

The value of DDI (Data Driven Innovation)

Executive Summary

1. Executive summary

Purpose And Background

Producing innovative outputs from data is known as “data driven innovation” (DDI). Myriad studies have shown that DDI has become a significant growth driver in the digital information age.

The accelerated development of information technologies in recent years has fostered the understanding that data is the most important resource in our world today. Nonetheless, while data is a highly accessible resource, it is not sufficiently exploited. Those who will know how to exploit it wisely will enjoy huge economic and social advantages.

The enormous volume of digital information in the world more than doubles every two years, and data is currently related to everything and everyone. At the same time, currently available technologies can now produce a vast array of data outputs that may be able to drive progress worldwide.

DDI refers to **innovative applications derived from data analytics**. Data is collected in countless datasets, internal company datasets as well as external datasets such as government, fee-based or other open datasets. In fact, the recognition that data is the lifeline of innovation in the 21st century paves the way to optimal exploitation of existing data. The economic and social potential of data-driven innovation continues to grow alongside development and improvement of data analysis technologies. A study conducted in 2013 showed that access to open data can produce \$3 trillion in additional value annually to the world economy (McKinsey Global Institute, 2013).

DDI presents huge potential for economic and social advancement, with varying effects on different businesses. According

to the OECD¹ data-driven innovation takes place when different technologies and techniques are used to “define and capture” relevant data, process and analyze it in order to produce innovative outputs in several innovation-related areas:

- Enhancing research and development (data-driven R&D);
- Developing new products (goods and services) by using data either as a product (data products) or as a major component of a product (data-intensive products);
- Optimizing production or delivery processes (data-driven processes);
- Improving marketing by providing targeted advertisements and personalized recommendations (data-driven marketing);
- Developing new organizational and management approaches or significantly improving existing practices (data-driven organization)

The techniques and methodologies used for data collection and processing do not have to be advanced, as use of data to support successful products and services, to optimize business processes or to facilitate data-based decision making is neither new nor innovative. Innovation is found in the output produced from the data – output that must be innovative for the organization, market or the world. There are times when the innovative use of data is on such a large scale that it leads to an entirely new product or service. Waze is a case in point. A process, product or service that is known but new to the organization is also considered data-driven innovation.

The purpose of the study is to assess the value of data-driven innovation to the Israeli economy, and to propose the best government policy for making Israel a DDI superpower that will know how to realize its DDI potential for economic growth, enhance competitiveness and reduce cost of living in Israel.

The study examines three central questions: the potential economic value of DDI for the State of Israel, recommended government policy for realizing this potential, and how to identify government datasets that should be made public.

¹ Definition of DDI as presented in the 2013 OECD Report on DDI, Exploring Data-Driven Innovation as a New Source of Growth (OECD, 2013).

Zillow – Asset Valuation Platform

The Zillow website, established in 2006, currently serves those with ownership rights of local real estate assets – buyers, leasees, leasers, sellers, financiers and others.

The website consumes vast amounts of information published by many entities, both private and government, including information about asset sales, the environment, neighborhood characteristics, maps and educational institutions. Using complex algorithms the website estimates the market value and monthly rent price of more than 110 million assets throughout the United States.

The aim of the company is to create full transparency about real estate information and to impart advanced analysis tools to empower consumers.

Zillow developed a value index, Zestimate, that has become part of the everyday lexicon of realtors and homeowners throughout the United States. A study conducted at Stanford University in 2014 examined the sensitivity of sale prices to online price estimates in the real estate market. The study used house price estimates from the Zillow website and found that online price estimates can have a direct and large impact on real estate price dynamics (Lee & Sasaki, 2014). This points to the strong influence of DDI on the real estate market.

DDI Contribution To The Modern Economy

An organization that adopts DDI enjoys vital business benefits that lead to improved productivity and economic growth to the organization and to the economy in general.

Increased Output and Productivity

Productivity is an important component in the growth of the modern economy. The key to increased productivity is not in production inputs, but in the technology and innovation outputs that enable increased production from given inputs.

Productivity is the total value of the goods and services produced during one work hour, in other words – output per hour of work. Numerous economic studies conducted since the 1950s have shown that **increased production inputs cannot explain economic growth, and that in fact the main driver of economic growth is increased value created from existing resources**. In other words, increased output is the result of improved production processes and technology. The effects of total productivity growth that are not explained by increased inputs are known as the “Solow Residual”² or Total-Factor Productivity (TFP).

Since technology and innovation are the major causes of increased productivity, DDI, by definition, provides a huge potential for productivity improvement.

The business performance of companies that use information and information analysis is usually higher owing to the contribution of this information to DDI processes. Technology and innovation substantially impact productivity, and in fact the

way inputs are exploited has a greater effect than the inputs themselves. Process excellence, marketing excellence and the creation of new products, services and businesses can increase revenues without substantial changes in inputs (capital and labor), and are therefore indispensable for improved productivity.

A study conducted by the OECD in 2014 found that DDI can improve a company's productivity by 5% - 10%. The researchers also indicated that productivity growth differs between economic sectors, whereby DDI may result in higher productivity in certain sectors (according to several experts for example, tenfold productivity growth in the agriculture sector).

Economic Growth and the Relationship to New Products and Services

DDI may, as noted, result in new products and services and even the development of new activity areas in existing companies and new technological initiatives. The opportunity to create new income sources arises in part from the “information as business” approach, which reflects the growing practice of companies to create additional income

² The Solow Residual is named after the economist and Nobel Prize Laureate Robert Solow and is also known as Total-Factor Productivity (TFP). Solow Residual describes the factor of productivity growth that is not explained by work inputs (capital and labor).

sources, new business units and entirely new businesses based on information and data.

More Efficient and Transparent Government

In the public sector DDI can contribute to improving operational efficiency and service quality to citizens, and can increase tax collection revenues and reduce tax fraud. A public service that uses DDI can shorten waiting times for public services, receive higher public feedback scores – and improve in the process. Similar to any business entity, DDI can improve public sector operational and managerial efficiency and reduce costs. A study conducted in 2014 found that European Union countries could reduce administrative costs by 15%, equivalent to about € 150-300 billion, if they fully and efficiently used and applied information and data (OECD, 2014).

In countries in which public services are more efficient, waiting times are shorter and government transparency is greater, the bureaucratic burden is usually smaller. Bureaucratic overload is one of the main barriers facing big and small businesses alike. Improving the ability to do business will increase Israel's attractiveness on international indices, as well as its competitiveness, which will lead to local business growth and to the entry of foreign companies.

It is important to remember that the first step towards DDI is to convert data and systems into digital form.

Storing data on servers, the cloud or local storage devices is vital for creating a system in which digital applications can provide data - the valuable resource, to businesses, developers and entrepreneurs. Digitally stored data can be copied, analyzed, transferred and stored. This is vital since only digital data has the potential to provide innovative insights, create new capabilities and form new industries.

Digitization of work processes is necessary to ensure that the data collection process is accurate and reliable. Moreover, in order to guarantee that available data is the most useful and relevant, it should be collected and saved on an ongoing basis as an integral part of work and decision making processes.

The following diagram illustrates the DDI process and its effects on the modern economy:

Data-Driven Innovation process

Existing Data

- Internal datasets
- External datasets: government data, open data, fee-based datasets

Data Processing and Analysis



Innovation

- | | | |
|-----------|--|--|
| Process | | <ul style="list-style-type: none"> • Increase process efficiency • Increase supply chain efficiency • Transform work processes • Data-based decision making |
| Marketing | | <ul style="list-style-type: none"> • Define target audiences • Individually customized marketing and marketing channel optimization • Individually customized products • New product and service lines |
| Business | | <ul style="list-style-type: none"> • Data-based innovative services • DDI infrastructures and tools • Provide DDI services |

↳ Economic growth and improved economic productivity



Israel Lags Behind In Productivity

While GDP in Israel is on the rise, a wide gap still exists compared to the average of developed countries, and to the U.S. average in particular. One fundamental reason is the wide productivity gap between Israel and the OECD countries (hereinafter: comparison countries), particularly the U.S. Israel is also characterized by productivity gaps between the various sectors in the Israeli economy.

Israel has lagged behind OECD member countries for many years, far behind GDP per capita in the U.S. Increasing GDP and narrowing the gap compared with OECD member countries, particularly the U.S., has been the goal of all Israeli governments that aimed to improve the welfare of Israeli citizens.

The GDP per capita gap between Israel and OECD countries remained during the 1990s, and even grew slightly in the beginning of the 2000s. However, a narrowing trend was evident from 2003 between Israel and OECD countries, except for the U.S. that continues to maintain a substantial gap compared to the State of Israel and to the OECD average.

A substantial gap is also found in labor productivity between Israel and countries worldwide, and the gap between Israel and the comparison countries only continues to grow. Thus, while labor productivity in the U.S. grew by about 50% in 1990-2013, productivity in Israel rose by only 25% (!).

A comparison of productivity rates in various sectors of the Israeli economy with the same sectors in the U.S. indicates a gap in all sectors, including sectors in Israel that make up only 25% of productivity in the same sector in the U.S. economy. Large productivity gaps are also evident between the different sectors in the Israeli economy.

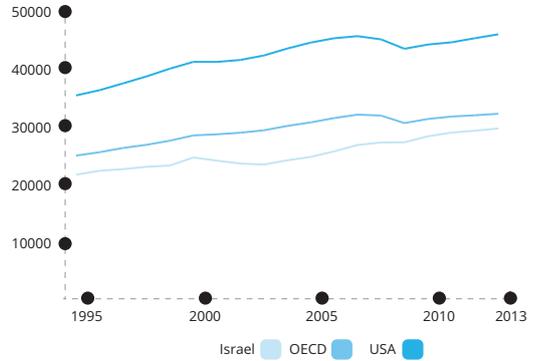
Although Israel has experienced economic growth in recent years, stagnant productivity growth leaves Israel at a relatively low level of GDP per capita in relation to the comparison countries. This conclusion supports the claims expressed by many regarding the need to increase labor productivity in Israel for the benefit of Israeli citizens and to address the sentiment regarding the cost of living.

Economic Value Of DDI To The Israeli Economy

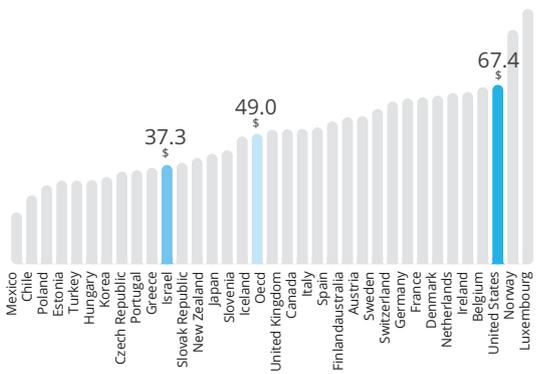
Contrary to the commonly held view that the productivity gap between Israel and the comparison countries has to do with capital and human capital gaps, most of this gap is explained by the "Solow Residual" (TFP), and only a small part from a gap in production inputs.

There is no clear-cut explanation for the substantial difference in TFP between Israel and the comparison countries.

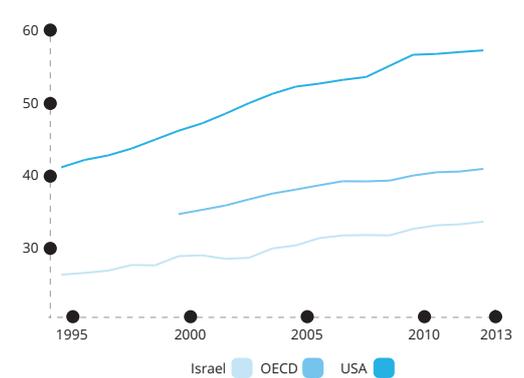
GDP Per Capita development(\$)- Global benchmark



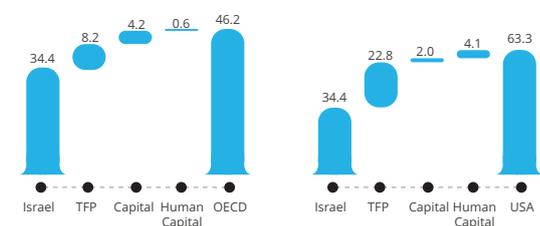
Productivity – Global comparison (\$,PPP, 2014)



Productivity development – Global comparison



Analyzing the productivity gap (\$,2013)



DDI is one of the factors indicated by the OECD as having the primary potential to increase labor productivity. **We maintain that this factor, that takes advantage of the modern era with its computerization capabilities and the quantities of data accumulated, has the potential for increasing labor productivity in the State of Israel and for closing productivity gaps both between economic sectors in Israel and between Israel and the comparison countries.**

In order to assess the importance of DDI to the Israeli economy in general, and its effect on productivity in particular, a perceptual and quantitative study was conducted using a questionnaire to measure the current contribution of DDI to the Israeli economy - at the total economy level and by various economic sectors. Based on the study findings we analyzed the potential effect of DDI on labor productivity in Israel and on potential GDP growth.

In order to isolate the effect of DDI on company productivity, a DDI Index was first developed to measure the extent to which the specific company implements data-driven innovation and/or adopts its applications. We then examined the strength of the relationship between this index and the financial performance of the company in general and revenue per employee (our estimate of productivity) in particular.

Our DDI Index is based on three main DDI drivers: financial investment in data and data analysis, access to and use of data, and the degree of innovation in the company based on exploitation of the data.

The main finding of our study, which is statistically significant, is that **substantial improvement on the DDI Index (half a score point) will lead to a 5% increase in company revenues. This increase**

will be achieved, irrespective of the effect of other input variables. This means: **improvement on the DDI Index of Israeli companies; companies encouraged to collect, process and use internal and external data; creating an environment that encourages innovation and data consumption; and incentivization of companies to produce and consume data -driven innovation - which may lead to notable productivity growth.**

Thus a higher score on the DDI Index of organizations will narrow the productivity gap between Israel and the U.S. and will add about NIS 54 billion to GDP.

In summary, improvement of organizations on the DDI Index will result in the following:



Narrow productivity gap between Israel and U.S.



Increased productivity to ~\$39 (PPP in 2014 terms)

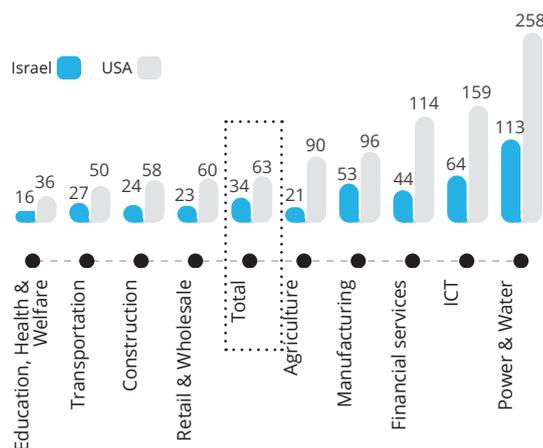


~54 billion NIS
Addition to GDP of Israel



~18 billion NIS
Additional tax revenues to the State

Productivity per segment - Israel and the U.S (\$,2013)



The Economic Value of DDI for Small and Medium - Sized Enterprises

The productivity gaps between small and medium-sized enterprises (SMEs) in Israel and comparable businesses in developed countries are pronounced. The integration of DDI in these businesses will produce positive financial results, substantially greater than the expected results of DDI Index improvement for large companies.

Small and medium-sized enterprises are the main growth driver of developed economies worldwide, among other things because of their substantial impact on GDP and on the labor force. This also holds true for Israel in which most jobs are created by SMEs. Strengthening these businesses is therefore a pre-condition for economic stability. SMEs in Israel are characterized by low labor productivity compared to large companies in Israel and in developed countries. Thus, for example, SMEs constitute about 99.3% of all businesses in Israel and employ 69% of all those employed in the business sector, but contribute only 49% of GDP to the economy (The Small and Medium Business Agency, 2014). Moreover, their productivity is only about 80% of the productivity of small and medium businesses in OECD countries.

The study shows that increased DDI in small and medium-sized enterprises will have a greater effect on their outputs compared to its impact on large companies. Moreover, the findings indicate that the expected growth in revenue per employee will be half a score point on the DDI Index, in other words 8.9%.

In summary, the study findings regarding the effect of DDI on small and medium-sized businesses are as follows:



8.9%

Increased productivity

Compared to 4.7% in large companies



5%

Narrow the productivity gap between Israel and OECD



~7 billion NIS

Addition to GDP of Israel



~2 billion NIS

Additional tax revenues to the State

Managers in SMEs point to less DDI implementation in their companies compared to large companies, on all parameters - they invest less in data infrastructures and in individuals responsible for DDI management and improvement, and in general do not report as much about the use of data for innovation insights. Nonetheless, our study showed that managers in these companies have a better understanding of the value of DDI compared to their counterparts in large companies. When asked about the reasons for the low DDI level in their company, the managers of SMEs indicated lack of knowledge and technology as the main barriers.

For these reasons, despite the fact that they understand and recognize the importance of DDI, managers in small and medium businesses in Israel do not plan to increase the exposure of their employees to reports and data, and indicate that there will not be a growth trend in the use of data for innovation purposes in their company.

The Economic Value of DDI for Non-Technological Sectors

Non-technological sectors in Israel are characterized by lower productivity than technological industries and difficulty in narrowing the productivity gap compared to the same sectors in the U.S. DDI offers significant potential to overcome the barriers and narrow this prolonged gap.

Technological industries are characterized by higher productivity than non-technological industries. Israeli technological industries are gradually narrowing the productivity gap compared to the same industries in the U.S. In contrast, marginal and even negative growth is apparent in the productivity gap, in favor of U.S. non-technological industries compared to their Israeli counterparts.

Every DDI improvement in non-technological companies is related to a 6.4% increase in company revenues, statistically significant at the 0.95 level, compared to a 3.8% increase in technological companies.

In summary, the study findings regarding the effect of DDI on non-technological industries are as follows:



6.4%

Increased productivity



~30 billion NIS

Addition to GDP of Israel



~10 billion NIS

Additional tax revenues to the state

Government Policy To Foster And Advance DDI

The extensive DDI potential for the Israeli economy has yet to be realized. The government can help achieve this potential by formulating a policy that fosters a DDI-rich environment and provides companies with tools to improve their DDI score.

The benefits of DDI for the State of Israel in general and for Israeli companies in particular are significant, yet far from fully realized. To exploit this potential an environment that promotes DDI must be created. The government must play a fundamental role in laying the groundwork for such an environment through a policy that will promote DDI in the public and private sectors. This policy will establish the framework for building information infrastructures available to the public while removing barriers and defining fair operating practices.

DDI integration is not an easy task. It requires learning, knowledge and recognition of the need, qualifying personnel and, of course, the existence of both internal and external datasets. Many Israeli companies acknowledge the need for innovation, its economic contribution and the fact that data is the driver of innovation, yet encounter barriers on the road to realizing this type of innovation. Some companies have yet to understand that DDI is the key to increasing productivity and to dealing with growing competition. Companies are hopeful that the government will act to make data available so that they can translate it economic value.

The role of government to exploit DDI potential includes opening government datasets and creating a suitable regulatory environment for adopting and fostering innovation – all under the appropriate limitations. Governments can open datasets to the public while protecting privacy; ensure accessibility, availability and convenience; and encourage application developers, companies and civil society organizations to utilize this data to generate economic benefits. Government has the power to set policy that will encourage the private sector to realize the economic-business potential DDI can offer, while it continues to uphold civil rights.

Just as an innovative country needs an innovative government, a country with abundant DDI resources needs a government that will harness this resource to fulfill its responsibilities, reap its many benefits and will be committed to actively promoting it in its numerous functions: as consumer, data provider, policymaker and regulator, educator, funder, and to incentivize its use among companies and citizens alike.



Government as Data Consumer

A country rich in DDI resources needs a government that will realize the potential of this resource.

- ▶ Digital in every interaction of government entities with citizens and “customers”
- ▶ Transition to decisions based on and monitored by data
- ▶ Engage with application developers, entrepreneurs and innovative entities in order to institute and implement DDI in the public sector



Government as Data Supplier

The foremost tool for fostering DDI is public access to government datasets that can generate economic and social value.

- ▶ Identify and provide access to datasets in demand
- ▶ Create an accessible and available user interface with advanced analysis capabilities
- ▶ Government entities are required and incentivized to share data

Government as DDI Consumer

By setting an enabling government policy and filling the abovementioned functions appropriately, the government of Israel can create an environment that fosters innovation and data consumption. Such an environment will impact the operation and practices of organizations in both the public and private sectors, heightening the effect of DDI on the Israeli economy. As our research shows, improved DDI will lead to significant productivity growth.

Innovation and excellence in service provision, processes and business is not only the province of the private sector. The public sector also has the impetus to garner the expected benefits of DDI. The important first step in transforming the government into a DDI champion is to ensure that its data is in digital format. In a government based on fax and paper, the discussion about datasets as potential value generators and about business analysis systems and innovation – is futile. The way to reaching the goal of DDI is by digitizing work processes and interfaces with service recipients. Data in digital format must be the basis for every interface of government entities with citizens and “customers”.

In its role as a DDI consumer the government can use datasets and data to make better decisions and innovate government activities. DDI offers an excellent opportunity for government to enhance the efficiency and effectiveness of the services it provides and improve their quality. Data can help government make more informed and evidence-based decisions, and save money in the process, improve the cost-effectiveness of government programs and reduce fraud and abuse of government allowances and benefits.

A government that is a DDI consumer will be a better data supplier. If government uses its own datasets chances are the data will be accurate, updated and user-friendly, and it will be easier to upgrade and enhance when needed. As a DDI consumer the government does not have to develop and implement DDI on its own. It can and should engage with civil organizations, developers and innovating entities in order to establish and reinforce DDI in the public sector.

Government as DDI Supplier

The government has a huge data archive with untold potential for economic growth and social gains. Data collected by a government elected by the people is considered to be public property entrusted to the care of the government. This may range from statistical data collected by the Israel Central Bureau of Statistics or other research entities, data about individuals and businesses gathered in the course of providing state services, through data related to phenomena such as climate

change and car accidents and data in other areas for which public entities are responsible.

Open government is the idea that government and institutions work better for citizens when they are transparent, engaging and accountable. These strengthen democracy and drive innovation and economic returns. Transparency is considered a hallmark of open government, meaning that the public should have access to government-held information and be informed of its use. Open government does not only involve the act of opening datasets – it requires a well-formulated policy that is of top priority for government and spearheaded by a government entity with a horizontal span of control.

In its role as data supplier the government must open datasets in a process that takes into consideration the economic potential of DDI in different economic sectors and the removal of major barriers to DDI and innovation. These barriers include difficulty providing quality and accurate data that can be conveniently and effectively integrated, limited rights regimes (such as fee-based data and use of “all rights reserved”) and the challenges to privacy protection and national security. It is important to emphasize that citizen privacy and security should not be jeopardized in the name of open government, but at the same time should not be misused to avoid its implementation. Many high priority datasets do not entail privacy and national security issues and, moreover, tools are available to deal with them if and when they are of concern.

Government as Policymaker and Regulator

The information age raises fundamental regulatory issues that may affect companies in their quest to realize DDI. This holds true for innovation based on government data as well as innovation derived from data collected by private entities.

As regulator the government can promote DDI through a legislative infrastructure and by establishing policies fostering optimal data use and distribution. Current legislation in Israel is limited, outdated and imposes barriers to the distribution and use of government data. These barriers can be removed by establishing legal criteria and initiating regulatory changes better suited for the information age that will provide flexibility yet ensure fundamental principles such as privacy protection. These changes include, among others, a set of tools that will serve all government entities handling data of a private nature, and address privacy issues while reducing bureaucracy and costs.

Intellectual property must also be addressed in promoting DDI, particularly uncertainty regarding the rights of government and public entities to use published information. The government must create a regulatory framework that will permit the use of



Government as Regulator

Create a suitable regulatory environment for adopting and promoting innovation while ensuring that appropriate limitations are maintained.

- Update legislation pertaining to privacy and datasets and establish legal criteria for non-release of information.
- Build a toolbox for handling data of a private nature and its use by government entities.
- Establish regulation that fosters opening private datasets in order to rationalize markets.



Government as Educator

Develop and qualify the future technological generation that is needed in the information age and raise awareness among Israeli companies about the benefits of DDI.

- Add tracks to qualify and train data scientists
- Encourage or conduct virtual training programs to raise awareness about DDI and impart basic skills
- Introduce the idea of data use as a basic tenet of management in the 21st century

Government as Funder



Offer incentives for adopting DDI processes and practices, with an emphasis on SMEs and non-technological businesses

- D Treat DDI similar to business R&D in terms of fostering mechanisms and incentives
- D Provide technological infrastructures (cloud, software, etc.) to SMEs and non-technological businesses

this data with maximum certainty. The overarching goal is that all actors will be able to make informed decisions and that the courts will not be overloaded with intellectual property claims.

Finally, the government can encourage private entities to disclose data in the aim of improving market rationalization or solving fundamental market failures. Thus, for example, the Israeli government succeeded in its efforts to increase transparency in the pension and provident fund market, and to strengthen competition between retail food chains.

Government as Educator

A DDI-supporting environment is not complete without the human factor. In their capacity as managers and employees individuals are consumers of both data and innovation while data scientists and the those charged with technology actually enhance and process data as the basis for innovation.

In its role as educator the government can promote DDI at two levels. First, it must develop and ensure a sufficient supply of individuals with advanced data and analytics expertise by creating dedicated education tracks in formal education institutions or by establishing suitable professional qualification programs. This is critical in light of the severe shortage of information science experts throughout the world. Second, the government must raise awareness of the immense value that can be gained from datasets, and also promote knowledge and skills in the information field. This is particularly important for SMEs and traditional economic sectors for which DDI integration holds great promise to increase productivity. It is just as vital, if not more so, for SMEs and non-technological sectors that have large knowledge gaps that hinder their ability to increase productivity and to enjoy the benefits of DDI.

Government as Funder

Government sometimes understands the considerable economic benefits it stands to gain from intervening steps and processes that do occur in the normal course of market activity. This may be due to lack of awareness, cultural differences or because these steps are not economically viable for companies.

In these cases the government may decide to directly incentivize companies to take these steps by offering grants or to support them indirectly through money-equivalent benefits. For example, the state supports data-driven R&D through the Chief Scientist and grants tax benefits for integrating target audiences (e.g. the ultra-orthodox Jewish population) into the workplace. Through a range of benefits and measures the government encourages companies to take the necessary steps they would otherwise not consider to implement DDI.

In its role as funder the government should focus on companies with a strong potential to generate economic gains, that without its support would be slow in adopting DDI processes and practices. This includes SMEs, technological initiatives and non-technological businesses. It is noteworthy that these companies indicated that the technological barrier was the most significant obstacle they face.

In its funding capacity the government can also promote DDI in the private sector through direct funding by awarding grants to DDI-based businesses, and by indirect funding in the form of tax benefits.

After all is said and done, technological infrastructures are the most important support the government can provide as a funder to promote DDI, particularly to SMEs and non-technological businesses.

Three DDI Policies

Three main policies can be employed to address DDI in Israel: an **enabling policy** that focuses on realizing the economic potential of DDI; a **limiting policy** that delays and/or prevents actualization of the potential; and a **non-policy** that in effect maintains the existing situation without changing current Israeli policy.

An enabling policy seeks to actualize DDI potential and promotes actions needed to achieve this goal. These actions will include adherence to commonly accepted open government principles, opening government datasets while defining legal criteria to ensure privacy protection, and establishing a DDI-supporting regulatory framework. **Untapped DDI potential can only be fulfilled by implementing an enabling policy.**

The impact of an enabling policy:



Economic Growth

- Increases revenues and profitability of companies benefiting from a DDI-oriented environment
- New business initiatives developed based on data processing and accessibility
- DDI as a differentiating factor between flourishing and failing companies, mainly among SMEs or in areas where data use changes the rules of the game (e.g., between companies that use big data and those that do not)



Productivity

- Improves productivity due to increased outputs without a change in inputs
- Narrows productivity gaps between Israel and the U.S. and OECD countries



Social Values

- Increases transparency, reduces corruption and encourages public oversight and involvement - important factors for a strong democracy
- Improves government services and increases public access to them



SMEs

- Narrows productivity gaps between SMEs and other businesses in Israel and around the world
- Eliminates barriers encountered by businesses that have difficulty collecting data on their own or funding data acquisition



Cost of Living

- Heightens competition with the entry of startups and the growth of SMEs.
- Consumers can make more informed financial decisions based on data in open public and private datasets



Competition

- Closes or narrows existing gaps with advanced countries on leading indices, and enables Israel to maintain its economic competitiveness in relation to other countries worldwide.

Needless to say a limiting policy does not foster DDI, however it also creates difficulties for entities seeking to develop and implement DDI processes. These include strict enforcement of the datasets law along with stringent and unreasonable privacy regulations. Governments that follow such a policy do not publish government data, a practice that is already widely accepted, and small amount of the data it does publish is not adequately accessible. This policy also ignores currently available technological solutions to maintaining privacy protections while opening datasets to the public.

The impact of a limiting policy:



Economic Growth

- Companies will be reluctant to collect and analyze data which will hinder their ability to fully exploit expected revenue growth from DDI integration.
- If data is not open, data-based startups will not be established or will have difficulty surviving, and DDI will become the exclusive province of large players.



Productivity

- The potential of DDI to narrow productivity gaps remains unrealized
- Companies that succeed in overcoming barriers will need to make heavy investments in capital and human resources without the help of government, which can adversely affect their productivity.



Social Values

- Lack of transparency hinders the cultivation of social values.
- Without DDI it is difficult to improve services provided to citizens.
- "Pirate" and independent attempts to collect and publish data, even though this data may not be comprehensive or accurate, may lead to misleading information and incorrect conclusions.



SMEs

- Data that is not public can still have an impact. Large companies with data collection and management capabilities have an advantage that creates market asymmetry and hinders SMEs ability to compete, to increase their productivity and to narrow gaps in relation to other sectors in the economy.



Cost of Living

- The competitive advantage of large players will increase, enabling them to become data monopolies. The level of competition in the economy will not improve, and efforts to reduce the cost of living may be unsuccessful.



Competition

- The adverse effects on the data-driven startup community are also detrimental to Israel's innovation environment.
- Israel will lag behind compared to leading countries in the world that adopt open government principles and actively promote DDI.
- The above two effects will hinder Israel's ability to compete in the international arena.

Choosing non-policy is equivalent to preserving the current situation, put simply - more of the same. In this case the state does not actively limit DDI, but at the same time does not actively promote it. Under such circumstances the chance to actualize the huge DDI potential is small to non-existent. **The most adverse effect of non-policy is the uncertainty it creates in the economy about DDI and the use of data. Moreover, the results on DDI-related measures are naturally not as good as they could have been had an enabling and encouraging DDI policy been in place.**

Open Government As A Means Of Implementing DDI

The foremost tool for cultivating DDI is adopting open government practices. This involves granting public access to government datasets that can generate economic and social benefits while at the same time protecting citizen privacy and national security. It is the responsibility of the government to make this data accessible and to remove process, technological and regulatory barriers.

Data has great value in the digital world and is a catalyst for economic activity. By opening its datasets the government encourages DDI and facilitates the realization of its potential. A study recently conducted in Europe found that **if datasets were opened, GDP in the EU28 countries would increase by €10 billion in 2020. Combined with big data capabilities for data-driven decisions, open data would contribute about €100 billion to GDP in 2020.** (Warsaw Institute of Economic Studies and demosEUROPA, 2014). If we extrapolate these figures to Israel, opening government datasets would increase GDP by about NIS 700 million, and combined with big data capabilities for data-based decisions would contribute about NIS 7 billion in 2020.

As an approach and a concept open government fosters three values: public access to government data; public participation to enhance government efficiency and the quality of government decisions; and cooperation between government ministries and between them, business entities and third sector organizations.

As the foundation of open government data access can be divided into three action levels: data released by request (implementation of the Freedom of Information Law); initiated data publication; and opening datasets to the public. With this in mind the benefits of open government can be examined from two perspectives:

Open Government As A DDI Driver With Economic Benefits

- Fosters innovation that leads to the development of business initiatives as well as new products and services
- Eliminates entry barriers by addressing asymmetrical data
- Produces economic value for the public sector through operational and service excellence. This includes maximizing output and tapping the potential of existing resources.
- Facilitates the release of quality data to the public as a result of data-sharing between government entities and enhanced government data.

Open Government As A DDI Driver Fostering Social Values

- Increases transparency and mitigates corruption. It is important to remember that not every opening of a database will boost transparency. Paying lip-service to opening marginal datasets of little value should be avoided.
- Access to data is a necessary step in encouraging the public to express its opinion and give of its time. This increases public participation and cooperation with the government.
- Employing the wisdom of the crowd for government decision making or for considering new issues that need to be decided.

Guidelines for creating open government

For open government to serve as an important tool in developing and promoting DDI, it must provide the infrastructure needed for release of government data based on the understanding that the key to DDI is in fact the data itself. To foster the use of data in general, and to generate innovation in particular, the way data can be accessed is no less important. Data that is not easily accessible and that cannot be machine-read hinders its use for advanced application. Finally, open government that seeks to foster DDI must also encourage the creation of a supportive innovative environment.

The important underlying principle of open government and open datasets is a paradigm shift from “closed by default” to “open by default”.

According to the latter, data is open and accessible to the public unless there is a fundamental reason to limit its access. The main reasons for imposing access limitations are danger to national security and harm to privacy. Open by default is an important principle in

promoting DDI since innovation, as its name suggests, is difficult to predict and forecast. We cannot define in advance all the possible uses of information and the benefits that may be derived from its use and applications. For this reason it is important to prepare the conditions in which innovation can develop, without limiting its areas or the information that may be required. It is no less vital to remember the costs involved in opening datasets, among other things for necessary database enhancement, for integrating different systems and for developing user-interfaces. Thus, even though “open by default” is the correct and preferable policy, there may be a need to prioritize database opening due to resource constraints. In such cases top priority should first be given to opening datasets that can generate the greatest benefits, as will be explained further in this study.

Breezometer - Real-Time Air Quality Information

The application provides real-time air quality information according to geographic location – down to the street level.

The application is based on data collected from air quality monitoring stations spread throughout Israel, along with algorithms it developed to calculate air pollution levels at a requested location.

The application provides great value to users by enabling them to plan their activities (sports, trips, etc.) according to environmental conditions, even to select a residential area or a vacation route based on the information.

Open Government In Israel

Israel has lagged behind in all matters relating to open government, and the issue has only reemerged in the past year.

The debate in Israel about open government gained momentum during the term of the former minister Michael Eitan, the minister responsible for improving government service to the public. During this period, 2012-2013, several important processes were set in motion, among them the launch of the government portal data.gov.il and Israel's joining of the international Open Government Partnership. Since then however, the gap between Israel and the advanced countries has only widened, and Israel currently lags behind.

A report published in 2014 assessed Israel's fulfillment of its commitments to the Open Government initiative. It showed that the State had taken upon itself 13 very modest commitments of which it had only fulfilled two in full and three others to a large extent (Israel, Progress Report, 2012-2013).

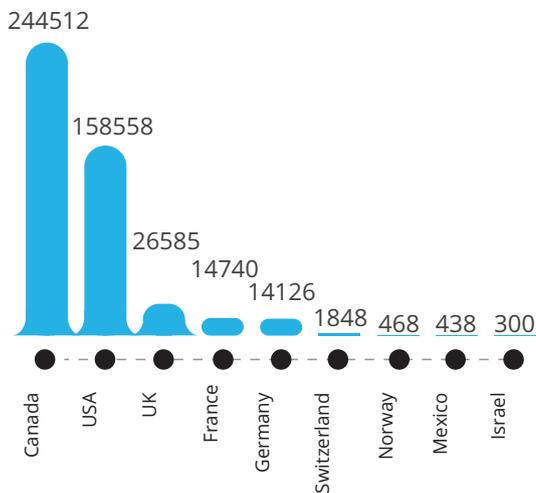
Furthermore, between 2013-2014 Israel's ranking dropped from 24 to 40 on the Global Open Data Index. This underscored the fact that Israel was lagging behind since the change in ranking was the result of the progress made by many countries on the open data index. The Czech Republic for example moved from 30 to 12th place and India from 27 to 10th place. According to the report, unavailable or insufficient information about legislation and government expenditures in Israel is conspicuously absent.

Another indication of Israel's decline is the number of datasets in general, as well as their opening and accessibility to the general public. While leading open government countries provide access to dozens if not hundreds of datasets through a government information portal (data.gov), only about 300 datasets are accessible in Israel. Moreover, only 50% of the datasets are machine-readable compared to 90% in the U.S. and 95% in Britain.

Several steps have been taken since the end of 2014 to promote open government in Israel, among them an updated working document that presents a work plan to advance Israel's commitments to the Open Government Initiative for the years 2015-2017.

Furthermore, government decision no. 2097 to expand computer-mediated communication to more government service areas, energized the discussion about open government in general and the opening of datasets in particular.

Number of Open Datasets in Each Country, 2015



Barriers to open government in Israel

The barriers to open government and to opening datasets in Israel can be divided into three types: process barriers, technological barriers and other challenges in realizing DDI potential. The first two prevent or hinder the release of datasets so that they are open, available and efficient, while the third group of barriers impedes the ability of data consumers to use the data for innovation and other purposes.

The first process barrier is lack of digital processes. In a government that relies on fax and paper, implementing advanced technological or process infrastructures is not possible. It is for this reason that **the public sector's transition to digital processes, led by the Digital Israel National Initiative, is the foundation without which building datasets that are of value and the ability to share them will not become a reality.**

Another process barrier is the absence of data-driven government decisions and operation. If the government itself was a consumer of government data, and its senior position holders demanded data-based policy and implementation, chances are that reliable and accessible government datasets would be available

and could be shared with the public. Providing reliable and adequate information to government is all but impossible at present, not to mention the ability to provide access to external entities.

Additional process barriers are government operating under the principle of "closed by default" and an intra-government organizational culture that does not promote open data. Not only is the government unaware of the many benefits of open data, in the eyes of many government officials information is power, and by releasing it they feel that they are relinquishing their sovereignty and power, not to mention exposing themselves to public oversight and monitoring. Finally, opening datasets requires both monetary and human resources. Needless to say that when awareness and willingness are lacking, this task is not given high priority and therefore is not budgeted.

Lacking data infrastructures and difficulty in data integration are technological barriers that hinder the building of relevant and reliable datasets that could provide a broader perspective across government ministries and entities.

Process and technological infrastructure barriers are currently the main impediments to open government in Israel. This is evident since most data requests could not be filled because the data could not be replicated and retrieved. **The leading reason given for requests denied under the Freedom of Information Law was inability to find the requested information.** By comparison, only 9% of the requests in 2013 were denied on the grounds of privacy.

The government's responsibility for open government does not end with government decisions to promote the issue and the mapping of existing datasets. Such measures are insufficient if the goal is to advance open government in Israel and to close the gap between Israel and its counterparts in the world. The government must create an enabling environment that removes existing process and technological barriers. It can do so by strengthening the government as an information consumer, formulating principles and guidelines for data collection, sharing and integration, and fostering a supportive organizational structure.

Creating A Regulatory Environment Fostering Open Government While Protecting Privacy

It is the government's responsibility to tap DDI potential while providing maximum privacy protection.

The law will always lag behind changing social paradigms. Shifts and sea changes in social and cultural perceptions must take place before suitable conditions for legislative changes evolve and are anchored in law. The cost of living was initially addressed in legislation in 2013, following the 2011 social protest that drew thousands to the streets, among other things through the Economic Concentration Law followed by the Food Law two years later.

Privacy protection mechanisms in Israel are grounded for the most part in the Privacy Protection Law enacted in 1981. Reflecting prevailing thought at the time, the law is based on the principle that "a man's home is his castle" and on the absolute approach that government must maintain an individual's privacy. This approach is an expression of attitudes towards privacy held by a generation for which privacy was sacred, in stark contrast to the perception of privacy among today's young generation. Along with the slow pace of legislation, the result is regulation incompatible with contemporary attitudes that view anonymity and privacy as relative rather than absolute terms (in other words an individual's consent to data collection and disclosure will depend on circumstances and context), and myriad private entities holding personal information (Amichai-Hamburger and Perez, The Israel Democracy Institute, 2012).

It is both possible and necessary to adapt the regulatory framework so that it continues to ensure privacy protection while enabling optimal use of data. The main characteristics of a policy that will foster DDI while maintaining maximum privacy and data security are as follow:

1. Dynamism and flexibility – in order to be effective and to promote data use regulation must support rapid technological development by showing flexibility towards technological changes. Such flexibility can be fostered by regulation that grants professionals a certain degree of discretion to update technological norms and standards in real time, all within the boundaries of existing law.
2. Complete agreement – many surveys show that the requirement to receive the individual's voluntary and complete agreement to use data that he or she created is ineffective, because most people are neither knowledgeable nor interested in this issue, many times acting against their own best interests. This calls for an examination of the commonly held paradigm regarding agreement that must be given to use personal data.

The classic data disclosure mechanism, the opt-in mechanism, requires the individual's complete and active agreement to disclose his or her personal information. In contrast, information disclosure is the default in the opt-out mechanism, yet every individual has the option to request its removal.

3. Transferring responsibility to data users - the term 'accountability, is frequently used in OECD privacy protection guidelines to indicate that responsibility will be transferred to the entities that use or distribute the data. This stands in contrast to classic limitations that do not permit any use of data (OECD Privacy Guidelines, 2013).
4. Anonymization - the state holds vast amounts of personal data and must therefore ensure privacy protection. This data is valuable for DDI and other purposes, however in order to use it without compromising privacy, standards should be defined regarding its use, among them data anonymization requirements. There are many data anonymization methods for maintaining the quality of disclosed information.
5. Oversight of data use – one of the necessary components of an effective DDI-promoting regulatory environment is an entity that will enforce data security standards and oversee data use of private sector entities. Effective enforcement will improve privacy protection which will foster further data disclosure.

Current privacy protection mechanisms are not sufficiently effective and are supported by outdated legislation incompatible with contemporary reality. Both the Privacy Protection Law and the Freedom of Information Law enacted in Israel are unsuited for today's digital reality. In particular, they do not provide the needed flexibility that will

enable them to remain relevant and to keep up with data protection capabilities and with the rapid pace of technological developments in the face of growing privacy threats.

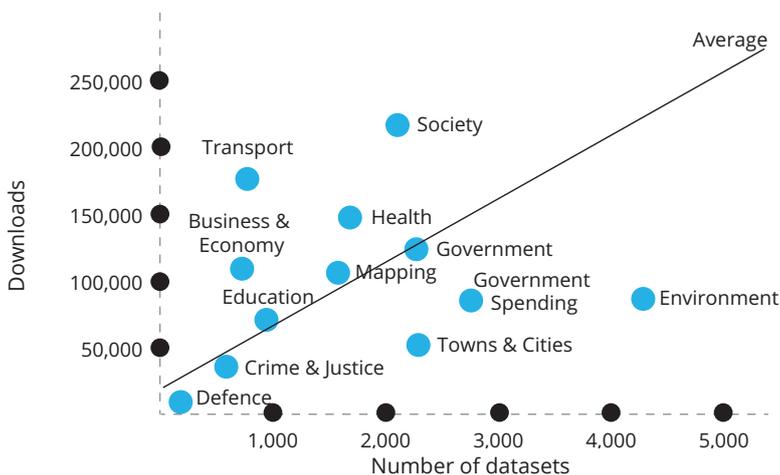
Mapping Government Datasets

While there are tens of thousands of government datasets, not all datasets have the same economic and innovation potential. Certain datasets are expected to generate extensive economic benefits and should therefore be opened first.

The vision of open government is that governments and public entities will open all the data they hold (taking into account privacy and national security issues), based on the notion that the data belongs to the public and should therefore be in its possession. Ideally, datasets should be open by default to everyone. Moreover, these datasets should be available and accessible, except in special cases.

Until conditions are ripe for realizing this vision, civil servants responsible for opening datasets must prioritize their efforts, first opening datasets with the greatest potential to make a significant positive impact.

Supply and Demand for Datasets in United Kingdom (cumulative up to 2014)



Analysis of demand for datasets in Britain (one of the most leading open governments in the world) clearly shows that demand is very high in certain areas such as business and economy, transportation and society. Moreover, despite the small number of datasets published in these areas, they are downloaded many more times compared to other datasets. From an overall system perspective, datasets in these areas should be given first priority when opening government datasets in Israel.

The graph also shows categories for which demand is low and the number of downloads is small, despite the large number of open datasets in these categories. From an overall perspective, these should be given lower priority.

In-depth understanding of the demand for datasets in the various categories reveals two important phenomena with implications for the prioritization process:

1. Datasets with the highest demand – a small group of datasets in each category are in high demand. They make up about 1% of all published datasets, but comprise 60% of all downloads. **Therefore, the first stage of the database opening process should include datasets with the highest demand in all categories.** Our study of open datasets in Britain examines the five datasets with the highest demand in each category, and provides examples of economic uses and innovations based on these datasets the world over.
2. Datasets with significant demand – another phenomenon found in all categories is the wide-ranging public use of most published datasets (66% on average) compared to only a small share of datasets for which there is little public demand. **This substantiates the need to establish an “open by default” policy since the bulk of datasets are in demand. In the second stage, after opening the datasets most in demand, efforts should continue to open as many datasets as possible, keeping in mind the categories with datasets that create the greatest value (based on the highest demand).**

The following table describes the distribution of demand for datasets within each category. Thus, for example, there was no demand for 33% of the datasets in the business and economy category:

Demand	Business & Economy	Crime & Justice	Defense	Education	Environment	Regulation	Government Budget	Health	Mapping	Social	Local Authorities	Transportation
No demand (0 downloads)	33%	32%	46%	27%	34%	44%	40%	21%	40%	20%	25%	27%
Low (0-200 downloads)	60%	63%	49%	68%	65%	53%	58%	75%	58%	76%	73%	67%
Medium (200-1000 downloads)	4%	3%	4%	4%	1%	2%	1%	3%	1%	3%	1%	3%
High (over 1000 downloads)	3%	1%	1%	1%	0.2%	1%	1%	1%	1%	1%	0.3%	3%

It is important to note that the prioritization mechanism examines the economic contribution of datasets in the different categories, and provides government entities responsible for open government with a tool to assess the expected economic value from their opening. There are of course datasets with limited economic benefit that should nonetheless be considered in the process owing to their social benefits or the values they represent.

THE CLIMATE CORPORATION

The American Climate Corporation provides a variety of datasets to help farmers deal with weather changes. The company employs more than 200 scientists who analyze 50 terabytes of weather-related data a day. It conducts complex analyses of relevant data that farmers can use to increase crop efficiency and profitability. The company's products are in effect the insights that can be gained from analysis of data from numerous datasets that farmers can use to improve profitability by making better informed operating and financing decisions. The company was sold in 2013 for about USD 1 billion.

Epilogue

DDI is a vital and necessary step if Israel is to become a modern country with economic and social resilience.

As we show in this document, DDI can significantly contribute to the Israeli economy and is the key to growth and prosperity. It is no coincidence that many countries have chosen to invest in DDI and have established a policy and an environment that views data as a vital infrastructure and recognizes that innovation is a driver of national growth.

The fact that Israel has not been successful in narrowing its productivity gap with the developed countries and with the U.S. impedes its global competitiveness and poses an obstacle to addressing cost of living and other vital issues.

In examining the huge potential of DDI to contribute to economic growth of companies and the economy of Israel as a whole, it became clear that this potential is far from being realized. The government has both the power and the ability to advance this critical area by establishing a DDI-enabling policy. Such a policy will have manifold consequences, including the growth of existing businesses, the development of new information industries and the closing of gaps between economic sectors. Its effect on the entire Israeli economy will be pivotal and consequential.

The following diagram illustrates the government's DDI-implementing roles and the expected benefits of effectively fulfilling these roles.

