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Promoting and Developing Digital Transformation in Israel toward 2030

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This is a short summary, for the full paper (in Hebrew) see
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Aaron Institute for Economic Policy

In the name of Aaron Dovrat z"l

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Promoting and Developing Digital Transformation in Israel toward 2030

Various studies have reported on the many advantages of digital progress in economic and social areas. Investing in information and communication technology (ICT) has a positive effect on economic growth, welfare and employee productivity in the market. A comparison between data from Israel and benchmark countries shows that Israel's public capital inventory of ICT is very low and that there is a large disparity in the total investment in ICT out the GDP compared to the benchmark countries.[1] Israel does try to close this gap through the "Digital Israel" initiative, the Ministry of Communication, the ICT Authority and more, but in order to succeed and realize the potential of promoting digital transformation in Israel, an ordered work plan based on measurement and data is required.

In this paper, we examine the OECD's strategy for promoting digital transformation and suggest ways to implement it in Israel, by establishing priorities, setting goals and engaging in continuous measurement. The Aaron Institute's pyramid model, regressions for assessing the relationships between digital transformation indicators and per capita GDP, closing gaps with benchmark countries and the road maps of leading countries are among the suggested methods for developing a strategic plan to promote digital use in Israel toward 2030, and all with the aim of promoting economic growth and individual welfare and reducing poverty.

[1] The benchmark countries are Austria, Ireland, Denmark, the Netherlands, Finland and Sweden.

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1. Summary and conclusions

Moving Israel to a path of digital transformation is a national project. Without it, economic competitiveness in Israel will suffer. This position paper supports the hypothesis derived from the macro model of the Aaron Institute (Eckstein, Menahem-Carmi and Sumkin, 2021) according to which digital transformation has significant macro-economic effects since investment in it affects all industries in the economy.

In order to promote a strategy of digital transformation, priorities must be followed considering existing conditions in Israel. This position paper examines several ways for determining such priorities. The first uses the Aaron Institute's pyramid and the priorities set by it, looking at the distribution of Going Digital indicators. In this way, priorities are supported by the results of regressions of indicators with the dependent variable being per capita GDP.

A second way is to examine the gaps between Israel and the benchmark countries in Going Digital indicators. To do so, missing data should be completed, and data should be collected consistently for all Going Digital indicators. This would allow us to examine the actual position of Israel compared to its counterparts around the world and establish priorities for closing gaps in various fields. The third way is to examine the road maps of leading countries regarding digital transformation and establish priorities in accordance with the various stages implemented by these countries. Our recommendation is to combine these methods so that they support each other. Using these methods, we can establish priorities based on the various indicators suggested by the OECD which could later be used to develop a detailed strategy.

Three critical issues are raised by each of the suggested three methods for establishing priorities that are important to promote. The first is investment in digital infrastructure. Investment is required not only in the deployment of infrastructure but also in the actual connection of households to this infrastructure (for example, through guidance or by removing other obstacles to connection). These two variables together correlate to 63% of the per capita GDP and are important for closing gaps and reducing poverty.

The second issue is digitalization in education. For example, the variable "Share of adults proficient at problem-solving in technology-rich environments" was found to correlate to 75% of the per capita GDP (Table 8). Therefore, even though the products of investment are expected to only have a long-term effect, investment in this area is very important. However, this is clearly a large and separate subject that we do not cover in depth in this position paper and that requires further examination.

The third subject is promoting digitalization in and for the business sector. A number of business indicators that we examined correlated to 66% of the per capita GDP, indicating the importance of this issue for facilitating business activity in the market, as well as innovation and competition in the business sector. Research also supports this investment. For example, the transition to digital tax reporting in Tajikistan reduced the time spent by companies on taxes by 40%. Among companies that previously tended to avoid reporting, the transition to digital reporting doubled the amount of tax they paid. Conversely, evidence suggests that digital reporting reduced the tax payments of companies that previously avoided less. These companies paid less bribes, since digital reporting reduces the chances for extortion (Okunogbe and Pouliquen, 2022). Similar studies conducted at the Aaron Institute (for example, the Ministry of Economy and Industry, 2021) show the importance of de-regulating businesses, among other ways, through digitalization. Since this was found to be a central issue, we assume that it is also central and important in this context.

Using the different strategic processes, an ordered work plan may be developed, divided by different ministries and government bodies. This, in light of the goal of increasing growth and individual welfare.

As part of this work plan, various obstacles would need to be addressed – obstacles that we discuss less in this position paper (a more detailed discussion can be found in the previous paper of the Aaron Institute on the subject, Axelrad and Danziger, 2021). For example:

- Obstacles of understanding the digital world – government employees sometimes are not acquainted with digital systems and capabilities and do not always know what options they have during the process of digital transformation. However, another significant obstacle is user experience design and informed use of data to make decisions, an area that government employees are not always experienced with.
- Human capital availability obstacles – many people need to be trained in technological fields in order to address the demand in both the governmental and business sectors.
- Legal obstacles – in the area of privacy, need for legislation changes and more.

The next stage could include models for various ministries and an examination of their success and weaknesses. Actual implementation may require structural changes in government ministries or the government itself, or changes in how goals are determined and how their achievement is examined. Challenges concerning acquisition and collaboration with work unions would also have to be addressed. All of this should be done in an informed way and through regular cooperation with all relevant bodies, since these processes are wide cross-ministry processes. Continuous cooperation would allow us to identify and solve market failures that may arise during the actual work and implementation.

2. The economic benefit of digital transformation

For three decades now, economic studies have been showing the high economic yield of public and private investment in digital systems. Investment in ICT has a positive impact on economic growth; this is a global phenomenon observed in both developed and developing countries (Jorgenson and Vu, 2005). All components of ICT promote economic growth, but some components, such as digital services, ICT infrastructure and electronic governance, are more beneficial to economic growth (Majeed and Ayub, 2018). Digital technologies contribute not only to innovation in products and services but also to innovation in processes, business models and organizational arrangements (OECD, 2017). ICT technologies can reduce poverty by improving the access of poor people to education, health, government and financial services (Cecchini and Scott, 2003). An increase of 1% in ICT input leads to a 0.408% increase in per capita GDP, when all variables are kept constant except the openness of the market (Waqa, 2015). Among the types of investment in ICT, investment in computerization contributed the most to promote ICT compared to investments in communication and software. A study conducted at the Aaron Institute examined the causes of disparity in product per work hour between Israel and the benchmark countries, particularly the causes that are influenced by government policies. The examination showed that Israel was behind in all market production factors (Eckstein, Menahem-Carmi and Sumkin, 2021). If work productivity in Israel were identical to the benchmark countries, Israel's product would have been higher by 700 milliard NIS in 2019.[2] Table 1 summarizes the results of macro-economic exogenous factoring that explain the disparity in productivity per work hour between Israel and the benchmark countries. Comparing the data of production factors, ICT capital inventory in Israel, which is lower by 37% than in the benchmark countries, contributes 2.1% to the productivity disparity or 0.5$ per work hour. Israel is also behind in fibre systems infrastructure and equipment and software in both the government and the private sector, therefore Israel's disparity in ICT investment damages its product. Closing the gap in ICT capital inventory would have raised the product by 14 milliard NIS per year (as product percentage). This is a much lower investment than the investment in transportation infrastructure but has a significant potential effect on the efficiency of the government and the promotion of the business sector because of the need of some of parts of the business sector to update its digitalization systems to work with new government interfaces. Ironically, in a country with a great innovative sector like Israel, most of the

[2] Using total market work hours 2019 and average exchange rate for 2019.

innovation in the high-tech industry is directed outwards and not toward promoting the Israeli economy as a whole.

Table 1: factoring of the work productivity gap, Israel compared to the benchmark countries

Productivity gap with benchmark countries per work hour		Total productivity		Public capital per capita		ICT public capital per capita		Private capital cost		Public capital
$25.3	=	2.8$	+	6.9$	+	0.53$	+	8.8$	+	6.12$
100%	=	11.3%	+	27.5%	+	2.1%	+	34.8%	+	24.2%

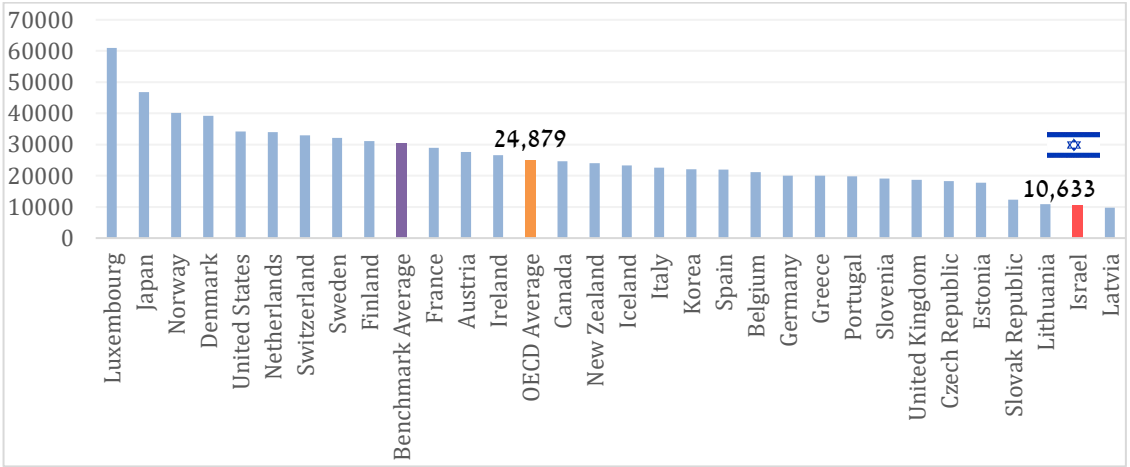
This calculation only takes into account public administration without education, health, etc. Based on average product per work hour for 2016 – 2019 and excluding Ireland.

Source: IMF, OECD and the Aaron Institute's processing.

The gap in labor productivity between Israel and leading countries and the need to improve the situation bring into focus the opportunity provided by investing in digital systems, both investment in physical infrastructure and investment in a transition to online services.

Figure 1 present the level of public capital per capita (ICT and non-ICT) in Israel, in the benchmark countries and in other countries. The level of public capital per capital in Israel is very low, in fact, almost the lowest among OECD countries.

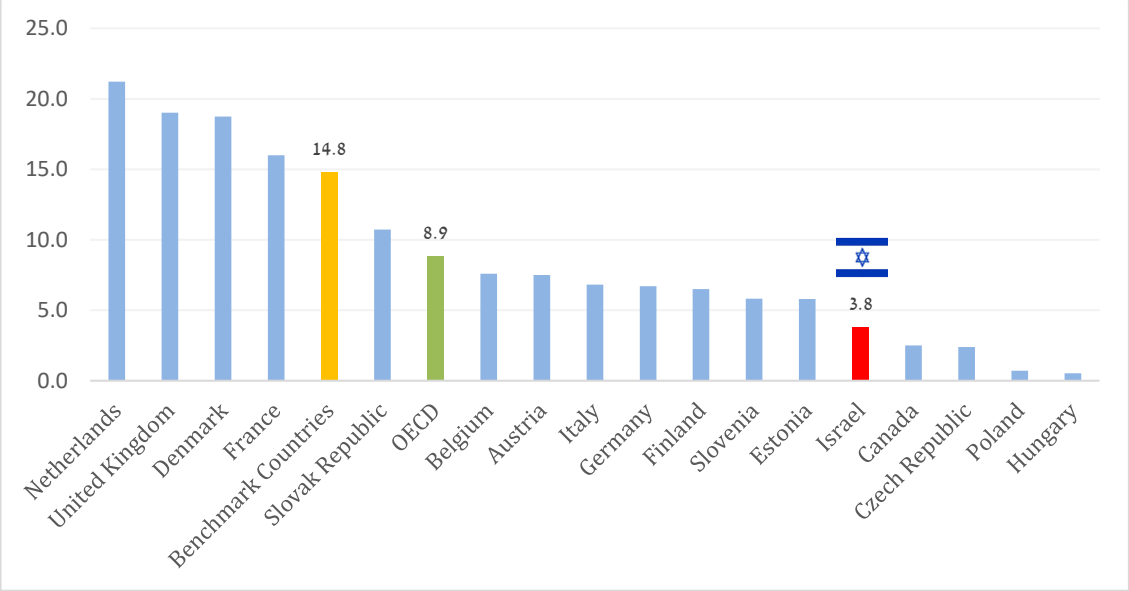
Figure 1: level of public capital per capita, 2017 data in fixed 2011 dollars



Source: IMF, OECD and the Aaron Institute's processing.

A similar picture can be seen when looking at the level of ICT public capital (Figure 2). Its level in Israel is very low, compared to both the OECD average and the average of the benchmark countries.

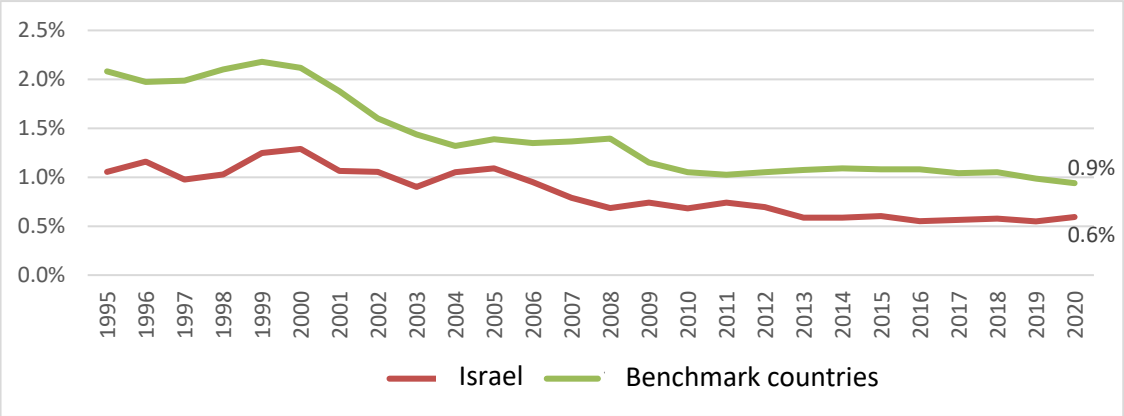
Figure 2: level of ICT public capital per capita, 2017 data in fixed 2011 dollars



Source: IMF, OECD and the Aaron Institute's processing.

Under current trends, the gap in the ICT public capital inventory is expected to widen because the level of per capita investment in Israel is about a third of the per capita investment in the benchmark countries (figure 3), and the population growth rate in Israel is significantly higher than in those countries (Eckstein et al., 2019). The private capital inventory per work hour in Israel explains 34.8% of the productivity gap, or a gap of 8.8$ in the productivity per work hour. As aforementioned, the level of private capital per work hour in Israel is very low – only 47% compares to the level of private capital per work hour in the benchmark countries. The capital cost, resulting from various factors, among them business transactions, is 14% in Israel compared to 10% in the benchmark countries.

Figure 3: total investment in ICT out of the GDP, 2017 data in fixed 2011 dollars



Source: IMF, OECD and the Aaron Institute's processing.

In light of low investment rates in ICT in Israel, there is need for further investment that would contribute to productivity, growth and, of course, the quality of life in Israel. A calculation that includes the sectors of public administration, health and education suggests that an investment of 18 milliard dollars is required in order to narrow the gap. The goal is, therefore, to promote digital transformation in Israel as means of increasing productivity and growth and bringing the Israeli economy to the level of leading countries by 2030.

3. Description of the current situation – Israel's digital strategy

In 2013, as part of the affairs of the Ministry of Social Equality, the government of Israel established the "Digital Israel" national initiative. The object of this initiative was to leverage digital potential for the social, economic and educational benefits of all Israeli citizens. It was intended, among other things, to develop a national digital strategy regarding the use of ICT, coordinate relevant bodies, and provide regular measurement and control. Under the initiative, the first perennial plan was developed for 2017 – 2022, focusing on **closing gaps**, **accelerated economic growth** and **smart governance** (the Ministry of Social Equality, Digital Israel Headquarters, 2017).

- **Closing gaps** – making social and public products available remotely to allow service provision to the entire population, particularly the periphery. For example, remote learning and remote medical services.
- **Accelerated economic growth** – in order to leverage digitalization and accelerate economic growth, three strategic goals have been set:
    1. Promote digital industries and businesses, develop digitalization-based industries and encourage information-based innovation. In addition, businesses in Israel should increases their online activity in order to improve competitiveness, open new potential markets and create new opportunities for growth.
    2. Develop the labour market in a digital age, focusing on lining digital skills in the education system, the academy and the labour force to the labour market, increasing the use of online professional training, expanding employment opportunities in a digital age by removing distance obstacles, and training professional personnel in the fields of digitalization and ICT.
    3. Support the development of infrastructure (such as broadband and optical fibres) and promote an enabling digital work environment.
- Smart governance – improving public products, promoting an advanced interface with government ministries that is available and convenient in order to reduce bureaucracy:
    1. Making national and local government accessible – improving government service to citizens and reducing bureaucracy, local government digitalization, making government databases available to the public, making it easier to conduct business.

2. Innovative and effective governance – improving digitalization in the internal work of the government, for example, government acquisition, information-based policies and increased information sharing among government ministries, innovation and entrepreneurship in the government.
3. Improving public products (such as education, health and welfare) by digital means.

The main principles guiding "Digital Israel" (according to the perennial plan) are:

1. **Focusing on customer needs** – developing digital services in consideration with the needs of citizens.
2. **Quickness perception** – reflected a quick adjustment to changing circumstances, including advance studies, working in stages through an integrative process that includes performance, improvement, measurement and amendment.
3. **Information sources management** – making information-based decisions, making information and conclusions accessible to the public in order to create a sense of transparency and increase trust in the government while maintaining information security.
4. **Digital inclusion** – providing equal opportunities for all citizens in benefiting from the advantages of digitalization by making service accessible to all and reducing gaps in digital literacy.
5. Digital as default – developing government services as digital services from end to end, standard and simple to use so that citizens would prefer to use them.

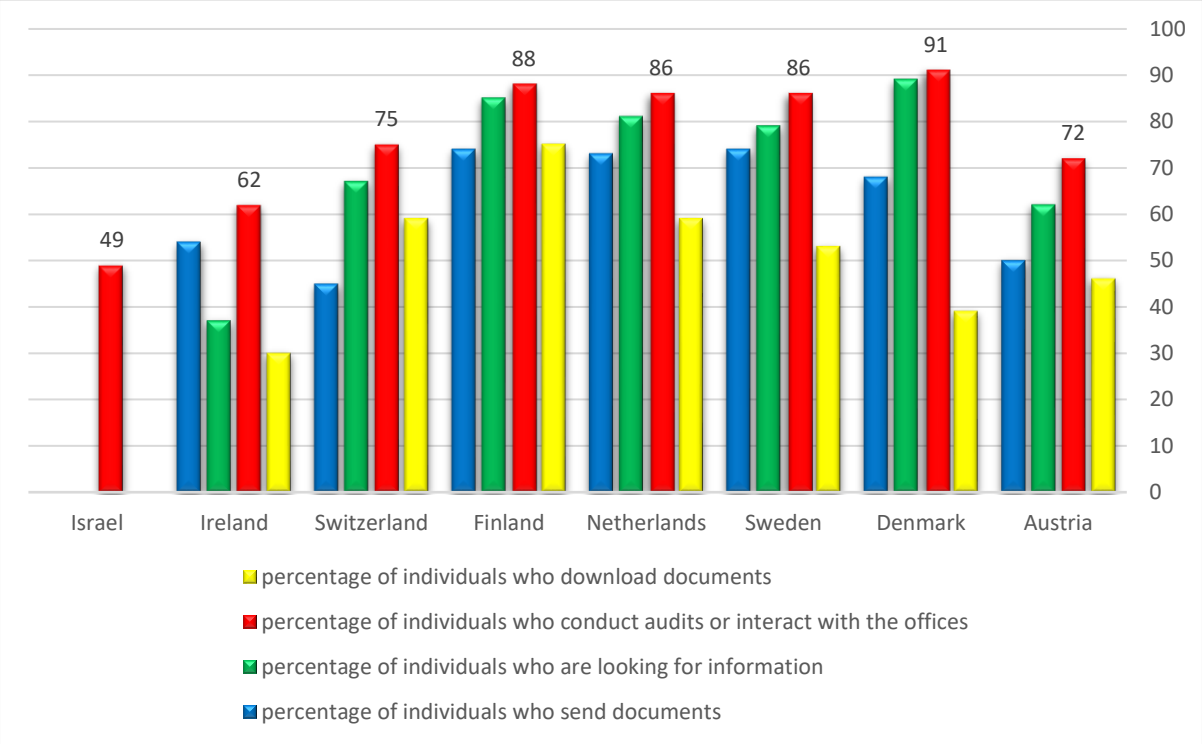
Regarding measurement, it appears that "Digital Israel" did not develop an ordered mode of operation and did not set indicators to follow up in 2017. A report of the State Comptroller (2020) suggested that this is the result of budgetary factors, and measurement began in the middle of 2019. The report further suggested that the process was delayed, encountered many obstacles and was de-prioritized in regard to other issues. Conversely, government ministries testify that cooperating with "Digital Israel" in leading digital initiatives has had a significant contribution to the improvement of capabilities.

The strategy is unclear about prioritization and resource allocation as well as the considerations when developing the strategy. It seems that there is some prioritization of economic areas, education and health; these received a larger share of the budget.

4. Comparing Israel to the benchmark counties

Measurement in Israel is not always up to date, and some data is missing regarding many international indicators. A large number of indicators that do have data show that Israel is in a worse state than the benchmark countries. For example, Figure 4 presents the percentage of individuals in the benchmark countries that use the Internet to contact authorities by type of service. Israel only has data regarding one of these types of services, and it ranks very low on this indicator compared to the benchmark countries.

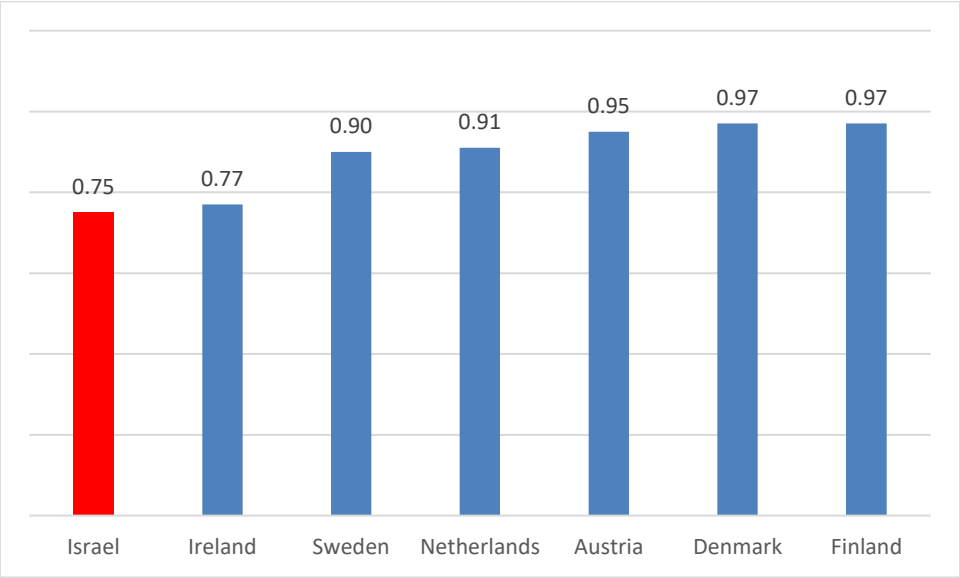
Figure 4: percentage of individuals using the internet to contact authorities, 2020



Source: OECD (2021).

Accordingly, Israel falls behind in the extent and quality of government online services, as shown in Figure 5, presenting the Online Services Index (OSI) developed by the United Nations.

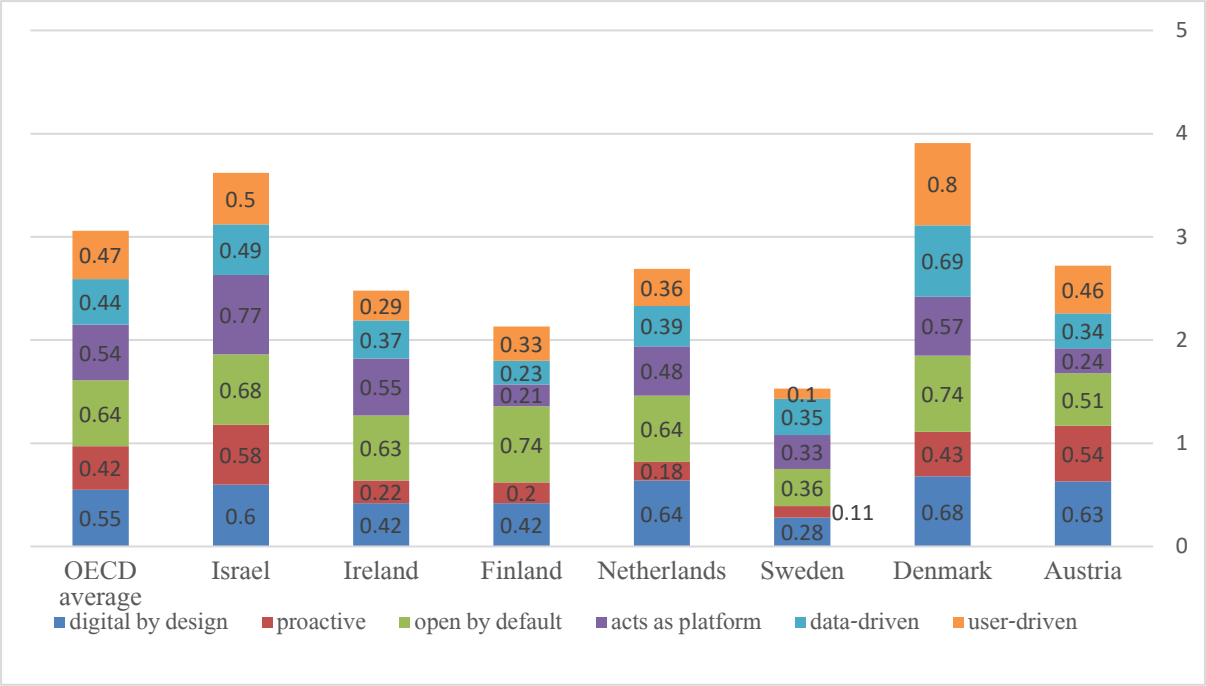
Figure 5: Online Services Index, 2020



Source: United Nations (2020).

On the OECD's Digital Government Index (DGI), Israel ranks particularly low in the **user-driven government aspect** (Figure 6), meaning that the interfacing with citizens fails to consider the capabilities, needs and convenience of the user when designing processes. Other aspects considered in the digital government index are: **digital government by design** – leveraging digital technologies to rethink and reengineer public processes, simplify procedures and create new channels of communication and engagement with stake holders; **Data driven** – valuing data as a strategic asset and establishing the governance, access, sharing and re-use mechanisms for improved decision making and service delivery; **acts as platform** – when deploying platforms, standards and services to help teams focus on user needs in public service design and delivery; **open by default** – when making government data and policy-making processes available to the public, within the limits of existing legislation and in balance with national and public interest; and **proactive** – anticipating people's needs and responding to them rapidly and efficiently.

Figure 6: Digital Government Index, 2019



Source: OECD (2019a).

Use of government online services in Israel

The 2020 social survey conducted by the Central Bureau of Statistics included an entire chapter on digital government. The survey included 7249 participants, 50% men, 53% who served in the army, 79% Jews, 2.9% Christians, and 13% Muslims. The survey showed diverse uses of online government services in Israel.

50% of the participants indicated that they visit the websites of public bodies. Of those who did not use online services, 30% indicated that they had no need of them, 20% indicated that they had no Internet access, 22% indicated that they did not know how to use the services or lacked adequate competence, and 19% indicated that they were not interested in using the services. According to the survey, only 32% of the population prefer to contact authorities online, compared to 50% who prefer face to face interaction and 18% who prefer using the phone.

Among those who did use the services, the method of use varied: 23% said they were looking for information, 50% downloaded files, and 46% used the websites to make payments. To understand the reason, the level of subjective understanding and the sense of security where examined. Only 20% indicated that the method of use was clear to them, and only 50% indicated that they felt safe to provide personal information on government websites.

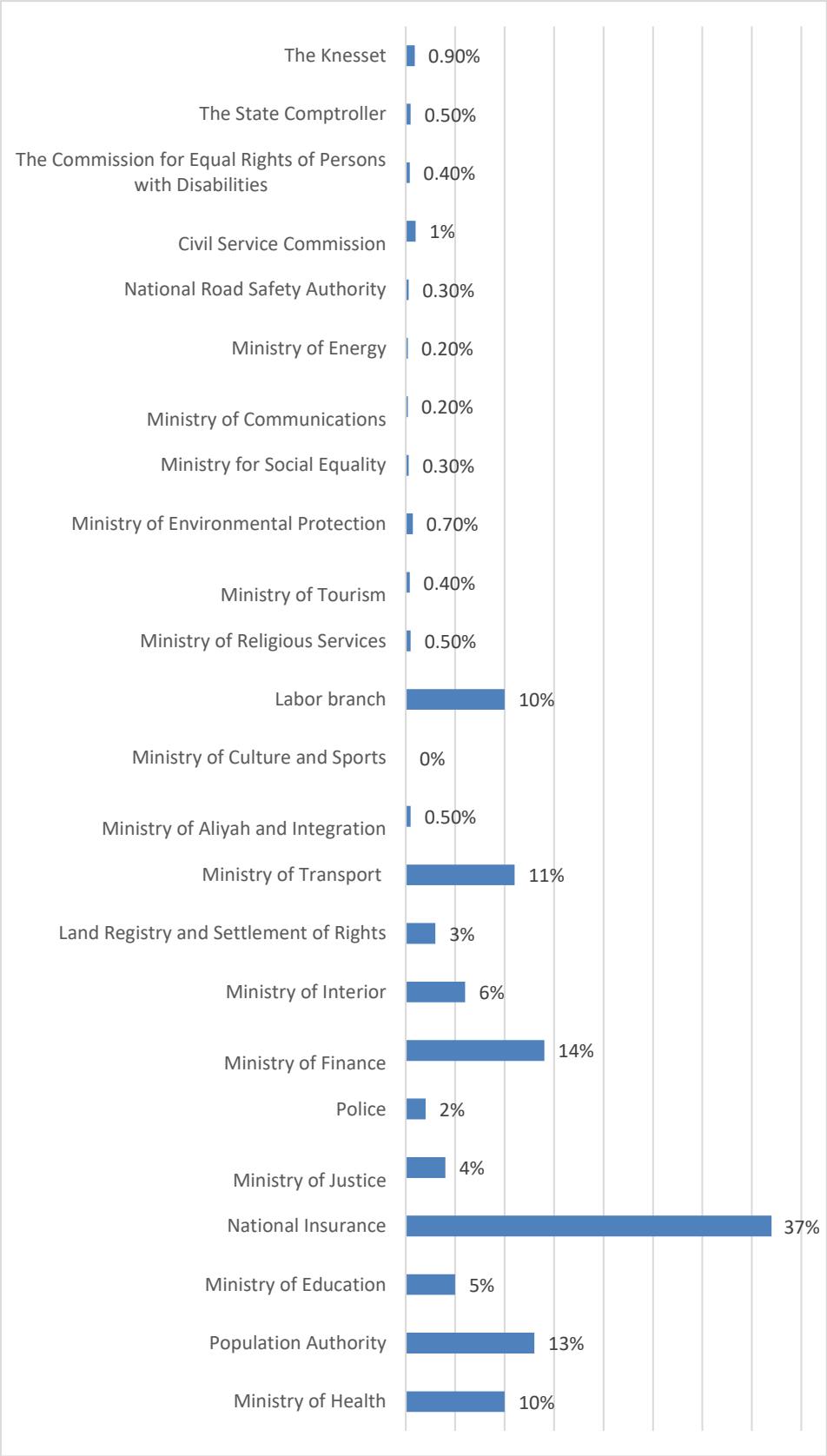
An examination of the use by ministries shows the use is very limited. The National Insurance Institute is the national body with the highest use of online services, followed by the Tax Authority (Figure 7). Conversely, an examination of the use of digital banking shows that 61.3% of citizens use these services. At the business level, it was found that 59% of businesses use online government services.

The survey also revealed the satisfaction with online public services by ministries (Figure 8). The National Insurance Institute, the Ministry of Finance and the Population Administration lead in satisfaction among those who use online services.

In regard to the use of the online services of local authorities, 31% of the participants reported that they use the websites of local authorities, but only 25% of these participants indicated that the services met their needs.

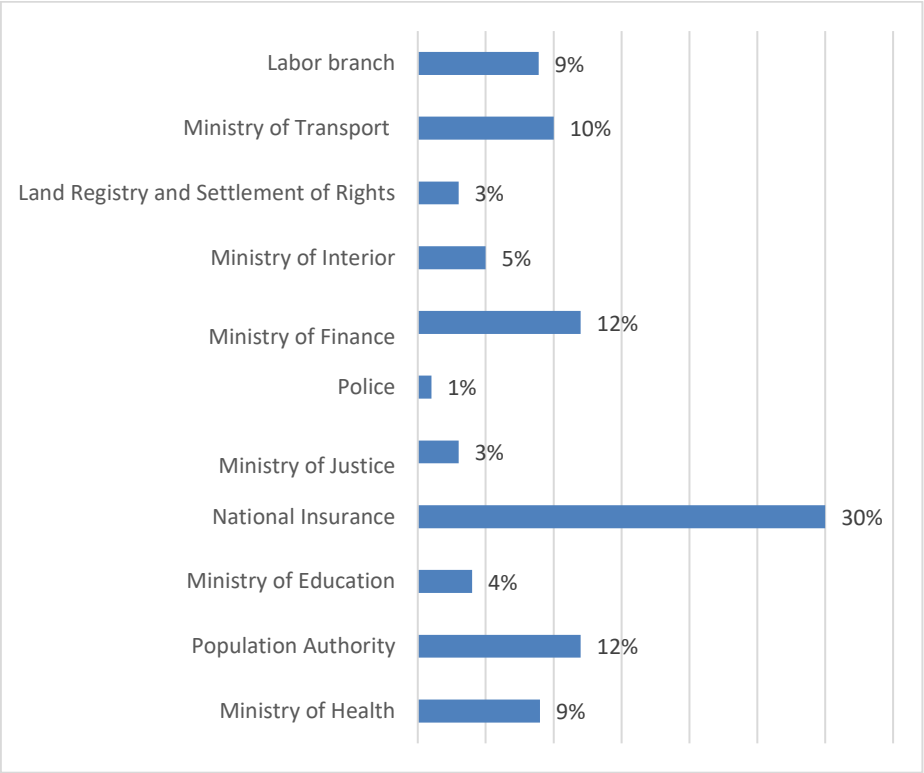
Regarding use, the data indicates that 80% of the participants in the survey have access to a computer and the internet at home. 77% indicated that they use the internet daily, and 64% indicated that they use the internet through their mobile phone. As for competence, only 50% indicated that they felt adequately competent to regularly use the internet. 73% thought that digital technology improved their quality of lives; 30% indicated that they had difficulty in acquiring new technological skills; and 30% indicated that they needed training in this area.

Figure 7: percentage of users of online services by government body



Source: processing by the researchers of the social survey 2020.

Figure 8: percentage of users of public online services whose needs were satisfied by government body



Source: processing by the researchers of the social survey 2020.

5. The OECD's digital transformation strategy, Going Digital

According to the OECD, a holistic approach to digital transformation should refer to the integration of seven interrelated dimensions to help realize the potential of digital transformation for the good of the economy and society (Figure 9). It is also necessary for the development of an effective strategy that is suitable for the goals. The Going Digital indicators are based on successful strategies implemented in countries as part of the digital transformation process.

Figure 9: integrated digital framework for achieving economic growth and welfare, the Going Digital Toolkit

Source: OECD (2019b).

1. **Access** – Access to communications infrastructures, services and data underpin digital transformation and become more critical as more people and devices go online.
2. **Use** – The power and potential of digital technologies and data for people, firms and governments depends on their effective use.
3. **Innovation** – Innovation pushes out the frontier of what is possible in the digital age, driving job creation, productivity and sustainable growth. Data-driven innovation, which is innovation that includes the collection, analysis and recording of data, is essential to digital transformation.
4. **Jobs** – As labour markets evolve, we must ensure that digital transformation leads to more and better jobs and to facilitate just transitions from one job to the next.

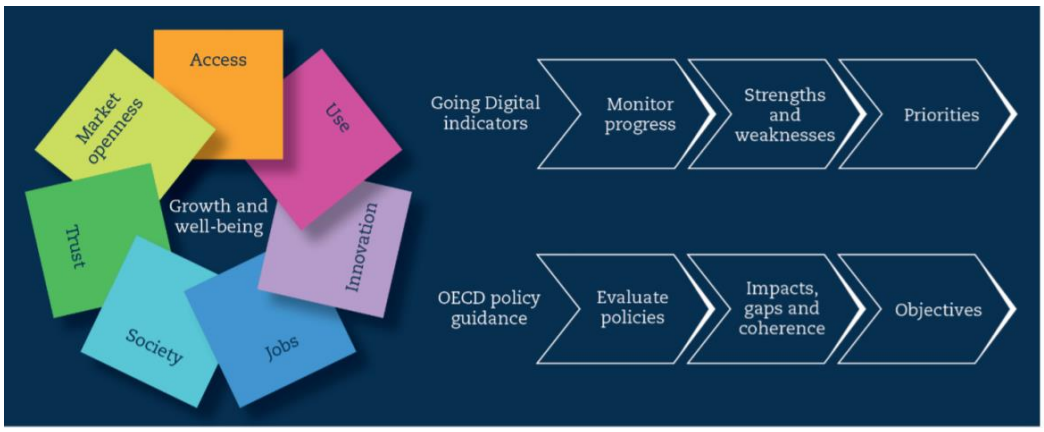
5. **Society** – Digital technologies affect society in complex and interrelated ways, and all stakeholders must work together to balance benefits and risks. In addition, digital transformation can lead to a prosperous and inclusive society.
6. **Trust** – Trust in digital environments is essential; without it, an important source of economic and social progress will be left unexploited.
7. **Market openness** – Digital technologies change the way firms compete, trade and invest; market openness creates an enabling environment for digital transformation to flourish.

Each of the dimensions includes a number of indicators for a total of 45 indicators for mapping the existing state. According to the OECD, these indicators were created to withstand a fast rate of change and to allow regular comparison between countries.

Since each country has its own unique characteristics, the OECD recommends guidelines for creating a strategy to realize the potential of digital transformation (Figure 10). The organization emphasizes that, in any country, collaboration is required between the various players, and recommends a supporting government body. Such body would be responsible to coordinate the work of various ministries, conduct evaluations and supervise the implementation of the strategy. In addition, the OECD advises countries to include policies in all of the aforementioned areas concurrently.

Beyond that, countries need to establish guidelines that are suitable to their characteristics and are in line with existing policies. These guidelines may be used to establish priorities and set the goals of the strategy. Furthermore, the existing situation should be assessed in order to determine the right strategy.

Figure 10: OECD strategy for promoting digital transformation



Source: OECD (2020b).

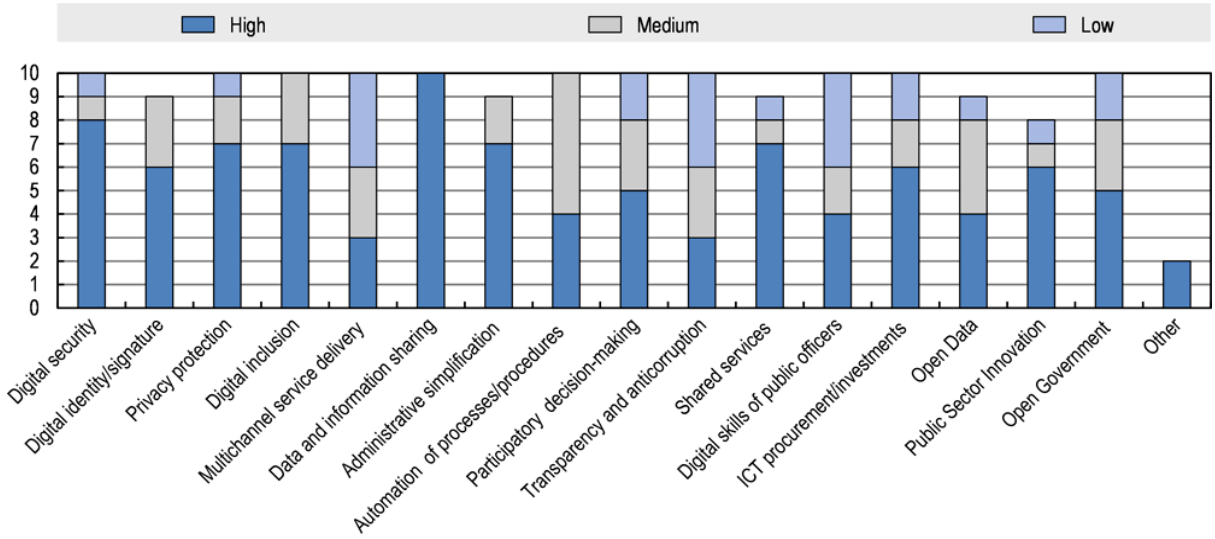
The work undertaken in the Going Digital project has led to a set of nine proposed actions that are a direct continuation of the digital strategy suggestions presented above. The organization recommends to place these at the top of the list of priorities regarding digital transformation:

1. Make the digital transformation visible in economic statistics.
2. Understand the economic impacts of digital transformation.
3. Measure well-being in the digital age.
4. Design new approaches to data collection.
5. Monitor transformative technologies (notably the Internet of Things, artificial intelligence and blockchain).
6. Make sense of data and data flows.
7. Define and measure the skills needed in the digital era.
8. Measure trust in online environments.
9. Assess governments' digital strengths.

The challenge is not to introduce digital technologies to public administration, but to integrate their use in the efforts to modernize the public sector. The capabilities of the public sector, its work processes, business processes, operations, work methods and needs should be adjusted to the existing dynamics with various stakeholders, who in many cases are already working in a digital environment, particularly service providers and service recipients. The implementation of more open approaches to policymaking and to public service provision requires governments to reorganize around the expectations of users, their needs and supplementary requirements, instead of around the internal logic and needs of governments themselves. To do that, the digital strategies of governments must integrate well with overall policy and the way services are designed so that relevant entities outside the government are taken into consideration, and the final results are relevant for them.

Countries have different strategies of digital governance focusing on different areas and issues in the digital development process. Figure 11 shows that sharing data in the public sector is the only strategic issue that is important and relevant to most countries. Other issues that were defined as important are data security, digital identification, protection of privacy and service sharing (for example, infrastructure, platforms, software). Digital inclusion, innovation in the public sector, ICT acquisitions and investments – are also ranked high on the agenda of the represented OECD countries.

Figure 11: priorities in promoting digital strategies in OECD countries



Data from Colombia, Denmark, Estonia, no way, Mexico, the Netherlands, New Zealand, Spain, Sweden, and Switzerland.

Source: OECD (2019e).

6. The relationship between digital transformation and per capita GDP

In order to examine the relationship between per capita GDP and existing indicators: OECD Going Digital, Doing Business and Digital Services Trade Restrictiveness Index (STRI), we used OLS regressions where the dependent variable is the log of the per capita GDP and the explanatory variable is the Going Digital, Doing Business or STRI indicator. We found that the Going Digital indicator had a strong significant relationship even when other indicators were constant. This means that the Going Digital indicators are the best explanatories for the per capita GDP log (Table 2).

Table 2: OLS regression analysing per capita GDP

Per capita GDP log	**1**	**2**	**3**	**4**
Going Digital	0.02***			0.02***
	(0.00)			(0.00)
Doing Business		0.05***		-0.00
		(0.01)		(0.01)
STRI			0.00	-0.00
			(0.00)	(0.00)
Intercept	9.44***	6.91***	10.5***	9.57***
	(0.12)	(0.85)	(0.16)	(0.68)
Observations	35	36	36	35
R squared	0.748	0.350	0.005	0.758

* p < 0.05, ** p < 0.01, *** p < 0.001; standard deviation in parenthesis.

Source: OECD and Aaron Institute processing.

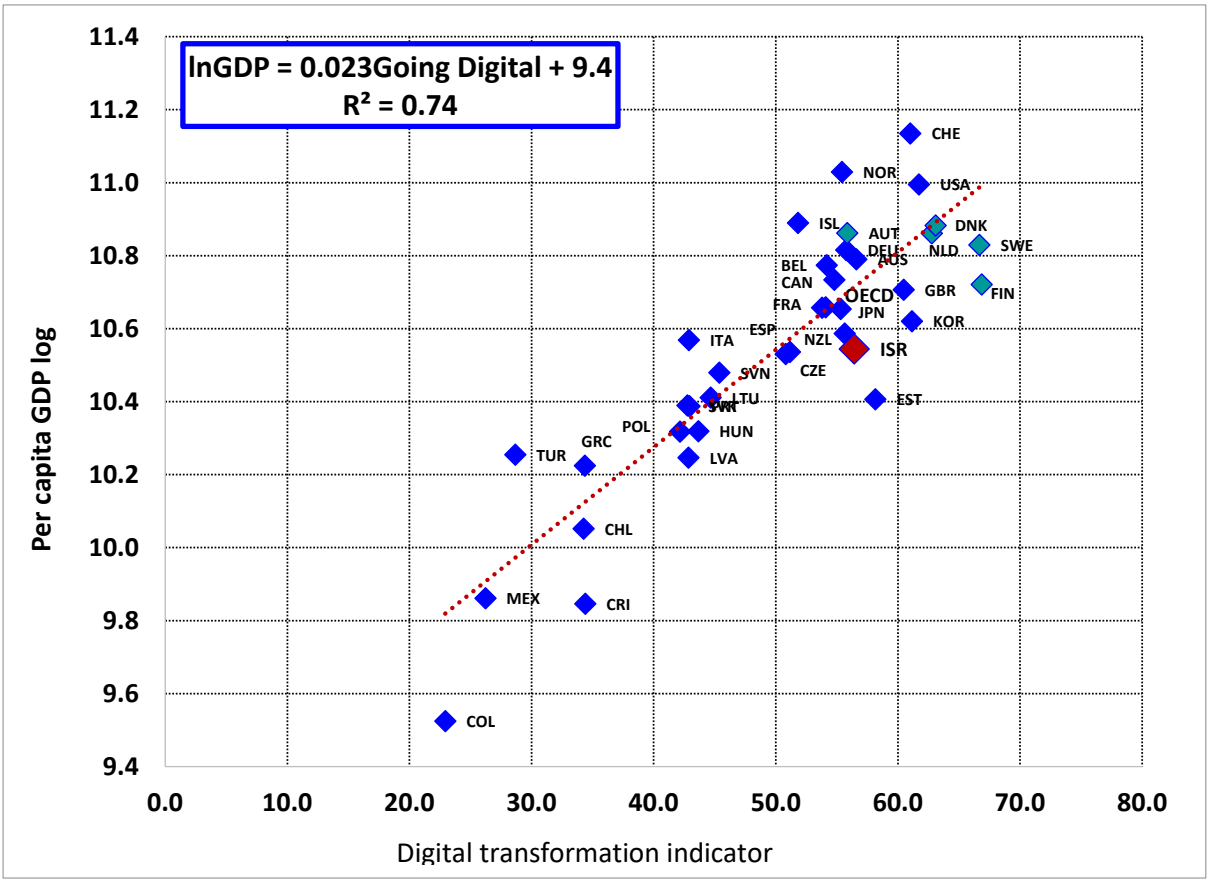
Next, we focused on the indicators of the Going Digital model to understand its components and their relationship with per capita GDP. Figure 12 shows the relationship between the digital transformation indicator and per capita GDP. The digital transformation indicator is an integrated indicator consisting of six dimensions (excluding "trust", for which there is very little data regarding Israel), and the figure shows the Distance to Frontier (DTF), which is the gap between a country's score and the best score in the same dimension. For indicators whose high value indicates an inferior digital position, DTF is calculated using the following formula:

$$100 \times \frac{maximum\ indicator - indicator\ of\ country\ i}{maximum\ indicator - minimum\ indicator}$$

For indicators whose high value indicates a good digital position, DTF is calculated using the following formula:

$$100 - 100 \times \frac{maximum\ indicator - indicator\ of\ country\ i}{maximum\ indicator - minimum\ indicator}$$

Figure 12: Distance to Frontier analysis – six digital transformation indicators and per capita GDP log



Source: OECD and Aaron Institute processing.

The figure shows that Israel, marked in red, is lower than the benchmark countries, marked in green, in the promotion of digital transformation and per capita GDP log. It is interesting to note that Austria, whose digital transformation level is similar to that of Israel, is ranked higher in per capita GDP. This suggests a possibly more efficient utilization of the achieved level of digital transformation.

Next, we ran an OLS regression using six of the dimensions of Going Digital (excluding "trust" due to lack of data for Israel) as the explanatory variables and the per capital GDP log as the dependent variable. As can be seen, all six indicators corelate with 77.7% of the per capita GDP log. We also found a positive and statistically significant relationship between each of the indicators and the per capita GDP log (Table 3). The dimensions of Access, Society and Jobs have the highest correlation with the per capita GDP log.

Table 3: OLS regression examining the relationship between six digitalization indicators and per capita GDP log

Per capita GDP log	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Access	0.017***						0.008*
	(0.002)						(0.004)
Use		0.014***					-0.01
		(0.002)					(0.003)
Society			0.015***				0.005
			(0.002)				(0.03)
Jobs				0.015***			0.004
				(0.002)			(0.003)
Innovation					0.013***		0.04
					(0.003)		(0.02)
Market openness						0.011**	0.001
						(0.004)	(0.003)
Intercept	9.596***	9.869***	9.673***	9.832***	10.093***	10.02***	9.458***
	(0.118)	(0.124)	(0.129)	(0.123)	(0.114)	(0.202)	(0.136)
Observations	35	35	35	35	35	35	35
R squared	**0.687**	0.514	**0.607**	**0.540**	0.376	0.187	0.777

The seventh dimension was excluded due to lack of data for Israel.

* p < 0.05, ** p < 0.01, *** p < 0.001; standard deviation in parenthesis.

Source: OECD and Aaron Institute processing.

We then used OLS regressions to examine the relationships between the various dimensions and the per capita GDP, with the per capital log as the dependent variable and the indicators of the different Going Digital dimensions as the explanatory dimensions. Table 4 shows the relationships between the seven indicators under the Access dimension. All indicators correlate with 77% of the per capita GDP. The indicators "Fixed broadband subscriptions per 100 inhabitants" and "Share of households with broadband connections" have the highest correlation (R squared of 0.437 and 0.513, respectively).

Table 4: OLS regression analysing the relationships between Access dimension indicators and per capita GDP log

Per capita GDP log	1	2	3	4	5	6	7	8
Fixed broadband subscriptions per 100 inhabitants	**0.008*** (0.002)**							0.006** (0.002)
Disparity in broadband uptake between urban and rural households		**0.004* (0.002)**						0.002 (0.002)
M2M (machine-to-machine) SIM cards per 100 inhabitants			0.004 (0.003)					0.002 (0.002)
Mobile broadband subscriptions per 100 inhabitants				0.002 (0.003)				-0.001 (0.002)
Share of businesses with broadband contracted speed of 30 Mbps or more					0.003 (0.003)			0.001 (0.002)
Share of households with broadband connections						**0.015*** (0.003)**		0.3008 (0.004)
Share of the population covered by at least a 4G mobile network							0.007 (0.005)	0.003 (0.003)
Intercept	10.1*** (0.136)	10.4*** (0.127)	10.6*** (0.066)	10.6*** (0.122)	10.4*** (0.190)	9.4*** (0.252)	10.0*** (0.432)	9.2*** (0.311)
Number of observations	24	24	24	24	24	24	24	24
R squared	**0.437**	0.179	0.106	0.023	0.060	**0.513**	0.101	**0.768**

* p < 0.05, ** p < 0.01, *** p < 0.001; standard deviation in parenthesis.

Source: OECD and Aaron Institute processing.

Under the Society dimension, the following indicators had the highest explanatory percentage for per capita GDP: "E-waste generated, kilograms per inhabitant", "Percentage of individuals aged 55-74 using the Internet", and "Percentage of individuals who live in households with income in the lowest quartile who use the Internet" (Table 5). These three indicators are also statistically significant, as well as the indicator "Top-performing 15-16 year old students in science, mathematics and reading". According to OECD data, Israel's score in this indicator is 29% lower than the average score of the benchmark countries.

Table 5: OLS regression analysing the relationships between Society dimension indicators and per capita GDP log

Per capita GDP log	1	2	3	4	5	6	7	8	9
Disparity in Internet use between men and women	0.002 (0.004)								-0.002 (0.003)
OECD Digital Government Index		0.000 (0.002)							-0.002 (0.001)
E-waste generated, kilograms per inhabitant			**0.010***** **(0.002)**						0.08* (0.003)
Percentage of individuals aged 55-74 using the Internet				**0.007***** **(0.001)**					0.003 (0.03)
Percentage of individuals who live in households with income in the lowest quartile who use the Internet					**0.006**** **(0.002)**				0.001 (0.002)
Percentage of individuals who use digital equipment at work that telework from home once a week or more						0.003 (0.002)			-0.002 (0.001)
Top-performing 15-16 year old students in science, mathematics and reading							0.007* (0.003)		0.002 (0.002)
Women as a share of all 16-24 year-olds who can program								0.002 (0.002)	0.000 (0.001)
Intercept	10.5*** (0.316)	10.6*** (0.132)	10.0*** (0.1)	10.2*** (0.097)	10.3*** (0.108)	10.5*** (0.098)	10.2*** (0.181)	10.5*** (0.176)	10.0*** (0.221)
Number of observations	18	18	18	18	18	18	18	18	18
R squared	0.019	0.001	**0.697**	**0.603**	**0.463**	0.128	0.271	0.033	0.903

* p < 0.05, ** p < 0.01, *** p < 0.001; standard deviation in parenthesis.

Source: OECD and Aaron Institute processing.

Under the Jobs dimension, the indicator "Workers receiving employment-based training, as a percentage of total employment" has the highest correlation with per capita GDP (0.513, Table 6). The indicators "Workers receiving employment-based training, as a percentage of total employment" (not necessary ICT training, assuming that training is an important means to supplement knowledge and skills and is essential for re-adapting in a digital age) and "ICT task-intensive jobs as a percentage of total employment" have a positive and statistically significant relationship with per capital GDP log.

Table 6: OLS regression analysing the relationships between Jobs dimension indicators and per capita GDP log

Per capita GDP log	1	2	3	4	5	6
Workers receiving employment-based training, as a percentage of total employment	0.005***					0.005*
	(0.001)					(0.002)
ICT task-intensive jobs as a percentage of total employment		0.004*				0.000
		(0.002)				(0.002)
Digital-intensive sectors' share in total employment			0.002			0.002
			(0.003)			(0.002)
New tertiary graduates in science, technology, engineering and mathematics, as a percentage of new graduates				-0.003		-0.002
				(0.003)		(0.002)
Public spending on active labour market policies, as a percentage of GDP					0.003	0.002
					(0.002)	(0.001)
Intercept	10.315***	10.441***	10.546***	10.784***	10.538***	10.276***
	(0.083)	(0.100)	(0.188)	(0.141)	(0.085)	(0.217)
Number of observations	21	21	21	21	21	21
R squared	0.513	0.224	0.017	0.051	0.116	0.592

* p < 0.05, ** p < 0.01, *** p < 0.001; standard deviation in parenthesis.

Source: OECD and Aaron Institute processing.

These regressions are a useful tool for factoring and screening indicators into critical and significant components according to their correlation with per capita GDP. The findings allow us to examine the specific sub-indicators according to their importance and their effect on per capita GDP. We should also consider the current disparity between Israel and the benchmark countries. For example, "Percentage of individuals aged 55-74 using the Internet", correlating to 60% of the change in per capita GDP and a 3% disparity with the refence counties, versus "Top-performing 15-16-year-old students in science, mathematics and reading", correlating to 27% of the change in GDP but with a disparity of 16% with the benchmark countries.

Compared to other tools for developing priorities and strategic plans, this method focuses on specific indicators and allows us to refer to specific areas considering the existing situation to maximize benefits. It also allows us to allocate budgets in intelligently and in a focused way. Furthermore, regular measurement allows control, re-adjustment, when necessary, and comparison to other countries.

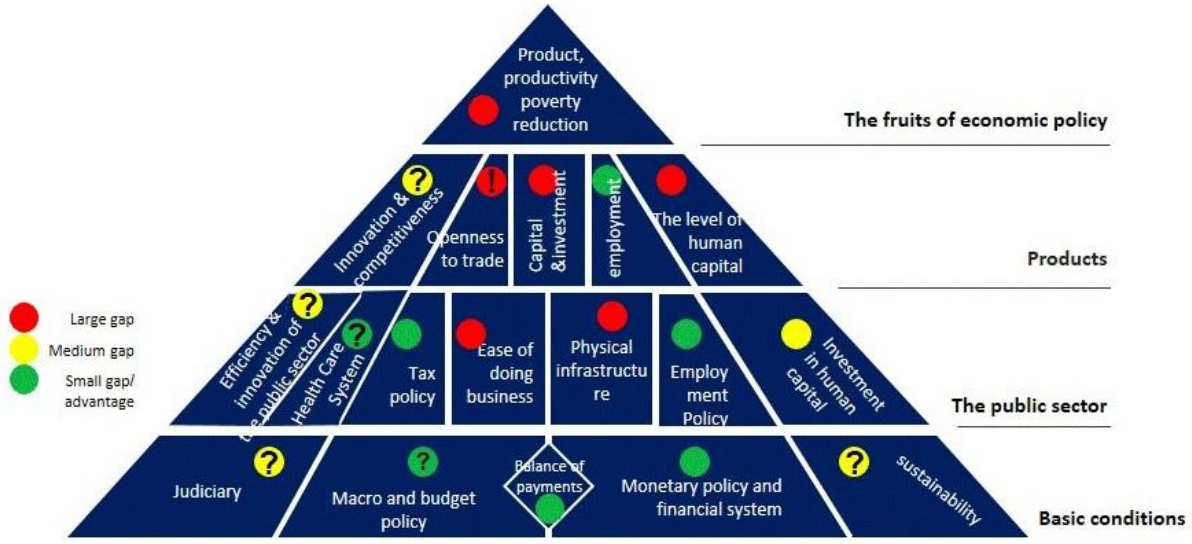
7. Using the digital transformation indicators to set priorities

The pyramid of continued growth reduction of poverty (Figure 13) is used as a methodological framework for the work of the institute and is updated from time to time in accordance with the products of works and the state of the economy. The base of the pyramid represents the basic institutional conditions necessary for the proper functioning of a modern economy, with efficiency determined by the inputs of the public sector in the level above.

The second level of the pyramid represents the inputs and policies of the public sector. These are the inputs required for a high functioning modern economy: an effective public sector acting to ensure stability and effective basic conditions, the quality of the health system, convenient business regulatory environment, an employment encouraging tax system, investment and entrepreneurship, high quality physical infrastructure, investment in education, encouragement of quality human capital development, market openness and investment in research and development.

The third level of the pyramid represents market performance in various areas that contribute directly to growth and reduction in poverty. These components are the production factors of the production function of the market that are influenced by government activity as represented in the second level, but are not directly determined by it. In this sense, they can be seen as the product of government activity.

Figure 13: the pyramid of continued growth and reduction of poverty



Source: Eckstein et al. (2019).

In order to set priorities for investment in digital strategy, the indicators of the seven dimensions of Going Digital were allocated according to their content to the different parts of the pyramid, as can be seen in figures 14 and 15.

Figure 14: allocation of Going Digital indicators to the Pyramid – base levels

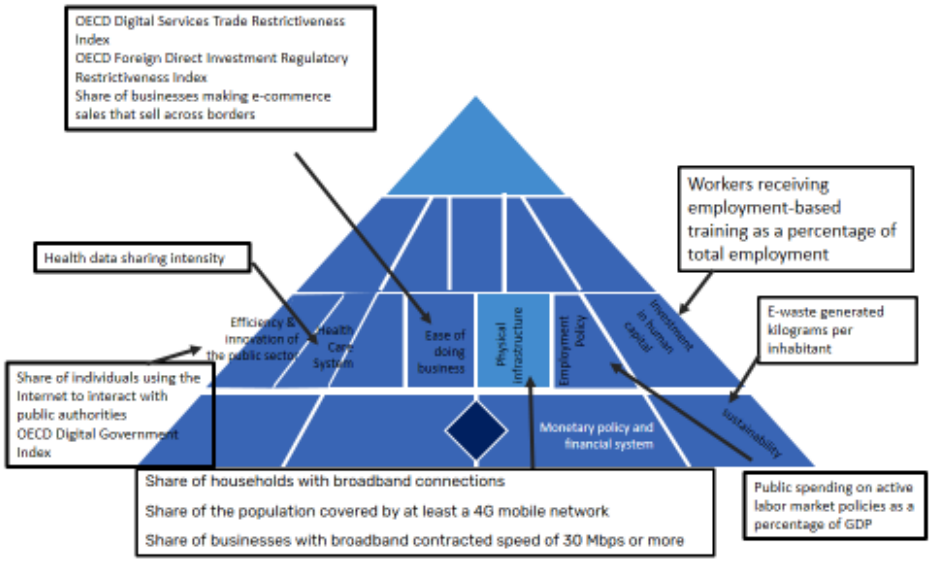
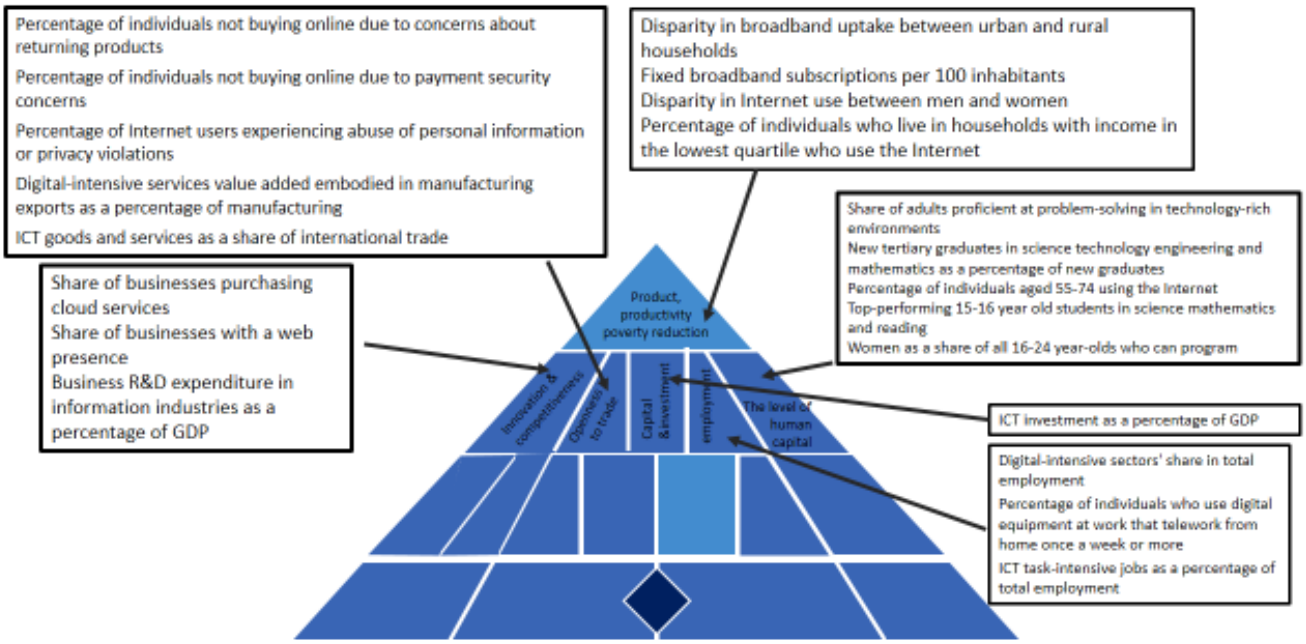


Figure 15: allocation of Going Digital indicators to the pyramid – government activity products



Next, after allocating and mapping the main indicators to the levels and subjects of the pyramid, we ignored the indicators defined by the OECD and examined specific indicators, evaluating their relationship with per capita GDP and whether the regression supports the priorities marked by the pyramid.

Table 7 presents the results of the regression where the explanatory variables relate to the distribution of infrastructure and connection to infrastructure, and the dependent variable is the per capita GDP log. both indicators are statistically significant, in other words the level of infrastructure determines not only the distribution of infrastructure but also how many people are actually connected to it. Both together correlate with 63% of the GDP and represent a reduction in disparity, poverty and inequality.

Table 7: OLS regression examining the relationships between infrastructure distribution, connection and per capita GDP log

	Per capita GDP log	Aaron Institute pyramid
Share of the population covered by at least a 4G mobile network	0.004* (0.002)	Infrastructure
Fixed broadband subscriptions per 100 inhabitants	0.008*** (0.002)	Poverty reduction
Intercept	9.94*** (0.099)	
Number of observations	33	
R squared	0.6347	

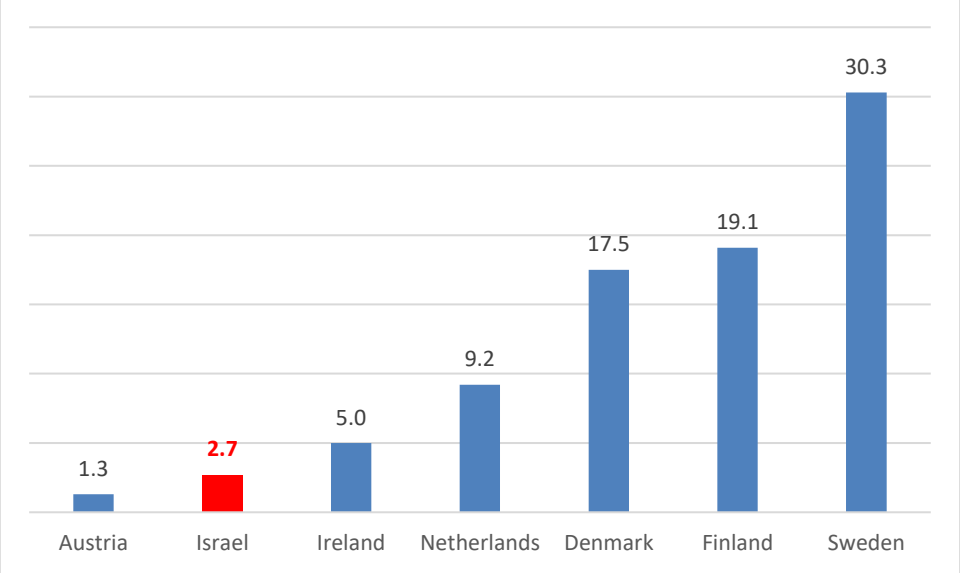
* p < 0.05, ** p < 0.01, *** p < 0.001; standard deviation in parenthesis.

Source: OECD and Aaron Institute processing.

Studies of similar processes conducted in the USA also found that the availability of a digital infrastructure alone does not guarantee use. Not paying the minimum price leads to the prevention of service from users, and, in spite of the social significance of nurturing widespread use and adopting border services, most suppliers and in the USA have unlimited discretion regarding prices and other aspects of the service (Greenstein, 2019).

Data from the Ministry of Communication shows that optical fibres coverage in Israel Is nearly 50% of the areas of the country (the Ministry of Communication, 2021) and it is expected to reach 80% in the coming years. However, according to OECD data, as of the end of 2020, the use percentage of optical fibre-based internet in Israel is only 2.7%, and according to "Digital Israel", this means 553 thousand households (as of the second quarter of 2020). This is significantly lower than the benchmark countries, as Figure 16 shows. The significant disparity may indicate how infrastructure is used, and, perhaps, the level of accessibility of infrastructure among the general population.

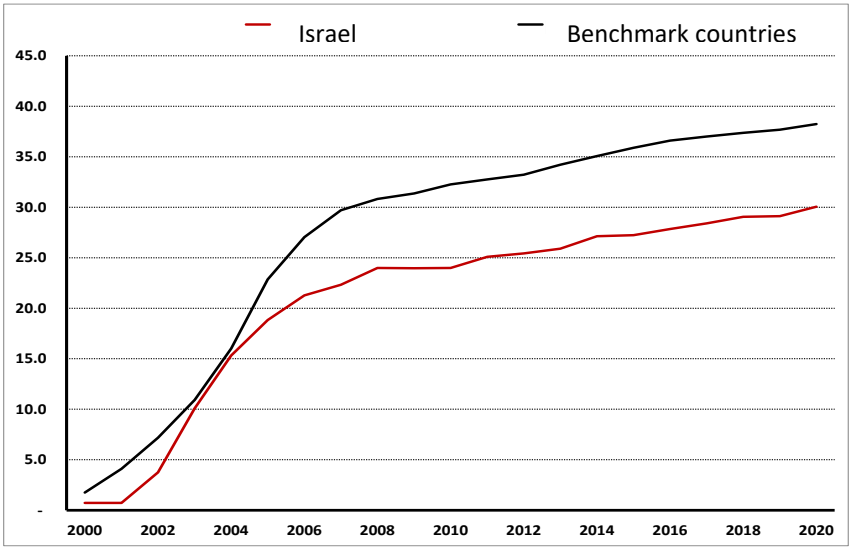
Figure 16: fibre-based internet subscribers per 100 inhabitants



Source: OECD and Aaron Institute processing.

Figure 17 shows that a 20% gap in the number of broadband subscribers is preserved throughout the last 20 years. This variable is important because research shows that investment in ICT which is mostly reflected in the percentage of broadband subscribers per 100 inhabitants has a strong positive correlation and causal relation with GDP per worker, with a flexibility of 0.4 between variables (Waqa, 2015).

Figure 17: broadband subscribers per 100 inhabitants in Israel and the benchmark countries 2000 – 2020



Source: The World Bank.

Following the examination of the indicators, we used a regression where the explanatory variable was "Share of adults proficient at problem-solving in technology-rich environments" (Table 8). The table shows that this indicator alone has a correlation of 75% with per capita GDP, therefore the level of human capital is important, and its effect is significant and critical.

Table 8: OLS regression examining the relationships between the human capital indicator and per capita GDP log

	Per capita GDP log	**Aaron Institute pyramid**
Share of adults proficient at problem-solving in technology-rich environments	0.008***	Human capital level
	(0.001)	
Intercept	10.1***	
	(0.068)	
Number of observations	24	
R squared	0.7537	

* p < 0.05, ** p < 0.01, *** p < 0.001; standard deviation in parenthesis.

Source: OECD and Aaron Institute processing.

Finally, we used a regression to assess the business variables as explanatory variables, variables related to innovation and creativity and the ease of conducting business (Table 9). The four presented indicators have a correlation of 66% with per capita GDP. We further found that the indicator "Share of businesses making e-commerce sales that sell across borders" and "Share of business with internet presence" are statistically significant. The conclusion is that promoting digital transformation in the business sector and for the business sector is important.

Table 9: OLS regression analysing the relationships between business variables and per capita GDP log

	Per capita GDP log	Aaron Institute pyramid
Score on OECD's digital STRI index	0.001 (0.002)	Ease of conducting business
Share of businesses making e-commerce sales that sell across borders	**0.006***** **(0.002)**	Ease of conducting business
Share of businesses purchasing cloud services	0.001 (0.002)	Innovation and competitiveness
Share of business with internet presence	**0.007**** **(0.002)**	Innovation and competitiveness
Intercept	9.96*** (0.123)	
Number of observations	31	
R squared	0.6594	

* p < 0.05, ** p < 0.01, *** p < 0.001; standard deviation in parenthesis.

Source: OECD and Aaron Institute processing.

It should be noted that the regressions presented here only show correlation between the variables and not causation. A high R^2 does indicate high correlation, but it is likely to assume that there are other factors involved that are not assessed by the regression, and, therefore, the resulting coefficients are biased. Notwithstanding this caveat, we can safely say that, since we know that ICT and its related growth are connected to government regulation and government investment in ICT, the regressions show that government investments affect the GDP and are translated to an increase in GDP. We have no intention of using regressions to assess this effect because of the previously mentioned bias. We assume that total affect is in accordance with the coefficients of the production function, as analyzed in previous works of the Aaron Institute (for example, Eckstein, Menahem-Carmi and Sumkin, 2021). However, in this paper we suggest using the priorities derived from the regression analyses to help in setting priorities and choosing areas for investment and development of a digital strategy.

8. Building an overall strategic plan for digital transformation

Governments have a critical role in promoting digital transformation. The role of the government may be divided into four areas:

1. Investment in digital infrastructure

Access to good quality internet infrastructure is not a luxury but a fundamental need similar to roads or electricity with tremendous social and economic implications. Market failures and infrastructure access in small and peripheral towns require government intervention, especially in planning and supervising implementation, and, partially, in financing. Such involvement would guarantee access to quality infrastructure to the entire population of Israel. Further down the line, emphasize should be place on use rather than the existence of infrastructure, for example, prices that would allow access and use by all population groups. Accessibility is a necessary condition for reducing inequality and providing equal opportunities regarding services, access to information, and more. At the top of the priorities list are the speedy promotion of optical fibre coverage, a G5 cellular network and the creation of a could services system for the government and the private sector in Israel.

2. Digital transformation of government services

A full system of digital government should be established, and this requires secure communication and information sharing and the trust of users to function optimally. This stage should include:

- Digitalization of all government ministries.
- Digitalization of business regulation, conducting bureaucratic procedures online quickly and efficiently, including opening a business, product import licensing, national insurance, and more.
- Digitalization of payments in the market and support for implementation in the private sector, including: bank authorizations, digital signatures and more.
- Promoting a culture of data use in the public sector.

3. Removing obstacles, solving market failures, reducing bureaucracy and regulation

The government should act to remove additional obstacles that may cause market failures, particularly in the area of bureaucracy and regulation. Legislation should be adjusted for the purpose of data sharing, digital signatures, digital identification, and issues related to information security and privacy.

4. Promoting digital literacy

Promoting digital skills among all population groups, particularly among populations that lack digital skills, such as the Arab population, the Orthodox Jewish population and the elderly.

Measuring digital transformation in the government

After setting priorities, the next stage in the process of promoting a digital transformation strategy is the measurement stage, examining the quality and contribution of various actions. For this purpose, measurable goals should be set, and a dynamic process of continuous monitoring and measurement is required. We would then measure the effectiveness (whether a project has the desired effects), the relevancy and efficiency.

Relevancy means the measure of fitness of political or strategic goals to the needs or social economic factors driving digital promotion. These provide the justification for the project of digital government. One of the indicators in this area is the level of demand for digital government among population groups, assessed by evaluating the ability of the population to connect to services.

Efficiency, and service efficiency, can be measured and determined by the extent of digitally conducted transactions, the percentage of public services provided digitally, the number of new services provided digitally, the coverage of digital services (business, private sector) and measurement of satisfaction (or complaints) concerning the provision of digital services.

Effectiveness means an evaluation of the measure in which projects result in the desired effects.

The Standard Cost Model (SCM), intended for the measurement of the economic price of bureaucracy and regulation for the business sector, can also be used to measure projects of digital transformation (Sumkin, 2020). The model's methodology suggests breaking legislation into information obligations, and a measurement of the economic cost (including time calculations) involved in the meeting such obligations. This measurement would allow a measurement with standardization over time: measurement of the time to receiving a response to a digital query, and measurement of changes in the costs of bureaucracy and regulations as a result of service digitalization (for businesses, citizens and the government).

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