

DIGITAL-ENABLING COUNTRIES PROVED MORE RESILIENT TO THE COVID-19 ECONOMIC SHOCK

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The US, Germany and Denmark once again make the top three of our 2020 Enabling Digitalization Index (based on data from end-2019). The EDI measures the ability – and agility – of countries to help digital companies thrive and traditional businesses harness the digital dividend. It scores 115 countries based on five components: regulation, knowledge, connectivity, infrastructure and size. For 2020, the US leads by far due to its best-in-class knowledge ecosystem, competitive market size and favorable regulation. In fact, its connectivity score has increased by +1.8 points after a +5.1 point increase in 2018 (see Appendix 1). Meanwhile, Germany boasts the best knowledge ecosystem and infrastructure for trade. It saw a moderate improvement in both the regulation and market size scores, but its connectivity quality has dropped relative to the rest of the world despite the continuing upwards trend in the number of secure servers. This is due to fewer mobile lines per 100 inhabitants and a slightly declining share of internet users. Denmark started 2020 as the best performer in terms of connectivity quality. Indeed, after tripling its number of secure servers in 2018, it has more than doubled it again to reach a higher number than China and Canada, and close to that of France (with a population of only 6 million).

China's rise seems unstoppable. In the three years preceding the outbreak of Covid-19, China moved from rank 17 to rank 4. China has seen rising scores across the board: the country's regulation score improved by +7.4 points after increasing by +15 points in 2018. The connectivity score also increased by +1.3 points. Lastly, the knowledge score rose by +12 points due to an increase in China's innovation capability over 2019. Yet, the skills score did not follow the same pattern, highlighting that China still has leeway to boost the skills (especially digital skills) of its population. This would allow Chinese companies to appropriately tap its innovation potential.

Data also show that others in Asia made progress in the years preceding the Covid-19 crisis: Hong Kong, now at rank 7, previously 11. South Korea, at rank 12 up from rank 16. Six out of the fifteen top digital enablers were in the Asia-Pacific region at the end of 2019. France had also advanced by two spots to rank 15, and Spain had gained 4 spots to rank 20. Other remarkable progressions include Vietnam from 67 to 57 and Saudi Arabia from 53 to 41, confirming a clear willingness to transition towards a new model of growth.



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Our estimates¹ show that an additional point in a country's 2020 EDI score translated to +0.25pp GDP growth in Q3 2020 y/y (i.e. compared to Q3 2019), suggesting that digitization plays the role of shock absorber. The economic interpretation is that countries whose environment was more conducive to the digitalization of companies (good connectivity, market size, regulation, logistics and knowledge) were likely able to respond to the crisis by ramping up multidimensional digitalization. Those countries likely enabled digitalization in administrative bureaucratic processes (state schemes to help companies and citizens in rapidly receiving financial help or sanitary assistance (testing, tracing, isolating, distributing vaccines), on the demand side (consumption with the help of web platforms) and on the supply side in terms of companies' ways of working (remote working, data storing and sharing etc.).

Our estimates also point to a statistically significant relationship between a country's economic performance in 2020 and the share of services in its value added, as well as the widening of its public deficit. This confirms that service-oriented economies with prominent arts, recreation, restaurants, hotels, and other tourism-related sectors suffered relatively more, all other things equal. As for the widening of the public deficit, it appears that higher spending was associated with a higher hit to the economy. This is probably due to the severity of lockdown measures; countries that were the most aggressive in closing their economies to control the pandemic would have had to resort to offsetting actions on the fiscal side to absorb the shock. This is confirmed by the fact that the stringency of government measures to fight the pandemic was not significantly correlated to a country's economic performance in 2020 across all 78 countries (size of the deficit capturing the information of this variable), nor were bureaucracy quality, institutional effectiveness, power distance and the democracy index².

Table 1: Model results

	Model 1
EDI	0.25*** (0.05)
Stringency	-0.12 (p-value=0.053) (0.06)
Share of services	-0.36*** (0.073)
Public Deficit Widening	-0.56** (0.17)

*p<0.05; **p<0.01; ***p<0.001

Grouping countries across our regression variables, we identify a first cluster containing those with high EDI scores, as well as significant deficits and a strong share of services in total value added. For this group, mainly comprising European countries and China, the mean change in GDP is -3%: a strong recession but much better than the worst performers. Since the first cluster contained the most countries, we tried to achieve more

¹ In order to investigate the link between the Enabling Digitalization Index and resilience to the economic shock, we regressed Q3 GDP growth (y/y, i.e. compared to Q3 2019) against several variables across 78 countries. The explanatory variables were the following: EDI (a high EDI means a high potential for digitalization), Oxford's Stringency Index (the higher, the more stringent), the change in the primary fiscal balance between 2020 and 2019 (an increase corresponds to a widening of the fiscal deficit) in % of GDP and the share of services in total added value in 2019 (%). All the variables were taken as a deviation compared with the average of the sample. An estimate between Q4 2019 and Q4 2020 did not drastically change our results.

² See methodology in the Appendix for more details.

granularity and precision by splitting it into two groups, according to the same criteria. It became apparent that even though the two groups presented comparable GDP reactions to the crisis, one was much more digitalized, stringent and with a bigger share in services than the other. This first subgroup of countries was much more exposed to the crisis (since they adopted heavier stay-at-home measures and relied much more on services, the most Covid-sensitive part of the economy), and yet they managed to limit economic losses in the same way as the second subgroup, thanks to their high potential for digitalization. In this group we find the US, Denmark, Germany, China, the UK, Singapore, Switzerland, Sweden, Austria, France, Finland, Australia, France, Belgium, Spain, and Luxembourg.

The second cluster is the “median” one, comprising countries with median values of each variable. This list is diverse, including some Western European and Latin American countries, which fared worse in terms of GDP performance (-8%).

The third cluster comprises those most hit by the Covid-19 crisis, and those with the lowest EDI and low fiscal spending in 2020 compared to 2019: mainly Latin American and Middle Eastern countries. Their mean economic performance is -9.4% y/y in Q3. These countries also implemented the most stringent restriction measures, and were forced to use fiscal policy to absorb the shock.

The last cluster comprises countries where a disaster has been avoided: they have low EDI and low fiscal spending but faced a benign economic shock (-2% y/y in Q3) relative to the rest of the sample. Most of these countries are located in Africa, where the pandemic did not spread as widely as in the rest of the world: activity was not halted by government measures, and the state did not resort to overly large fiscal spending programs to save the economy.

Lastly, we test the robustness of our EDI indicator and regression by replacing it with other digitalization-related indices. We obtain similar results, with digitalization being significantly positively correlated to economic performance.

Policymakers have another incentive to boost digitalization: Companies reporting higher digital adoption proved more resilient and better prepared for future challenges amid the Covid-19 crisis. Our [Global Supply Chain Survey](#)³ showed that digitalization correlates with resilience. In fact, digitalization means agility and proactivity: highly digitized companies took more swift action to mitigate the supply-chain disruptions in 2020. In contrast, low digitization was synonymous with indecision: 35% of less digitized companies neither agreed nor disagreed when we asked them if the pandemic would push them to find new suppliers, double the share of those with the same response among highly digitized companies.

Highly digitized companies are also more forward looking, and this contributes to resilience. Digitalization means better knowledge and preparedness for the future: 80% of mostly highly digitized companies

³ We surveyed a sample of high-level executives in 1,181 companies in these countries across six sectors (IT, tech and telecoms, machinery and equipment, chemicals, energy and utilities, automotive and agrifood) about their experiences with disruption and their plans to make their supply chains more resilient. The survey was conducted online from mid-October to early November.

know their Tier-2 suppliers vs. 61% of the less digitized. As these companies are faced with more diverse and complex risks, they also have a better information management system and better risk analysis. 25% of less digitized companies stated they would prefer a local supply chain but their market or company cannot afford a cost increase vs. 9% of highly digitized companies. Highly digitized companies are perhaps more non-cost competitive, while the other are cost-competitive.

Our survey also shows that digitalization can mean exposure to more complex and multidimensional risks. Highly digitized companies see protectionism as a higher risk (11%) for supply chains than companies with a low level of digitalization (4% of respondents only) and those with a medium level (6%). Political risk on the supply chain matters much more for the most digitized companies than for those who have a lower level of digitalization (31% vs. 13%). ESG risk to production sites was also more important for highly digitized companies (26% vs. 12% for those with low level of digitalization).

APPENDIX 1 : Top 40 Countries in EDI 2020

Global ranking	Country	Connectivity quality	Logistic performance	Business environment	Knowledge Ecosystem	Market Size	EDI (end-2019 data)	Ranking Change vs. end-2018
1	US	76	86	95	97	83	88	0
2	Denmark	100	90	97	95	1	77	1
3	Germany	76	100	87	100	18	76	-1
4	China	34	72	84	75	100	73	5
5	UK	70	90	94	94	13	72	0
6	Singapore	80	91	99	90	1	72	0
7	Hong Kong	91	87	97	82	2	72	4
8	Japan	66	92	84	89	23	71	0
9	Netherlands	80	92	81	94	4	70	-5
10	Switzerland	76	86	82	98	3	69	-3
11	Sweden	59	93	92	95	2	68	-1
12	South Korea	68	72	95	90	9	67	4
13	Austria	64	92	86	90	2	67	-1
14	New Zealand	64	85	100	83	1	67	0
15	France	68	83	82	87	13	67	2
16	Finland	57	89	88	94	1	66	-3
17	Canada	62	78	87	91	8	65	-2
18	Australia	60	79	90	88	6	65	0
19	Belgium	60	93	79	88	2	64	0
20	Spain	64	83	84	79	8	64	4
21	UAE	66	89	90	72	2	64	2
22	Norway	57	77	93	89	2	63	-2
23	Ireland	70	68	87	83	1	62	-2
24	Iceland	75	55	86	87	0	60	-2
25	Luxembourg	72	73	70	86	0	60	0
26	Italy	54	79	75	79	10	59	2
27	Estonia	70	58	89	77	0	59	-1
28	Israel	60	58	82	90	2	58	1
29	Czech Republic	55	76	81	76	1	58	-2
30	Portugal	60	74	82	72	1	58	0
31	Poland	54	69	82	71	4	56	1
32	Slovenia	62	58	82	78	0	56	-1
33	Malaysia	53	54	91	75	3	55	0
34	Hungary	56	64	76	68	1	53	0
35	Lithuania	56	45	91	72	0	53	0
36	Qatar	57	66	68	70	1	52	0
37	Thailand	42	63	88	62	5	52	3
38	Russia	55	33	85	71	14	52	-1
39	Cyprus	61	51	76	69	0	52	-1
40	Chile	50	59	75	66	2	50	-1

APPENDIX 2: METHODOLOGY

Table 1 : Linear regression of GDP growth (Q3 2020, YoY) on centered mentioned variables

	Model 1	Model 2	Model 3
EDI	0.25*** (0.05)	0.25*** (0.048)	0.23* (0.07)
Stringency	-0.12 (p-value=0.053) (0.06)	-0.10 (0.06)	-0.07 (0.08)
Share of services	-0.36*** (0.073)	-0.39*** (0.08)	-0.24* (0.04)
Public Deficit Widening	-0.56** (0.17)	-0.58** (0.17)	-0.48* (0.20)
Democracy Index		0.29 (0.35)	-0.12 (0.37)
Bureaucracy Quality			-0.34 (0.92)

* p<0.05 ; ** p< 0.01 ; *** p< 0.001

Table 1 shows the coefficients obtained when regressing our GDP variable on several variables. In each model, we add another variable to account

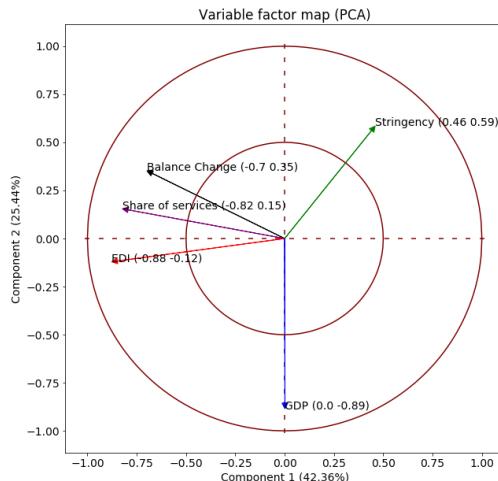
for more and more effects. The coefficient associated to EDI is always at least 95% significant, which is all the more reason to trust the positive effect of being a digital-enabling country. This is also the case for the share of services and deficit variables, for which the coefficients are always negative, which makes sense for the former: the more an economy relied on services, the harder it was hit by the pandemic crisis.

However, the sign of the deficit coefficient is more ambiguous. A negative sign indicates that the more a country widened its deficit to fight the pandemic, the bigger the GDP loss between Q3 2020 and Q3 2019. Yet we know that increasing the deficit allows a country to absorb part of the damage done to the economy and hereby reduce GDP loss. The answer probably lies in the fact that countries that faced the crisis the hardest are also the ones that had to provide the biggest budget effort. In other terms, there is reverse causality here, which means that GDP loss has caused a rise in the fiscal deficit as much as the deficit prevented GDP from going any lower. In such cases, the concerned regression estimate is often heavily biased and inconsistent.

A surprising result is that our estimates did not allow for an unquestionable assessment of stringent measures, as Model 1 (the simplest) was the only model in which the coefficient associated with the stringency variable was 94% significant. In the two other models, significance was uncertain, which may seem odd since one can have the feeling that stringent political measures have driven GDP loss. The information contained in this variable can actually be captured by the deficit variable, as stricter confinements were often accompanied with higher deficits (accompanying measures).

Coefficients associated with the Democracy Index and Bureaucracy Quality, which aimed at capturing the effectiveness with which a government could implement sanitary decisions such as vaccination campaigns or stay-at-home measures, never proved significant. Rather, their inclusion seemed to lower other variables' significance. Several other indicators of state centrality were used, such as Institutional Effectiveness and Policy Implementation (OECD), but the results were somewhat poorer in terms of coefficient significance.

Once we establish positive effect of the EDI on GDP resilience, we try to identify different groups of countries with respect to the aforementioned variables. These groups will be visualized, thanks to a previously executed PCA, which allows us to identify and interpret the main axes on which countries will be projected.



This PCA shows how all five variables contribute to the formation of each component. In total, the two axes explain $42.36+25.44=67.8\%$ of the total dataset variance. Since each PCA component is a linear combination of the different variables, the

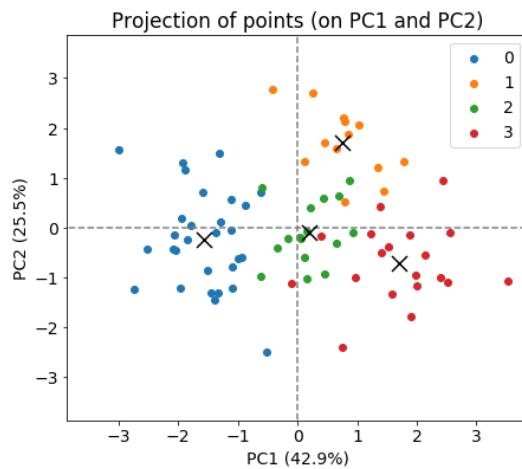
coordinates of each variable gives its coefficient in the linear relation that forms each component. For example, we have:

$$\begin{aligned} \text{Component}_1 = & 0.46 \cdot \text{Stringency} + 0 \cdot \text{GDP} - 0.88 \cdot \text{EDI} \\ & - 0.82 \cdot \text{Services Share} - 0.7 \cdot \text{Balance Change} \end{aligned}$$

We can therefore see that Component 1 is mainly composed of EDI, share of services and balance change, while GDP is the main contribution to Component 2. These observations will facilitate our clustering interpretations.

A k-means clustering on all variables allows us to automatically assign each country to a certain group to minimize the variance within each group, that is, to produce groups that are coherent and as compact as they can be. Our tests led us to choose four groups, since adding another one would not have improved our results enough to compensate for the loss in visibility. With every country belonging to a certain group, we can now project our data on the previously constructed PCA components to try and visualize them (the country repartition details are in the Appendix).

On the projection below, each dot represents a country and its color the cluster it belongs to. The "X" letters stand for the centers of each cluster. Notice those are the same axes as the PCA's, which means we could also draw the arrows representing each variable from the previous factor map. From there, we can characterize each group.



Then, a second k-means solely on cluster 0 was executed to form the list of countries available below.

Countries in the different clusters :

Cluster 0		Cluser 2	Cluster 1	Cluster 3
Sub-group 1	Sub-group 2			
United States	Netherlands	Thailand	Malaysia	Chile
Denmark	UAE	Greece	Qatar	Oman
Germany	Norway	Latvia	Saudi Arabia	Kazakhstan
China	Ireland	Croatia	India	Panama
United Kingdom	Iceland	Malta	Turkey	Kuwait
Singapore	Italy	Romania	Bahrain	Colombia
Switzerland	Estonia	Bulgaria	Indonesia	Argentina
Sweden	Czech Republic	Mexico	Ukraine	Morocco
Austria	Portugal	Costa Rica	Egypt	Peru
France	Poland	Uruguay	Kenya	Philippines
Finland	Slovenia	Botswana	Paraguay	Ecuador
Australia	Hungary	Tunisia	Ghana	Dominican Republic
Belgium	Lithuania	Namibia	Nigeria	Guatemala
Spain	Russia		Pakistan	Algeria
Luxembourg	Cyprus		Senegal	Bangladesh
	Brazil		Cameroon	
			Mali	
			Mozambique	
			Ethiopia	

The last step of our analysis consisted of choosing other variables to account for the degree of digitalization of each country, and checking whether our results are robust or not. To that end, we first turn to the Digix 2020 index from BBVA research and regress our GDP variable on the same variables as Model 1, except for the fact that we switched EDI for the Digix index. We then did the same with the World Bank Digital Adoption Index (DAI) from 2016. The results are below:

Table 2 : Linear regression of GDP growth (Q3 2020, YoY) on centered mentioned variables

	Regression 1	Regression 2
Digix	0.10** (0.03)	
DAI		0.18** (0.05)
Stringency	-0.08 (0.06)	-0.13 (0.07)
Share of services	-0.14* (0.07)	-0.36*** (0.09)
Public Deficit Widening	-0.36* (0.15)	-0.48* (0.19)

We find a consistent result with our previous analysis: our first proxy for our digitalization index, Digix, has a positive and significant influence on GDP behavior during the crisis. This time, an additional point of Digix translates to a +0.1 pp GDP resilience in y/y growth terms, which is less than the effect estimated for EDI, but of the same magnitude, and coherent with our previous values. The same can be said for the World Bank DAI and both coefficients are 99% significant. One can also note that the different degrees of significance for other variables are lessened compared to Table 1, which indicates that EDI provides a better understanding of the relation between GDP resilience and digitalization.

APPENDIX 3 : DIFFERENT MEASURES OF CENTRALITY

Different measures of state centrality were tested for this analysis. We used several variables from the Economist Intelligence Unit, such as social unrest, policy implementation and institutional effectiveness. The main downside of those variables was that they reduced our sample to 46 countries (versus 78 in Table 1). Nevertheless, here are the estimated coefficients for each regression:

Table 3 : Linear regression of GDP growth (Q3 2020, YoY) on centered mentioned variables

	Regression 1	Regression 2	Regression 3
EDI	0.28** (0.08)	0.37*** (0.08)	0.20* (0.08)
Stringency	-0.09 (0.08)	-0.08 (0.06)	-0.06 (0.08)
Share of services	-0.22* (0.10)	-0.26* (0.10)	-0.17* (0.10)
Public Deficit Widening	-0.51* (0.18)	-0.66** (0.18)	-0.48* (0.19)
Institutional Effectiveness	-0.72 (0.50)		
Policy Implementation		-3.00 (1.00)	
Social Unrest			0.16 (0.80)

Overall, all coefficients are less significant, which may be an effect of the reduction of sample size. All coefficients for the EDI variable are at least 95% significant. Additional measures of state centrality were never significant.

These assessments are, as always, subject to the disclaimer provided below.

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