]	Recovery Plan (2021, Government of Slovak Republic) [Plán Obnovy]
Sweden		National strategy for a sustainable wind power expansion (2021, Swedish Energy Agency) [Nationell strategi för en hållbar indkraftsutbyggnad] Circular Economy – Strategy for the Transition in Sweden (2020, Swedish Government) [Cirkulär ekonomi - strategi för omställningen i Sverige]	Sweden's National Reform Programme (2020, Swedish Government) [Sveriges nationella reformprogram]
United States	Fiscal Year (FY) 2022 Administration Research and Development Budget Priorities and Cross-cutting Actions (2020, Office of Management and Budget and Office of Science and Technology Policy)	Pioneering the Future Advanced Computing Ecosystem: A Strategic Plan (2020, National Science and Technology Council) Building Resilient Supply Chains, Revitalizing American Manufacturing, and Fostering Broad-Based Growth (2021, White House)	

This study used directed content analysis and national policy expert validation (Hsieh & Shannon, 2005). The study focused on the following four core topics, which were taken from (Paunov & Planes-Satorra, 2021) as the authors identified those as important topics for STI following the COVID-19 experiences:

- **Environmental sustainability** refers to responsible interaction with the environment to avoid depletion or degradation of natural resources and allow for long-term environmental quality.
- **Digitalisation** refers to the development of digital technologies, their adoption and diffusion in an economy as well as the impact of these technologies on the economy and society.
- **Inclusivity** refers to economic development that generates benefits that are distributed fairly across society and that creates opportunities for all to participate.
- **Resilience** refers to the ability to both respond to and overcome shocks or disruptions.

The analysis focused on identifying how prominent these concepts are in STI strategy documents. The “centrality” of the topic in STI strategies was also a criterion for identifying significance; for example, a subject referenced extensively in a “central” document would be considered more important than one referenced extensively elsewhere, *ceteris paribus*.

The results were validated by national STI policy experts by means of interviews and written exchanges. The first drafts of this analysis were shared with experts in national delegations for feedback and additional inputs, either by correspondence or a direct meeting. National experts proposed changes where they found that the analysis had not fully represented the details of their national STI strategy or where the information included in the documents was unclear.

1.3. Characteristics and functions of STI strategy documents

This section discusses the diversity of strategies that were analysed as part of this study as well as the diversity of structure and function of STI strategy documents observed.

Countries produce significantly different numbers of STI strategy documents. The number of strategy documents included for each country in this study ranges from 8 to 25 and are of different lengths. Consequently, the total number of words of STI strategy published in a given time period differed between countries. Strategy documents totalling nearly or more than one million words were considered for Japan and the United States, the two highest totals in this study; Austria, at about 170 000 words, published the shortest corpus of countries that were surveyed (Figure 1).

Differences in the number and length of STI strategies are a result of country-specific practices. There are important differences in the number of core strategies issued by central executive institutions, such as Japan’s Cabinet Office and ministries and government bodies in charge of STI. Moreover, all countries included in this study issued “sector-specific” strategies, which laid out strategic measures for STI that are specific to one field or sector. Chile and Germany issued innovation strategies specific to artificial intelligence, for example. In most countries in the sample, individual STI-related ministries, departments, or agencies would issue their own organisation-specific strategies.

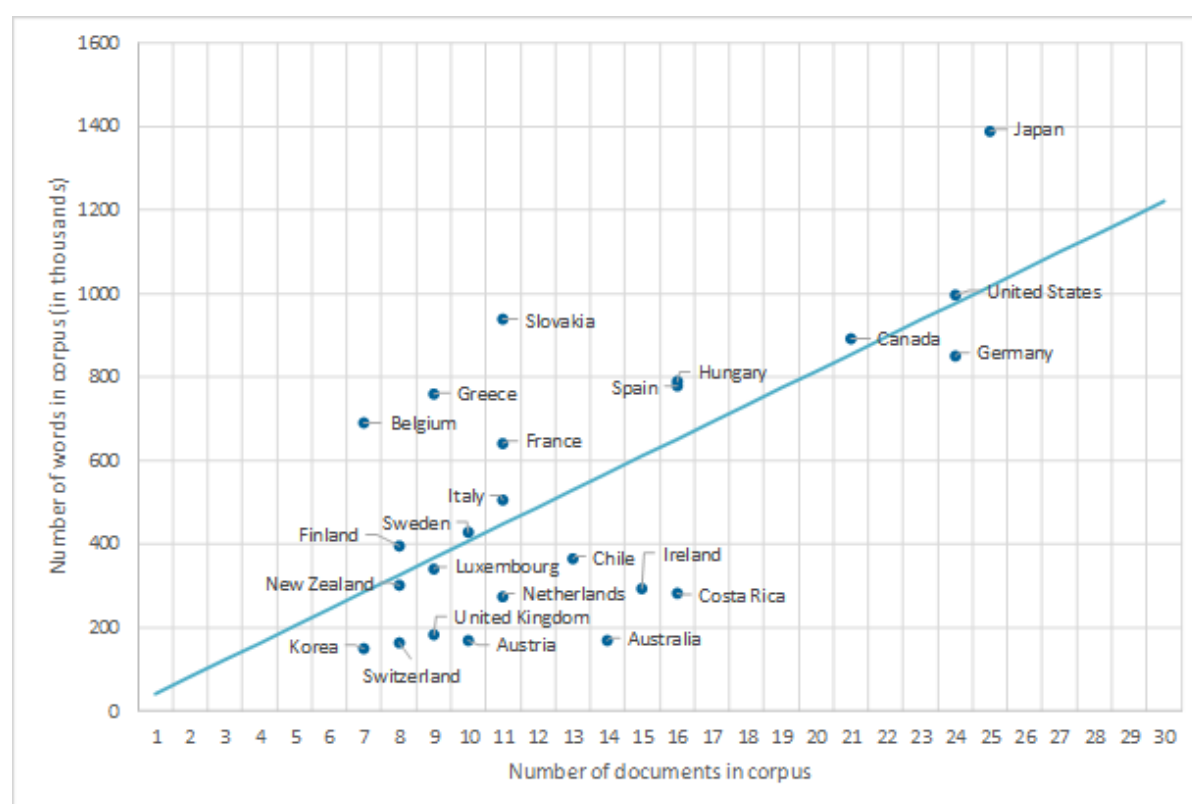
Governments included STI priorities in other strategy documents relevant to specific technologies or societal objectives. These documents referencing specific technologies or goals were one of the most common types of STI strategy identified as part of this study; these strategies, however, included provisions related to domains of policy beyond STI. The Slovak Republic, for example, included STI provisions in its broader energy and climate plan. Governments made different choices about the epistemic boundaries of STI, with some including non-STI provisions in an overall STI strategy, and others including

STI provisions in a strategy dedicated, in general, to broader societal goals or missions, such as a climate transition. In the context of societal transitions towards greener, more resilient, or more inclusive futures, the links between policy domains are expected to increase.

Some governments issued broad national plans in which STI was one component among many. This was particularly common in EU member countries, which generally issued Recovery and Resilience Plans (one-time and specific to the COVID-19 pandemic) and National Reform Plans (annual and ongoing) in compliance with EU standards. Both of these types of plans would make reference to some elements of STI policy. In Australia and Canada, for example, consultations with policymakers revealed that key elements of national STI strategy were included in budget documents. In other countries, such as Japan, STI was exceptionally featured as part of economic strategies issued as part of their response to the COVID-19 pandemic.

Each approach – differing number and length of STI strategy documents – has its own advantages and disadvantages. For example, greater length allows articulating a more detailed plan and to better design the instruments for implementing it. However, more length raises the risk that important messages are diluted. Shorter documents facilitate communicating key takeaways, but may fail to adequately capture the complexity of an issue and provide insufficient detail as to implementation plans. In some countries, experts reported that norms and styles, rather than specific needs, dictated document length.

Figure 1. Number and length of STI strategy documents collected for this study in 11 sample countries and thirteen other OECD countries

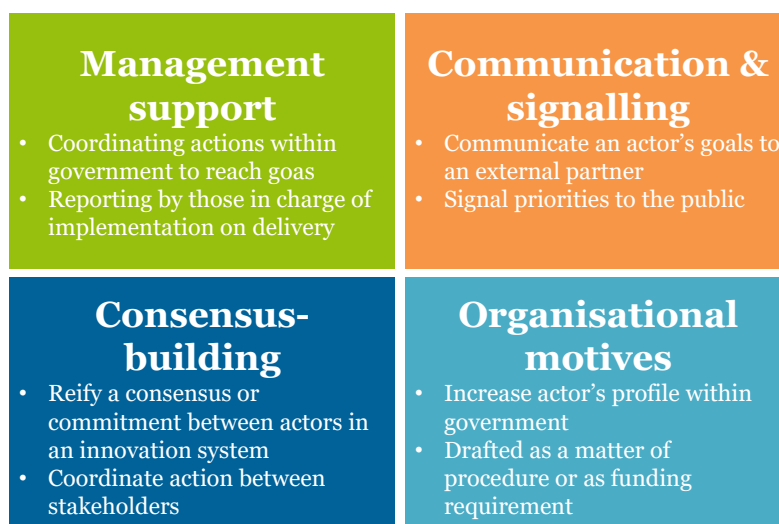


Note: The horizontal axis signifies the number of documents collected for this country's "corpus" of relevant STI strategy documents from both the pre- and intra-COVID-19 periods. The vertical axis signifies the total word count of these documents (in thousands of words) after translation to English (where necessary). The blue

line indicates the average word count for a given number of documents; countries above the line published documents with more words per document than the average, while countries below the line published strategies with fewer words per document.

Strategy documents for STI are drafted for one or more of the following functions: building consensus among stakeholders, management support within government, communicating or signalling directions for policy, or for achieving organisational motives. Figure 2 summarises these findings.

Figure 2. Summary of possible functions of an STI strategy document.



Consensus-building

An STI strategy can aim at building a consensus between stakeholders in an innovation system. While consensus-building can take place outside the context of formal report-writing, the production of a written strategy can reify and formalise the results of a formal or informal consensus-building process. Consensus-building is also relevant in federal countries contexts where the national STI strategy document issuing bodies collaborates with subnational bodies. Formalising this consensus in a written and published document can then serve as a commitment, on the part of the issuing actor, and also as a form of coordination, by laying out clear activities and priorities that other stakeholders can accommodate.

Management support within government institutions

Issuing a strategy document that sets out priorities and that lays out roles and responsibilities could be a way of coordinating different actors within government to adhere to the strategic goals set out. For instance, the issuer could be a ministry in charge of innovation while the agent would be an innovation agency. If the strategy is circulated to a broader audience, it could create “peer pressure” to deliver. For an issuer, a strategy document could be issued for the consumption of their principal to describe how the issuer is adapting the strategic goals for implementation by the issuer.

Communication and signalling

Communication with the public is an important part of a government's work. Government agencies or departments active in STI policy might wish to advertise their plans in order to inform the public, engage with the public, or build public support for a set of goals. For

these purposes, producing a written strategy document that clearly specifies plans and goals might serve as a form of communication, allowing civil society and citizens to learn about and engage with STI policy themselves. This communication might serve a coordinating function, especially when directed to civil society, markets, or to the research community. This is essential for taking on such ambitious objectives as implementing the

Strategy documents can also communicate or signal policy objectives to external stakeholders, like foreign partners or supranational institutions. A strategy that emphasised international collaboration might, for example, improve relationships with strategic foreign partners. Finally, for countries that participate in supranational fora like the European Union, strategy documents can sometimes be required as part of that institution's funding, coordination, and oversight activities.

Organisational motives

Government bodies may also draft strategy documents to meet internal needs that are not solely related to the content of the strategy document. An example would be the pursuit of organisational motives, where an organisation produces a strategy document as a result of planning requirements might override strategic considerations in such cases. The strategy document may also be a requirement to receive funding as is the case of the Recovery and Resilience Plans of the European Commission.

1.4. Implementation challenges of strategies

Consultations with national experts as part of this study suggest that strategy documents are sometimes not implemented. They fail to be implemented for a variety of reasons:

- First, perhaps they were drafted by an actor, that lacked the power – either direct authority to compel other actors to behave a certain way or indirect power through negotiation and consensus building – to see to the strategy's implementation. A strategy document may also rely on the consent or cooperation of other actors; where that is lacking, or where it is withdrawn, the strategy outlined in a document can fail to be implemented.
- Second, this can occur when the strategy described in a document is unrealistic, overly ambitious, or detached from reality. In this case, attempts at implementation will be frustrated by conditions “on the ground”, forcing actors to modify their approach and cease to follow the plan laid out in a strategy document, even if that plan was drafted with the best of intentions.
- Third, the circumstances may have changed after a document was drafted, leading to a change in emergent strategy.

Conversely, some documents are drafted without a strong view to implementation. In this case, the strategy document's reason for existing may have been communication and signalling, or it may have been drafted due to organisational motives. However, publishing a strategy document without following through on implementation plans is not effective. It affects credibility and public trust.

Regarding success factors, the following directions help increase the likelihood strategies will be implemented:

- **Strategy documents should be grounded in a clear understanding of reality and have realistic goals.** Strategy documents should be rooted in a clear understanding of how the actions that they propose can create the future that they target.

- **Strategy documents should contain an implementation plan and obtain buy-in from key actors.** Particularly in STI systems where multiple stakeholders play a role, support from the relevant actors is important to success.
- **Strategy documents should mutually reinforce related strategy documents.** This could be achieved on the basis of consensus-building, where common directions are negotiated, de-conflicted, and formalised into strategies.

1.5. Limitations to an analysis of STI strategy documents

An important challenge for interpreting findings is the extent to which STI priorities are fully and accurately included in STI strategy documents, even where the selection of documents correctly locates the relevant STI strategy documents (see Section 1.2).

Further consider the example of Sweden, where experts familiar with Sweden's innovation policy context emphasised the importance of innovation in several sectors, such as green steel and battery-electric vehicles, in Sweden's innovation system. This study's review of Sweden's STI strategy documents, however, paints a different picture. These areas were not observed to be significantly more important than other innovation priorities like advanced mobility, rail, and biomass energy. Furthermore, this study's review of strategy documents did not identify those areas with the same precision, identifying industrial decarbonisation and automotives rather than green steel and battery-electric vehicles. Why do the policy areas identified in Sweden's STI strategy documents lack the prominence and specificity of these expert-identified dimensions of industrial and innovation policy?

Consultation with experts revealed several causes that explain differences in STI priorities from those identified in strategy documents that apply to Sweden and, possibly, to other countries as well. First, Sweden's innovation system includes a large role for public-private partnerships like "Fossil Free Sweden" which set strategy in a deliberative fashion. These bodies do not set strategy – their outputs are proposals to the government and as such are not eligible for inclusion in this study – but play an important role in setting the agenda and in mobilising research in municipalities, regions, and companies. The private sector may also play important roles in setting direction for innovation policy and consequently, shape the direction of innovation. Other drivers relevant to several other countries in this sample include the roles played by subnational governments in federal systems and of transnational institutions like the European Union. Second, strategy documents are also shaped by a variety of considerations, in particular by political and communication considerations that may affect the specific priority areas that are identified (see Section 1.3 for a discussion on strategies' objectives).

What does this mean for understanding STI strategy through studying STI strategy documents? The example demonstrates the limitations of understanding STI strategy on the basis of strategy documents only. Nonetheless, as discussed in Section 1.1, STI strategy documents issued by national governments are useful resource as they allow understanding governments' future vision and societal priorities and goals with regards to STI.

Chapter 2. Key findings

2.1. Environmental sustainability is a prominent goal for national STI strategies, but its meaning differs between countries

Most STI strategies are set around a dominant societal goal, often emphasising strongly social and ecological objectives in addition to economic goals. Environmental sustainability is the most popular, featuring among six of the 11 countries sampled (Austria, Chile, Finland, Italy, Sweden and the Slovak Republic). Other core concepts are improving international competitiveness (Australia and Canada) and pushing forward digitalisation (Japan). Germany and the United States were exceptions in that they define a variety of goals in strategy documents rather than a single central one. This is coherent with an acceleration of wider trends that precede the COVID-19 shock for a mission-oriented focus to STI strategies (Larrue, 2021). STI strategy documents often also make reference to specific technologies since the start of the COVID-19 pandemic to support reaching societal goals.

Across all of the countries in the sample, qualitative analysis indicated that the volume of discussion around sustainability objectives was significant and showed clear evidence of increasing since the start of the COVID-19 pandemic (the “intra-COVID-19 period”; see Section 1.2), with interpretive analysis reporting that a greater proportion of strategy documents was dedicated to sustainability in this period. The prominence of sustainability also increased – with the volume of discussion increasing as well as the prominence of sustainability-related objectives in the forewords, introductions, and summaries of documents as well as in concrete outlines of plans. Sustainability-related innovation goals were discussed in a significant, prominent fashion in all 11 countries in the sample.

In the context of the COVID-19 pandemic, there was furthermore a growing sense of urgency in the discussion of sustainability-related innovation issues. Environmental sustainability was increasingly paired with strong wording – such as use of the terms “crisis” which was featured in relation to sustainability in the strategy documents of Austria, Chile, and Japan. In Italy, sustainability was described as a “necessary condition” for future innovation. Consultations with national policymakers confirmed this prioritisation and the increase in the significance attached to sustainability objectives.

Environmental sustainability increased in significance probably also because the shock of COVID-19 “raised public awareness of the need to tackle climate change and environmental degradation as a key policy priority, as they pose risks of future shocks at an unprecedented scale” (OECD, 2021). There was no evidence of diminished importance of the green transition due to the identification of other priorities such as “health matters and [the] economic recovery (including preserving jobs at any cost) gain in importance”(ibid.) was not observed.

The role of green technologies and innovation to support a low-carbon future is a common theme of discussions around sustainability. Green technologies and innovation are also discussed as an engines of competitiveness and growth. In Austria, for example, STI strategy documents in the intra-COVID-19 period emphasised the link between the country’s goal of boosting competitiveness and its goals in sustainability; green technologies would boost productivity and competitiveness in the markets of the future. In Chile, innovation in artificial intelligence was singled out as being closely linked to progress on sustainability and to support growth. In Sweden, sustainable innovation is discussed principally in terms of its ability to boost exports, reflecting a belief in the long-

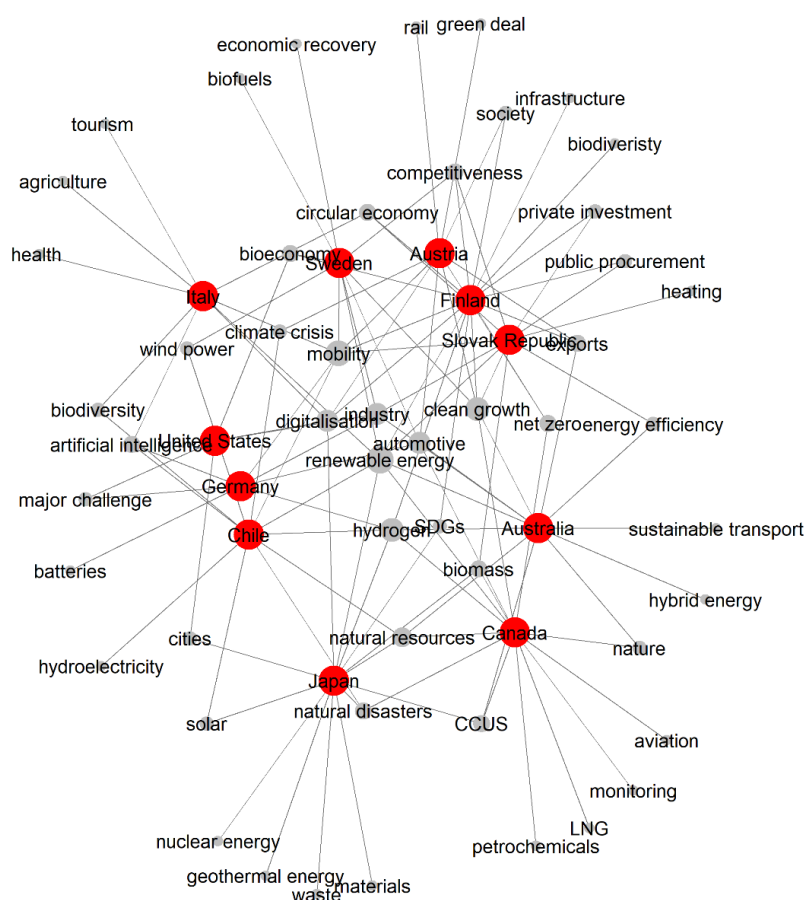
term growth potential of environmentally sustainable technologies. Of the 11 countries in the sample, Austria, Canada, Finland, Germany, Italy, Japan, and Sweden explicitly reference innovation for the green transition as a driver of competitiveness.

Countries' STI strategies showed evidence of considerable variety in specific sectors, core focus areas and technologies that they identified as relevant to clean growth sustainability objectives. Specific technologies or fields related to sustainability goals in the context of STI ranged from the reference to specific sources, including digital technologies and AI but also others such as hydrogen, to specific fields, such as mobility, and specific focuses, such as expanding renewable energy. The most heavily subscribed were "renewable energy" (noted as a target in 8 countries), "mobility" (7 countries), "hydrogen" (6 countries), and "clean growth" (6 countries) (Figure 3). Several countries in the sample explicitly referenced the role of innovation in accomplishing their pledges to reach net-zero carbon emissions in the coming decades – Australia (2050), Austria (2040), Canada (2050), Chile (2050), Finland (2035), Germany (2045), Italy (2050), Japan (2050), the Slovak Republic (2050), and Sweden (2045).

Within the specific sectors, focus areas and technologies discussed in these strategy documents, there is substantive variety across countries. Smart urban mobility, for instance, was discussed as a priority sector in Australia, Austria, the Slovak Republic and the United States. The electrification of public mass transportation infrastructure, especially rail, was another theme in Austria, Finland, and Sweden. In Australia, Canada, Chile, Germany and Italy, mobility goals related to innovation focused on the development of zero- or low-emissions vehicles rather than on mass transit. Figure 3 illustrates further unique terms included both specific technologies and broader principles. Their prevalence lends credence of national diversity in sustainable innovation priorities. Green energy is another sector on which almost all the countries agreed in principle, but which belied clear differences in priorities. Canada, Japan, the Slovak Republic, and Sweden emphasised biomass energy; Japan was unique in noting priorities in geothermal and nuclear energy in its strategies. Canada and Chile emphasised solar technology, and Australia and the Slovak Republic referred to innovation priorities under energy efficiency. Chile and Sweden made extensive reference to innovation in wind power. Sweden devoted a full strategy document to the subject, while Chile was the only country whose strategies made significant explicit mention of innovation priorities in hydroelectricity. The "circular economy" was emphasised in Finland, Italy, and the Slovak Republic.

Countries that are rich in natural resources – like Canada and Chile – discussed the importance of innovation to ensure that the exploitation of natural resources – such as petroleum, minerals and marine resources – does not result in environmental damages. The contribution of reducing reliance on traditional sources of energy, discussed widely in the context of the ongoing war in Ukraine that exposed strong reliance on energy supplies from the Russian Federation, was not a major focus of the strategies reviewed due to the timing of their publication.

Figure 3. Priority areas of each country's STI strategy with respect to "sustainability"



Note: This figure is based on a qualitative analysis of 171 STI strategy documents. Priority areas are visualised graphically in relation to one another in this chart. Red circles indicate a country; grey circles indicate a concept referenced in the strategy documents of at least one country included in this study. Grey circles are sized based on the number of countries referencing that priority. Light grey lines indicate that the country referring to a priority is the only one to do so. Darker grey lines indicate that several countries refer to a priority. CCUS stands for Carbon Capture, Usage and Storage. LNG stands for Liquefied Natural Gas. SDGs stands for United Nations Sustainable Development Goals.

2.2. Digitalisation is identified as an important tool in all countries' national STI strategies

Every country in the sample strongly emphasised the importance of digitalisation as a key goal in STI strategies. This emphasis parallels the findings of a recent OECD report on national digital strategies, which found that just as digitalisation is prominently featured in national STI strategies, innovation is a key pillar in almost all national digital strategies. National digital strategies also highlight robust policy linkages between digitalisation and other national priorities (Gierten & Leshner, 2022). Both before and in the context of the COVID-19 pandemic, national STI strategy documents attached considerable importance to digital technologies and innovation. This generally relates to the shared understanding that digital technologies are widely applicable and have a mandate to support broader societal transformations. Their status as general-purpose technologies - i.e. technologies that facilitate broad opportunities for innovation throughout the economy - makes them, by

their nature, transformative of economies and innovation. References to the “new paradigm” and to building “society 5.0” speak to this.

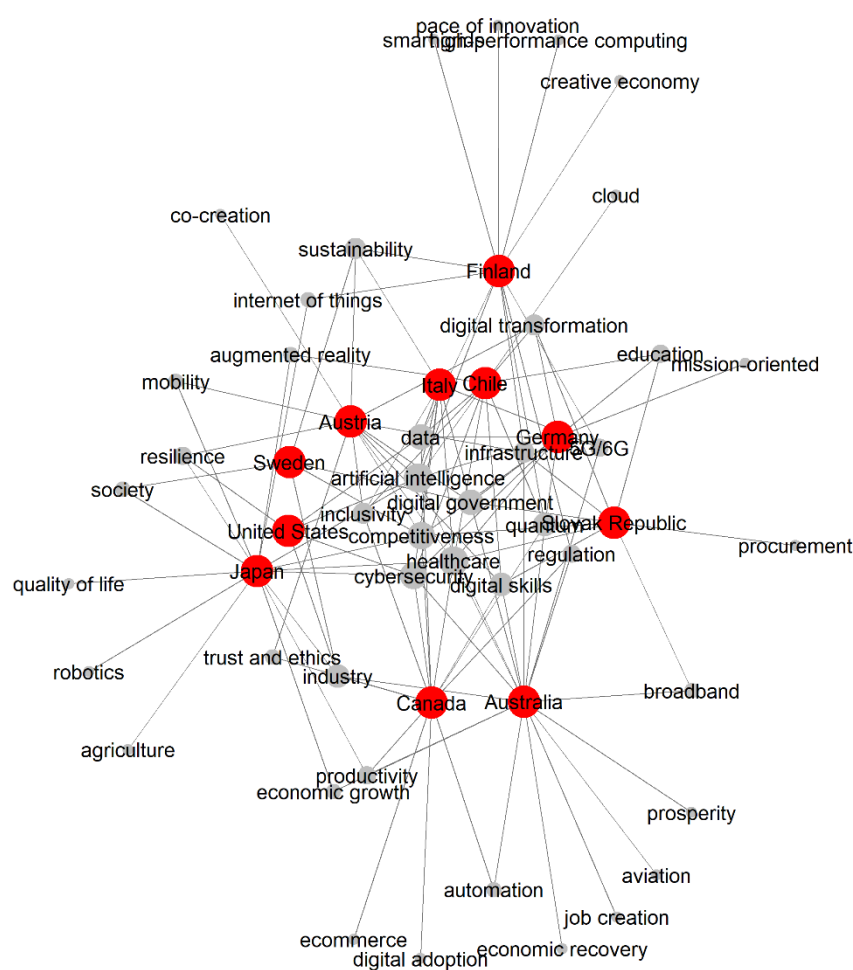
Digitalisation was broadly treated as an instrumental innovation goal in the context of other innovation or economic transition objectives. For instance, Austria’s Digital Action Plan explicitly states that “digitalisation is not an end in itself: Austria wants to use digitalisation to further develop competitiveness, inventiveness, prosperity, climate protection, health, and cultural education.” Germany’s strategy documents explicitly refer to the ability of digitalisation to be “mission-oriented” and help society achieve innovation objectives in green and inclusive areas. The COVID-19 context strengthened emphasis on a broader set of socio-economic goals digital technologies and innovation are set to contribute to (Planes-Satorra & Paunov, 2019).

STI strategy documents in most countries emphasised similar combinations of specific technologies: artificial intelligence, data, infrastructure, quantum, healthcare, digital government, and cybersecurity. While noting national variety in priority areas, digitalisation was distinct in the degree to which different national strategy documents expressed a consensus on the technological domains to explore. This may reflect an attitude towards digitalisation, especially certain key technologies, as being an exogenous trend rather than a societal goal. The 2021-22 departmental plan for Industry, Science and Economic Development Canada refers to digitalisation as a “new paradigm”, and Finland’s RDI roadmap calls it the “most significant driver of change in the coming decade”. Germany’s Recovery and Resilience Plan calls digitalisation one of the “major challenges of our time”, alongside climate change.

Digitalisation was also discussed as means to provide solutions to the COVID-19 crisis but did not gain in importance due to the pandemic. Explicit references to the COVID-19 pandemic were found throughout the sections of innovation strategies relevant to digitalisation, in particular with reference to the role of digital technologies in supporting economies through periods of lockdown. Japan’s Emergency Economic Measures to Cope with the Novel Coronavirus (COVID-19), for example, explicitly referenced the importance of digital transformation in order to facilitate pandemic resilience, especially in areas like telemedicine. Despite these trends, however, this study did not find evidence of a general increase in the salience of digitalisation-related goals, nor did it observe that the volume of discussion of digitalisation had, in general, increased. The lack of an observed increase in the prioritisation of digitalisation may be related to the observed growth elsewhere

National variety was observable in some of the specific technologies that were emphasised. Although the overriding message of the results of this analysis are the similarities between countries and the degree of tight clustering, some idiosyncratic topics emerge which demonstrate the extent to which national authorities targeted digital technologies relevant to their unique contexts. “5G/6G” technologies were targeted in Finland, a historical leader in the telecommunications space, as well as in Australia and Italy. “Mobility” was a digital innovation priority in Austria and Japan, referring to autonomous vehicles and to data-optimised urban mobility. Finland and Japan emphasised the internet of things. Chile, Germany, and the Slovak Republic specifically highlighted the role of digital innovation in the education sector, which was significantly less broadly discussed than the healthcare sector; in the creative sector and agricultural sectors, only Finland and Japan, respectively, emphasised innovation there.

Figure 4. Priority areas of each country's STI strategy with respect to “digitalisation”



Note: This figure is based on a qualitative analysis of 171 STI strategy documents. Human readers identified priority areas through manual interpretation. These priority areas are visualised graphically in relation to one another in this chart. Red circles indicate a country; grey circles indicate a concept referenced in the strategy documents of at least one country included in this study. Grey circles are sized based on the number of countries referencing that priority. Light grey lines indicate that the country referring to a priority is the only one to do so. Darker grey lines indicate that several countries refer to a priority.

The web of terms associated with digitalisation in Figure 4 shows a high degree of clustering, with countries tightly grouped around a small group of common terms like healthcare, artificial intelligence, and cybersecurity. Compare this to Figure 3 on sustainability, where countries are not as tightly clustered and where less-frequent terms, shared between a handful of countries, make up a larger share of the diagram. This suggests a weaker consensus between countries on the key terms associated with sustainability.”

Evidence also emerges on the differing national priorities that each country emphasises for its digital innovation. If digital innovation is an “instrumental” innovation goal for achieving missions and transitions elsewhere, then the links to other priority topics are revealing. Austria, Japan, and the United States linked digitalisation to resilience, noting in particular the impact of the COVID-19 pandemic on supply chains and the importance of digital technological sovereignty. Austria, Finland, Italy, and Sweden articulated a role for digitalisation in goals related to sustainability. Austria, Canada, Chile, and Italy referenced

the ways in which digitalisation could contribute to inclusivity, whether this was regional – such as in Italy – or societal – such as in Canada – through increased connectivity and decreased barriers to access. Australia, Austria, Canada, Germany, Italy, Japan, the Slovak Republic, and Sweden all linked digitalisation to competitiveness.

2.3. Inclusivity reflects country-specific circumstances and social priorities

References to inclusivity were less dominant across countries than the topics of digitalization and environmental sustainability. This may be partly related to inclusivity being perceived as less central to STI policy even though attention to this issue increased with the COVID-19 pandemic (Planes-Satorra & Paunov, 2019). Differential socio-economic impacts of the crisis and the engagement of individuals in STI to provide solutions gave new impetus on inclusivity and STI policies.

Inclusivity strongly reflects country-specific contexts in how it is discussed with regards to STI policy. **Error! Reference source not found.** shows a non-exhaustive list of examples of the various ways in which national STI strategy documents referenced inclusivity. Topics ranged from involving civil society in STI to improving inclusion of under-represented groups in innovation, such as the involvement of women in STEM in Austria. In Chile, for example, social inclusivity was framed around the ability of STI to contribute to civil society, territorial cohesion, and gender equality by promoting new opportunities; in the United States, more of an emphasis was put on ensuring that students from underrepresented populations could participate in the innovation economy.

Table 2. Examples of national differences in dimensions of inclusivity considered in STI strategy documents

	Example of an inclusivity-related goal	Type	Target
Australia	Inclusion of minority groups in STEM	Societal	STI system
Austria	Inclusion of women in STEM	Societal	STI system
Canada	Entrepreneurial and scientific opportunities for underrepresented groups such as indigenous peoples	Societal	Broader society
Chile	Opportunities for STI to contribute to regional development	Territorial	Broader society
Finland	Innovation that includes civil society	Societal	STI system
Germany	Opportunities for STI to contribute to regional development	Territorial	Broader society
Italy	Creation of opportunities in STEM in Southern Italy	Territorial	STI system
Japan	Innovating for solutions for an ageing population	Societal	Broader society
Slovak Republic	Innovation to support youth job creation	Societal	Broader society
United States	Inclusion of minority groups in STEM	Societal	STI system

2.4. Protecting STI ecosystems and using STI to build more resilience is a shared priority across countries

As was the case of inclusivity, references to resilience were less prominent than the topics of digitalisation and sustainability. The impacts of the COVID-19 shock, however, drew more attention to STI's role in building resilience. In the Business at OECD (BIAC)'s 2021 Economic Policy Survey, a large majority of the 28 business associations affiliated to the BIAC highlighted in particular the importance that they attach to post-crisis economic reforms that boost long-term resilience (BIAC, 2021).

There are two ways in which STI strategies have discussed resilience to a variety of shocks beyond COVID-19. The first is about protecting STI systems from shocks of crises ranging from natural disaster, health shocks and climate change. The other is about the role STI strategies can play in helping build more resilience, for instance, by providing for capacities to address future crises (such as addressing future pandemics or building up key enabling technology capacities to respond to international supply shocks). As to the type of shock, Chile, the United States and Japan, for instance, discuss the risk of natural disasters. Japan was the only country where resilience with regards to natural disasters had been a significant innovation priority before the COVID-19 pandemic due to the Great East Japan Earthquake of March 2011. The impact of this catastrophe was explicitly referenced as a driver of efforts to innovate for greater societal resilience in the face of earthquakes and tsunamis. A link was also established to climate change as a systemic risk for the STI ecosystem and as a factor STI should attend to in response to build resilience.

Protecting national economies and international value chains was an important theme. The temporary breakdown to supply from international value chains due to local COVID-19 outbreaks strongly impacted the economic situation in several OECD countries. Countries like Austria, Canada, Finland, Germany, and the United States emphasised the connection between STI and the security of national value chains. Australia, Austria, Chile, Italy, the Slovak Republic, and Sweden connected resilience in particular to the threat of climate change and other environmental catastrophes, noting that new technologies had a role to play in supporting economies and societies in handling the impact of environmental challenges and natural disasters linked to climate change. Australia and Canada explicitly referenced future health crises, noting that new technologies could have a role to play in mitigating the impact of future pandemics.

Discussion of resilience share concerns over shocks countries share, such as the pressures of climate change and the impacts of the COVID-19 pandemic (Paunov & Planes-Satorra, 2021).

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Annex: Document list

The below tables summarize the documents that were used as sources for the analysis of this country's STI policies, as well as the period (pre-COVID-19 or intra-COVID-19) that they were assigned to.

Australia

		Pre-COVID-19	Intra-COVID-19
Type A		A.1.P.1. Global Innovation Strategy (2016, Australian Government) A.1.P.2. National Innovation and Science Agenda (2015, Australian Government)	A.1.C.1. Technology Investment Roadmap (2020, Department of Industry, Science, Energy and Resources)
Type B	B.1	-	B.1.C.1. Budget 2020-2021 (2020, Australian Government)
	B.2	-	-
	B.3	-	-
	B.4	B.4.P.1. Australian Medical Research and Innovation Strategy 2016-2021 (2016, Australian Government) B.4.P.2. Data Strategy 2018-2020 (2018, Department of Industry, Innovation and Science) B.4.P.3. Vision 2025 (2018, Digital Transformation Agency) B.4.P.4. National Hydrogen Strategy (2019, COAG Energy Council)	B.4.C.1. Digital Economy Strategy 2030 (2021, Australian Government) B.4.C.2. Make it happen: The Australian Government's Modern Manufacturing Strategy (2021, Australian Government)
	B.5	-	-
Type C		C.1.P.1. CSIRO Corporate Plan 2019-2020 (2019, Australia's National Science Agency)	C.1.C.1. COVID-19: Recovery and resilience (2021, Australia's National Science Agency) C.1.C.2. CSIRO Corporate Plan 2020-2021 (2020, Australia's National Science Agency) C.2.C.1. Partnerships for Recovery: Australia's COVID-19 Development Response (2020, Department of Foreign Affairs and Trade)
Type D		-	-

Note: Type A is STI Strategies. Type B documents are other government strategies: COVID-19 recovery strategies (1), Strategies concerning inclusivity, sustainability, or resilience (2), Whole-of-government reform strategies (3), Strategies on specific technologies (4), and others (5). Type C documents are ministerial plans. Type D documents are COVID-19 recovery packages in legislation.

Austria

		Pre-COVID-19	Intra-COVID-19
Type A		-	A.C.1: FTI-Strategie 2030 (2020 Federal Government) [STI Strategy 2030]
Type B	B.1	B.1.P.1: Open Innovation Strategy for Austria (2016, Federal Ministry of Science and Research) [Open Innovation Strategie für Österreich]	B.1.C.1: Austrian Reconstruction and Resilience Plan 2020-2026 (2021, Ministry of Finance) [Österreichischer Aufbau- und Resilienzplan 2020-2026] B.1.C.2: Austria's Digital Action Plan (2020, Federal Ministry for Digital and Economic Affairs) [Digitaler Aktionsplan Austria]
	B.2	B.2.P.1: Bioeconomy: A Strategy for Austria (2019, Ministry for Sustainability and Tourism)	B.2.C.1: STI Strategy for Mobility (2020, Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology) [FTI-Strategie Mobilität]
	B.3	B.3.P.1: National Reform Programme 2019 (2019, Federal Chancellery)	B.3.C.1: National Reform Programme 2020 (2020, Federal Chancellery)
	B.4	-	-
	B.5	-	-
Type C		-	-
Type D		-	-

Note: Type A is STI Strategies. Type B documents are other government strategies: COVID-19 recovery strategies (1), Strategies concerning inclusivity, sustainability, or resilience (2), Whole-of-government reform strategies (3), Strategies on specific technologies (4), and others (5). Type C documents are ministerial plans. Type D documents are COVID-19 recovery packages in legislation.

Canada

The below table summarizes the documents that were used as sources for the analysis of this country's STI policies, as well as the period (pre-COVID-19 or intra-COVID-19) that they were assigned to.

		Pre-COVID-19	Intra-COVID-19
Type A		A.P.1. Seizing Canada's Moment: Moving Forward in Science, Technology and Innovation (2014, Industry Canada) A.P.2. Canada's Science Vision (2019, Innovation, Science and Economic Development Canada)	A.C.1. Restart, Recover and Reimagine Prosperity for all Canadians (2020, Industry Strategy Council)
Type B	B.1	-	B.1.C.1. Supporting Canadians and Fighting COVID-19: Fall Economic Statement (2020, Government of Canada)
	B.2	B.2.P.1. Building a Nation of Innovators (2019, Innovation, Science and Economic Development Canada)	B.2.C.1. A Healthy Environment and a Healthy Economy (2020, Environment and Climate Change Canada) B.2.C.2. Canada's Climate Actions (2021, Environment and Climate Change Canada)
	B.3	-	-
	B.4	B.4.P.1. Digital Operations Strategic Plan: 2018-2022 (2018, Treasury Board of Canada Secretariat)	B.4.C.1. Digital Operations Strategic Plan: 2021-2024 (2021, Treasury Board of Canada Secretariat)

	B.5	B.5.P.1. Investing in the Middle Class: Budget 2019 (2019, Government of Canada)	B.5.C.1. A Recovery Plan for Jobs, Growth, and Resilience: Budget 2021 (2021, Government of Canada) B.5.C.2. Intellectual Property Strategy (2021, Innovation, Science and Economic Development Canada)
Type C		C.1.P.1. ISED Departmental Plan 2019-20 (2019, Innovation, Science and Economic Development Canada) C.1.P.2. NRC Strategic Plan 2019-2024 (2019, National Research Council Canada) C.1.P.3. NSERC Departmental Plan 2020-21 (2020, Natural Sciences and Engineering Research Council of Canada) C.1.P.4. CIHR Departmental Plan 2020-21 (2020, Canadian Institutes of Health Research)	C.1.C.1. ISED Departmental Plan 2021-22 (2021, Innovation, Science and Economic Development Canada) C.1.C.2. Responding to Canada's Needs from COVID-19 to Climate Change (2020, National Research Council Canada) C.1.C.3. NSERC Departmental Plan 2021-22 (2021, Natural Sciences and Engineering Research Council of Canada) C.1.C.4. CIHR Strategic Plan 2021-2031 (2021, Canadian Institutes of Health Research) C.1.C.5. CIHR Departmental Plan 2021-22 (2021, Canadian Institutes of Health Research)
Type D		-	-

Note: Type A is STI Strategies. Type B documents are other government strategies: COVID-19 recovery strategies (1), Strategies concerning inclusivity, sustainability, or resilience (2), Whole-of-government reform strategies (3), Strategies on specific technologies (4), and others (5). Type C documents are ministerial plans. Type D documents are COVID-19 recovery packages in legislation.

Chile

		Pre-COVID-19	Intra-COVID-19
Type A		A.P.1: Science, Technology, Knowledge and Innovation in Chile (2019, National Council for Innovation for Development) [Ciencia, Tecnología, Conocimiento e Innovación para Chile] A.P.2: Science, technology and innovation in a new pact on sustainable and inclusive development: strategic orientations in view of 2030 after a 10-years trajectory (2017, National Council for Innovation for Development) [Ciencias, tecnologías e innovación para un nuevo pacto de desarrollo sostenible e inclusivo: Orientaciones estratégicas de cara a 2030 tras diez años de trayectoria] A.P.3: A common dream for the future of Chile: Report for the President of the Republic, Michelle Bachelet (2015, Presidential Commission Science for Development of Chile) [Un sueño compartido para el futuro de Chile: Informe a la Presidenta de la República, Michelle Bachelet]	A.C.1: National Policy on Science, Technology, Knowledge and Innovation (2020, Ministry of Science, Technology and Innovation) [Política nacional de ciencia, tecnología, conocimiento e innovación] A.C.2: Acciona Plan: National Policy on Science, Technology, Knowledge and Innovation (2021, Ministry of Science, Technology and Innovation) [Plan de acción: Política nacional de ciencia, tecnología, conocimiento e innovación] A.C.3: Basis for the National Strategy on Science, Technology, Knowledge and Innovation (2021, National Council on Innovation for Development) [Base para la Estrategia Nacional de Ciencia, Tecnología, Conocimiento e Innovación] A.C.4: National Policy for Gender Equality in STI (2021, Ministry of Science, Technology and Innovation) [Política Nacional de Igualdad de Género en CTCI] A.C.5: Strategy of Development and Technology Transfer for Climate Change (2021, Ministry of Science, Technology and Innovation) [Estrategia de Desarrollo y Transferencia Tecnológica para el Cambio Climático]
Type B	B.1	-	-
	B.2	B.2.P.1: Report for a Resilient Chile against Disasters: an Opportunity (2016, National Council for Innovation for Development) [Informe Hacia un Chile Resiliente frente a Desastres: Una	-

		Oportunidad] B.2.P.2: Report on Science and Innovation for Water Challenges in Chile (2017, National Council for Innovation for Development) [Informe Ciencia e Innovación para los Desafíos del Agua en Chile] B.2.P.3: Energy 2050: Chile's Energetic Policy (2017, Ministerio de Energía) [Energía 2050: Política Energética de Chile]	
	B.3	-	-
	B.4	B.4.P.1: National Policy on Artificial Intelligence (2019, Ministry of Science, Technology and Innovation) [Política Nacional de Inteligencia Artificial]	B.4.C.1: Proposal of Policy for open access to scientific information and to research data that are financed with public funding by ANID (2021, Ministry of Science, Technology and Innovation) [Propuesta de Política de acceso abierto a la información científica y a datos de investigación financiados con fondos públicos de la ANID]
	B.5	-	-
Type C		-	-
Type D		-	-

Note: Type A is STI Strategies. Type B documents are other government strategies: COVID-19 recovery strategies (1), Strategies concerning inclusivity, sustainability, or resilience (2), Whole-of-government reform strategies (3), Strategies on specific technologies (4), and others (5). Type C documents are ministerial plans. Type D documents are COVID-19 recovery packages in legislation.

Finland

		Pre-COVID-19	Intra-COVID-19
Type A		A.P.1: Vision and road map of the Research and Innovation Council Finland (2017, Research and Innovation Council)	A.C.1: RDI Roadmap: Solutions for a sustainable and developing society (2020, State Council)
Type B	B.1	B.1.P.1: Inclusive and Competent Finland (2019, Finnish Government)	B.1.C.1: Sustainable Growth Programme for Finland – Preliminary Recovery and Resilience Plan (2021, Finnish Government) [Suomen kestävä kasvun ohjelma – alustava elpymisja palautumissuunnitelma]
	B.2	-	B.2.C.1: The regional development decision 2020–2023: Sustainable and vital regions (2020, Ministry of Economic Affairs and Employment)
	B.3	B.3.P.1: Finland's National Reform Programme 2019 (2019, Ministry of Finance)	B.3.C.1: Government Report on the Implementation of the 2030 Agenda (12/2020, Prime Minister's Office) B.3.C.2: National Reform Programme 2020 (2020, Ministry of Finance)
	B.4	-	-
Type C		-	-
Type D		-	-

Note: Type A is STI Strategies. Type B documents are other government strategies: COVID-19 recovery strategies (1), Strategies concerning inclusivity, sustainability, or resilience (2), Whole-of-government reform strategies (3), Strategies on specific technologies (4), and others (5). Type C documents are ministerial plans. Type D documents are COVID-19 recovery packages in legislation.

Germany

		Pre-COVID-19	Intra-COVID-19
Type A		A.P.1: High Tech Strategy 2025 (2018, Bundesregierung) [Hightech-Strategie 2025] A.P.2: Internationalization of education, science and research (2017, Bundesregierung) [Internationalisierung von Bildung, Wissenschaft und Forschung]	-
Type B	B.1	-	B.1.C.1. German Recovery and Resilience Plan (2021, Federal Ministry of Finance) [Deutscher Aufbau- und Resilienzplan] B.1.C.2: Coalition decision paper: Tackling consequences of the pandemic, securing prosperity, strengthening future prospects (2020, Federal coalition committee) [Corona-Folgen bekämpfen, Wohlstand sichern, Zukunftsfähigkeit stärken]
	B.2	B.2.P.1: National Bioeconomy Strategy (2020, Bundesregierung) [Nationale Bioökonomiestrategie] B.2.P.2: Framework Programm Research for Sustainable Development (2015, BMBF) [Rahmenprogramm Forschung für Nachhaltige Entwicklung (FONA)] B.2.P.3: Framework Programm for Health Research (2018, Bundesregierung) [Rahmenprogramm Gesundheitsforschung] B.2.P.4: STEM Action Plan (2019, BMBF) [MINT-Aktionsplan] B.2.P.5: National Skills Strategy (2019, Bundesregierung) [Nationale Weiterbildungsstrategie]	B.2.C.1: Idea to market: SME innovation programme (2020, BMWi) [Von der Idee zum Markterfolg: Programme für einen innovativen Mittelstand] B.2.C.2: Research for Sustainability Strategy (2020, BMBF) [Neue Strategie „Forschung für Nachhaltigkeit“ (FONA 3)] B.2.C.3: National Skills Strategy (2021, Bundesregierung) [Nationale Weiterbildungsstrategie]
	B.3	B.3.P.1: National Reform Programme 2020 (2020, BMWi) [Das Nationale Reformprogramm 2020]	B.3.C.1: National Reform Programme 2021 (2021, BMWi) [Das Nationale Reformprogramm 2021]
	B.4	B.4.P.1: German AI Strategy (2018, Bundesregierung) [Strategie Künstliche Intelligenz] B.4.P.2: Action Plan "Research for autonomous driving - an overarching research framework from BMBF, BMWi and BMVI" (2019, Bundesregierung) [Aktionsplan „Forschung für autonomes Fahren – ein übergreifender Forschungsrahmen von BMBF, BMWi und BMVI“] B.4.P.3: Quantum technologies – from basic research to market (2018, BMBF) [Quantentechnologien - von den Grundlagen zum Markt] B.4.P.4: "Research factory battery" umbrella concept (2019, BMBF) [Dachkonzepts "Forschungsfabrik Batterie"] B.4.P.5: Blockchain Strategy (2019, Bundesregierung) [Blockchain-Strategie]	B.4.C.1: German AI Strategy Update (2020, Bundesregierung) [Strategie Künstliche Intelligenz – Fortschreibung] B.4.C.2: National hydrogen strategy (2020, BMWi) [Nationale Wasserstoffstrategie] B.4.C.3: Quantum Computing Roadmap (2021, BMBF) [Roadmap Quantencomputing]
	B.5	B.5.P.1: Digitalisation Strategy of the BMBF (2019, BMBF) [Digitalstrategie des BMBF „Digitale Zukunft: Lernen. Forschen. Wissen.“]	B.5.C.1: Impulse paper on technological sovereignty (BMBF, 2021) [Technologisch souverän die Zukunft gestalten. BMBF-Impulspapier zur technologischen Souveränität]
Type C		-	-
Type D		-	-

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Italy

		Pre-COVID-19	Intra-COVID-19
Type A		<p>A.P.1: Strategy for the technological innovation and digitalization of the country 2025 (2019, Ministry of technological innovation and digital transition) [Strategia per l'innovazione tecnologica e la digitalizzazione del Paese 2025]</p> <p>A.P.2: National Program for Research 2015-2020 (2016, Ministry of university and research) [Programma Nazionale per la Ricerca 2015-2020]</p> <p>A.P.3: National Strategy for Intelligent Specialization (2016, Ministry of education, university and research; Ministry of economic development) [Strategia nazionale di specializzazione intelligente]</p> <p>A.P.4: National Program for Research Infrastructures 2014-2020 (2016, Ministry of university and research) [Programma Nazionale per le Infrastrutture di Ricerca 2014-2020]</p> <p>A.P.5: Horizon 2020 (2013, Ministry of Education, University and Research)</p>	A.C.1: National Program for Research 2021-2027 (2020, Ministry of university and research) [Programma Nazionale per la Ricerca 2021-2027]
Type B	B.1	-	-
	B.2	-	-
	B.3	-	B.3.C.1: National Plan for Recovery and Resilience (2021, Council of Ministers) [Piano Nazionale di Ripresa e Resilienza]
	B.4	-	<p>B.4.C.1: Proposals for an Italian Strategy on Artificial Intelligence (2020, Ministry of economic development) [Proposte per una Strategia italiana per l'intelligenza artificiale]</p> <p>B.4.C.2: 3-years Plan for digitalization of public administration (2020, Agency for Digital Italy; Department for Digital Transformation) [Il Piano Triennale per l'informatica nella Pubblica Amministrazione]</p>
Type C	C.1	C.1.P.1: National Plan Industry 4.0 (2016, Ministry of economic development) [Piano Nazionale Industria 4.0]	-
	C.2	C.2.P.1: National Strategy for Sustainable Development (2017, Ministry of the environment and protection of territory and sea) [Strategia Nazionale per lo sviluppo sostenibile]	-
Type D		-	-

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Japan

		Pre-COVID-19	Intra-COVID-19
Type A		<p>A.P.1: Integrated Innovation Strategy (2019, Cabinet Office) [統合イノベーション戦略 2019]</p> <p>A.P.2: Industrial Technology Vision 2020 (2020, Ministry of Economy, Trade and Industry (METI)) [産業技術ビジョン2020]</p> <p>A.P.3: 5th Science, Technology, and Innovation Basic Plan (2016, Cabinet Office) [科学技術基本計画]</p>	<p>A.C.1: Integrated Innovation Strategy (2021, Cabinet Office) [統合イノベーション戦略 2021]</p> <p>A.P.2: Integrated Innovation Strategy 2020 (2020, Cabinet Office)</p> <p>A.P.3: 6th Science, Technology, and Innovation Basic Plan (2021, Cabinet Office)</p>
Type B	B.1	-	<p>B.1.C.1: Emergency Economic Measures to Cope with the Novel Coronavirus (COVID-19) (2020, Cabinet Office)</p> <p>B.1.C.2: Comprehensive Economic Measures to Secure People's Lives and Livelihoods toward Relief and Hope (2020, Cabinet Office)</p> <p>B.1.C.3: Economic Measures for Overcoming COVID-19 and Opening Up a New Era (2021, Cabinet Office)</p>
	B.2	<p>B.2.P.1: Energy White Paper 2020 (2020, Agency for Natural Resources and Energy) [エネルギーに関する年次報告]</p> <p>B.2.P.3: Strategic Energy Plan (2018, Cabinet Decision)</p>	<p>B.2.C.1: Energy White Paper 2021 (2020, Agency for Natural Resources and Energy) [エネルギーに関する年次報告]</p> <p>B.2.C.2: Green Growth Strategy Through Achieving Carbon Neutrality in 2050 (2020, Ministry of Economy, Trade and Industry (METI)) [2050年カーボンニュートラルに伴うグリーン成長戦略]</p> <p>B.2.C.3: Strategic Energy Plan (2021, Cabinet Decision) [エネルギー基本計画]</p> <p>B.2.C.4: The Basic Policies for the Project for the Green Innovation Fund (2021, Ministry of Economy, Trade and Industry (METI)) [グリーンイノベーション基金事業の基本方針]</p> <p>B.2.C.5: Global Warming Countermeasure Plan (Draft) (2021, Ministry of Economy, Trade and Industry (METI)) [地球温暖化対策計画(案)]</p>
	B.3	-	-
	B.4	<p>B.4.P.1: Declaration to Be the World's Most Advanced IT Nation (2019, IT Comprehensive Strategy Office) [世界最先端デジタル国家創造宣言]</p> <p>B.4.P.2: AI Strategy 2019 (2019, Cabinet Office)</p>	<p>B.4.C.1: National Data Strategy (2021, Digital Agency)</p> <p>B.4.C.2: Basic Policy on Reform for The Realization of a Digital Society (2020, Prime Minister's Office) [デジタル社会の実現に向けた改革の基本方針]</p> <p>B.4.C.3: Strategy for Semiconductors and the Digital Industry (2021, Ministry of Economy, Trade and Industry (METI)) [半導体・デジタル産業戦略]</p>
Type C	C.1	-	-
	C.2	-	-
Type D		<p>D.2.P.1: Basic Law on Science and Technology (1995, Parliament of Japan) [科学技術・イノベーション基本法]</p> <p>D.2.P.2: Law Concerning Revitalization of Science and Technology / Innovation Creation (Partial Amendment of the R & D Strengthening Law) (2018, Parliament of Japan) [科学技術・イノベーション創出の活性化に関する法律（研究開発力強化法の一部改正）]</p>	<p>D.2.C.1: Science and Technology / Innovation Basic Law (Revision of Science and Technology Basic Law) (2020, Parliament of Japan) [科学技術・イノベーション基本法（科学技術基本法の改正）]</p> <p>D.2.C.2: Partial amendment of the law on revitalization of science and technology / innovation creation (2020, Parliament of Japan) [科学技術・イノベーション創出の活性化に関する法律の一部改正]</p>

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technologies (4), and others (5). Type C documents are ministerial plans. Type D documents are COVID-19 recovery packages in legislation.

Slovak Republic

		Pre-COVID-19	Intra-COVID-19
Type A		A.1.P.1. Research and Innovation Strategy for Smart Specialisation of the Slovak Republic (2013, Ministry of Investment, Regional Development and Informatization of the Slovak Republic)	-
Type B	B.1	-	B.1.C.1 Recovery Plan (2021, Government of Slovak Republic) [Plán Obnovy]
	B.2	B.2.P.1 Adaptation Strategy Slovak Republic for Climate Change (2018, Ministry of the Environment) [Stratégia Adaptácie Slovenskej Republiky Nazmenuklímy] B.2.P.2. Strategy of the Environmental Policy of the Slovak Republic until 2030 (2019, Ministry of the Environment) B.2.P.3. Low-Carbon Development Strategy of the Slovak Republic until 2030 with a View to 2050 (2017, Ministry of the Environment)	-
	B.3	B.3.P.1. National Reform Programme (2019, Ministry for Finance) [Národný program reforiem Slovenskej republiky]	B.3.C.1. National Reform Programme (2020, Ministry for Finance) [Národný program reforiem Slovenskej republiky] B.3.C.2. Stability Programme 2021-2024 (2021, Ministry for Finance) [Program stability Slovenskej republiky na roky 2021 až 2024]
	B.4	B.4.P.1. Action plan for the digital transformation of Slovak Republic for 2019-2022 (2019, Government of Slovak Republic) B.4.P.2. Strategy of the Digital Transformation of Slovak Republic 2030 (2019, Office of the Deputy Prime Minister for Investments and Information)	B.4.C.1. National Energy and Climate Plan 2021-2030 (2021, Ministry for the Economy) [Integrovaný národný energetický a klimatický plán na roky 2021-2030]
	B.5	-	-
Type C		-	-
Type D		-	-

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Sweden

		Pre-COVID-19	Intra-COVID-19
Type A		-	-
Type B	B.1	-	-
	B.2		B.2.C.1. Circular Economy – Strategy for the Transition in Sweden (2020, Swedish Government) B.2.C.2. Sweden's long-term strategy for reducing greenhouse gas emissions (2020, Ministry of the Environment) B.2.C.3. A sustainable digitalized Sweden 2030 – a proposal for a strategic program (2021, Vinnova Swedish Innovation Agency) [Regeringsuppdrag att föreslå ett strategiskt program för digital strukturovandling]
	B.3	B.3.P.1. Sweden's National Reform Programme (2019, Swedish Government)	B.3.C.1. Sweden's National Reform Programme (2020, Swedish Government)
	B.4	-	B.4.C.1. National strategy for a sustainable wind power expansion (2021, Swedish Energy Agency) [Nationell strategi för en hållbar indkraftsutbyggnad]
	B.5	B.5.P.1. Sweden's Trade and Investment Strategy (2019, Swedish Government)	-
Type C		-	-
Type D		D.2.P.1. Government Research Bill (2016, Swedish Government) [Kunskap i samverkan – för samhällets utmaningar och stärkt konkurrenskraft]	D.2.C.1. Government Research & Innovation Bill (2020, Swedish Government)

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United States

		Pre-COVID-19	Intra-COVID-19
Type A		A.P.1. Fiscal Year 2021 Administration Research and Development Budget Priorities (2019, Office of Management and Budget and Office of Science and Technology Policy)	A.C.1. Fiscal Year (FY) 2022 Administration Research and Development Budget Priorities and Cross-cutting Actions (2020, Office of Management and Budget and Office of Science and Technology Policy) A.C.2. Multi-Agency Research and Development Priorities for the FY 2023 Budget (2021, Executive Office of the President) A.C.3. A Letter to Dr. Eric S. Lander, the President's Science Advisor and nominee as Director of the Office of Science and Technology Policy (2021, White House)
Type B	B.1	-	-
	B.2	-	-
	B.3	-	-
	B.4	B.4.P.1. A Strategic Vision for America's Quantum Networks (2020, The White House National Quantum Coordination Office) B.4.P.2. National Strategic Computing Initiative Update: Pioneering the Future of Computing (2019, National	B.4.C.1. Recommended Practices for Strengthening the Security and Integrity of America's Science and Technology Research Enterprise (2021, National Science and Technology Council)

		<p>Science and Technology Council)</p> <p>B.4.P.3. The National Artificial Intelligence Research and Development Strategic Plan: 2019 Update (2019, National Science and Technology Council)</p> <p>B.4.P.4. Assessing and Strengthening the Manufacturing and Defense Industrial Base and Supply Chain Resiliency of the United States (2018, Interagency Task Force in Fulfillment of Executive Order 13806)</p>	<p>B.4.C.2. Pioneering the Future Advanced Computing Ecosystem: A Strategic Plan (2020, National Science and Technology Council)</p> <p>B.4.C.3. Final Report (2021, National Security Commission on Artificial Intelligence)</p> <p>B.4.C.4. Building Resilient Supply Chains, Revitalizing American Manufacturing, and Fostering Broad-Based Growth (2021, White House)</p> <p>B.4.C.5. Hydrogen Program Plan (2020, Department of Energy)</p>
	B.5	B.5.P.1. Manufacturing USA Report to Congress Fiscal Year 2019 (2020, Manufacturing USA)	B.5.C.1. Manufacturing USA Report to Congress Fiscal Year 2020 Including COVID-19 Emergency Response Highlights (2021, Manufacturing USA)
Type C		<p>C.1.P.1. NIST Three Year Programmatic Plan 2017-2019 (2017, National Institute of Standards and Technology)</p> <p>C.1.P.2. Creating Technology Breakthroughs and New Capabilities for National Security (2019, Defense Advanced Research Projects Agency (DARPA))</p> <p>C.1.P.3. Advanced Research Projects Agency – Energy Annual Report for FY 2018 (2019, U.S. Department of Energy)</p> <p>C.1.P.4. NIH-wide Strategic Plan: Fiscal Years 2021-2025 (2021, National Institutes of Health)</p> <p>C.1.P.5. Building the Future, Investing in Discovery and Innovation: NSF Strategic Plan for Fiscal Years 2018-2022 (2018, National Science Foundation)</p>	C.1.C.1. NIH-Wide Strategic Plan for COVID-19 Research (Updated) (2021, National Institutes of Health)
Type D	D.1	-	<p>D.1.C.1. Coronavirus Aid, Relief and Economic Security Act (CARES) (2020, 116th Congress)</p> <p>D.1.C.2. American Rescue Plan Act of 2021 (2021, 117th Congress)</p>
	D.2	D.2.P.1. Department of Energy Research and Innovation Act (2018, 115 th Congress)	-

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