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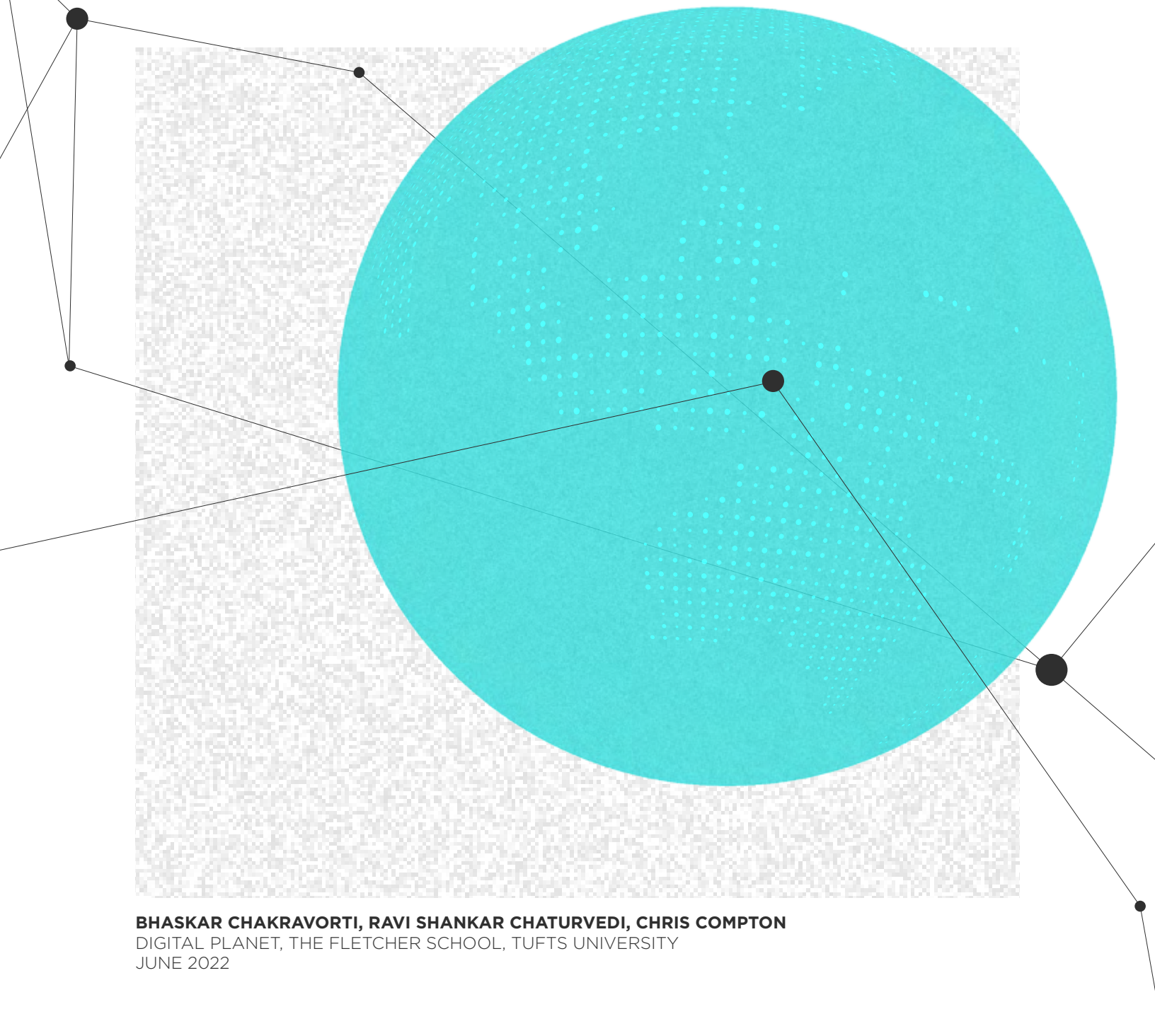
Digital Planet Where Digital Innovation Meets the World DEA 2030

Digital Inclusion vs. Innovation Momentum: Is There a Tradeoff? And Must Economies Choose?

An Archetypal Analysis of the Interplay Between the State of Socioeconomic Digital Inclusion and the Rate of Innovation among Digitally Advanced Economies



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JUNE 2022

This report was originally developed for the Center for Governance of Change (CGC) project with the IE Business School in Madrid, Spain. An abridged version of this paper is available from our partners at this link: https://static.ie.edu/CGC/Chakravorti-Chaturvedi-Compton%20-%20Inclusion%20and%20Innovation.pdf

This research project—a part of the IDEA 2030 initiative by Digital Planet at The Fletcher School, Tufts University—was made possible by the generous support from the Mastercard Center for Inclusive Growth.

This paper was developed by the authors for the Digital Revolution and the New Social Contract program by IE's Center for the Governance of Change. The authors are grateful to the project Advisory Board (Andrés Ortega, Helena Malikova, Lucía Velasco, Manuel Muñiz, Juan del Alcázar, Gloria Hervas, Carlos Torrecilla and Joanna Bryson) and IE's CGC team (Irene Blázquez, Carlos Luca De Tena, Miguel Otero, and Paula Oliver) for their thoughtful critiques and constructive feedback. This research publication is the richer for it.

Abstract

Governments place enhanced focus towards continuously advancing digital societies, competing to be at the forefront of growth in talent, intellectual property, and cutting-edge research and development. For those economies that fall into the upper echelons of digital advancement, however, we notice that this push for growth in innovation comes at the cost of digital inclusion of the more vulnerable in their societies. To dig deeper into this trend, we at Digital Planet ask questions pertaining to the interplay between innovation momentum and digital inclusion as measured in our Digital Intelligence Index.

We begin by exploring whether such a tradeoff manifests across digital economies around the world or whether this occurs only in digitally advanced economies. Having ascertained through regression analysis that this is an advanced economy phenomenon, we conduct an archetypal analysis to understand this phenomenon better. We consider the United Kingdom and Spain as archetypal of countries at the crossroads of innovation and inclusion with three approaches to potentially emulate: the first, New Zealand, is also our primary motivation for the study. Policymakers in the country consciously recalibrated towards ensuring digital inclusion of those marginalized, sacrificing some innovation momentum. The inverse archetype is South Korea, an exemplar of innovation-driven growth with glaring socioeconomic digital inequalities. Finally, we consider the socio-economic inclusion and innovation dynamics of Germany, which straddles both quite well. We conclude with observations and recommendations policymakers would do well to take note as they work towards fostering and realizing a technologically competitive and inclusive digital economy for all.

Authors

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Contents

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The IDEA 2030 initiative was made possible with support from the Mastercard Impact Fund

The motivation for our research questions around whether there exists a tradeoff between digital inclusion and the rate of innovation in an economy and whether economies must make a conscious policy choice between the two is rooted in our triennial empirical scorecard—the Digital Intelligence Index[1] (DII)—measuring of the state and rate of digital evolution across 90 economies since 2008 (see Digital Planet reports 2014[2], 2017[3], 2020[4]) and our ringside view of digital economy policymaking discussions across several countries we've had the privilege of working with—both in the advanced Digital North and emerging Digital South—since 2015.

We were particularly struck, and continue to be, by the performance of economies we identified as "digital entrepôts." Much like traditional entrepôts that gained prominence as nodes at the nexus of international trade and communication flows owing to their geographic advantages, digital entrepôts, we observed, are embracing digitalization to upend traditional sources of competitive advantage and forge new ones. In doing so, these economies establish a self-reinforcing system of attendant network effects and attract global investments and talent to create a demonstration effect for the rest of the world as to what the future might look like. We further noted that these entrepôts, such as Singapore, Hong Kong, United Arab Emirates, New Zealand, Estonia, and Taiwan—buoyed by their strong foundations of sophisticated domestic demand conditions (the willingness and ability of consumers in a country to participate in the digital economy), world-class digital (access, transaction, and fulfillment) and analog infrastructure, and enabling institutional environments—are emerging as the linchpins for corralling talent and investments into innovation and diffusion of digital innovations in their respective regions and beyond.

Indeed, the notion of competitiveness in digital innovation, since scorecards like ours started measuring it, has become front and center in the minds of policymakers as an area of national importance and interest and as a basis for keeping score. Such importance is evidenced by the expositions of elected leaders and the civil service in, among several other countries, Hong Kong[5], New Zealand[6], and Ireland[7] regarding their country's position and performance on our digital evolution scorecard.

In our subsequent analyses, we noticed a curious pattern among some of these digital entrepôts and stand out economies (UAE, Hong Kong, South Korea): their innovation momentum continues unabated despite a flatlining of or regression in at least one aspect of their digital inclusion levels in society. We saw this aspect playing out in real-time during our multi-year engagement with the New Zealand government on "Building Smart Societies[8]", where the center-right Bill English-led administration (circa 2016/2017) advanced an outward-focused agenda of being seen and counted among leading digital governments[9], growing innovation-led weightless exports[10], and building digital trade corridors[i] with populous "break out" digital economies of South and South-East Asia. Meanwhile, the subsequent Jacinda Ardern-led center-left administration recalibrated the government's policy focus and turned it inward and towards advancing digital inclusion as a means to achieve the stated objectives of closing gaps in access[11] to equitable opportunities and enabling every New Zealander to participate to their fullest potential in the economy and society and in a world that is rapidly digitalizing.

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i In conversations with the lead researchers of Digital Planet at the Beehive, Wellington, New Zealand, May 2017.

Interestingly, the indicators in our 2020 edition of the digital evolution scorecard captured the effects of this change in policy—New Zealand, which featured as a Stand Out[ii] economy in our 2014 and 2017 scorecards, propelled primarily by innovation momentum, moved to the Stall Out Zone in 2020. Yet this was coupled with world-beating levels of socioeconomic digital inclusion: it scored perfectly on our measure of socioeconomic digital parity[12], meaning that the poorest 40% in its economy are equal in digital access and literacy to its richest 60%; its innovation momentum, however, fell from the highs of 30th out of 90 in 2015 to 59th in 2019[13]. This led us to wonder whether digital economies must consciously choose between innovation momentum and socio-economic digital inclusion and, despite the well and widely understood importance of both inclusion and innovation for a robust digital economy and society writ large, do countries tend to prioritize one over the other. The evidence of such a tradeoff, we believe, can become the basis for a deeper exploration into the whys and the wherefores of such choices.

The importance of and need for inclusive digital advancement was brought into sharp focus by the COVID-19 pandemic. In the aggregate, as our research shows, digital advancement, while no silver bullet, has been a silver lining in cushioning the economic impact of the pandemic and contributing to economic resilience[14]. At an individual level, the internet, for those fortunate enough to have access to it, has been a source of succor throughout the pandemic enabling people to maintain social connections, remain informed, and stay entertained during the waves of lockdown, and an outlet for cathartic relief through social sharing and the airing of thoughts, fears, hopes, anxieties, and concerns. Indeed, digital technologies have been the only tether holding the economy and society together in most parts of the world during the worst phases of the pandemic by keeping knowledge and information-based parts of the economy somewhat functioning in a socially distant mode, facilitating the last mile delivery of groceries and domestic supplies, and, most vitally, enabling contact tracing to identify and isolate infection hotspots.

Even as digital advancement contributed to the macroeconomic resilience of nations in the aggregate in the wake of COVID-19, the reverberations of the pandemic have driven heightened interest in the dynamics of socio-economic inequality around the world[15] both between and within countries, exacerbated by the inclusivity gaps in digitalization—an aspect we measure in our Global Digital Inclusion: Progress to Parity Scorecard[16]. While those less well-off in digitally advanced and developing economies needed to pause face-to-face work and risk losing their livelihoods, those more privileged were able to seamlessly shift to digitally intermediated modes of work with little unease. There exists a rich body of work by several researchers establishing and exploring the linkages between socioeconomic status and digital access. Korupp and Szydlik identified income disparities as a determinant of digital divide within a country both on the first level[17] (pure access to digital technologies) and the second level (ability to adequately use digital technologies). Van Deursen and Van Dijk examined the impact of access device-related costs on the persistence of digital divide among lower-income groups[18] and Zhang explored the relationship between higher levels of wealth inequality and lower internet consumption[19].

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ii For detailed definitions of each of these zones, refer to our Digital Intelligence Index at https://digitalintelligence.fletcher.tufts.edu/trajectory.

Meanwhile, the pandemic also drove greater investments into the tech sector[20] and drove up profits and valuations of technology-based businesses ever higher[21], entrenching the "winner-take-all" dynamic of the technology sector[22] and exacerbating the wealth gap between those with a stake in the technology sector and those without[23]. Such exponentially growing private and public investments into the technology sector, one of the drivers of and a measurement variable for the momentum of inputs for innovation in our digital intelligence index[24], are likely to increase innovation input momentum in the future iterations of our scorecard.

Our empirical observations of the interplay between the state of socioeconomic digital inclusion and the rate of innovation are corroborated by the findings of several other researchers. Podobnik et al. argue that STEM firms across the globe tend to have higher growth rates and greater contributions to wealth inequality than non-STEM firms[25]. Consequently, countries with a higher concentration of their public and private resources in STEM-related fields would generate greater wealth inequality over time, rendering a larger gap in digital inclusion between the rich and poor[26], as Zhang concluded. Further, Frank et al. observe that the inherent complexities of these boundary-pushing STEM firms within a country tend to raise the skill requirements of the labor needed for such firms[27] to maintain their competitive advantage and create and capture economic value—such talent tends to get disproportionately rewarded, thus widening the wealth gap between the skills haves and the have-nots. We argue that in the absence of equitable access to digital literacy and skills required to participate in this portion of a technology-driven economy, countries with a focus on driving innovation-led growth tend to deepen the economic wedge between their haves and have-nots, thereby cementing the negative tradeoff between socioeconomic digital inclusion and innovation momentum.

This exploration of whether there is a tradeoff between innovation momentum and socioeconomic inclusion—in digitally advanced and incipient economies—and whether countries must choose, draws on years of empirical observations and policy machinations we were privy to. This analysis is a part of IDEA 2030[28]—our multi-year study to illuminate pathways to a digital economy that works for everyone, everywhere. The country case studies shaped by the archetypal analyses are intended to shed light on the emerging nature of the social contract shaped by the digital economy.

Research Overview

For the purposes of our exploration of the interplay between the state of socioeconomic digital inclusion and the rate of innovation of an economy, we use two internally created metrics plotted against one another.

The first, "progress to socioeconomic digital parity", is a measure drawn from our "Global Digital Inclusion: Progress to Parity Scorecard" for the 90 economies in our study[iii]. To create this metric, we used disaggregated data on digital access and literacy between a country's richest and poorest citizens from the World Bank's Global Findex database. We created a ratio of access and literacy among the country's poorest over that of the richest to arrive at a measure of parity of access between the two groups in said country and arrayed it against a hypothetical digital economy with perfect parity. This measure of progress to socio-economic digital parity relative to that of the imagined perfect parity economy is plotted on the y-axis as our dependent variable in the analysis.

Our x-axis variable, innovation momentum, is a measure of how innovation—as measured by the three underlying components: inputs into innovation[iv], processes of innovation[v], and outputs of innovation[vi]—has been progressing over time. The inputs component of innovation is a compilation of indicators measuring the factors of production and value creation in the digital economy. This includes investment capital, both from private and public funding, directed towards technology ventures and the ease of access to loans and risk capital for entrepreneurs; the relative ease (of difficulty) for startups to seed, sprout, and scale, a handy proxy for entrepreneurial capacity/ capital and ; and the availability of skilled talent i.e., intellectual capital and ease of finding and hiring such talent.

The next component, processes, captures the existence, efficiency, and effectiveness of the translational infrastructure i.e., the capacities within an economy to conduct basic research, develop and diffuse innovations and innovative ideas, and turn them into commercially viable propositions. The measures include public and private R&D and innovation capacities, the state of cluster development, robustness of university-industry collaborations and innovation absorption capacities of the private sector, and the relative sophistication of businesses in absorbing and using the best available digital technologies.

Lastly, the output component measures the extent of value creation and capture occurring in an economy, which includes the creation of patents and related intellectual applications, commercial gains from high technology production and consumption domestically, and exports of ICT goods and services.

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iii For the methodology and a detailed analysis of how 90 economies rank in closing the gender, rural-urban, and socioeconomic digital divide please refer to our "Global Digital Inclusion: Progress to Parity Scorecard" here: https://sites.tufts.edu/digitalplanet/global-digital-inclusion-progress-to-parity-scorecard/.

iv Inputs encompass elements needed to drive innovation and change, such as creating the right talent pool, having sufficient investment, and the creation of new ventures.

v Processes are the extent to which there are systems in place that can facilitate the development of innovative ideas and practices.

vi Outputs are the extent to which new ideas, products, and systems are created, adopted, and exported. A detailed description of the underlying indicators shaping innovation inputs, processes, and outputs is available here: https://digitalintelligence.fletcher.tufts.edu/methodology.

Taken together, the sum of the inputs, processes, and outputs provides a handy assessment of the state of innovation in an economy. Innovation momentum is the compound annual growth rate of the state of innovation over the years (beginning 2008 to the latest year, 2019) normalized across the 90 economies in our study to create a relative measure of the pace or rate of innovation.

We find no meaningful correlation between the state of socioeconomic digital inclusion and the rate of innovation (aka innovation momentum) for countries in the Digital South, defined as countries falling in the bottom two-thirds of our 90-country DII, with an R-squared between the two variables of 0.01 and a p-value of 0.40[29]. However, for the world's 31 most advanced digital economies, which we refer to as the Digital North, the tradeoff between socioeconomic digital inclusion and innovation momentum is statistically significant, with an R-squared of 0.47 and a p-value below 0.0001[30]. This preliminary assessment of the divergent relationship between socioeconomic digital inclusion and innovation momentum in the Digital North and the Digital South does not prove causality or directionality. To better understand the phenomenon and the tradeoff, if there is one, we conduct an archetypal analysis, in the next section, on five digitally advanced economies—the United Kingdom, Spain, New Zealand, South Korea and Germany—through which we try to tease out the interplay between these two variables.

For the archetypal analysis, we break innovation momentum down into its component parts—the progression of inputs, processes, and outputs of innovation over time—and map it against the state of socioeconomic digital inclusion in the country.

We begin our study of the archetypes with two advanced digital economies at what we call the inclusion vs. innovation crossroads—the U.K. and Spain—since they are underperforming vis-à-vis their peers on both dimensions. We highlight New Zealand as an archetype for altering course to prioritize a digital economy for all over a near-term innovation advantage. South Korea as an archetype for fostering an innovation-led digital economy albeit with inclusion inequities and lastly Germany as an archetype for straddling both inclusion (ranked 11th out of the 31 Digital North economies) and innovation momentum (ranked 8th among the Digital North) and advancing a reasonably innovative digital economy for all.

A caveat is in order. We recognize that country contexts vary as do the drivers and the make-up of their digital economies. The purpose of this archetypal analysis is not to advocate for the blind replication of a model that works in one country across others. What works in and for Germany will likely not work in and for Korea. Our objective here is to identify some generalizable policies and emulation-worthy practices from these archetypes for policymakers to consider in their endeavors to foster an inclusive and innovative digital economy that works for everyone, everywhere.

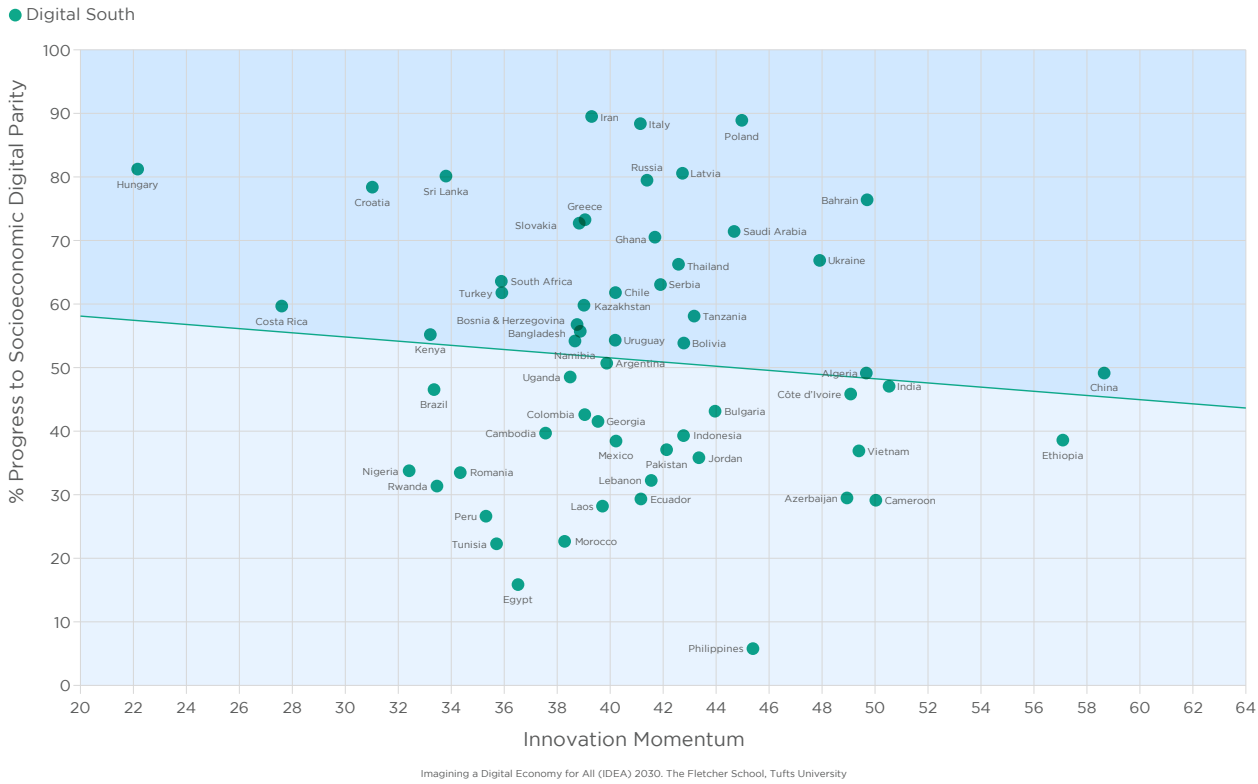
The divergence between Digital North and the Digital South

We label the top 1/3rd—31 in total, characterized by their state of digital advancement—of the 90 economies in our DII as the "Digital North" and the bottom 2/3rd—59 in total— as the "Digital South." The economies of Digital North have a few things in common, such as strong and sophisticated domestic demand conditions (including but not limited to the willingness and ability to engage in digital and digitally intermediated consumption and creation of goods and services and an ever-growing propensity to use digital devices and applications to buy, sell, work, play, and pay); robust digital and analog infrastructure; enabling institutional environments, and vibrant innovation ecosystems. These economies also tend to be members of the OECD. The Digital South, on the other hand, has significant headroom for growth and improvement on most, if not all, of these dimensions. These economies tend to be from sub-Saharan Africa, South and Southeast Asia, and Latin America and the Caribbean.

We commence this analytical exploration by assessing whether there are discernable relationship patterns between socioeconomic digital inclusion and innovation momentum in the Global South, as shown in Figure 1. Given the large disparities between economies in the Digital North and South, it is not surprising that there are no discernable global patterns. Further, the relationship between our two variables of interest in the Digital South proves to be statistically insignificant[31].

We have some working theories and explanations as to why the relationship between socioeconomic digital inclusion and innovation momentum does not manifest in any meaningful manner in the Digital South. First, early digital innovations tend to diffuse to larger proportions of society. This has been observed in several parts of emerging Asia, South America, and sub-Saharan Africa—representing over 50% of Digital South economies in our study—where mobile phone adoption has spread among both low-income and high-income consumers at a rapid clip[32]. This includes 477 million people in sub-Saharan Africa and an equivalent number in South Asia subscribed to pay-as-you-go mobile phone services, with accessible financing models available for low-income consumers to access 4G devices in daily installments[33]. Additionally, many of the economies in the Digital South may experience higher rates of innovation momentum from low base effects. This means that these economies, starting at low levels of innovation, see higher marginal increases in their innovation momentum scores because of increasing investments into their ICT and adjacent sectors, regardless of the inclusion of those at the lower end of the socioeconomic spectrum.

Figure 1
The Innovation Momentum and Inclusion Tradeoff: The Digital South

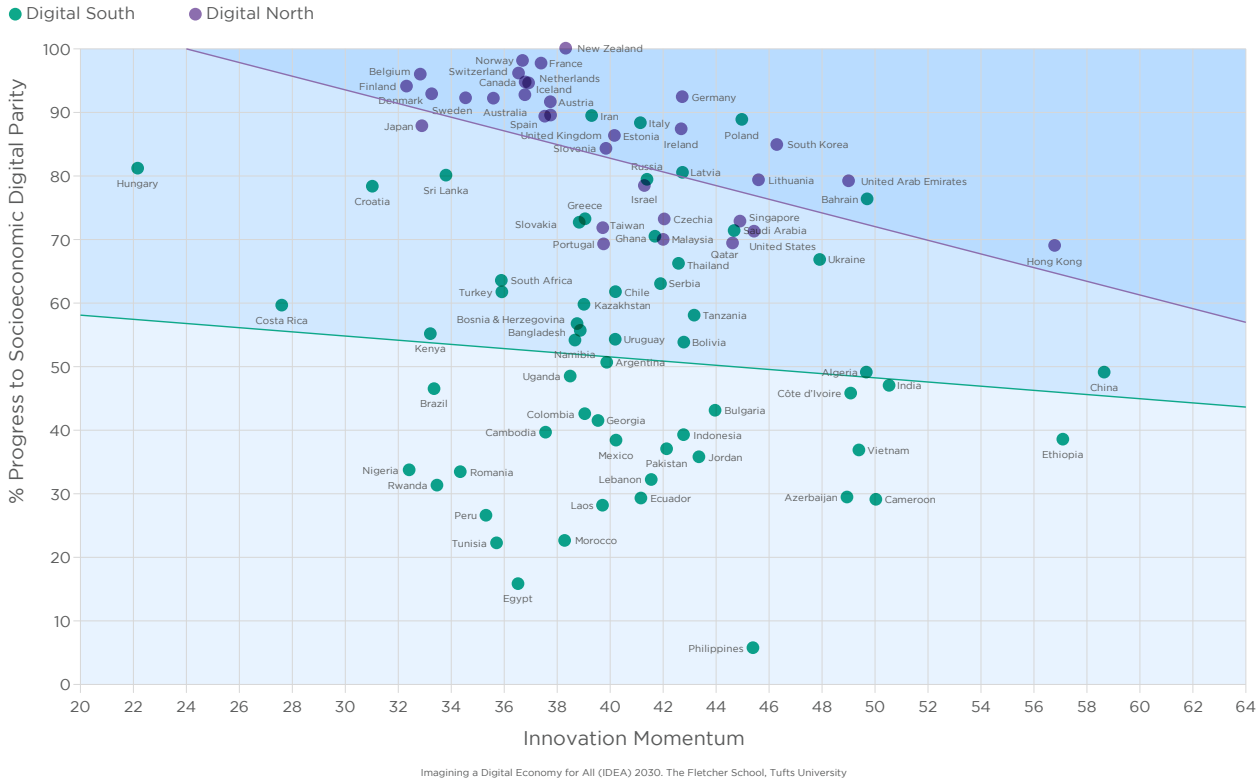


When the Digital North is added to the picture, however, a clear dichotomy surfaces, as shown in Figure 2 below. While no relationship exists between socioeconomic digital inclusion and innovation momentum in Digital South countries, the relationship between the two variables is stark and negative in the Digital North, with a statistically significant relationship up to 99.99% confidence[34].

We hypothesize a few reasons for a statistically significant relationship between the state of inclusion and the rate of innovation in the Digital North. First, these countries tend to have much larger economies than those in the Digital South: GDP per capita in Digital North countries averaged approximately $46,000 in 2020, compared to an average of just over $7,000 for Digital South countries[vii]. Because of the larger size of their economies and correspondingly large size of the public purse, we reckon that resource allocation decisions are slow, deliberative, and contentious. Additionally, actors in the high-tech sectors in the Digital North economies tend to have highly concentrated market power[35]. We theorize that this high level of market concentration in innovative sectors keeps wealth highly entrenched among the relative few, thus exacerbating the socioeconomic gap.

vii Authors' calculations, using data from the World Bank as of 2020. GDP per capita for the 31 Digital North economies averaged $46,099, while it averaged $7,346 for Digital South economies.

Figure 2
The Innovation Momentum and Inclusion Tradeoff:
The Digital North Compared to Digital South



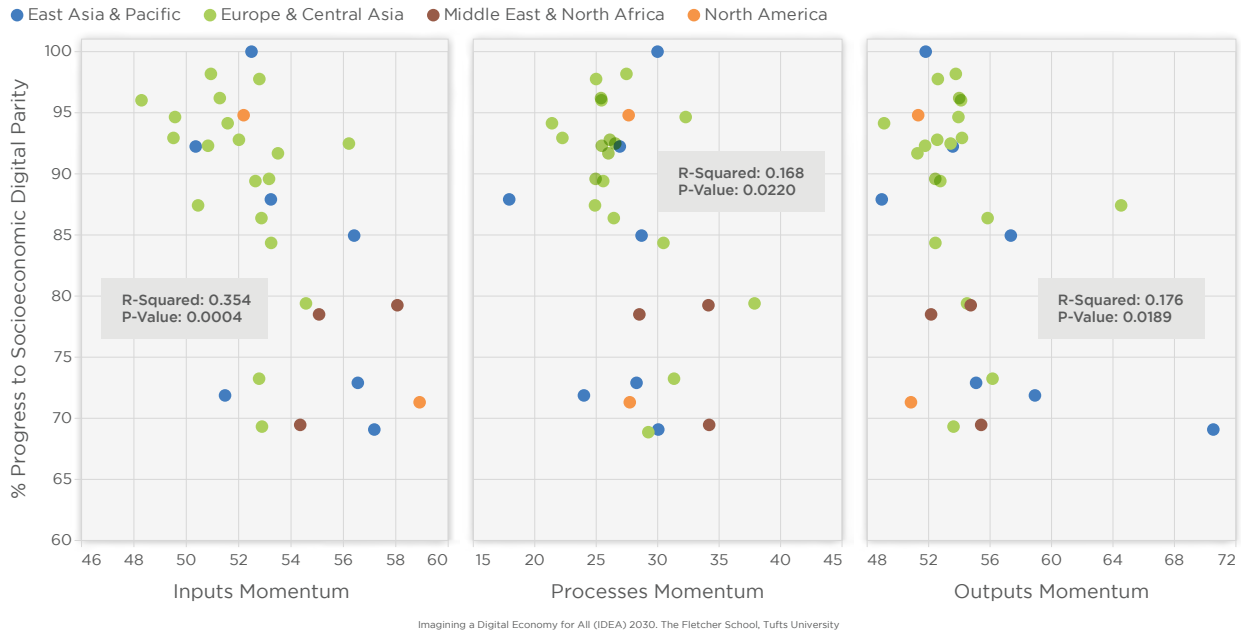
Testing the relationships between Digital Inclusion and the components of Innovation

Shifting focus from the statistically insignificant relationship between our variables of interest in the Digital South to the statistically significant relationship between them in the Digital North, in this section we dig deeper into the component elements of innovation—inputs, processes, and outputs—and their interplay with digital inclusion in our subset of 31 Digital North economies.

Our goal in this exercise is two-fold: to identify the specific aspects of innovation momentum contributing to the statistically significant negative relationship with the state of digital inclusion and, in turn, generate a set of generalizable recommendations for corrective action for policymakers.

We begin, along the same lines as our exploratory analysis of the relationship between overall innovation momentum and socioeconomic digital inclusion, by plotting the component elements of inputs momentum, processes momentum, and output momentum respectively, as independent variables in a univariate analysis against the dependent variable of progress to socioeconomic digital parity, our measure for the state of socio-economic digital inclusion, on the y axis. The r-square and p-values for each of them are outlined in Figure 3 below.

Figure 3
The Innovation Momentum and Inclusion Tradeoff: Comparing Three Innovation Components



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Our analysis reveals that inputs momentum bears the most statistically significant negative relationship with socioeconomic digital inclusion, with a p-value of 0.0004 making it statistically significant at 99% confidence. As outlined in the Research Overview section of the paper, the inputs component of innovation encompasses the factors of production and value creation in the digital economy: investment capital, intellectual capital, and entrepreneurial capital.

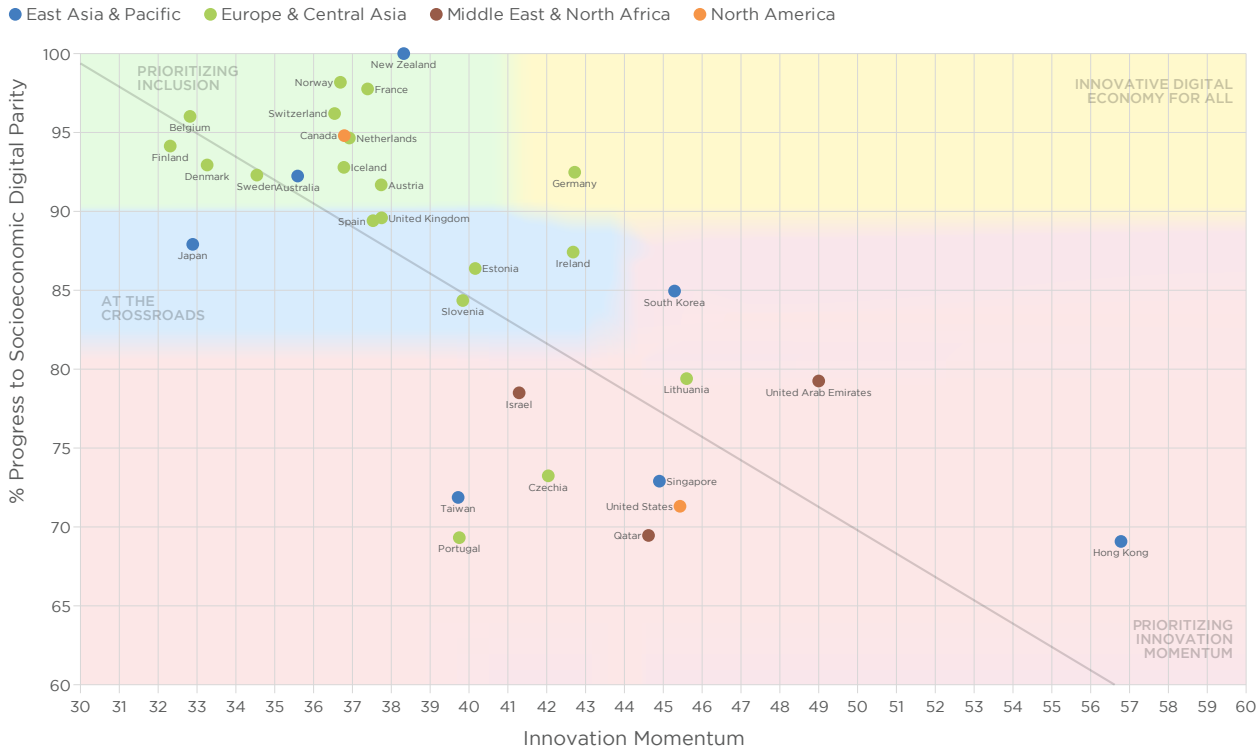
While the other two components of innovation momentum—processes and outputs—are statistically significant at 95% confidence, the r-squared values of 0.176 and 0.168, respectively, are dwarfed by a factor of two compared to the r-square of 0.354 of inputs momentum against socioeconomic digital inclusion.

Based on this, we infer that the most important drivers of the negative correlation between the rate of innovation and the state of socio-economic digital inclusion are the inputs to innovation momentum. For the rest of this paper, we consider this significant negative relationship as evidence of a tradeoff between innovation momentum and socio-economic digital inclusion. An exploration of the manifestation of this tradeoff ensues in our archetypal analysis section.

Our working theory for why such a tradeoff manifests is as follows: once societies reach a critical mass of users in the digital economy—as is characteristic of all economies in the Digital North—the factors of production and value creation in the digital economy, such as investment, intellectual, and entrepreneurial capital, which we define and measure as inputs into innovation, tend to gravitate towards creating and capturing value from the attendant network effects of existing, oft-adept and affluent users. This leaves those at the socioeconomic margins further behind and exacerbates the gaps between the digitally affluent and the digitally deficient in a society in the absence of policy interventions channeling these inputs into inclusive innovation by design.

Having plotted the dynamics between socio-economic digital inclusion and the components of innovation momentum, we continue our exploration of the innovation and inclusion tradeoff writ large. We begin by recreating our socioeconomic digital inclusion and innovation momentum frontier specific to these 31 economies. Each economy on the chart is colored according to its geographic region in Figure 4 below.

Figure 4
The Innovation Momentum and Inclusion Tradeoff: Top 31 DII Economies



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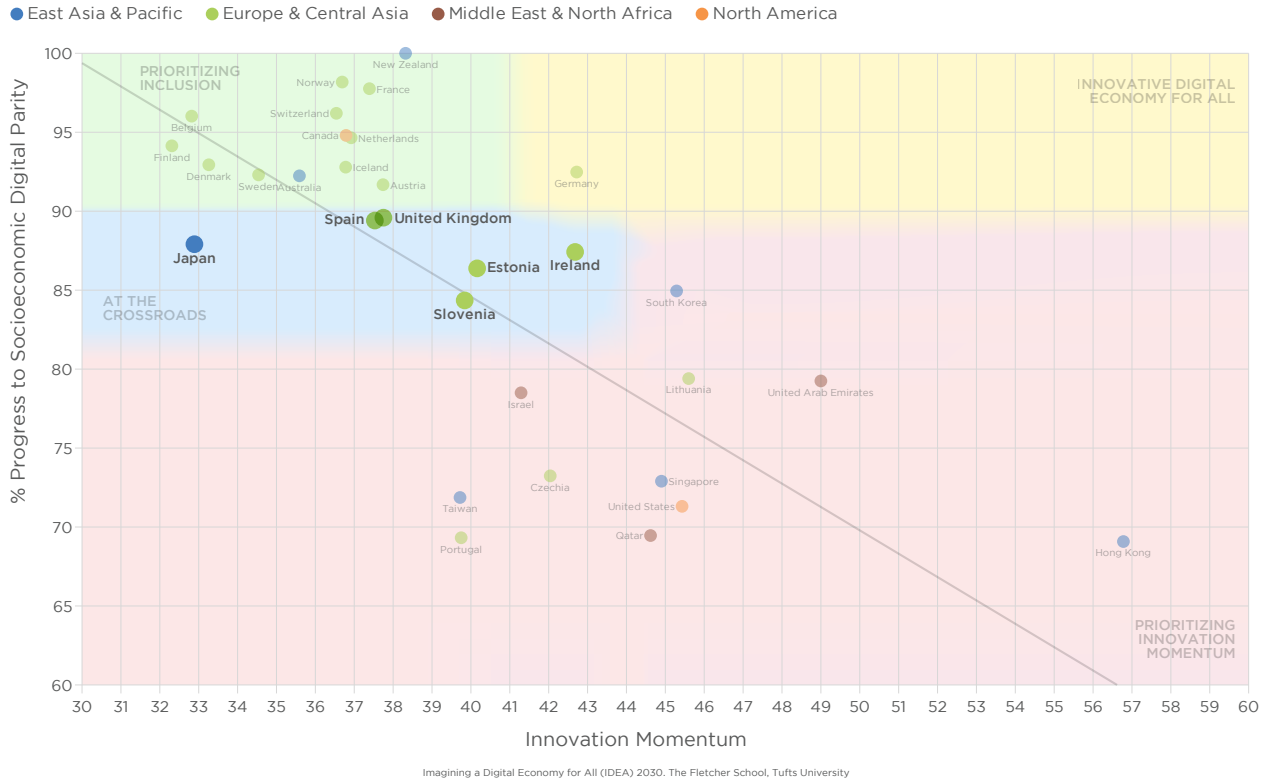
The line of best fit in the chart represents our model of the interplay between socioeconomic digital inclusion and innovation momentum. Countries that lie on or close to the line can be seen as trading off a certain amount of socioeconomic digital inclusion for a certain level of innovation momentum. For example, with innovation momentum ranked 4th out of 31 economies, Lithuania's % progress to socioeconomic digital parity of 79.4% is in-line with our expectations. On the other side of the spectrum, Belgium ranks 30th in innovation momentum and has approximately 96% progress to socioeconomic digital parity, which is as expected. Two interesting case studies are countries that appear to be at a crossroads between the two variables: the United Kingdom and Spain. Each economy is about in-line with one another in both of our variables of interest and each lies near the center of the distribution of countries in each. The United Kingdom and Spain rank 15th and 16th in socioeconomic digital inclusion, respectively, and 17th and 19th in innovation momentum, respectively. Given these trends, in the next section of the paper, we conduct an archetypal analysis of the United Kingdom and Spain.

Figure 5
The Innovation Momentum and Inclusion Tradeoff: Top 31 DII Economies



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Archetypal Analyses

At the Inclusion vs. Innovation Crossroads: United Kingdom

Figure 6
At the Inclusion vs. Innovation Crossroads: United Kingdom

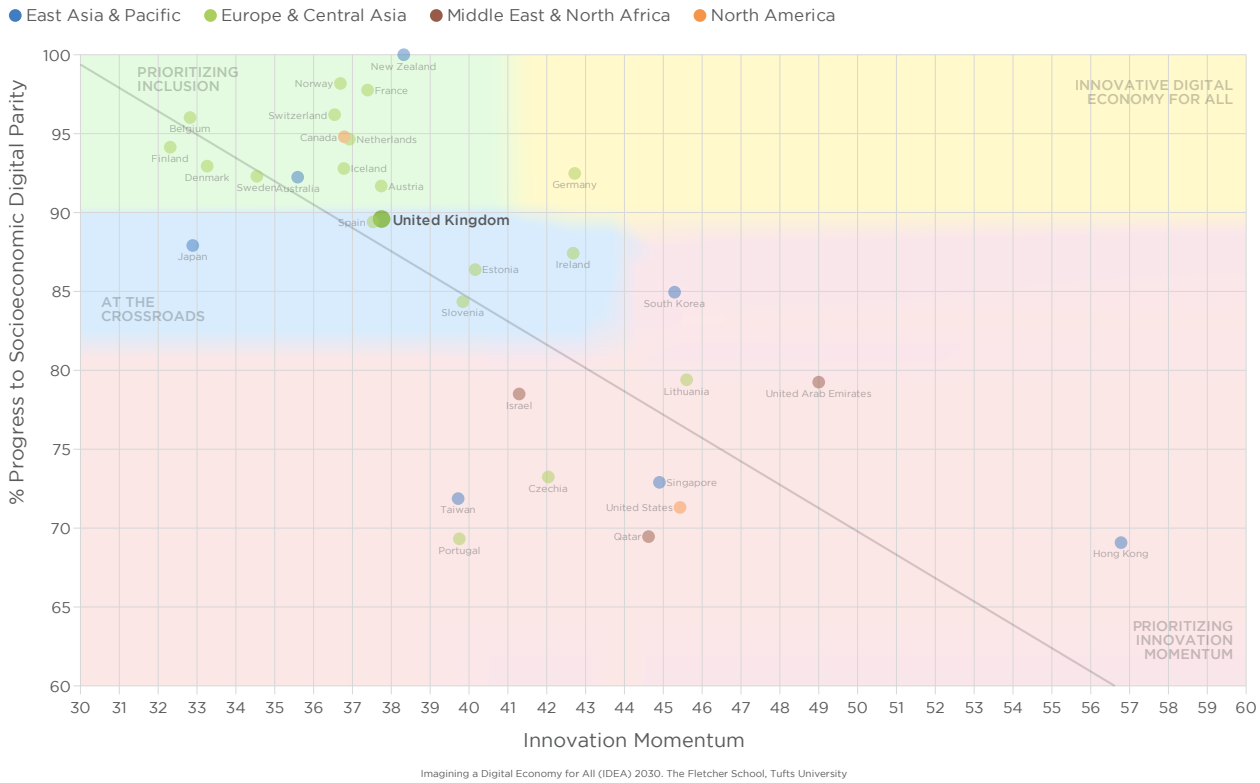
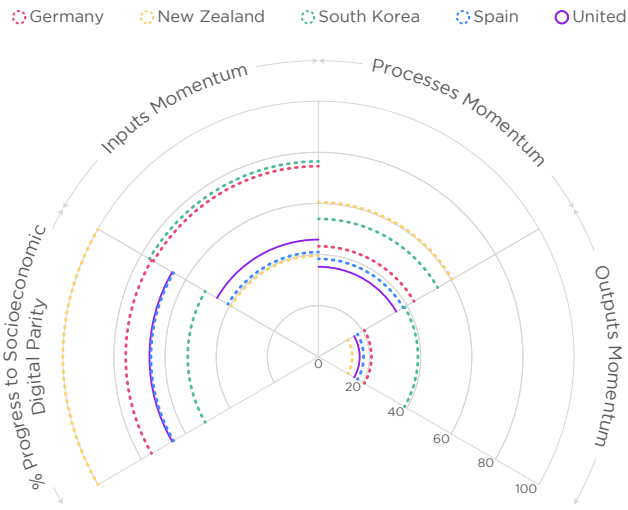


Figure 7
At the Inclusion vs. Innovation Crossroads: United Kingdom



"...the UK is not reaping the full potential provided by the opportunity to connect innovative businesses—from the UK and overseas—with the excellence in the UK's academic research base."

Dowling Review of Business-University Research Collaboration[36]

The United Kingdom is home to some of the world's top universities, with the likes of the University of Oxford and the University of Cambridge consistently ranking as the world's top-rated universities[37]. However, this highly ranked education system does not diffuse to the country's poor. For example, the cost of education in the United Kingdom was over 75% higher than the world average as of 2017[38], pricing the poor out of top-bell academic access. Additionally, the poor in the UK live in disproportionately rural areas[39], while the country's top universities are clustered in cities like London, Cambridge, Oxford, and Warwick, leaving the poor far away from access to this crucial asset.

The United Kingdom ranks low in our process and output momentum scores – 26th and 23rd respectively – implying that the investments made by the government into innovation do not have commensurate payout. A nagging issue driving this inefficiency is in information silos between the country's world-renowned academia and its private innovation sector, as outlined by Digital Planet's Smart Societies research in 2017[40]. As the quote from the Dowling review of Business-University Research Collaborations outlines above, the country does not adequately utilize research carried out by the country's elite universities with innovative businesses.

Finally, while the country has invested in providing its population with sufficient access to the internet by 2020 to the tune of £1.1 billion[41], this is far outweighed by the country's recent plans in accelerating investment into innovative endeavors at a rate of £22 billion annually[42]. Years after its enactment in 2014, the latter commitment to digital inclusion by the government[43] has met with criticism for not meeting its targeted goals of bridging the digital divide[44]. The UK appears to be on a path of trading off socioeconomic inclusion for innovation oomph.

At the Inclusion vs. Innovation Crossroads: Spain

Figure 8
At the Inclusion vs. Innovation Crossroads: Spain

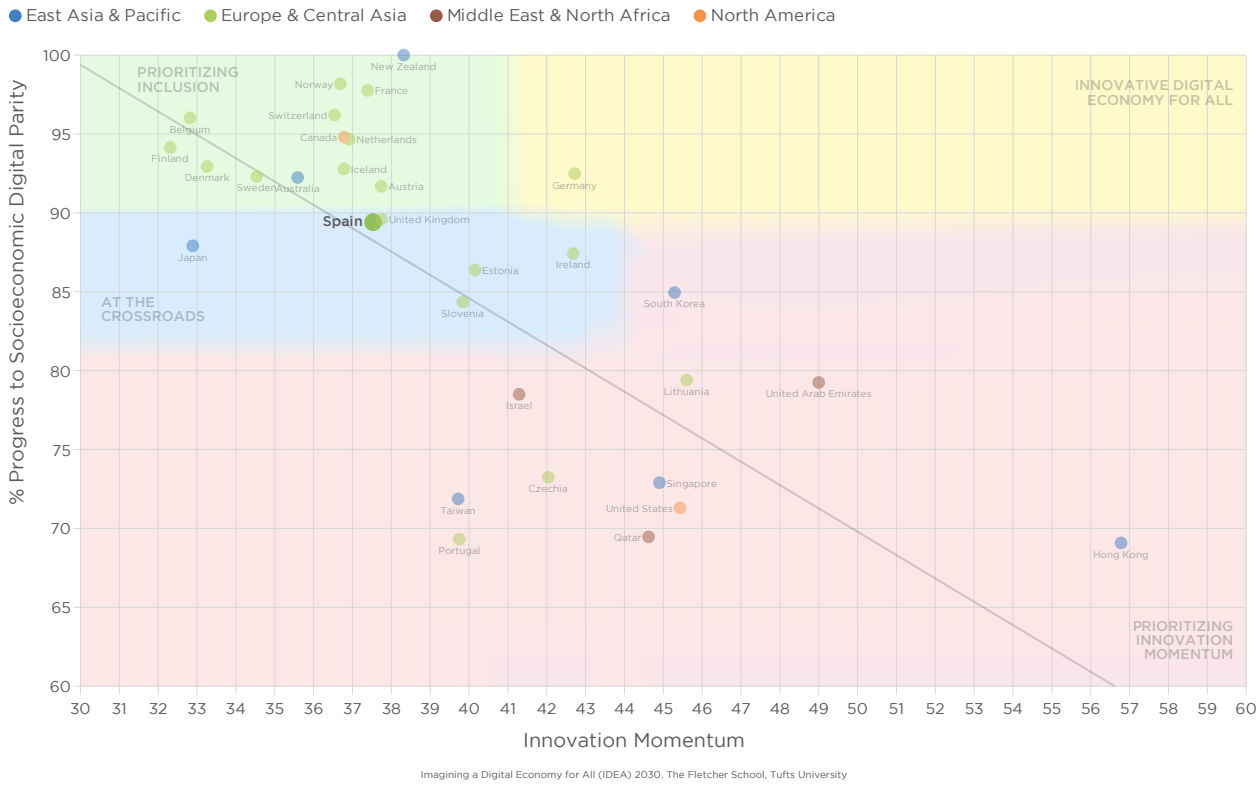
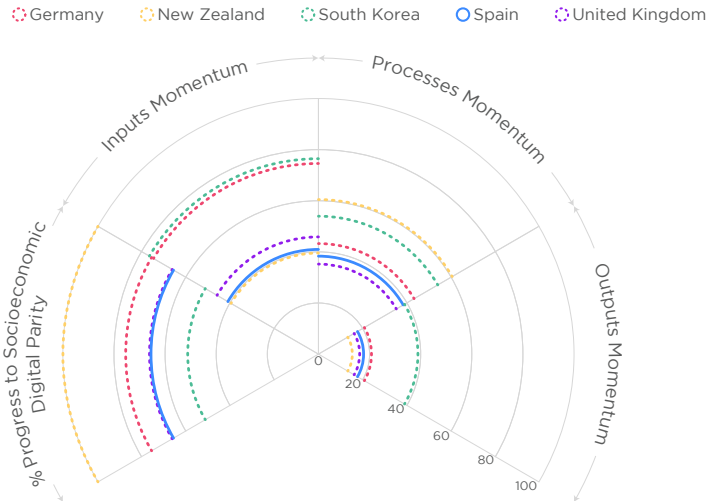


Figure 9
At the Inclusion vs. Innovation Crossroads: Spain



"Although the last decade saw significant reforms in product markets, there is still room for deepening. Establishing more dynamic product markets is essential for strengthening Spain's international competitiveness."

OECD Perspectives: Spain Policies for a sustainable recovery[45]

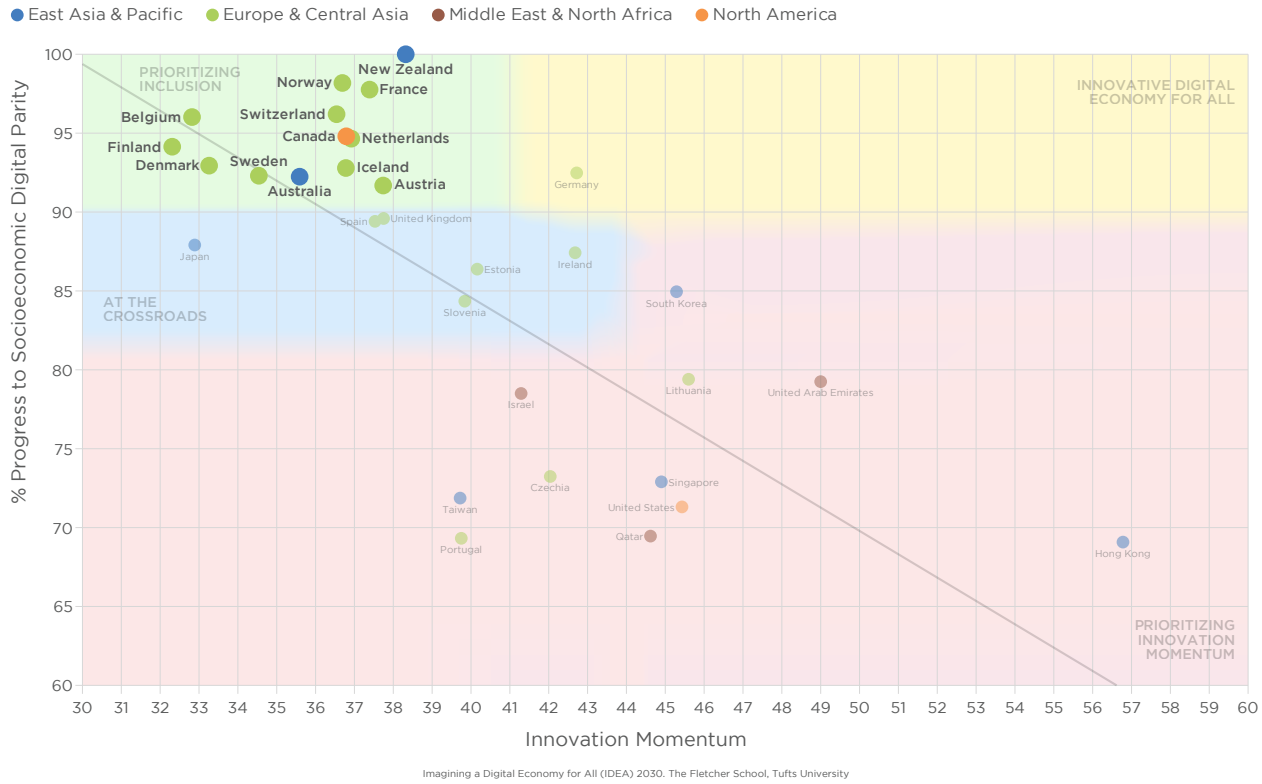
Spain ranks like the United Kingdom in all four of the categories measured in our archetypal analysis radar charts, ranking slightly higher in both its innovation output growth and innovation process growth, but slightly lower in innovation inputs growth. However, the country's innovation inputs momentum is set to increase in upcoming years, as the Spanish government launched the Spanish Science, Technology and Innovation Strategy for 2021 to 2027[46]. This plan sets an objective to double the percent of Spanish GDP spent on research and development by 2027—it stood at 1.20% of GDP in 2017, slightly above the average in our Digital Intelligence Index. Additionally, the Spanish cities of Madrid and Barcelona have had a boom in startup activity since the financial crisis[47], and outside investment into such startups in those cities of €342 million and €871 million in 2019, respectively[48].

While interest from outside investors and the Spanish government is focused on spurring innovation-led growth, we highlight Spain's need for digital inclusion of the country's poorest 40%. The country ranks right in the middle of our digitally advanced economies in progress to socioeconomic digital parity but has experienced increased wealth inequality between the rich and poor in recent years[49]. To combat the risk of this heightened wealth inequality exacerbating the digital divide, Spain launched The National Plan for Digital Skills in 2021. This plan—with €3.75 billion in funding—aims to ensure that no Spanish citizen is left behind in digital access and literacy by 2025[50]. Additionally, a separate Digitalization of SMEs Plan 2021-2025 aims to integrate more robust digitization of small and medium companies in the country[51]. If such a plan succeeds in helping these small corporations to compete better, this policy could drive growth in both innovation and socioeconomic digital inclusion.

A primary focus of policymakers in Spain trying to bridge the socioeconomic digital divide should be on education. The percentage of students without a high school diploma or equivalent is much higher in Spain (19%) than the average in the EU (11%)[52]. Meanwhile, analysis shows that a more educated society tends to be more participative in its digital economy, and vice-versa[53]. As such, Spain's commitment to promoting digital skills and literacy in early education through The National Plan for Digital Skills and through formal education and vocational programs for adults will be key in bridging its socioeconomic digital divide in the coming years.

Now that we have set the basis for the crossroads of inclusion and innovation momentum as the United Kingdom and Spain, we aim to explore those countries outperforming these economies on socioeconomic digital inclusion and innovation. We show this in Figure 10 below. Countries circled in green have similar growth rates in innovation as the United Kingdom and Spain. However, these countries are much more adept at being inclusive in areas of digital access and literacy. Next, we explore New Zealand both as an inspiration for this paper—as indicated above—and as an archetype for altering course to prioritize the inclusion of all over every other aspect of its digital economy.

Figure 10
The Innovation Momentum and Inclusion Tradeoff: Top 31 DII Economies



Imagining a Digital Economy for All (IDEA) 2030. The Fletcher School, Tufts University

Altering Course to Prioritize a Digital Economy for All over Innovation Momentum: New Zealand

Figure 11
Altering Course to Prioritize a Digital Economy for All over Innovation Momentum: New Zealand

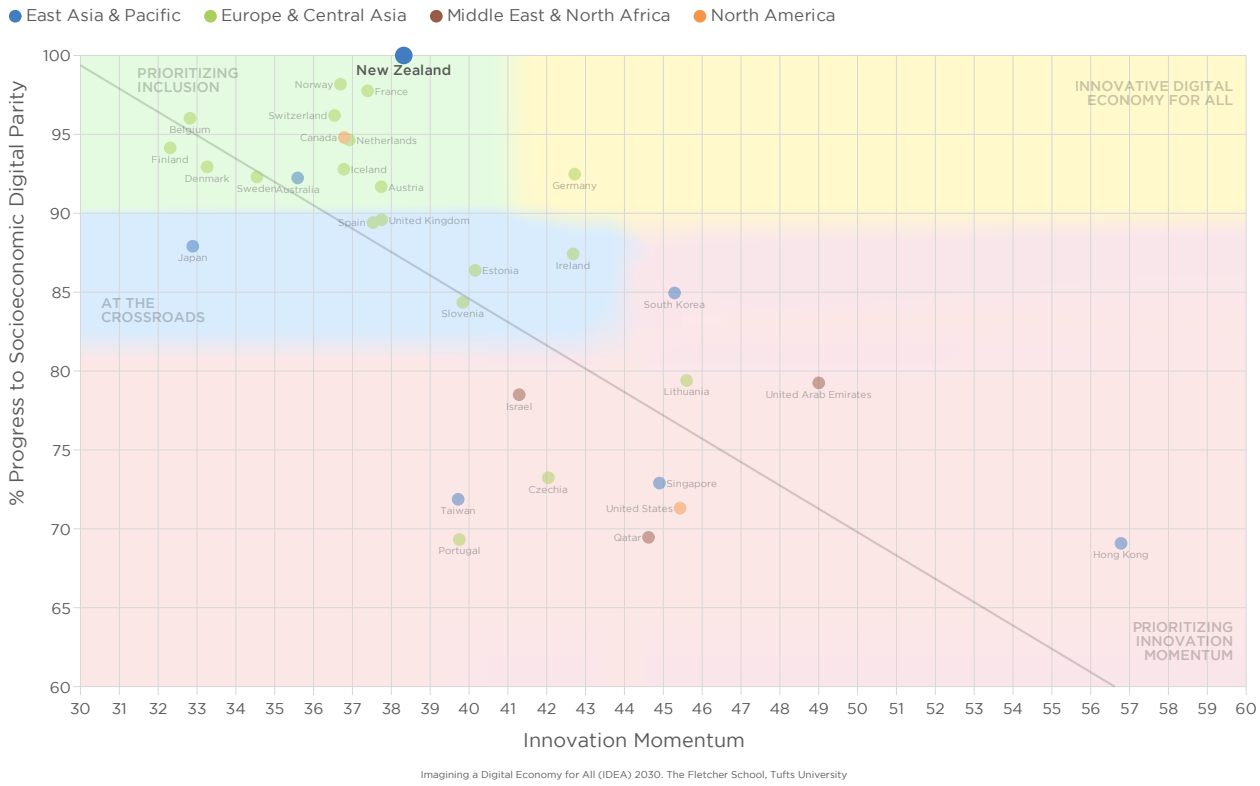
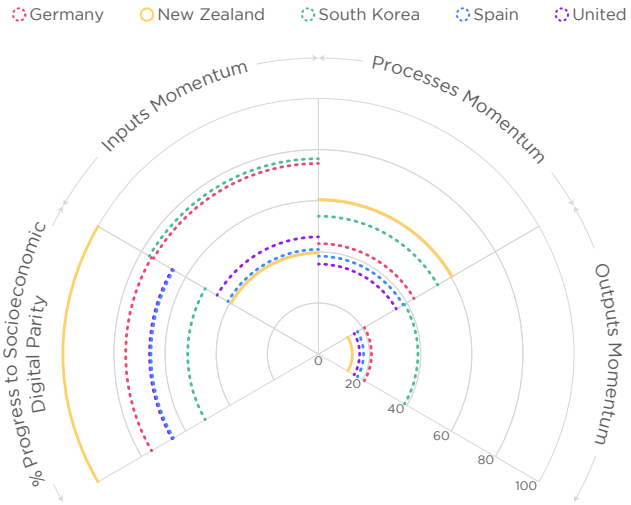


Figure 12
Altering Course to Prioritize a Digital Economy for All over Innovation Momentum: New Zealand



"The [New Zealand Digital Inclusion Blueprint]... focuses on enabling non-users and sporadic users of the internet to become users, rather than on upskilling people who already access and use the internet in their day-to-day lives."

New Zealand Digital Inclusion Blueprint[54]

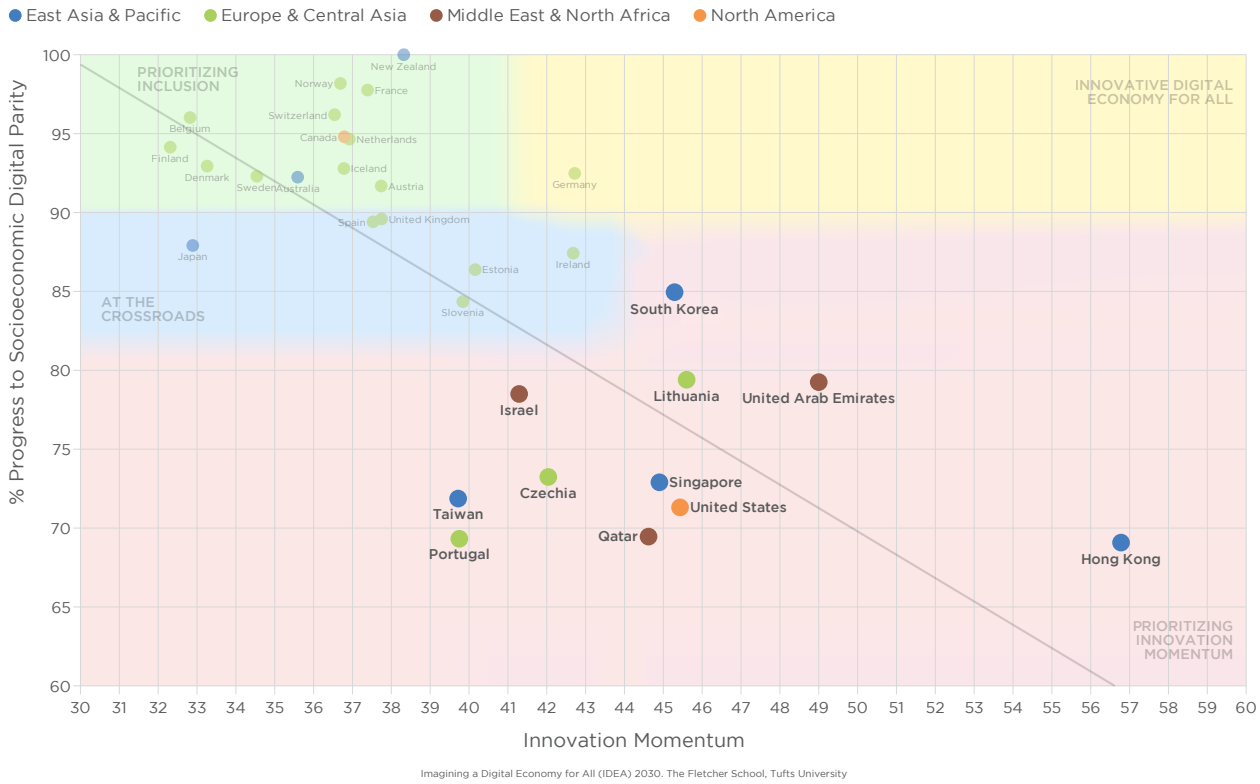
The quote above is from New Zealand's Digital Inclusion Blueprint, which outlines the government's steadfast commitment to ensuring a digital economy for all. An important distinction in the quote is that New Zealand places primary focus on those who do not currently use the internet over advancing the digital skills of those who already use the internet. This reprioritization is reflected in New Zealand's drop in its innovation & change momentum rank in the DII from 30th in 2015 to 59th in 2019.

New Zealand began its digitally inclusive revolution in the government's priority in digitizing public goods. Beginning in 2012, this meant that the government committed more to digital inclusivity in a variety of public services, including applying for visas, applying for a license, and applying for financial assistance[55]. By requiring public services to be digitized, New Zealand promoted digital literacy among the entire population, regardless of socioeconomic status. It is important to note, however, that New Zealand, with its population of approximately
5 million as of 2021[56], is among the least populous compared to its advanced nation peers. Further, with over 4/5ths of its population living in urban areas (87% as of 2020[57]), New Zealand has a relative advantage of both small size and a heavily urbanized citizenry, which may have contributed to making digital inclusion easier—a plausible explanation for its high levels of digital inclusion.

While it leads the world in socioeconomic digital inclusion, New Zealand lags in innovation momentum. A key factor dragging its innovation engines down is a low rate of research and development undertaken by the New Zealand private sector, ranking among the lowest in the OECD.[58]

For the next set of archetypes, we look towards the opposite corner of our socioeconomic digital inclusion and innovation momentum frontier. The countries circled in blue in Figure 12 fall below our countries at the crossroads—the United Kingdom and Spain—in the digital inclusion of their poor. However, these countries have substantially stronger innovation momentum in their economies. We dive into South Korea as an archetype for the dynamics of a highly innovative economy, with relatively low socioeconomic digital inclusion.

Figure 13
The Innovation Momentum and Inclusion Tradeoff: Top 31 DII Economies



Imagining a Digital Economy for All (IDEA) 2030. The Fletcher School, Tufts University

Fostering an Innovation-led Digital Economy with Inclusion Inequities: South Korea

Figure 14
Fostering an Innovation-led Digital Economy with Inclusion Inequities: South Korea

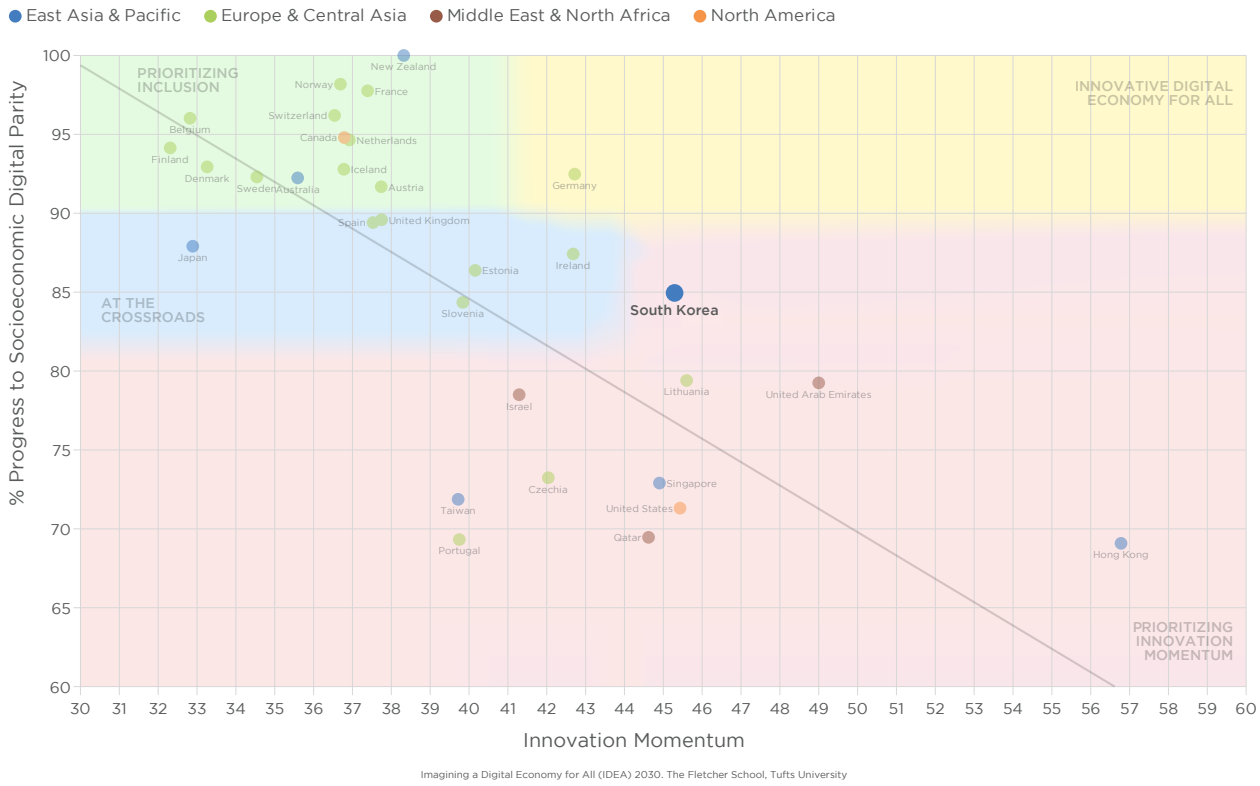
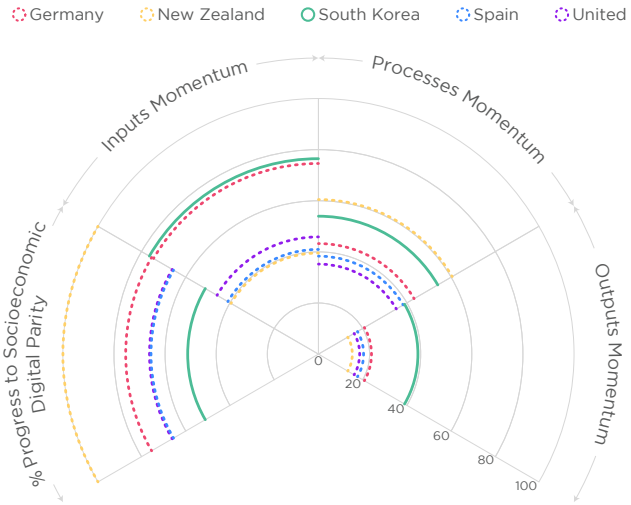


Figure 15
Fostering an Innovation-led Digital Economy with Inclusion Inequities: South Korea



"[South Korea] spending more on R&D than any other economy not only reflects a domestic consumer base with a high demand for new technological developments, but also the government's objective to build a creative economy."

Kyle Ferrier, Director of Academic Affairs and Research at the Korea Economic Institute of America[59]

South Korea's immense innovation momentum is indeed owed to the government's commitment to investing in research and development. Case and point; South Korea's government expenditure of 4.5% of GDP on research and development in 2018 was the second-highest of all economies in the Digital Intelligence Index[60]. Additionally, unlike the United Kingdom, South Korea has an excellent soft infrastructure for the diffusion of knowledge between industry and academia in research and development, with the highest share of researchers moving from industry to academia from 2017 to 2019[61].

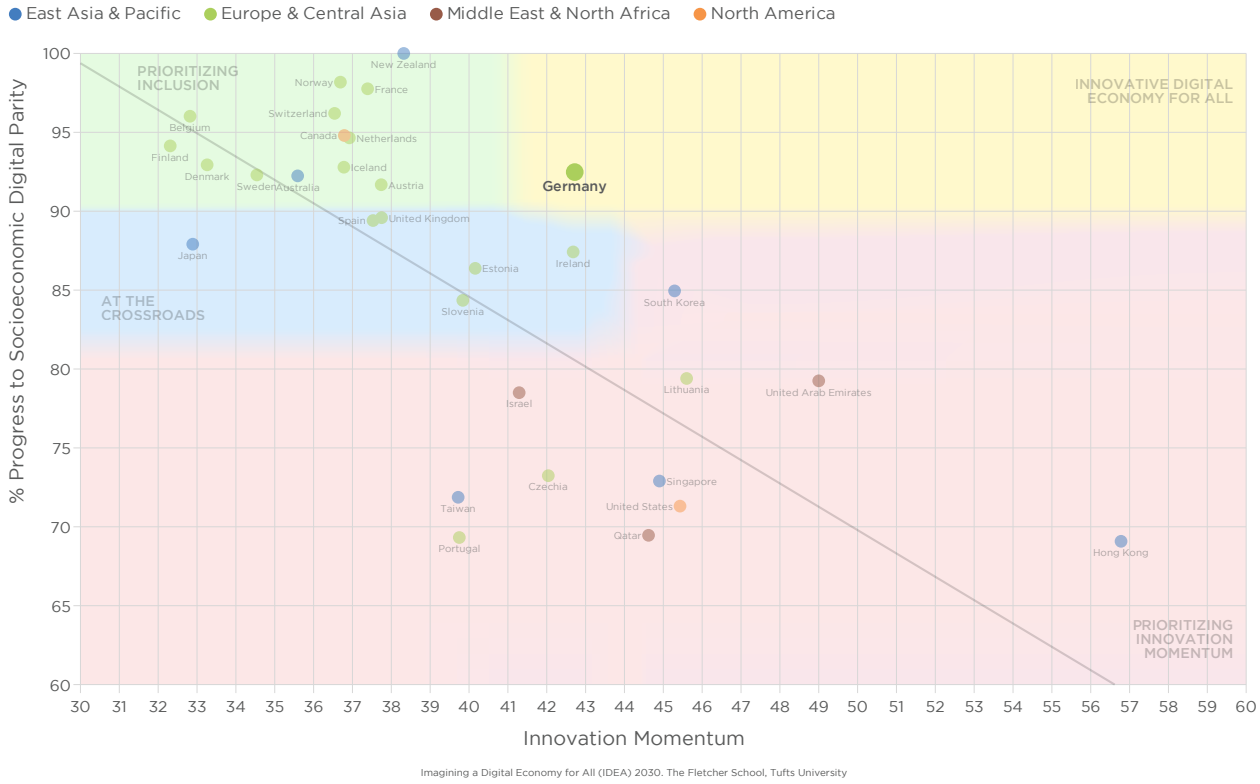
Where South Korea falls behind despite and perhaps because of its high innovation growth rate is in the inclusion of its poorest 40%, especially in their uptake of digital payments. For example, only 59.4% of South Korea's poorest 40% used the internet to pay bills or buy something online in 2017, far outshined by 87.1% of the richest 60%'s rate that year[62]. This may be impacted by a socioeconomic divide in educational attainment and opportunity in South Korea: students with higher incomes are much more likely to achieve higher academic attainment[63].

A factor driving inequality in access to education and consequently in access to high-wage employment is the cost of education: South Korean households pay for about 42% of the costs associated with schooling their children, while the OECD average is 22%[64]. In addition, a lack of digital financial literacy was found to be a crucial factor driving income inequality in the country in a recent paper[65]. Given a relative need to be financially literate to take out a loan, digital inequality between the rich and poor in South Korea has led to higher-income groups leveraging higher rates of loans to accelerate their wealth[66]. Finally, the dynamic of wealth inequality in South Korea is stark, with a poverty rate of 17.4% as of 2019, the second-worst in all the OECD[67].

The South Korean government enacted a program called Government 3.0 in 2013 that promises to create a more digitized and open government[68]. The goal of this program is to allow public access to data on government services, incentivizing innovative use of data[69]. While South Korea's government is a global leader in e-government[70], without increased emphasis on digital access this increased digitization may continue to cater only to the affluent in the South Korean economy.

Germany (circled in yellow in Figure 16) is an exemplar of straddling relatively high digital inclusion for low-income individuals, and yet posts reasonably decent rates of growth in innovation than the United Kingdom and Spain. For our next archetype, we explore how Germany is able to remain in this Goldilocks zone of advancing a reasonably innovative digital economy for all in the country.

Figure 16
The Innovation Momentum and Inclusion Tradeoff: Top 31 DII Economies



Imagining a Digital Economy for All (IDEA) 2030. The Fletcher School, Tufts University

Advancing an Innovative Digital Economy for All: Germany

Figure 17
Advancing an Innovative Digital Economy for All: Germany

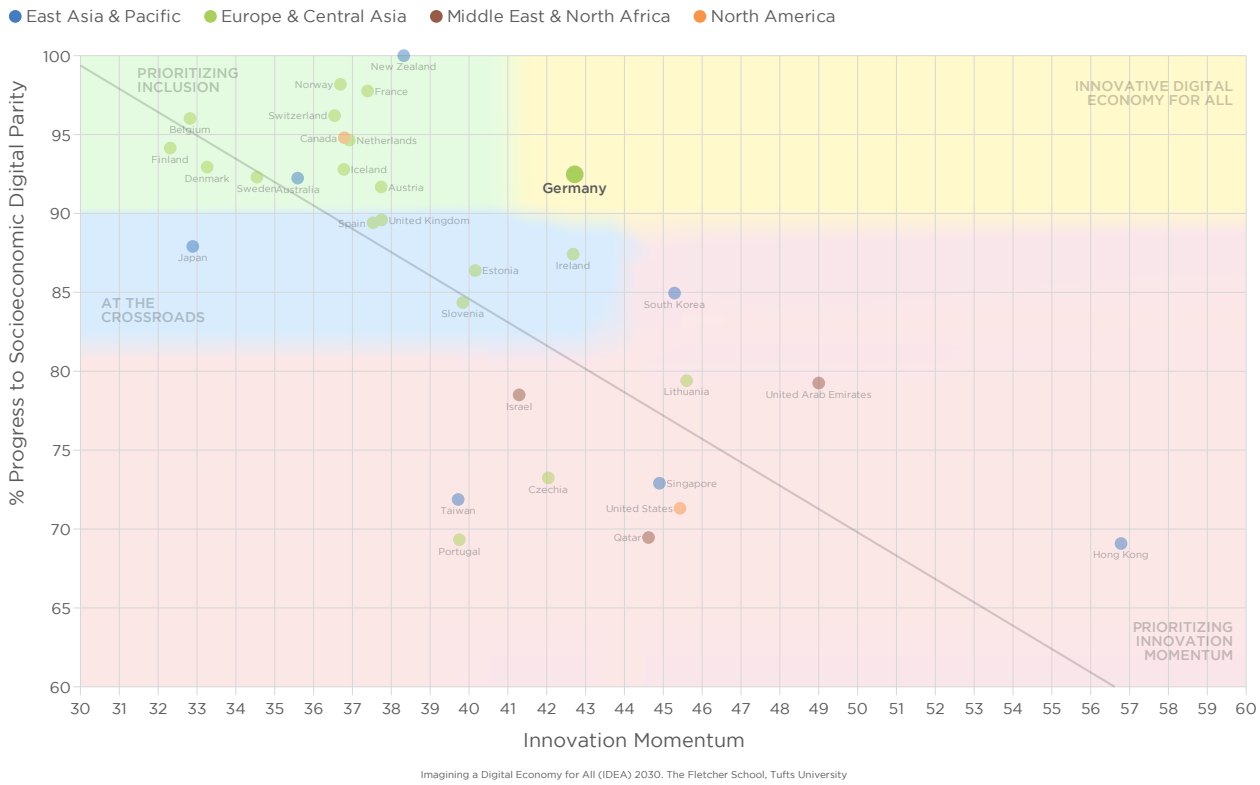
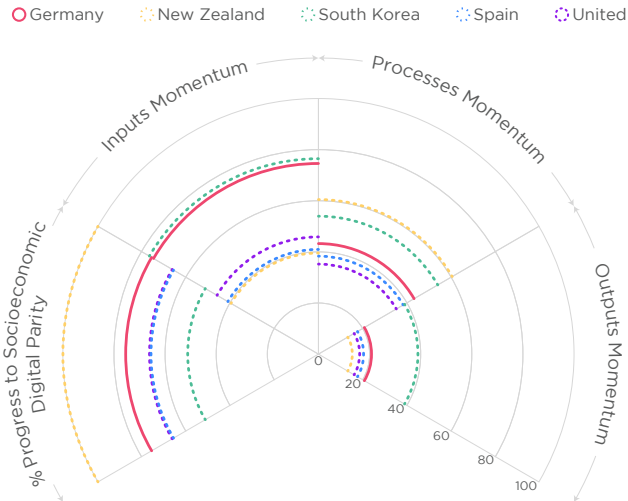


Figure 18
Advancing an Innovative Digital Economy for All: Germany



The Mittelstand—Germany's group of small and medium-sized (SME) companies—plays a key role in Germany's innovative economy[71]. These businesses' relatively small size gives a higher percentage of Germans—even those with lower incomes—access to knowledge, fostering a simultaneously innovative and inclusive digital economy.

Lying at the forefront of the socioeconomic digital inclusion and innovation momentum frontier is Germany, with 92.5% progress to socioeconomic digital parity—11th of the digital north—and innovation & change momentum ranked 8th of the digital north. Germany has a society that is widely included in internet usage; 94% of its population uses the internet, one of the highest rates in the world[72].

The secret to Germany's straddling of both inclusion and innovation are the Mittelstand and the Fraunhofer Institute. The Mittelstand is Germany's group of small and medium-sized firms and accounts for nearly 60% of all jobs created in Germany's economy[73]. These businesses are consistent drivers of innovation in the German economy, while simultaneously providing vocational and apprenticeship opportunities for those at the lower end of the wage spectrum in Germany[74]. The relationship between German labor and these companies—who invest 50% more into training labor than other European nations[75]—is key to having both high innovation and high digital inclusion across the board. The government has also prioritized the need for the country's SMEs to stay at the forefront of innovation with Mittelstand 4.0, which places contact points for businesses with the government to determine areas where those businesses can improve their digital advancement and transformation[76]. To connect public and private innovation, the German government invests heavily in the Fraunhofer Institutes[77], a research initiative to drive Germany to the cutting edge of technology in over 75 industries. Along with the Mittelstand, these institutes keep Germany at the forefront of global competitiveness in innovation.

Germany's lesson for countries attempting to simultaneously drive digital inclusion and innovation growth forward is to marry an innovative, fragmented private sector with accessible skills and training for those at the margins.

Preliminary Conclusions

Our archetypal analysis reveals the outcomes of conscious choices made by governments. Such choices have consequences:

- Advanced governments, by choosing to prioritize innovation—i.e., deciding that they are better off investing their finite resources and finite institutional/ administrative bandwidth and focusing on the most cutting edge parts of the economy—will realize gains in digital momentum and status as a stand out digital economy in the short run, with its own attendant benefits of crowding in greater investments into the digital innovation ecosystem and a corresponding greater share of exports of digital innovations. This will, however, widen socioeconomic disparities and sow distrust in the digital economy among those citizens that are left behind in the medium term.
- Diverting those finite institutional resources towards making conscious and proportionate investments in bringing those left behind along and facilitating them to partake in the dividends of the extant digital economy comes at the cost of being at the cutting edge of innovation in the short run but can be the recipe for a more inclusive and trustworthy digital economy in the medium term.
- Straddling both and fostering an innovative digital economy that works for everyone, everywhere—as Germany's experience demonstrates—is possible and deserves to be researched in greater detail. While we understand that the German model is somewhat unique and cannot be replicated or exported as is—and to be clear, the purpose of this analysis is not to advocate for a blind replication of a model that works in one country across all others—our endeavor here is to extract some generalizable recommendations and emulation-worthy practices from the German experience for policymakers around the world to consider as they navigate the socio-economic digital inclusion and innovation momentum tradeoff. We list a set of emerging policy implications below.

Emerging Policy Implications

In our analysis, we found that the most significant driver of the tradeoff between innovation momentum and socioeconomic digital inclusion is the inputs component of innovation encompassing the factors of production and value creation in the digital economy: investment capital, intellectual capital, and entrepreneurial capital. Policymakers desirous of navigating this tradeoff without sacrificing either would do well to provide incentives to entrepreneurs to target their innovations towards those at the margins, support entrepreneurs from marginalized communities, and encourage investment capital to flow towards ventures that are inclusive by design.

The global picture of the digital inclusion and innovation momentum interplay section of this paper highlights the significantly greater impact innovation inputs momentum has on socioeconomic digital inclusion in the Digital North: a stronger inputs momentum tends to widen socioeconomic digital inclusion gaps, as is the case in the likes of the United States, Hong Kong, the UAE, and Israel, just to name a few. Conversely, relatively weaker inputs momentum is associated with better socioeconomic digital inclusion outcomes, as is the case in the Nordic economies, New Zealand, and Canada.

Given that inputs momentum is the key ingredient driving the innovation momentum and socioeconomic digital inclusion tradeoff, we recommend that policymakers focus on enacting policies that are inclusive by design of those at the socioeconomic margins. For example, consider three countries demonstrating strong socio-economic digital inclusion given their levels of innovation momentum: Germany, Austria, and The Netherlands. All three economies have inclusive entrepreneurship programs highlighted in the OECD's "Inclusive Business Creation: Good Practice Compendium"—Germany's New Start-Up Subsidy, Austria's Business Start-up Programme, and the Netherlands' Welfare Support for the Self-Employed are all excellent examples of advancing innovation momentum and digitally inclusive entrepreneurial policies[78].

In economies with a critical mass of digital users (as is the case in our subset of Digital North economies), pro-innovation policies that facilitate investment in digital skills and entrepreneurship must be inclusive of those at the socioeconomic margins. The absence of policy interventions to encourage inclusive innovation by design will risk exacerbating the gaps between the digitally affluent and the digitally deficient in a society.

Invest in equitable and affordable digital skills training through the formal secondary and tertiary education system, vocational and trade schools, and through continuing education initiatives for adults and seniors. Equitable access to digital skills and education can help foster an innovative and inclusive digital economy and close the gap between the digitally affluent and the digitally deficient.

Education and skills training are constantly recurring themes throughout our archetypal analyses. The convergence or divergence between a country's quality of universities—determined by aspects such as pedagogy, research outputs, and career prospects of their graduates—and the existence of equitable access to such education for people living in said country is a key factor in our analysis.

For example, the UK scores highly in global rankings for the quality of its universities[79]; yet this asset—a crucial means to partaking in the dividends of the innovative sectors of the economy—is not accessible to those from lower socioeconomic levels of society[80]. Similarly, only one in one hundred South Korean students get to attend the country's coveted universities that feed the innovative sector[81]; such a highly ranked, well-regarded, and hard-to-reach education system may yield stronger innovation momentum that South Korea enjoys but it also risks widening the gulf between those with access to such an education system and all the dividends it begets and those without.

Meanwhile, to straddle the innovation momentum and socioeconomic digital inclusion frontier, Germany made a conscious policy choice to foster a digital skills-forward environment that is within the reach of most of its population. This is supported by a compulsory education for all Germans to receive at least a secondary education[82]. If students fail to meet this requirement, they move on to a vocational program with strong pathways into apprenticeships and employment within the innovation-savvy Mittelstand[83]. Such an approach ensures equitable opportunities for everyone to participate in and contribute to the innovative sector. Overall, an education system and skills offerings that are accessible to the country's majority are key to constructing an innovative and inclusive digital economy.

Ensure that small and medium-size enterprises (SMEs) have the digital resources to compete in the global markets. These businesses employ most of any country's population. Raising the digital skill levels of the employees and the technology absorption capacities of SMEs will go a long way in forging an innovative and inclusive digital economy.

A widely-cited issue with some of the markets with strong innovation momentum in the Digital North—especially the United States—is that the disproportionate market power of the technology sector is exacerbating wealth inequality[84]. High market concentration in the innovative sectors is also prevalent in South Korea[85], our archetype of a country that fosters an innovation-led digital economy with inclusion inequities. There are, however, two countries in our archetypal analyses that stand out in promoting competitiveness among small and medium-sized enterprises to spread the diffusion of innovation to the masses. Spain, our first of the two, recently introduced a plan to digitize and foster productivity to directly impact approximately 1.5 million SMEs[86] as part of its Digital Agenda Spain 2025. Additionally, Germany's consistent reliance on and support of the Mittelstand as a driver of innovation momentum is key to helping it straddle the innovation momentum and socioeconomic digital inclusion frontier.

SMEs are the economic backbone of any economy. According to McKinsey, a consultancy, "in OECD countries, SMEs account for about 99 percent of firms and 70 percent of all jobs, and they contribute more than 50 percent of GDP in high-income countries worldwide."[87] Raising the digital skill levels of the workforce in SMEs and the technology absorption capacities of SMEs will have multiplicative effects across the economy. Second-level digital skills (the ability to use digital technologies) are often necessary for partaking in the dividends of innovation, given the high skill levels demanded of participants in that sector[88]. Meanwhile, a variety of regional-specific studies (take the UK[89] and sub-Saharan Africa[90] as examples), highlight the importance of SMEs in the economic system for training, educating, and employing the population. Perhaps of equal, if not greater, importance, SMEs are also major contributors to the generation of new innovative ventures[91] (as captured within the inputs component of our innovation metric), therefore proving to be a major cog both in the socioeconomic digital inclusion and innovation momentum of an economy. Prioritizing the digital skills of the SME workforce and the digital transformation of SMEs will go a long way in fostering an inclusive and innovative digital economy.

Methodology

Our methodology for the paper stems from two previously created metrics by Digital Planet: % progress to socioeconomic digital parity and innovation & change momentum. Both metrics build upon the methodology followed in the last iteration of the Digital Intelligence Index (DII).

The 4 indicators used in progress to digital parity come from the World Bank's Global Findex, while the 31 indicators used to calculate innovation & change momentum come from Euromonitor, PCRI, the World Bank, World Economic Forum, UNESCO, and International Monetary Fund. For the % progress to socioeconomic digital parity metric, each indicator compares the poorest 40% for the socioeconomic cluster to the richest 60%. For innovation & change momentum, each indicator is taken as a stock value from the data source. The weight of each indicator within the two respective metrics is based on data quality, strength of collection methods, and centrality to the respective cluster. Any of the 90 economies that had missing data points for the indicators were estimated using the methodology of the DII:

1. Where any observations exist for a given economy and indicator, our estimation method first relies on Stineman interpolation to fill in missingness between observed datapoints. Next, NOCB (next observation carried backward) and LOCF (last observation carried forward) treatments are applied to fill in missingness outside observed data range.
2. Where no observations exist for a given economy and indicator, our estimation method relies on recursive rounds of targeted mean imputation to fill in missing values, whereby missing values are estimated as the average of the sample observations of the most characteristically similar economies for the same year as the missing datapoint. Estimated data points are then given similar interpolation, NOCB, and LOCF treatments.

For % progress to socioeconomic digital parity, the parity line that countries are compared against has values for its indicators manually coded such that the poorest 40% has equal digital access to the richest 60%. The fully estimated data for the 90 economies are grouped together with data for the parity line. Normalized values are then created for countries in the socioeconomic digital inclusion cluster. For the final measure of percent of progress to digital parity, the country scores are compared to the parity line. Readings below 100% progress to parity mean that the typically excluded group has lower digital access than the privileged group in that economy. Readings equal to 100% mean that the typically excluded group has equal digital access to the privileged group.

To calculate innovation & change momentum, we first calculate yearly normalized scores for each of the 90 economies in the DII based on values for each indicator, using the weighting and estimation methodology outlined above. The indicator scores and weights aggregate to form cluster scores, which are then rolled up into the three components: inputs, process, and output. The final innovation & change scores are derived from aggregation of the three components, normalized on a scale of 0 to 100.

The final innovation & change momentum score, along with the momentum scores of the three components, are generated using the compound annual growth rate formula (CAGR). The CAGR method, by smoothing out changes in the growth rates over the years, allows us to describe the rate at which the index score is changing for a particular economy over time. We like this method because it is a well-tested and robust approach that stakeholders in business and public policy can easily understand and utilize. After calculating index growth rates for each economy, we rescale economy CAGRs on a similar 0 to 100 scale as final scores. Momentum scores, like the final index scores, are relative.

Radar Charts

Our radar charts take the momentum in the three innovation & change components—inputs, process, and outputs—and the % progress to socioeconomic digital parity metric to create a visual of the dynamics of innovative growth and inclusion in our spotlight countries. The values used for each of the four components in the radar charts are relative to the minimum and maximum values for each component in the 31 Digital North economies. For example, Germany's inputs momentum value on our radar charts is 75%. This means that Germany is 75% of the way to the maximum inputs momentum value of all 31 Digital North economies.

Quality Assurance

Throughout the imputation, weighting, standardizing, and aggregation processes, we adopted several quality assurance measures to ensure the validity and robustness of the Progress to Parity values. By deploying different statistical tools throughout the process, including data cleaning, variance analysis, regression analysis, and simulations, we stress-tested the values at multiple levels to produce the most comprehensive and robust numbers possible. Any economy's scores that jumped out as outliers in the index in the QA process were rigorously checked to make sure that the data in that economy are accurate and robust. This mitigates the chances of systematic errors in the process.

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