The value of DDI (Data Driven Innovation)
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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 OECD 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.

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” 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

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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**
- Increase process efficiency
- Increase supply chain efficiency
- Transform work processes
- Data-based decision making

**Process**

- Define target audiences
- Individually customized marketing and marketing channel optimization
- Individually customized products
- New product and service lines

**Marketing**

- 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.
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:

![Graph showing productivity per segment - Israel and the U.S ($, 2013)](image)

- ~54 billion NIS Addition to GDP of Israel
- ~18 billion NIS Addition to GDP of Israel
- Increased productivity to ~$39 (PPP in 2014 terms)
- ~3% Narrow productivity gap between Israel and U.S.
- ~18 billion NIS Additional tax revenues to the State
- Productivity per segment – Israel and the U.S ($, 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 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 innovative 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
Offer incentives for adopting DDI processes and practices, with an emphasis on SMEs and non-technological businesses.

- Treat DDI similar to business R&D in terms of fostering mechanisms and incentives.
- 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.
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. 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.

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.

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.
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.

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.

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).

**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 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:

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

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.
2. Introduction

The world is undergoing a quiet revolution in recent years

The invention of the steam engine in the 17th century enabled the production of energy from water and coal, resources available at the time, and propelled the world forward.

The accelerated development of information technologies in recent years has fostered the understanding that information is the most important resource in our world today. While information is a highly accessible resource, it is not sufficiently exploited. Therefore, those who will have the ability how to exploit it wisely will enjoy huge economic and social benefits.

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.

The practice of generating innovative outputs from data is known as “data driven innovation” (DDI), and numerous studies have shown that it is becoming the driver of significant growth. Since data already exists in digital form it can be used almost immediately in contrast to other resources such as oil or gas whose mining and production require huge investments. Existing digital datasets in government and civic systems are a valuable source of innovation that enables, among other things: the development of innovative products and services that could not be provided in the past, more effective and efficient management techniques based on real-time data, more efficient supply chains, and advanced and focused marketing methods – and the sky is the limit.

Many countries have decided to exploit this resource and have established national programs to advance the use of data in general and to drive innovation in particular. The first stage was the decision to establish an open government policy that encourages the opening of government datasets. This was followed by enabling and optimal regulation and allocation of resources for its implementation. It is not surprising that DDI-leading countries also earned the highest scores on global productivity and innovation indices, among other things because of the huge benefits gained from innovation which they knew how to generate from data they had at their disposal.

"Data really is the new oil. Data is a raw material for information businesses, just as oil is a raw material for fuel and plastics businesses. Data is also everywhere, it is cheap, and it can deliver huge rewards both in terms of services and financial returns”

Neelie Kroes ³

The State of Israel lags far behind in labor productivity and was ranked 25th in productivity on the 2014 Bloomberg Global Innovation Index⁴, far behind the developed western countries. As a result, GDP per capita is lower in relation to these countries, affecting the quality of life of all those in the country. The productivity gap is even more conspicuous in traditional industry and in SMEs whose labor productivity is significantly lower than the average productivity in Israel and in similar businesses in other western countries. Numerous studies have found a direct and strong relationship between productivity level and the existence of DDI processes at the country, economic sector and single business level. It is therefore not surprising that DDI is one of the factors the OECD mentions as having a significant potential to increase labor productivity, and as a result economic growth.

The study we conducted found that real improvement in DDI level in Israel will lead to increased labor productivity of about 5%, will narrow the productivity gap between Israel and the U.S. by 3% and will add NIS 54 billion to GDP as well as an addition of about NIS 18 billion in tax revenues. Our study

³. European Commissioner for Digital Agenda.
also showed a statistically significant positive relationship between a company’s DDI level and its success level.

Beyond the huge economic rewards, social benefits are to be gained from the use of data since a key component in creating a DDI infrastructure includes opening the vast amounts of data found in government datasets. Thus, for example, many governments have decided to release all the data they hold that can be disclosed, within the framework of the “Open Government Partnership Initiative”. This step not only advances endless innovative technological initiatives and serves as a catalyst for improving government services, it also increases government transparency and the public’s trust in the state. We are witnessing a global shift from cumbersome actions of civil servants, with binders and archives, to more advanced use of online services, government cloud services and big data. It goes without saying that Israel must join this trend if it wishes to remain attractive and competitive to international markets.

The aim of this study is to assess the value of DDI to the Israeli economy while examining the best government policy needed to transform Israel into a DDI superpower. As a superpower it will be know how to realize the DDI potential for economic growth, for improving Israel’s competitiveness and for reducing the cost of living.

To achieve its goal the study attempts to answer three key questions: what is the economic value of DDI for the State of Israel, which government policy is suited in order to realize this potential, and how to identify government datasets that should be made public.
The Economic Value of DDI

The first part of the study aims to examine the contribution of DDI to the Israeli economy. This was conducted from a productivity perspective – an important indicator that is strongly affected by technology and innovation. Based on a comprehensive survey of companies from different economic sectors and advanced analytics, we show that DDI can substantially improve labor productivity in Israel and can drive economic growth, provided the state invests in DDI as needed. It should be noted that certain economic sectors can benefit from DDI more than others, particularly because of the large gap between them and other leading economic sectors. We also explain the essence of the term DDI, present its countless benefits and review how DDI is implemented in other countries. This will be accompanied by examples of countries that have successfully invested in DDI.

Government Policy that Promotes DDI

In the second part of the study we define the guiding principles of a government policy that promotes DDI. These principles were formulated based on an examination of leading countries that have gained extensive experience in fostering DDI and accepted practices. We define the importance of an enabling policy and its implications, and the considerable damage created by not adopting a policy or from following a restrictive policy. We also define the various roles the state must fill to promote DDI: the state as DDI consumer that sets data-driven policy, improves its services to the public and improves its governing processes by using data; the state as data supplier that follows the principle of “open government” and releases valuable government information for the sake of innovation and transparency; the state as regulator and policymaker that creates the optimal environment which facilitates open government and DDI but also protects privacy rights and intellectual property; the state as educator that raises awareness of DDI, facilitates its integration and trains required personnel; finally, the state as funder that effectively incentivizes programs or processes to advance DDI.

Mapping Government Datasets

The third part of the study identifies future steps the government must take to make public the data it holds. Although the widely accepted approach is to adopt an “open by default” policy, the release of information requires time, resources and a budget, which is why opening datasets must be a prioritized process. In this part we map the datasets that, if opened, will provide the greatest initial value.

It is important to note that the cornerstone of government policy that fosters DDI is digitization in the public sector. Just as an innovative country needs an innovative government, a country, government and public sector that rely on faxes and paper cannot build quality and useful datasets and work processes that foster DDI. The various digitization initiatives currently advanced by the public sector are Israel's springboard in many areas, first and foremost in anchoring DDI in Israel.

We were glad to discover that many government entities in Israel understand the need to create a DDI infrastructure, and that there is keen willingness to take up this task. This spirit is reflected in government decisions on the issue, in the expanded authority of the National Information Technology Unit and in interviews with many senior officials in government ministries. The latter expressed their willingness to act vigorously in order to realize this vital national endeavor – transforming the State of Israel into a DDI superpower.
3. Data driven innovation

"Data is the new capital of global economy, and as organizations seek renewed growth, stronger performance and more meaningful customer engagement, the pressure to exploit data is immense"

Deloitte

3.1 What is data-driven innovation

The past decade has been characterized by technological developments that are dramatically changing the world as we know it and impacting all aspects of daily life and the world of business, from laptop computers and laser printers to smart devices and 3D printers. Infrastructures and technological capabilities such as high-speed internet, information systems, big data and the internet of things are becoming an integral part of the economy, driving new initiatives, processes, products and services that give certain businesses a competitive advantage.

AIG Israel Insurance Company, in collaboration with the mobile company Partner and Traffilog, a fleet management system, launched a new customized car insurance service for customers willing to install AWS and MRM solutions (telematics) in their cars. These systems enable AIG to collect and analyze real-time data about the driver’s behavior on the road and to track every customer's driving history.

With this collaboration the insurance company could offer an innovative insurance policy tailor-made to the insured person's driving characteristics. Traffilog provides real-time feedback to both the driver and the insurance company about the individual's driving behavior. By analyzing this data AIG can improve its risk assessment policy and reduce insurance premiums to “good” drivers. For “bad” drivers the service provides an incentive to improve their driving behavior in order to decrease their insurance costs.

From the customer’s perspective this technology enables drivers to save not only on insurance premiums but also on gasoline consumption and costs through improved driving skills. Moreover, this can help customers improve car maintenance since they know the car's mechanical condition at any given time, while the insurance company reduces its risk is more attractive to customers.

Innovation that creates real business value and stems from data processing and analysis is known as data-driven innovation or DDI. The term is gaining a foothold in the world that recognizes the myriad benefits and importance of this type of innovation.

In this chapter we will focus on understanding the term, illustrate the benefits of implementing this type of innovation and discuss the great value it contributes to the modern economy.
"Data is the new natural resource of the twenty first century. If we harness it effectively, it could drive innovation and improve our daily lives in many significant ways"  

_Yike Guo_  

Data Driven Motivation

DDI refers to **innovative applications derived from data analytics**. The data may be found for example in the datasets of a company that implements DDI processes or in external datasets such as government, fee-based or other open datasets. In fact the understanding that data is the lifeline of innovation in the 21st century enables optimal exploitation of existing data.

DDI presents huge potential for economic and social progress, with varying effects on different businesses. According to the OECD, data-driven innovation takes place when different technologies and techniques are used to “define and capture” relevant data and then process and analyze it in order to generate 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, since 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.

From Data – to Data Driven Innovation

Businesses have been using data for many years, for example statistics and trend analyses used to improve decision making processes and allocate resources. A breakthrough took place in 1950 when ENIAC was successful in creating the first numerical weather forecast (World Economic Forum, 2014). As noted, using data for decision making is not new. Making the data accessible and available to the public, the development of data processing and analysis methods and the creation of innovation is the province of the current information age.

It is easy to confuse between big data and DDI.

Big data focuses on the size and variety of datasets and therefore big data refers to the scope and variety of data in the datasets and its processing. In contrast to the use of big data, the most important component of DDI is not necessarily the scope of data, but the value created from innovation produced from data processing and analysis. There is no real value in data in and of itself, but rather in the innovative outputs that create economic and social value. Using and applying the innovative output is the real value while the data becomes the fundamental infrastructure which is a powerful force for growth of a company and its success, and for the economy as a whole.

It should be emphasized that DDI is not dependent on big data. DDI, as its name connotes, needs data, but dataset size, the variety of data types and timing are not prerequisites. A small company that employs 5 workers and stores data about its activities in a simple Excel file can also enjoy the benefits of DDI.

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5. A computer science professor at Imperial College, London who served as CEO of a data analysis company and has published hundreds of articles on the subject.
3.2 Main benefits

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 public access to “open data” can produce $3 trillion in additional value annually to the world economy (McKinsey Global Institute, 2013).

As shown in the following examples, DDI is a powerful force for economic and social growth, impacting varied businesses in a variety of ways.

Joel Gurin, President and founder of the Center for Open Data Enterprise8, whose mission is to maximize the value of open data as a public resource that anyone can use, divides DDI benefits/rewards into three categories:

**Process Innovation**

DDI allows for innovative work, manufacturing and shipping processes that enable businesses and public entities to increase output while reducing costs.

Process innovation includes the integration of new work, manufacturing and shipping processes. These processes are the result of data analysis aimed at increasing outputs and reducing costs. In fact, these changes will usually also lead to significant changes in manufacturing techniques and tools and in software processing capabilities. In government offices for example, the changes can substantially improve public services. When the product of DDI is process innovation, then manufacturing or transportation costs per unit can be reduced considerably, along with enhanced quality, increased quantity and new product development.

In 2013, UPS launched the ORION project (On-Road Integrated Optimization and Navigation) at a cost of USD 1 billion annually. The aim of the project was to develop a complex mathematical analysis tool that would ultimately provide drivers with the optimal driving route and advanced navigation capabilities to improve the efficiency of the company's truck fleet. The project is intended to reduce the miles UPS trucks travel to deliver shipments. According to the company, reducing one mile per day travelled by every truck will generate annual savings of USD 50 million. Thus data analysis will ultimately result in reduced transportation costs for the company.

**Marketing Innovation**

Correct data analysis and implementing innovative marketing strategies lead to increased sales.

DDI can generate marketing innovation reflected in the ability of companies to actively engage with their customers in a more focused manner, and to collect important information from them about the company's services or products. Marketing innovation can also strengthen brands and enable companies to deliver higher quality, optimal and even personalized products and services. Thus, a company can use customer provided information to market products specifically suited to the customer, and produce new products or improve products based on customer preferences.

From the outset the global video online services company Netflix used machine learning capabilities to predict user viewing preferences. The ability to offer customers movies compatible with their viewing preferences has had a substantial impact on customers’ use of the Netflix service that accounts for as much as 75% of Netflix usage.

**Business Innovation**

DDI can lead to the development of new businesses: technological initiatives that offer innovative services, companies that provide DDI services or companies supplying necessary infrastructures for DDI implementation.

DDI fosters both business innovation and the creation of new businesses. The number of new businesses with data mining and analysis at the core of their business model is continuously growing. These businesses do not use data to increase internal processes or to characterize their customers, but rather to create completely new data-based products and services. Several companies

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8. The Center for Open Data Enterprise is a non-profit organization whose mission is to promote open data as a public resource in the aim of advancing economic and social goals. Before opening the center in January 2015, Gurin was a senior advisor at the GovLab at New York University.
established in Israel in recent years supply advanced services that implement DDI, among them WOBI, Breezometer, Waze and Moovit.

An American company, the Climate Corporation, provides a variety of datasets to help farmers deal with changes in weather conditions. 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 (The New Yorker, 2013).

It goes without saying that DDI implementation is no simple matter, and there are sometimes disparities between a company’s desire to use DDI and its ability to implement it. These gaps create the need for companies that can provide DDI services. The latter rely on data relevant to the company - internal, government or external – processing and analyzing the data to reach innovative insights (product, service, process or marketing) that will be used by the company that commissioned the DDI services.

These gaps also lead to the development of companies offering needed DDI infrastructures, such as companies that supply data and aggregative data infrastructures, as well as those offering information systems and analysis tools.

**Cognitive Technologies – The Next Stage of Datasets and a Key DDI Tool**

Computers cannot think. They can however increasingly do things only humans were able to do. It is now possible to automate tasks that require human perceptual skills, such as recognizing handwriting or identifying faces, or cognitive skills, for example planning, reasoning, by learning and from partial or uncertain information. Technologies able to perform tasks traditionally assumed to require human intelligence are known as cognitive technologies.

A comprehensive study conducted by Deloitte showed that cognitive technologies are one of the leading business success drivers of our time, and that in the coming five years the effect of these technologies on organizations will increase significantly. Appropriate investment can dramatically improve performance and create competitive advantage.

DDI implementation in effect enables companies to offer and integrate innovative insights, products services and processes derived from informed and smart use of data and findings. This process begins with companies building simple datasets that collect relevant operational data and then use cognitive technologies that process and analyze the data, ultimately generating innovative insights. These technologies are becoming a central tool in DDI implementation.

Using cognitive technologies as a bridge between datasets and innovation (DDI) is increasingly common among business entities. One such company is Intel that uses the learning capabilities of technological systems to increase the effectiveness of its sales organization and increase revenue. Its systems classify all customers into categories with similar needs or buying patterns. The company then uses this information to prioritize its sales and marketing activities and tailor its packages and offerings. As the outset of the initiative, Intel expected that by 2015 this strategy would generate USD 20 million in additional revenue.

DDI in general, and the use of cognitive technologies in particular, can offer many benefits to the public sector as well. The rapid transit railway system (MTR) in Hong Kong is a good example of the use of cognitive technologies to implement DDI that improves service to the public. Serving more than 5 million passengers daily, the MTR system punctuality rate is 99.9%. In a typical week, 10,000 people carry out 2600 engineering works across the system to ensure it is working properly. An innovative and advanced system optimizes engineering work planning and scheduling. The system uses rules of thumb based on past performance and accumulated experience of dozens of experts, and constraints such as schedules and regulations that impact maintenance activity. For every problem that arises the system generates a series of possible solutions and compares them to each other based on several criteria and
automatically produces an optimal engineering work schedule. Nonetheless, the system does not replace human experts and expertise. Planning engineers are such a valuable and scarce resource, and the system frees them to handle more complex problems that require the human touch.

Deloitte developed a model to help companies assess the opportunities they have to deploy and assimilate cognitive technologies. The companies need to examine their business processes, products and markets in order to assess where the use of cognitive technologies may be viable, where it could add value and where it may even be vital. Table 1 shows the model that enables companies to screen and prioritize the various opportunities.

<table>
<thead>
<tr>
<th>Screen</th>
<th>Cognitive Technology Indicators</th>
<th>Application Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Viable</td>
<td>All or part of a task, job, or workflow requires low or moderate level of skill plus human perception</td>
<td>Forms processing warehouse operation</td>
</tr>
<tr>
<td></td>
<td>Large data sets</td>
<td>Investment advice, medical diagnosis</td>
</tr>
<tr>
<td></td>
<td>Expertise can be expressed as rules</td>
<td>Scheduling maintenance operations</td>
</tr>
<tr>
<td>Valuable</td>
<td>Workers’ cognitive abilities or training are underutilized</td>
<td>Writing company earnings reports; e-discovery</td>
</tr>
<tr>
<td></td>
<td>Business process has high labor costs</td>
<td>Health insurance utilization management</td>
</tr>
<tr>
<td></td>
<td>Expertise is scarce; value of improved performance is high</td>
<td>Medical diagnosis; aerial surveillance</td>
</tr>
<tr>
<td>Vital</td>
<td>Industry-standard performance requires use of cognitive technologies</td>
<td>Online retail product recommendations</td>
</tr>
<tr>
<td></td>
<td>A service cannot scale relying on human labor alone</td>
<td>Fraud detection</td>
</tr>
</tbody>
</table>

Table 1 – How to Identify the Need for Cognitive Technologies?

Reports from the field...
models for implementing DDI in Israeli companies and entities

An Israeli mobile phone company sought to boost its revenues from equipment sales with minimum exposure to credit risks from customers – refunds, legal collections and bad debts. To meet this goal an analytical model was designed to analyze customer characteristics, credit history and sales event characteristics. The model enables the company to tailor the credit framework for each customer and to make a decision during the sales process whether to approve the sale and in what amount.

The model was designed based on the customer’s credit history and overall characteristics in order to predict the probability of credit failure:

1. Low probability of credit failure, i.e. “good customer” (low probability that customer will not repay debt).
2. High probability of credit failure, i.e. “bad customer” (high probability that customer will not repay debt)

In order to develop the credit model, data from the company’s system was used, including: customer’s financial data (e.g. means of payment, credit history, buying history, charge records, etc.), customer’s usage data (e.g. roaming history, service plan, age, etc.) and specific sale characteristics.

Identifying “good” and “bad” customers, and offering a credit framework compatible with the data will help the company increase equipment sales and save more than NIS 20 million annually due to “bad” sales.
3.3 DDI and the Modern Economy

The more the abilities to store data and develop new technologies improve, the greater the effect of DDI on the world economy and on quality of life. DDI use can impact the business performance of companies, improve government services and lead to growth of the economy as a whole.

The more accessible the data and the ability to apply it to generate business innovation, the greater the benefits businesses will be able to enjoy. Added value can be generated in several ways: new products and services; supply chain optimization; focused marketing; more efficient management; more rapid R&D.

Madlan - Application for Home Buyers

This Israeli company developed an application for individuals looking to buy or rent a home. During the home purchase process there are significant information gaps between the seller and the potential buyer who is not necessarily familiar with the neighborhood and the area. The information available to potential buyer’s is limited despite the fact that the government has extensive relevant data that is not published or is dispersed, which makes it difficult if not impossible to gain insights prior to a purchase.

The application collects government information from various published sources, including the Israel Tax Authority and the Central Bureau of Statistics, and presents a comprehensive picture about the potential residential area such as prices of apartments sold in the area in recent years, crime rates, quality of schools, cellular antennas in the area and transportation. The application is an example of the added value that can be generated from DDI processes, using existing and previously unexploited data.

Increasing Output and Productivity

The most important result of the use of DDI is increased output and productivity. Business performance of companies that use information and data analysis is usually higher owing to the contribution of DDI processes.

In the next chapter we show that technology and innovation significantly impact productivity and that in fact the way inputs are exploited has a greater effect than the inputs themselves. Process and 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.

MIT Sloan School of Management conducted a study that examined business practices and investment in information technologies among 179 large publicly traded companies. The study showed that companies that adopt data driven decision making achieved about 6% higher output and productivity than would be expected given their other investments and information technology usage (Social Science Research Network, 2011). The OECD also views DDI as a source of increased productivity and expects that DDI implementation holds the potential for 5%-10% productivity growth in general, and even more in certain sectors such as traditional industry (OECD, 2014).

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 among local technological initiatives. Information does much more than improve a company’s operation and performance - DDI can generate additional revenue from new products and services that ultimately leads to business growth and increased profitability. The opportunity to create new revenue sources arises in part from the “information as business” approach, which reflects the growing practice of companies to create additional revenue sources, new business units and entirely new businesses based on data.

Innovation level (including business innovation) increases the more accessible the data and the more advanced the data technologies used. The following figure describes the strong relationship between development of information and communications technologies (ICT) and innovation. The Y
axis reflects the global innovation index that ranks innovation capabilities in world economies; The X axis reflects the ICT Development Index that measures ICT capabilities among OECD countries.

Another important benefit of DDI processes are the tools provided for reliable decision making. Data based decision making enables policy makers to make better decisions, and in fact to transition to a world in which decision making will be based on much more reliable real-time data, that will naturally improve decision quality.

The following figure presents the relationship between the development of ICT and information technology infrastructures in countries and the perception of government corruption. The Y axis shows the perception of corruption in the public sector worldwide, with the lowest score indicating perception of a high level of corruption and a high score the perception of a low level of corruption. The X axis reflects the ICT Development Index that measures ICT capabilities among OECD countries.

DDI has additional possible impacts that are more difficulty to quantify, such as:

**More Efficient and Transparent Government**

In the public sector, DDI can contribute to significant operational efficiency and service quality to the public and even increase tax collection revenues and reduce tax fraud (see example in Chapter 7.1 below). 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 boost 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 with more efficient public services, waiting times are shorter, government transparency is greater and, 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.

9. The 7th report of the Global Innovation Index (GII) in 2015 is the joint product of Cornell University, INSEAD and the World Intellectual Property Organization (WIPO). Note – in the GII calculation presented, the ICT component was removed from the innovation index components because this information comprises the X axis.

10. The 2014 Measuring the Information Society report identifies key ICT developments and tracks the costs and affordability of ICT services.

11. The Corruption Perceptions Index, first published in 1995, measures global perception of corruption level in the public sector. A 0 score indicates perception of? A very high corruption level, and 100 designates perception of a very low corruption level.
BillGuard – Preventing Credit Card Fraud

BillGuard developed a breakthrough approach that can identify fraud as well as billing errors and unauthorized credit card charges. The application is powered by the collective knowledge of millions of people, “crowd wisdom” and conducts complex analyses of millions of online consumer complaints about their credit card charges. Thus the application monitors problem charges and alerts credit card holders in real-time. The company uses datasets with millions of credit card charge complaints and its product offers, among other features, the ability to warn of and thus prevent fraud attempts. The company’s product is based entirely on information published by credit card companies, and in 2014 was able to flag more than USD 70 million suspicious charges (U.S. News, 2015).

The American Recovery and Reinvestment Act (ARRA) 2009

In 2009, after the “Great Recession”, the U.S. enacted the ARRA, commonly referred to as the Stimulus or The Recovery Act, in the aim of stimulating the economy by injecting $800 billion into the economy. The law establishes a monetary reporting mechanism that includes stringent accounting practices, among them the requirement to report federal contracts at all levels in real-time and to publish the information on the Recovery.gov website. The data that was collected enabled the government to monitor entities that received government funds, the flow of funds and the economic impact at the local, state and federal level. By using the data it was possible to provide funds effectively and to places where they would have the optimal impact. The benefits were twofold – it increased transparency to the public during the crisis and enabled the government to make data based decisions regarding resource allocation when needed. Ultimately the U.S. economy was able to recover from the crisis more effectively (Association of Government Accountants, 2012).

Increased Transparency and Openness in Society

DDI does not only lead to increased public transparency, but also compels businesses to be transparent with their customers and enables customers looking for a fair price or to advance interests such as environmental protection to exert pressure on businesses to disclose more information. As a result, corporate transparency has increased and there is a trend towards improved corporate responsibility and sustainability processes. Taken together, these trends and processes enhance corporate engagement with customers and boost shareholder confidence in corporations.
3.4 Guiding principles for creating DDI infrastructures

First and Foremost – Digitization

In a world where data is stored in binders and archives is a world where information systems and innovation are useless.

The important first step in moving towards DDI is to convert data and systems to digital format. The digitization process refers to the process of converting analog data in all forms (text, pictures, maps, etc.) into digital format and to transform work processes into a digital dimension that will integrate information systems and automation.

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, develop new capabilities and shape new industries.

Digitization of work processes is necessary to ensure that the data collection process is accurate and reliable. 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.

Privacy by Design

In a world with vast amount of datasets and advanced analysis capabilities, businesses can “connect the dots” and create a better profile of customers using their products from slivers of data that are supposedly unidentified. This profile may include details such as lifestyle, buying frequency and information posted on social media. Privacy protection mechanisms are challenged by the nature of the data and by data analysis capabilities. The “privacy by design” approach aims to protect personal data when analysis is used to generate innovation and produce new insights.

Privacy by design (PbD) is predicated on 7 foundational principles that provide for an effective balance between the organization’s desire to realize its DDI potential and effective privacy protection:

1. Proactive not Reactive: characterized by proactive rather than reactive measures seeking to prevent privacy invasive events before they happen.

2. Privacy as the Default Setting: personal data must be protected automatically in any given IT system or business practice. If an individual does nothing, their privacy must remain intact, not the other way around. No action is required on the part of the individual to protect their privacy — it is built into the system, by default (will be elaborated below).

3. Privacy Embedded into Design: privacy is embedded into the design of systems, products and business practices. Privacy considerations must be taken into account as an integral part and essential component of planning and core functionality.

4. Full Functionality - positive-sum, not zero-sum: legitimate interests and objectives must be addressed identically - the more both are achieved, we/everyone wins.

5. End-to-End Security - Full Lifecycle Protection: information/privacy protection must be embedded into all stages – from the time the data enters the system to the time it is destroyed or leaves the system.

6. Visibility and Transparency - Keep it Open: seeks to ensure all stakeholders that whatever the business practice or technology involved, it is in fact, operating according to the stated promises and objectives regarding data protection.

7. Respect for User Privacy - Keep it User-Centric: the interests of the individual are uppermost, therefore enable defaults that ensure maximum privacy protection, and create user-friendly interfaces in all matters pertaining to privacy protection.

12. This framework was developed by Dr. Ann Cavoukian in 1990 and it includes embedding the privacy component into the design of technology, business practices and physical infrastructures.
Data Portability Capability

Harmonization of datasets between businesses or different business units is critical for a successful DDI policy. In many large organizations data storage is compartmentalized, creating a barrier to DDI implementation. Thus, for example, it will be difficult to institute DDI in an organization in which every division does not have access to data held by other divisions. Similarly, in many organizations data reuse capability is restricted, hindering the ability of managers and employees to be active partners in DDI processes. Therefore, every organization must consider DDI in formulating its internal data storage and compartmentalization policy. This holds true also for the government, with its complex organizational structure and multiple units, lead to numerous data systems that cannot interact easily or at all and are difficult to synchronize for the purpose of sharing data.

The following diagram illustrates the DDI process and its effects on the modern economy:
4. DDI – A Key Tool for Improving Productivity

4.1 What is productivity

Productivity is the total value of the goods and services produced during one work hour, in other words – output per hour of work.

Productivity in Israel is calculated by dividing gross domestic product (hereinafter: GDP) of Israel by total work hours of all workers in Israel in a given year. Similarly, productivity can be calculated for economic sectors in the Israeli economy, by measuring output in the sector and dividing it by total work hours of all workers in the sector in a given period.

As we will elaborate in this chapter, there is a wide productivity gap between Israel and the average productivity level of OECD countries, particularly compared to the U.S. (hereinafter: comparison countries). Moreover, productivity level also varies significantly between the various sectors in the Israeli economy.

Many factors determine productivity level in the total economy and its various sectors. With the development of economic theory over the years, we now have a better understanding of productivity drivers. Thus we now have the knowledge and information to explain a large part of the productivity gap between Israel and the comparison countries, as will be detailed below.

The chapter will first discuss productivity drivers, including innovative studies conducted in recent years, and then focus specifically on the productivity level of the Israeli economy and attempt to provide an explanation from the perspective of productivity drivers.

The Key to Economic Growth is not Inputs - but how they are used

A dramatic shift occurred in the 1950s regarding the question of the source of economic growth and increased production. Up until 1956, prevailing economic theory held that the main growth engine of GDP is increased inputs into the production process.

In other words the overall product was thought to grow as a result of additional labor and capital. It was at the end of the 1950s that Prof. Moshe Abramowitz and Prof. Robert Solow showed that increased production inputs cannot explain rapid economic growth and that the main growth driver is greater value produced from existing resources and not from more of these resources. In other words, increased output is the result of improved technology and production processes.

Prof. Abramowitz of Stanford University measured output growth in the U.S. economy in the years 1870-1950 as well as increased inputs (capital and labor) during this period. He calculated expected output only taking into account invested inputs. The increase in inputs during these years was found to account for merely 15% of actual output growth (Rosenberg, 2004).

Many economists conducted similar studies over the years and obtained similar results. The most notable of which was Prof. Robert Solow who was awarded the Nobel Prize for defining this economic phenomenon. Solow discovered the productivity coefficient and showed that at least 80% of growth in the modern economy is not the result of increased inputs but rather technological, process and other improvements. The effects of total productivity growth that are not explained by increased inputs are known as the "Solow Residual" or Total-Factor Productivity (TFP).

One of the main conclusions of the model is that without technological changes there will be no significant productivity growth over time (Solow, 1957). This is especially true with respect to developed countries that lack natural resources. In other words, for an economy to stay on the path of productivity growth, it is not enough to increase production inputs, it must also enhance the efficiency of using them.

Following Solow’s study, many studies published over the years attempted to find additional factors that increase productivity – from increased human capital through developing state infrastructures, investments

13. This is known as the Solow Residual because it is the residual productivity growth factor after controlling for the effect of work inputs (capital and labor) on productivity.
and vocational training to complex state bureaucracy. Notwithstanding, there is widespread agreement among most productivity researchers and economists that innovation and technological improvements are the cornerstones of increased productivity and the outputs generated from production inputs.

**Figure 3: Growth of GDP and Production Inputs in the U.S.**

![Graph showing growth of GDP and production inputs in the U.S. from 1876 to 1946.](image)

**4.2 Information and knowledge – the new driver of productivity growth**

In 2011 the OECD launched a project on new sources of economic growth, focusing mainly on “knowledge based capital (KBC)” as a growth engine. The study was initiated on the backdrop of the desire of OECD countries to better understand economic growth drivers in light of the economic crisis and the aging population – two factors that threatened their future growth. It was also born of findings from the OECD’s Innovation Strategy published in 2010 which showed that many innovative companies do not invest in R&D, contrary to expectations. KBC is based on the notion that there is another type of capital involved in production processes besides monetary capital that was not considered in calculating production inputs – knowledge based capital (e.g. datasets, software, patents and design). As we see it, this OECD project has to do with a broader outlook of the information age in which we live as technological developments are changing ecosystems. Vast amounts of data are collected annually and this data becomes a key component in development and innovation processes, and in decision making processes in business.

Based on European Union and U.S. data, the first phase of the study showed that business investment in KBC contributes 20% to 34% of GDP. This is reinforced by additional findings pointing to the importance of investment in KBC for optimal allocation of resources and increased competitiveness of the economy and individual companies. In fact, many countries already invest extensive resources in developing KBC sources. For example, KBC investment in Britain, Sweden and the U.S. in 2010 exceeded investments in traditional capital (machines, equipment and buildings).

As part of the OECD recommendations, along with tax and investment regulation the researchers address the importance of processing and analysis of the vast amount of data and gaining insights for all sectors. The researchers call on governments of OECD countries to formulate a coherent information policy (information access, privacy protection and investment and development of ICT capabilities) to enable and incentivize this activity.

Up until 1920 the steam engine was the main source of energy in manufacturing plants. Machines were arranged on the production floor according to their proximity and dependence on this power supply. Every machine on the production line received energy in turn from the steam engine through a cumbersome and wasteful pipe system. With the transition to electric energy every machine could be equipped with a separate electric motor and the production line could be organized more flexibly and efficiently. The computer had a similar impact. This example illustrate how innovation can increase productivity.

14. One widely accepted classification groups KBC into three categories: computerized information (software and databases), innovative assets (R&D, copyrights, design, and trademarks) and economic competitiveness (firm-specific human capital, networks of people and institutions, marketing, etc.).
Figure 4: Amount of Accumulated Global Data Measured in Exabyte (= 1 billion gigabytes)

Figure 5: Investment in KBC compared to investment in traditional/tangible capital – USA
**Using DDI to develop new business models**

For many years most GE revenues were based on the sale of engines to leading aircraft manufacturers as well as maintenance and repair services. In 2011, following increased competition from software companies, GE launched the “industrial internet” that includes installation of advanced digital sensors that collect data on engine performance, and the development of advanced analytics capabilities. Analysis of collected data enabled the company to develop innovative products and to change its business model from product sale to performance based. The gaining momentum of the Internet of Things is ushering in the DDI era. As more “things” become connected more data can be collected and optimization and analyses can be conducted, leading to new business models, improved finances and productivity growth.

**DDI – the Main Candidate for Productivity Growth**

The second phase of the OECD’s knowledge based capital project focused on the importance of data and analytics. The study aimed to better understand and substantiate knowledge regarding the contribution of analytics to increased productivity and social well-being, and to articulate recommendations for policy guidelines to promote them and heighten their impact.

The study shows that while companies that adopted ICT are the main candidates for generating benefit from data and analytics, there is growing interest among non-ICT companies to exploit these analytics methods in order to enjoy their benefits. These companies strive to use accumulated data and new technologies to unlock value and improve the products, processes and services they offer. These methods come under the umbrella term “data driven innovation” (DDI).

Empirical studies and examples from the field suggest that DDI can improve a company’s productivity by 5%-10%. They indicate that this productivity growth is also dependent on the economic sector in which they are implemented, having a much greater impact in certain sectors (e.g. tenfold productivity growth in agriculture according to several experts).
5. DDI – A Tool for Closing Productivity Gaps in Israel

5.1 Production And Productivity In Israel

Production in Israel indicates a growing trend but the gap remains significant.

As already mentioned, GDP per capita is an accepted measure used to gauge and compare economic health and prosperity. It is calculated by dividing total amount of products and services produced over a specific period of time by total population of the country.

The story of the Israeli economy compared to world economies in recent years can be illustrated from the following graph that describes GDP per capita over the years compared to OECD countries, particularly the United States (see Figure 6).

“Continuing on the current path will ultimately cause the economy to backslide. We must focus our policy in an effort to break through the Productivity barrier, in order to ensure sustainable and inclusive Growth, prosperity and an adequate standard of living, while continuing to maintain macroeconomic stability and strengthening the resilience of the economy in the face of volatility.”

Karnit Flug, Governor of the Central Bank of Israel

Figure 6 shows that Israel has lagged behind OECD member countries for many years, and far behind the United States. Increasing GDP and narrowing these gaps, particularly with the U.S., has been the goal of all Israeli governments seeking to improve the quality of life of Israeli citizens.

The GDP per capita gap between Israel and OECD countries did not change during the 1990s, and even widened slightly in the beginning of the 2000s. This trend reversed itself in 2003 except in comparison to the U.S. that continues to maintain a substantial gap compared to Israel and to the OECD average.
5.2 Analysis of productivity gaps in Israel

To better understand the determinants of the GDP of Israel we will break down its components and examine their development over the years. GDP per capita can be divided according to the following equation:

\[
\frac{Y}{N} = \frac{Y}{H} \times \frac{H}{L} = \frac{Y}{N}
\]

- Y – GDP of Israel
- N – Population of Israel
- H – Work hours a year in Israel
- L – Working population in Israel

The first component is the labor force participation rate \((L/N)\). This is the number of employees of employment age (25-64) divided by the entire population in this age group. In the past Israel ranked below the OECD average and the U.S. However, 2003 saw a sharp rise in the labor force participation rate in Israel, accompanied by a decline in the OECD countries and the U.S, which resulted in a higher rate in Israel compared to these countries in 2013. It is unlikely that GDP will increase through this parameter again.

The next component is work hours per worker \((H/L)\). Over the years we can expect a significant gap “in favor” of Israel since the Israeli worker works many more hours on average compared to the comparison countries. Indeed, the gap has narrowed in recent years, yet Israelis work more hours than their counterparts in most OECD countries. As we see it, this parameter should not be used as a driver of GDP growth in Israel.

The third component is productivity \((Y/H)\) – also known as “labor productivity”. As we will see below, most of the gap in GDP per capita in Israel compared to the comparison countries is found in this parameter, which means that it also carries considerable potential for GDP growth.

According to Figure 7, a global comparison shows substantial labor productivity disparity between Israel and countries worldwide. As a matter of fact, Figure 8 below indicates that the gap between Israel and the comparison countries continues to grow. Thus, while labor productivity in the U.S. rose by about 50% in 1990-2013, it only increased by 25% in Israel!

A comparison of labor productivity rates in various sectors of the Israeli economy with the same sectors in the U.S. (Figure 9) points to a gap in all sectors, including sectors that in Israel make up only 25% of productivity in the same sector in the U.S.

From an analysis of GDP components the conclusion is that despite the positive decade experienced by Israel regarding two of these components, stagnant productivity growth leaves GDP per capita in Israel relatively low in relation to the comparison countries. This conclusion supports the claims of many regarding the need to increase labor productivity in Israel for the benefit of its citizens and in response to the widespread feeling of the high cost of living.
Productivity Factors and Identifying Sources of Growth - (TFP)

To understand the productivity gap between Israel and both the U.S. and OECD countries, we will use economic theory to examine the determinants of productivity and to identify the factors that most impact the gap. Specifically, the Cobb-Douglas production function and its underlying assumptions will be used to examine the separate components of the productivity gap between Israel and the comparison countries.

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, Figure 10 shows that most of this gap is explained by the “Solow Residual” (TFP), and only a small part by the gap in production inputs.

There is no clear-cut explanation for the substantial difference in TFP between Israel and the comparison countries. Several studies published recently attempt to explain TFP disparity by factors such as: differences in competitiveness level in Israel, the structure of the Israeli economy, economies of scale and amount of government bureaucracy.

One of the factors indicated by the OECD as having significant potential to increase labor productivity is data driven innovation. We think that this component, that exploits the advantages of the modern era with its computerization power and vast amounts of accumulated information, has a strong potential to increase labor productivity in the state of Israel.
5.3 DDI in Israel – current situation and future potential

The study focused on two key questions: the first has to do with the economic value of DDI to the State of Israel, and the second examines the recommended policy for promoting DDI in the public and private sectors in order to realize this value, if it indeed exists. This chapter will examine the first question in an attempt to quantify the economic value of DDI.

We evaluated this value by examining its impact on labor productivity in Israel. As shown in Chapter 4, the key to productivity growth is not in increased inputs, but in how they are used. Over the years many Nobel Prize laureates have shown that technology and innovation are the most significant determinants for productivity growth, and therefore DDI, by definition, holds the huge potential for improved productivity.

Productivity is at the core of economic discourse in Israel in recent years, grounded in the understanding that improved productivity and narrowing productivity gaps with the OECD and with the U.S. in particular are of the utmost importance.

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 based on data we collected 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.

The methodology was based on accepted academic theory adopted by world renowned researchers\(^{15}\) on whom the OECD bases its recommendations\(^ {16}\). We use this method to isolate the effect of DDI on the output of companies in the Israeli economy, particularly by economic sector and company size. At the end of the process we could identify the contribution of DDI, controlling for the contribution of other production factors.

**Study Methodology**

**Overview of the study**

The aim of the study is to measure the current contribution of DDI to the Israeli economy, and to measure the potential effect of expanding DDI implementation on the economy. The study examines differences between companies with respect to economic sector, company size and the extent of technology use.

Contrary to the productivity study presented above that used many data series from countries worldwide to conduct a comparative study, in the DDI field there is no international index that can be used to examine the effect of DDI. While global data about various innovation indices are to be found, these do not provide a sufficiently accurate basis for calculating DDI contribution, certainly not at the economic sector level.

In light of these difficulties, we based the study on the methodology applied by the researchers Professor Erik Brynjolfsson from MIT and Professor Lorin Hitt from the Wharton School of Business in studies about the contribution of data driven decision-making to firm performance\(^ {17}\).

To answer the question regarding the contribution of DDI to labor productivity we used the multiple linear regression model employed by the above researchers to isolate the effect of the DDI component on company outputs, controlling for the effects of production factors.

The linear regression is:

\[
\ln(\text{revenues})_i = \beta_0 + \beta_1(\text{DDI})_i + \beta_2\ln(\text{employees})_i + \beta_3\ln(\text{budget})_i + \text{controls}
\]

• Target variable: annual revenues of the company.

• Explanatory variables: DDI – level of DDI in the company. While most of the required data for the study can be obtained from a company's financial statements, there is no reported figure that can be used for the DDI variable. Thus, we decided to adopt Brynjolfsson and Hitt's method and created the DDI variable for companies by using a survey we conducted among senior managers in various companies.

In order to isolate the effect of DDI on revenues we introduced two additional types of explanatory variables into the model:

1. Input variables: variables that affect a company's productivity level (number of employees and total 2014 company budget).

2. Control variables: controlling for additional effects that according to prior studies are connected to the tendency to innovation and to use data (business sector to which the company belongs and the year the company was founded).

Study population and sample
The study was conducted in 2015. The study population included 5,123 private and public companies in the business sector, including small, medium and large companies (we did not approach very small businesses). The companies in the study population generate about 85% of the revenue of companies in the Israeli economy and employ 35% of the employees. Among these, 154 senior decision makers (CEO, CFO, IT managers, strategy managers) filled the questionnaire. Sample distributions are detailed in Annex 1.

Study tools
The designed questionnaire was comprised of 48 questions. It encompassed four content worlds: investments in information infrastructures, data accessibility and the extent of its use, extent of data use for innovation purposes (i.e. actual DDI implementation), and a company's innovation level. The questionnaire also included questions for collecting information about the companies, including: financial data such as company budget, revenue; background information such as number of employees and geographic areas; and finally, questions regarding opinions, perceptions and attitudes about data use and innovation.

Each content world was comprised of several questions validated in other studies as relating to DDI, among them: funds and human capital invested in IT department and extent to which decision makers use data to make decisions. Questions about actual DDI implementation were formulated based on the OECD definition and separate variables were defined as detailed below in the section on the design of DDI variables.

Method
After designing the questionnaire we conducted in-depth interviews with eight senior managers in the Israeli economy to hone and improve the questionnaire in line with the study goal. The interviewees were Deloitte customers who agreed to participate in the study. The questionnaire was further enhanced and fine-tuned following these interviews so as to be congruent with the study objectives.

The questionnaires were then filled using two methods:

1. Telephone interviews: the interviews were conducted by experienced and skilled interviewers that participated in a comprehensive training about the questionnaire and the study goal. Prior to the survey, the institute that conducted the survey received a list of phone numbers to be used for the survey. A pilot was also conducted prior to the survey to assess question comprehension and the questionnaire filling process in the phone mode. A total of 130 full interviews were conducted over a period of five weeks.

2. Email survey: towards the end of the phone survey we sent an email to managers who we did not succeed in reaching during the telephone survey or those who preferred to answer the questionnaire via email. The questionnaire was adapted to the internet format and was filled by sixteen respondents.

Variable design and enhancement
After the questionnaires were filled, and before analyzing the data, we verified the financial information provided in the questionnaires by cross checking with varied information sources (financial statements for public companies, business datasets and online open data sources). Seven questionnaires for which the information could not be verified not included the sample.
Establishing the DDI Index

The meaning of the term “DDI” was explained to the questionnaire respondents as defined in Chapter 3 of this document:

“In the following questions I will ask you about practices in your company regarding the extent to which data is used to generate innovative outputs. This does not pertain to utilizing data for product operation and control reports that show the existing situation, but rather its use for creating innovation, i.e. based on the internal and external data the company collects, and its analysis, the company succeeds in creating new products or services, enhancing and adapting existing products and services and to improving business and organizational processes. In effect, to gain innovative insights through the use of data”.

Building the DDI index

To build the DDI Index factor analysis was conducted as well as reliability and validity tests to evaluate internal consistency reliability and validity of the variables that represent the content worlds on the questionnaire. Variables found to be unreliable or that did not contribute to the variance of the content world were not included in the analysis.

Based on the reliability test we selected the variables with the highest internal consistency reliability (Cronbach’s alpha=0.74) to comprise the DDI Index.

The Index was calculated as a linear combination (weighted average) of the following ten variables. They could receive a score from 1-5, and each variable was assigned an identical weight.

DDI Index variables

- Investment in data
  - Extent of monetary investment in collecting, managing and enhancing data in the organization.
  - Extent of monetary investment in consulting services based on data, in the aim of creating innovation.
- Data accessibility and enhancement
  - Accessibility of required data for decision makers found in company datasets and systems.
  - Degree of accuracy and enhancement of data collected in the company
- Actual DDI implementation
  - Extent of improved human resource management in the organization based on data
  - Extent of improved marketing based on data
  - Extent of greater financial efficiency based on data
  - Frequency of data use by company decision makers for the purpose of innovation
  - Extent of data use for innovation purposes compared to other companies in the same field
  - Extent of agreement regarding the statement: “My company uses data analysis and informed data use to produce new insights, to create new products and to improve business performance

Similar to Brynjolfsson and Hitt’s DDD Index, we standardized the DDI Index with mean of 0 and standard deviation of 1. The index values range from -2.5 to 2.5.

Business data

Financial data about the companies that participated in the study was collected both directly and indirectly. The managers were asked directly about number of employees, revenues, percentage of investment in collecting and enhancing data in IT department, investment in technology for data collection, R&D and analysis. Financial data provided by the managers was cross-checked with data purchased from BDI for examination and enhancement. In cases of contradictions between interviewee answers and BDI data, data was rechecked using financial statements (for public companies) or online financial websites (for privately held companies).
Additional variables

- Economic sector – every company was classified by economic sector: commerce, industry and services. The companies were also grouped into technological or non-technological: a technological company uses technology for production in industry, or is a communications, or Information Company, or a company that provides technology-based technical and professional services. All other companies were classified as non-technological.

- Company size\(^{18}\) - every company was classified by size: small-medium or large, based on number of employees, according to the Israel Ministry of Economy definition.

- Ratio of revenue per employee – a variable based on the company's revenues in 2014 divided by the number of employees in the company, divided by 2000 annual work hours. This variable provides an indication of the company's success.

Data analysis

All survey data was analyzed at the overall sample level and at additional levels of data granularity: sector, company size, ratio of revenue per worker and the extent of DDI implementation in the company that was divided into three levels: low, medium and high.

Regression Model Used to Examine the Relationship between DDI and Revenue

As noted, we based the analysis on the regression model used in Brynjolfsson and Hitt's study that we applied to isolate the effect of the DDI component on company output, controlling for the effects of production factors.

\[
\ln(\text{revenues})_{it} = \beta_0 + \beta_1(\text{DDI})_{it} + \beta_3\ln(\text{employees})_{it} + \beta_4\ln(\text{budget})_{it} + \text{controls}
\]

- Target variable: the company's 2014 annual revenues obtained from its financial statements, or from collected and enhanced data from business datasets.
- Explanatory variables:
  - DDI level- an index comprised of ten variables as described above. To control for the effect of DDI from various production factors we added the number of employees in the company and total 2014 company budget (both with natural logarithmic transformation) to the regression model.
  - Controls – control variables in the regression model were used to control for additional effects, in line with prior studies that found that these variables are correlated with the tendency for innovation and use of data. These variables are the business sector to which the company belongs (with natural logarithmic transformation) and the company's founding year.

\(^{18}\) Company size according to the Ministry of Economy definition. See detailed definition in Annex.
5.4 DDI impact on the Israeli economy

An additional half score point on the DDI index will lead to a 5% increase in company revenues. This is controlled for the effect of other input variables and is statistically significant at the 95% confidence level.

Based on prior studies, this means that successful government policy that will foster DDI in Israeli companies will substantially increase revenue when using the same existing resources (i.e. without recruiting or laying off employees and without investing additional funds). Given a representative sample, we can state unequivocally that improvement on the DDI index of Israeli companies; encouraging companies to collect, process and use internal and external data; creating an environment that fosters innovation and data consumption; and incentivizing companies to produce and consume data driven innovation - will lead to 5% productivity growth (given a representative sample of 85% of revenues generated by the Israeli economy). This represents significant productivity growth, particularly in light of the fact that for 23 years (1990-2013) productivity in Israel increased by 25%.

In 2014 productivity in Israel was 55% that in the U.S. and 76% that of average productivity in OECD countries, amounting to USD 37.4 (in PPP terms). Successful implementation of DDI in Israeli companies could narrow the continuous gap between Israel and the leading superpowers to 58% and 80% of productivity in the U.S. and OECD countries respectively.

A summary of the study findings regarding the effect of DDI on the Israeli economy – a half score point increase on the DDI index, would produce the following results:

- **~54 billion NIS** Addition to GDP of Israel
- **~18 billion NIS** Additional tax revenues to the State
- **~3%** Narrow productivity gap between Israel and U.S.
- **5%** Increased productivity to ~$39 (PPP in 2014 terms)

Let's imagine a world state where the DDI gap between companies in the Israeli economy is narrowed by improving the situation of all companies with a DDI score lower than the DDI index average for the Israeli economy. Improving their DDI level to the average level in the economy will increase revenue per worker in these companies by 0.5%, which will translate into an additional NIS 4 billion to total revenues of Israeli companies.

**Invest More, Succeed More**

Analysis of the study findings indicates a statistically significant positive relationship between a company’s DDI level and its success. Managers in successful companies engage in more DDI than managers in less successful companies. Figure 11 describes average revenue per company according to extent of DDI.

Managers in successful companies indicate that they invest much more in data infrastructures in order to gain innovative insights. They place a great deal of emphasis on data management and enhancement and are willing to confirm that the company’s internal data is highly accurate and complete, more than managers in less successful companies. There is widespread agreement among all respondents with the statement that: companies that use data are more successful; and with the statement that: the state stands to gain if companies increase their use of data.

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19. The figures presented are based on a calculation of 85% of revenues of the entire Israeli economy, and given that for the companies removed from the sample population the conservative assumption is that no improvement would be achieved.

20. A (more) successful company is one in which an employee’s work hour generates more money for the company.
Innovation and Data Driven Management

Successful companies understand the value and importance of data for ongoing management of the company, for creating innovation and for business leadership. This is evident from the fact that more employees in these companies are exposed to reports compared to less successful companies (37% and 25% respectively). Managers of successful companies also indicate that they advocate a policy of data driven decision making in general and regarding various parameters such as creating new products in particular.

Furthermore, a statistically significant positive relationship was found between extent of DDI and innovation level. Managers who indicated that their company uses more DDI also perceive their company as more innovative, compared to managers in companies with less use of DDI.

Closing Gaps

Despite the above, perceptually, managers in successful companies link this success to DDI less than managers in less successful companies. The latter understand the need to close the DDI gap and indicate that they plan to invest more resources than the successful companies in the future – invest funds internally as well as willingness to purchase external data. This may stem from the successful integration of DDI in work routine processes, contrary to its perception in the past as a separate and unique event, among companies for whom use of data and creating innovation were foreign to their organizational culture.

Demanding data – more extensive use of external datasets and willingness to invest funds to use them

The study shows that companies in Israel use 2.3 different datasets on average. Among the managers, 42% indicated that their company uses government and Central Bureau of Statistics datasets. The managers see value not only in open government data but also in open data in general. Half of them noted the willingness of their company to share internal information and to purchase information from other companies, and 4% have already done so.

5.5 DDI in SMES compared to large companies

Small and medium-sized enterprises are the main growth driver of developed economies worldwide, among other things because of their potential significant impact on GDP and the labor force. This also holds true for Israel where most jobs are created by SMEs and strengthening them is therefore a necessary condition for economic stability.

SMEs in Israel are highly vulnerable, among other things because of the regulatory, capital and competitive environment. They are also characterized by low labor productivity compared to large companies in Israel and in developed countries. Thus, for example, in Israel SMEs make up 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. When divided into sub-categories, the data shows that without medium size businesses (between 20-100 workers) the situation is even more extreme since freelancers, small and very small businesses (0-19 workers) together comprise about 96% of all businesses in the Israeli economy and employ 53% of the workers in the business sector, but contribute only 33% to GDP (The Small and Medium Business Agency, 2014).

An examination of SME productivity underscores the existing gaps, with productivity of SMEs employing 10-250 workers considerably lower than the productivity average in OECD countries. In the group of businesses with 5-19 employees the situation is even worse, with the lowest productivity among all groups. Average revenue per worker in this group is lower than NIS 150,000, while average annual revenue per worker in Israel is NIS 181,896 and the OECD country average stands at NIS 221,742.
Strengthening small and medium businesses will have a strong effect on economic growth in Israel that seeks to strengthen and fortify them. DDI has the potential to fuel the growth of these businesses and to narrow the productivity gap between them and their counterparts in OECD countries and large companies in Israel by 26%. SMEs in Israel note that unfair competition on the part of large businesses is the main barrier to their growth. Therefore, by implementing tools such as using government data that can narrow information asymmetry in the market, analyzing their company’s data, making decisions based on data and fostering innovation SMEs will be able to overcome this barrier. For these reasons, our study focused on an examination of the impact of DDI on these businesses rather than large companies in the Israeli economy.

**Improvement on the DDI index will have a greater effect on SMEs than on large companies**

To isolate the effect of DDI on SMEs compared to large companies we ran the regression equation again, this time controlling for company size. The results indicated that the effect of DDI on company revenue is smaller in large companies than in SMEs and stands at 5.5%. This effect was found to be statistically significant at the 95% confidence level.

We can conclude from this finding that increased DDI will have a greater effect on company output of SMEs than on output of large companies. Moreover, the difference between the effect on large companies and the total effect of DDI, i.e. the effect on SMEs, indicates that expected revenue growth per employee from an improved DDI index score will be 8.9%.

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

We also examined the world state when narrowing the gap between SMEs that lag behind in terms of DDI and revenue. If we are successful in raising the DDI level of these companies to the average market DDI level, total revenue per worker in these companies will increase by 1.4% (compared to 0.4% in large companies given a similar world state), as shown in Figure 12.

**Figure 12: Revenue Growth per Employee under Different World States**

Managers in SMEs indicate that less DDI is implemented in their company, regarding all aspects – they invest less in data infrastructures, less in personnel responsible for data management and enhancement, and in general report less use of data for gaining innovative insights. Nonetheless, the study showed that managers in these companies understand the value of DDI better than managers in large companies. When asked about the reasons for the low level of DDI use in their company, the managers noted that the main barrier they face is lack of knowledge and technology.
Less Investment in Data, Less Innovative

The picture that emerges from analysis of the survey data is that managers in SMEs assert that the data infrastructures in their company are less developed than in large companies, and that they invest less funds (6 time less) in both internal company data and in external data.

The managers in these companies also note that they rely less on data for decision making and insights and that they perceive their company as less innovative. They also stress more than large companies that their company lacks the technology for using the data.

It is also interesting to see the disparities between SMEs and large companies regarding the perception of their company as “innovative”. In responding to perceptual statements such as: “my company is innovative”; “my company relies on data analysis and informed use of data to gain new insights, create new products and improve business performance” – managers in large companies ranked their company higher compared to SMEs (3.4 and 2.9 respectively).

No change on the Horizon

Taking a future perspective, less managers in SMEs noted that they will invest in data infrastructures compared to managers in larger companies – only 41% of the SME managers noted that they assume they will increase the data management and enhancement budget in the next 3 years – while 71% of the managers in large companies indicated that they would do so – a statistically significant finding.

It appears that managers in SMEs do not plan to increase their employees’ exposure to reports and data, further indicating that there does not appear to be a growth trend in the of use data for innovation purposes in their company.

Make Less Use of Datasets but Think that Information is Power

Less managers in SMEs indicated that their company uses external datasets compared to managers in large companies (74% and 89% respectively). They expressed greater concern to invest funds in datasets and their lack of understanding of the value such databases can deliver was evident.

However, more managers in SMEs than in large companies expressed willingness to share internal data with other companies and indicated that they would request data and not money in return.
5.6 DDI in the technology-based sectors vs. the non-technology-based sectors

Technology-based sectors are characterized by higher productivity than non-technology-based sectors. The technology-based sectors in Israel are gradually narrowing the existing productivity gap between them and their counterparts in the U.S. In contrast, productivity growth in non-technology based sectors is marginal and even negative compared to the U.S. This creates a dual economy, with a flourishing high-tech (high productivity and wages) alongside a weakening traditional market (low productivity and wages).

In an attempt to isolate the effect of DDI on the various sectors we ran the regression equation again. We found that the sector variable does not have a fundamental effect on the strength of the relationship between extent of DDI and company revenue level. One reason that may explain the fact that we did not find a statistically significant effect may be the small number of respondents in each sector. When we examined the effect of the technology variable the finding was statistically significant. In non-technology based every improvement (improvement of half a score point) in DDI level is related to a 6.4% increase in company revenues at a 95% confidence level, compared to 3.8% in technology based companies.

We can conclude from this finding that increased DDI in non-technology based companies will have a stronger effect on company outputs than a similar increase in technology-based companies.

It is important to note that we do not purport to represent the entire economy in terms of revenues of technology compared to non-technology based companies because there is no one absolute indicator that can be used to classify companies, and also since we do not know the revenue distribution of the companies we removed from our sample. Therefore, the findings about technology and non-technology companies are based on the representation found in the sample.

Nonetheless, our study shows that there is a difference in the behavior and the results of technology and non-technology based companies with respect to DDI. For the latter it appears that every improvement in DDI (half a score point on the DDI index) is related to increased revenue of about NIS 30 billion in GDP, and every increase in DDI level of technology based companies is related to an increase of about NIS 20 billion.

In summary, the study findings regarding the effect of DDI on non-technology based sectors are as follows:

- **Increased productivity**: ~30 billion NIS
- **Addition to GDP of Israel**: ~10 billion NIS
- **Additional tax revenues to the state**

Another analysis we conducted examined the world state in which we narrowed the gap between non-technology based sectors lagging behind in terms of DDI and revenue. The findings show that if we are successful in raising the DDI level of these companies to the average DDI level in Israel, we will increase revenue per worker in these companies by 0.7% (compared to 0.2% in a similar world state in technology based companies). The significance is an addition of NIS 2.9 billion to non-technology based companies (compared to NIS 1.9 billion in technology-based companies), as shown in Figure 13.

And in the world of excelling companies, increased DDI performance of these companies on the DDI index to the level of companies in the 75th percentile, will
translated into an additional NIS 8.8 billion in revenues of non-technology companies (compared to NIS 1.9 billion in technology-based companies).

**Service Companies and Technology Companies Invest More in Data**

Managers of companies in the services and technology sectors indicate more than other managers that their company invests in data, both internal and external, and is willing to invest more in the future.

The services sector has a certain advantage over other sectors in terms of their future intentions: to invest funds in data management (managers in service companies indicated that they intend to invest more funds in this area in the future), and to expose more employees to the use of reports to promote innovation (significantly higher than the other sectors). Furthermore, the services sector already has the largest number of IT employees compared to other sectors, a statistically significant finding.

**Actual DDI Implementation**

Perceptually, more managers in companies from the non-technology based sectors and the trade sector indicated that they tend to base their activities on data and that they introduced improvements based on DDI, compared to managers in the other sectors.

Regarding data management, enhancement and future investment of funds, managers in the trade sector noted that they lag “quite behind”. However when it comes to actually implementing DDI, for example improving company processes, these managers indicated that they rely on data before instituting or changing processes, more than managers in companies in the industrial and service sectors.

**Use of External Data and Data Sharing**

Service companies are more willing than other companies to invest funds in fee-based datasets, while trade companies are willing to invest the least. Service and technology companies are more willing than others to share data, particularly in exchange for data.

**Summary**

The aim of this chapter was to measure the contribution of DDI and the potential impact of its increased implementation on the Israeli economy. Besides the DDI index and the advanced regression, the study results also include a perceptual analysis and an analysis of actual DDI performance in various companies in Israel. The study findings, that are statistically significant, show that DDI can improve the productivity of every company that decided to adopt this conception, as well the productivity of the State of Israel.

Improvement on the DDI index (half a score point higher) will lead to a 5% increase in revenue per worker (which is our estimate of productivity). This can close the gap compared to the U.S. and developed countries, increase the competitiveness of the State of Israel, add NIS 54.4 billion to GDP and raise tax revenues by about NIS 18 billion.

Low-level technology sectors in the Israeli economy such as traditional industry and SMEs will gain greater benefits from improved DDI implementation and integration, and from closing the gaps between them and the leading sectors and companies in Israel.

The notable expected benefit to every company and to Israel from data driven innovation is extensive but still far from being fully realized. To tap into this potential an environment that cultivates DDI must be created. The government has a fundamental role in creating such an environment by...
maintaining a government policy with the goal of promoting and cultivating DDI in the private and public sectors. This policy and its implementation will build data infrastructures accessible to the public, remove barriers and establish fair operating practices.

The DDI index that was designed as part of the study defines three key drivers for the existence of DDI in a company: data accessibility in the organization; capability to process, analyze and use data; and the ability to produce innovative outputs. Promoting one of these drivers will improve the organization's DDI index score. Creating an environment that will enable the realization of these drivers will not only lead to company growth, it will have a positive growth effect on the economy as a whole.

In the following chapters we will characterize government policy that promotes DDI in the public and private sectors, and review the government's roles in formulating this policy.

**DDI in the public sector**

The survey focused on business and not on the public sector, however we did conduct six interviews with senior officials in the public sector.

The results are obviously not statistically significant, yet several areas elicited similar responses from the interviewees. All six emphasized that the government entities to which they belong do not use data to gain insights. Another notable fact was that in the past these entities used data more than they do today, yet they still believe that "companies that use data are more successful than those that do not".
6. DDI Advanced by the Government

6.1 The multiple roles of government in advancing DDI

DDI is a source of economic growth that can drive initiatives, action and revolutionary decisions for society. It can lead to both innovation and business success that can in turn boost productivity and economic growth. Similar to technological breakthroughs such as the printing press, the steam engine and semiconductors – a perceptual change to correctly implement DDI, a quantum leap for those that adopt it.

DDI integration is not an easy task. It requires learning, knowledge and recognition of the need, training personnel and, of course, the existence of both internal and external datasets. Nonetheless, its benefits are substantial for a company that succeeds in overcoming the obstacles. Improving the ability to offer new products, to renew marketing channels and improve their efficiency or to maximize work processes through data driven innovative means will improve productivity by about 5%. The impact is even greater in SMEs and traditional businesses characterized by substantial productivity gaps compared to the national average and to counterpart businesses in developed countries and in the U.S.

Many Israeli companies are well aware of the need for innovation, of the economic contribution of innovation and of the fact that data is a significant innovation driver, but find it difficult to overcome barriers to realizing this type of innovation. Some have yet to understand that DDI is the key to the competition they face in the market and to increased productivity. Companies want government data to be made public that they can translate into economic value. Strong awareness of the impact of DDI policy will generate a discussion among government officials, leading managers and entrepreneurs about the value that can be derived from DDI.

In addition to creating a suitable regulatory environment, the role of government in exploiting DDI potential is to adopt and foster innovation and to release, as much as possible, data needed so that the DDI process is successful. Government can open datasets to the general public, while protecting policy; ensure accessibility, availability and convenience; and foster efforts to generate economic benefits from these datasets among application developers, civil organizations and companies. The government has the power to formulate a policy that will encourage the private sector to realize the economic-business potential of DDI, 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 potential, reap its many benefits and commit to actively promote it in its numerous functions: as consumer, data provider, policymaker and regulator, educator, funder and incentivizing force among companies and citizens alike.

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.

In the following chapters we will review the tools available to government in its many roles in the digital era to realize the benefits of DDI.

Promoting DDI is a necessary and fundamental effort, however it should be emphasized that it is only one stage in the digitization processes that governments in developed countries must undergo. Public sector digitization is a threshold condition for promoting and realizing DDI and should therefore be the first step. In a place where fax and paper are the main information and communication systems there is no room for a discussion about data collection and opening datasets, initiating competitions or training data scientists, not to mention an expectation for supporting and flexible regulation that takes into account the needs of companies and individuals in the digital age.
Government as DDI Consumer

Innovation and excellence in service provision, processes and business are 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. The way to reach the goal of DDI is by digitizing interfaces with service recipients and work processes. Data in digital format must be the basis for every interface of government agencies with citizens and “customers”.

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. In its role as a DDI consumer the government can use datasets 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 the 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 strengthen DDI in the public sector.

Government as Data 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, data related to phenomena such as climate change and car accidents and data in other areas under the responsibility of government agencies.

Open government is an idea and a concept that promotes accessibility of government data to the public, while maintaining accepted principles that will enable the use of data to foster innovation that drives economic rewards. 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 a government entity with horizontal span of control to spearhead the effort.

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, restricted rights regimes (such as fee-based data and use of “all rights reserved”) and 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 abused 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 release and use. Current legislation in Israel is limited, outdated and is a barrier 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.

Intellectual property must also be addressed in promoting DDI, particularly uncertainty regarding the rights of government and private entities to use published information. The government must create a regulatory framework that will permit the use of 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 perfection 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 incomplete without the human factor. This factor has a dual function, on the one hand technology personnel and data scientists who are the one that process and enhance data so that innovation can be created. On the other hand there are managers and employees at different levels that demand and consume 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 regarding 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-technology based sectors that have large knowledge gaps that hinder their ability to increase productivity and 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 not occur in the normal course of market activity. These steps may not be part of ongoing market functioning due to lack of awareness, cultural differences or because they 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 supporting them indirectly through benefits of monetary value. 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 in order to implement DDI.

The focus of government as funder must center 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-technology based businesses.

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.

Nonetheless, the main support the government can provide in its capacity as a DDI funder is to provide infrastructures that support SMEs and non-technology based sectors. These companies indicated that the technological barrier is the most notable obstacle they face in realizing DDI as part of their company’s business and organizational culture.
6.2 DDI environment model

A DDI-based market is comprised of a variety of entities that supply and consume data as well as services and products derived from this data. The environment is both simple and complex since it involves several stakeholders that fill various roles. Of all the entities involved, the government is the most important as it owns most of the open data (or data that can be opened), and it establishes policy and regulation that impact the nature of interactions in the market.

Figure no. 14 is a flowchart of DDI processes that describes the various stakeholders. Clearly, the data driven innovation process is based on data. Data suppliers can be companies that collect data about their activities as well as those of their customers for their own use; companies that collect information and open it for use by other companies and the general public, e.g. Google Trends that supplies analytics about search engine performance; or the government, that releases datasets of data it collects. Another entity that may serve as a data supplier are private citizens that systematically collect information of some kind. These data collection, storage and analysis processes should first and foremost stem from a management culture that views data and figures as a necessary infrastructure for the organization's proper and adequate functioning.

Sometimes there is an additional component between the first and second phase in the flowchart – the aggregators – organizations that collect and aggregate open data, purchased data or data belonging to organizations – and make them available to various users. In certain cases they also offer statistically processed data from datasets.

The second phase in the flowchart refers to the intermediaries – these are companies and application designers that process data and make it accessible, that in effect enabling innovation. These may be part of the same entity that collected the data, such as the operations department of a manufacturing plant, the IT department of a government office or the project management department in a technology company. They may also be technology companies whose business is data processing and analysis and creating DDI, for example Deloitte Analytics. These entities route the data to create process, product marketing or business innovation. Additional actors in this phase include startups and developers that offer data driven services such as WOBI, Moovit, Breezometer and Madlan.

The last phase is that of data consumers which includes businesses, private individuals that use innovative applications and services, and the government that utilizes innovation outputs to maximize its services and activities. Sometimes both the government and companies consume DDI produced in an internal process, and at other times DDI is offered as a service by companies that specialize in producing data for this purpose.

The DDI environment may also include additional essential stakeholders that are not part of the data flow and innovation process – these are the “enablers” – organizations that facilitate data use by providing, among other things, dedicated infrastructures and consulting and data management services. These organizations are not data consumers, nor do they create innovation from data. As both a data supplier and a data consumer, government has the tools to promote DDI and its flourishing in each and every phase.

The existence of an advance DDI environment can contribute to the growth of existing companies that decide to consume and implement DDI. Moreover, it will also bring about the development of a new sector of companies that provide infrastructures needed to implement DDI.
We will use the following example to illustrate the DDI environment model and the processes it entails, from the initial creation of data and its collection all the way to gaining the benefits of innovation: imagine a government dataset that provides data about land quality. This dataset is released and an agriculture technology company relies on this data to offer an innovative application that helps farmers make operational and financial decisions. Ultimately, farmers around the world use this application and improve their profits. In this example, the government is supposedly directly responsible only for data collection and release, however the policy it fosters is what creates the environment that enables the agriculture technology company to offer its services and products.

**Figure 14: DDI Environment Model**

- **Companies benefiting indirectly from open data**
  - Data management and storage companies
  - Platform and software providers
  - Crowdsourcing hosts
  - Advisory services

- **Enriched data, apps, inform decision-making and policy-making improved analytical skills**

- **New products and services and wider outcomes delivered with support from open data – economic growth, increased innovation, efficiency savings and broader impacts**
6.3 The importance of adopting the suitable policy

To realize the full potential of DDI there must be a government policy in place that both advances and fosters it. The need for an overall policy that will enable the development and flourishing of a DDI environment is expected to continue and even grow in recent years. However, it is important to emphasize that the goal is not “a DDI promoting policy at any price”, but rather fostering an enabling policy, one that ensures realization of the economic potential and the economic and social benefits to the state, the business and the individual.

Three possible world states can be imagined in establishing policy for promoting DDI in Israel: an enabling policy that leads to realizing the economic potential of DDI; a restrictive policy that delays and/or prevents actualization of the potential; and a non-policy that in effect preserves the existing situation without changing current policy.

Enabling Policy

An enabling policy takes action in line with the goal of realizing DDI potential. These actions adhere to commonly accepted open government principles and include opening all government datasets that do not harm national security and that ensure privacy protection. This policy defines legal criteria for privacy protection and establishes a DDI-supporting regulatory framework. The government employs a variety of tools to encourage the business sector and the general public to use government data and DDI to foster innovation.

The impact of an enabling policy:

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

**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)

**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

**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

**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.

**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
Restrictive Policy

Not fostering DDI, a restrictive policy also creates difficulties for entities seeking to develop and implement DDI processes. These include strict enforcement of the database law that imposes monetary fines on even the smallest and most marginal datasets. This deters companies from collecting data which in turn cannot be analyzed and used. A restrictive policy is one in which the state can enact stringent and unreasonable laws in all matters relating to privacy that ignore available technologies that enable data disclosure without harming privacy. In doing so it blocks any possibility to open many government datasets and for companies to collect data. As part of this policy government data is neither free nor accessible (in a machine-readable format). In the context of privacy it is important to note that this policy ignores technologies and methodologies that enable the disclosure of information without harming privacy, even though it is possible, and in doing so prevents the release of data which could have been disclosed without endangering privacy or national security.

The impact of a restrictive 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.
A Non-Policy

This policy can be characterized as “more of the same”. The state does not actively limit DDI, but at the same time does not actively promote it. Under such circumstances the likelihood of realizing the huge potential of DDI is small to non-existent. Companies need open, accessible and available government data find it difficult to do business in Israel. Besides having an adverse effect on competitiveness, lowering the cost of living and stymying economic growth, the State of Israel under this world state will simply lag behind other developed countries. Over time, the significance of a non-policy is in effect adopting a bad policy. The most adverse effect of non-policy is the uncertainty it creates in the economy about DDI and the use of data, resulting in less benefits than could have been generated from an enabling policy.

“A Faucet for Every Sink” is a small business with 10 employees and twenty years of experience in offering plumbing services to residents of the Israeli city of Rehovot. The company advertises itself mainly through magnets and flyers it distributes to residents of nearby neighborhoods. Moti, the owner, was faced with growing competition from maintenance companies that also offer plumbing services and with customer complaints that he is not knowledgeable in up-to-date plumbing trends.

Imagine the future of “A Faucet for Every Sink” under an enabling policy. Due to various government initiatives Moti is exposed to the importance of using data and to the economic advantages to his small business. Using convenient and available analysis tools found on the government portal, along with government datasets, Moti discovers that in the area he serves several new neighborhoods are characterized by young families of high average income, and another neighborhood with buildings built 30 or more years ago with a mostly aging population. Based on this information Moti decides to invest his marketing efforts in the new neighborhoods and to develop a new service tailored to the aging population, with advertising targeted to these audiences and professionals specializing in old water and sewage infrastructures. At the same time, Moti takes advantage of the tools and knowledge he received from the government to collect and analyze data about his activities and discovers that complex tasks performed later in the day take more time than those that are started early in the morning. With this knowledge in hand Moti reschedules the plumbers’ appointments so that they can now serve more customers per day. Taken together, the changes undertaken by the company significantly increase its revenues without requiring major changes in resources invested, thus improving productivity.

Now imagine a restrictive policy. Moti continues his way of doing business without the ability to assess the effectiveness of his advertising investments. At the same time, a maintenance services company, “Home is Us”, the largest and leading maintenance service chain in Israel with countrywide dispersion, acquires advanced IT systems that collect information about its activities and customers and purchases demographic datasets, improving and focusing its services. This enables “Home is Us” to offer more attractive prices and services, making it all the more difficult, if not impossible, for “A Faucet for Every Sink” to compete under these conditions.

The following chapters will examine the various roles of the government as DDI consumer, data supplier, regulator, educator and funder. This will be followed by a discussion of the optimal government policy.
7. Government as DDI Consumer

It is difficult to imagine a genuinely innovative country without an innovative government that serves as a role model for generating benefits from DDI. This is where the role of the government as DDI customer enters the story. DDI offers an excellent opportunity for government to improve its efficiency and effectiveness as well as the quality of its services to the public. Effective use of data as part of a government management culture can facilitate informed and data driven decision making, and achieve better results at a lower cost. Furthermore, datasets offer the opportunity for innovation through the activities of government entities themselves. In its role as DDI consumer the government can operate at two levels: first, use its own datasets to obtain benefits and create innovation; second, harness the private sector and the public to use the data it has at its disposal to find innovative solutions to the challenges it faces.

7.1 The state as data consumer and innovation driver

As a precondition for securing the benefits of using the information it holds, the government must transition to a digital format. The public sector must undergo a digitization process and convert, as much as possible, the data to this format. This is a prerequisite for processing and analyzing government data so it can be used in an optimal manner. In other words, the digital format must be the government’s main means of interaction with “customers” and the public.

By using government datasets, government entities can make better decisions, improve service quality and expand their responsibility. DDI is an excellent opportunity for the public sector to become more efficient and effective and to save vast amounts of money at the central government and local government levels. For example, according to the Director of the UK’s Government Digital Service Unit, in Britain alone exploiting public sector datasets may save $16-33 billion annually. This calculation is based on a number of initiatives in Britain that used big data to improve the cost-effectiveness and efficiency of government programs, to reduce fraud against the government, to decrease abuse of government allowances and benefits and to narrow the tax gap between potential and actual tax collection (Morabito, 2015).
The government can use datasets to increase efficiency and save funds, and in doing so improve and increase provision of services to the public:

- **Evidence and data driven policy**
  Effective use of data enables decision making that is not based on "gut feeling" or intuition, but on knowledge about reality gained from data collection and analysis. For example, in budget decisions preference will be given to funding of programs that have been proven to be effective. Decisions based on evidence of the effectiveness of these programs in achieving the desired results increase the likelihood of obtaining better results at lower costs. Therefore, adopting a management culture that is committed to facts, data and analytics will help government entities make more informed decisions and in turn become more effective and efficient.

- **Assessment and improved performance**
  Analysis and examination of data about government programs and activities enable assessment of their performance and the ability to identify opportunities to cut waste and increase efficiency.

- **Reduce fraud and deception**
  Analyzing data from a variety of sources, government and extra-governmental, may help uncover fraud tactics, identify suspicious behaviors and expose stolen identities. This can reduce abuse of government allowances and other benefits and grants. The tax authorities can also use this data to prevent fraud and to narrow the gap between potential and actual tax collection. Data mining by the FBI in the U.S. reduced fraud in federal health care programs for citizens 65 years and above by $4 billion (Yiu, 2012).

- **Predicting threats and danger**
  By examining and analyzing the relationship between data items it is possible to design models that describe how things are expected to develop in the future. Thus the government can predict future threats and danger, and act to contend with and even prevent them. For example, analysis of datasets can provide the Defense Ministry with the ability to predict and prevent terror events.

Self-consumption of datasets provides opportunities for the government to innovate and become more efficient. Another no less significant advantage of self-consumption is the ability to ensure that government datasets are up-to-date, accurate and accessible, and if necessary also upgrade and enhance them. An apparent conclusion is that in order to ensure quality government datasets, it is vital that the government will use the same data that will also be accessible to the public.

It should be noted that the quality of government datasets is highly critical to ensure correct and efficient use of the data. Data that is incorrect, inaccurate or outdated may lead to erroneous conclusions and unsuited policy (see expanded discussion about information problems in the real estate market in Israel).

To encourage public institutions to take advantage of open datasets, at the central and local government levels, the government can recruit employees with professional expertise and skills in information science. No less important, it can educate employees, including those that are not in technical positions, about the value of datasets and the way data can be used to gain new insights, to make better decisions and to improve public services. It doing so it can create a data consumption culture as part of the management culture of government entities, increasing the likelihood that DDI will be perceived as an integral part of their responsibilities, not just a peripheral project.
Leading DDI consumers

New York City uses data mining to fight fires. There are about 1 million buildings in the city, and fires that cause severe damage occurring in about 3,000 structures annually. The city's Fire Department uses data mining to predict which of the city's buildings are at the highest risk of catching fire. Department analysts claim that certain characteristics of buildings increase the probability that they are at fire risk. A fire is twice as likely to occur in vacant structures. Additional factors found to be strongly correlated with fatal fires are, among others, building age, electricity problems in the building, number and location of sprinklers and whether there are elevators. NYC used about 60 factors to build an algorithm that assigns buildings a score based on their fire risk. Now, when Fire Department inspectors perform weekly building inspections they do so in buildings with the highest risk rather than at random as they did in the past. NYC has succeeded in reducing the number of fires and their severity. Moreover, as a result of this policy fire fatalities have been the lowest since 1916, when data was first collected.

Louisville Kentucky is one of the worst cities to live in for people suffering from allergies and asthma. In cooperation with a healthcare organization the city implanted monitoring and tracking devices in inhalers to measure what parts of the city they are used the most. Using this information, in conjunction with air quality data, the city drew a map that identifies the areas where residents have difficulty breathing. This mapping enables city officials to make data based and informed decisions regarding its health policy and to design a healthier environment for city residents.

San Francisco collaborates with the American company Yelp that operates the popular “business recommendations” website for business owners, and publishes hygiene data on Yelp about inspections conducted in restaurants throughout the city. San Francisco was the first city to get on board with Yelp's health inspection program. Thus, alongside restaurant reviews and recommendations, users can find the restaurant's hygiene inspection score. Due to Yelp's great popularity, this application receives updates about hygiene problems in restaurants around the city and motivates restaurants to adhere to hygiene regulations.
U.S. federal government DDI budget

The United States and Britain are the leaders of open government. The U.S. government upholds the importance of open government in general and the opening of government datasets in particular as a driver of innovation and economic growth, investing substantial resources in its achievement (OECD, 2015).

A budget for promoting DDI at the federal government level was first allocated in 2014 (not only at the government office content area level) for the amount of $14 million. The aim of this step was to promote the use of data, findings, and analytics capabilities and advanced digital services in order to improve the federal government’s efficiency and effectiveness.

From the total DDI budget, about $8 million were earmarked for promoting efficient, effective and secure use of information technologies by the federal government, among other things by allocating resources to the following areas:

- An expert team to oversee the government’s information technology management
- An open website that enables users to obtain data about government investments in information technologies and their effectiveness
- Infrastructure optimization (including the adoption of cloud computing technologies)
- Strengthening government cybersecurity

In addition, about $6 million of the budget were allocated to improve the effectiveness and efficiency of government performance and programs by fostering evidence-based and results-focused practices in federal government entities, among other things by:

- Increasing the share of evidence and data-based government investments and federal grant programs
- Expanding the use of evidence-based tools to assess and improve the performance of government entities
- Extending the use of quality data and benefits gained from this information to assess government programs

It is important to note that this DDI budget is an additional component of the national computerization and IT budget, and includes general DDI infrastructure, as the various government agencies were also allocated an earmarked budget to advance DDI.

The federal government continues to allocate budgets to promote DDI for the years 2015-2016, and to advance additional goals such as: funding relevant projects, promoting collaboration between various organizations and supporting measures that promote data driven decisions by government organizations.

In addition to government budgeting to promote open government, the federal government invests huge funds in additional DDI advancing components. For example, the Obama administration's 2016 budget proposal includes vast investments in this area, including the following budget allocations:

- $215 million for a health initiative aimed at developing personalized drugs based on data about one million persons that took them and volunteered to shared their medical information
- $92 million to improve the sharing of medical information, including creating an electronic medical file that will move with the patient from place to place
- $3 billion to promote technological professions such as engineering, mathematics and sciences in order to meet growing demand for information science and statistics professionals
- $57 million for advanced developments, including the internet of things
- $12 million to develop smart cities
- $16 million to advance mechanisms that will enable and improve open government and data based decisions of government entities (an additional $2 million compared to 2014).

This illustrates the large and continuous investment of the U.S. in advancing DDI in its public institutions and their transformation to more effective and efficient digital organizations. The investment will facilitate optimal utilization of the data resource, which will in turn increase productivity and improve quality of life and the wellbeing of individuals.
**Advanced Israeli initiatives as a tool for realizing the potential of government data**

Webhose.io is a website with tool for accessing unstructured data from hundreds of online sources such as forums, online discussion, news outlets and blogs. Its advanced search capabilities enables companies to convert data that is difficult to find and that cannot be analyzed or compared into an easy to use, accessible and structured format.

Webhose.io is an example of an Israeli initiative that gives its customers advanced tools for processing and analyzing data and access to unstructured data. In the digital age unstructured data comprises 80% of all data. The ability to use such a tool in government offices can give the government a vast advantage, enable it “to put things in order” in the world of government data which includes, among other things, datasets, government decision and a large number of online websites that belong to public entities.

**Reporting from the field...DDI implementation models in Israeli companies and organizations**

The number of cars in Israel is growing daily, directly impacting pollution and city traffic. The government as well as local government are concerned and consistently looking for ways to deal with this challenge.

One large municipality in central Israel, with hundreds of thousands of residents and a similar number of passengers daily, sought to learn about the transportation and heavy traffic patterns in the aim of improving access to crowded areas in the city. The municipality decided to conduct a study based on geographic data provided by a mobile phone company from external traffic data. The goal was to build a model that could analyze transportation behavior in the city during different times of the day.

The model was based on analysis of the segment of passengers who enter and leave the city daily. It identified six major types of passengers who came into the city from at least five geographic areas. Moreover, data analysis showed the arrival/departure times of all types of passengers, as well as their destination in the city.

These findings help the municipality accurately identify where new bus routes are most needed and where there are roads and parking infrastructures clamoring for improvement. Furthermore, by analyzing the distribution of rides in the city the municipality can enhance its strategic city planning for the coming years.
7.2 Involving the private sector and the general public

In addition to the government itself as a dataset consumer, it can harness the private sector and the public to use datasets in order to find innovative solutions to challenges it faces. To this end it can take two key steps:

A. Organize entrepreneurship and innovation events

One of the common actions used throughout the world to promote use of government datasets is to organize events known as “hackathons” or “datapaloozas”. These events are usually conducted over several concentrated days aimed at creating an atmosphere of innovation and entrepreneurship. They bring together programmers, entrepreneurs, application developers, experts and other stakeholders to collaborate in developing an innovative product, service or application based on data found in government datasets. The participants are requested to present proposals for products that would improve quality of life or advance a solution to a challenge presented to them using data at their disposal. The best project is usually awarded a monetary prize. These events enable the government to benefit from the participants’ expertise in order to advance solutions to challenges it faces using its own datasets.

B. Development and innovation competitions

Another common way to promote the use of datasets is to conduct a competition with monetary prizes for developing innovative applications based on government datasets. These competitions are an incentive for the private sector to take part in DDI and encourages them to invest time and money (that are greater than the prize amount in most cases). This course of action requires a relatively small monetary investment, attracts strong media attention and increases the number of companies and organizations that take part in DDI development.
“Health Datapaloozas”

The first Health Datapalooza, conducted in 2010, was initiated by Todd Park, the U.S. Government's Federal Chief Technology Officer. Park brought together 40 brilliant technologists and professional experts and sat them down in one room with one huge database at their disposal. Following an 8-hour brainstorming session the participants had proposed ideas about various innovative health-related applications and services. They were asked to attend a conference that would be conducted 90 days later to present a viable plan for the idea they had proposed. The idea had to have clear concrete value and a well-formulated business model. The experts came to the conference with 20 brilliant and innovative products or services that no manager in a government agency would have thought about (let alone reached the development of a proven business model).

Since then, Health Datapaloozas have become a tradition that takes place annually in Washington D.C. While the first conference attracted 45 participants, the 6th conference in 2015 already drew more than 2,000 attendees. The Datapalooza brings together programmers, entrepreneurs, startup entrepreneurs, academics, public opinion leaders and health experts for brainstorming in developing innovative applications intended to improve the health system in the U.S.

Development and innovation competitions worldwide

In 2009 the government of Australia announced the Mashup Australia contest (‘paste’: a website or application for combining content from more than one source to create a single new entity from their combination) awarding monetary prizes for practical experience in using open government data made accessible by the government. Among the contest winners was an application that enables users to compare neighborhoods taking into consideration economic, education and security characteristics, and an application for obtaining historical, geographic and real estate information by zip code.

In 2010 the government of New Zealand held the first contest between Mashups that consume data from at least one New Zealand government dataset and are willing to make their development accessible to the public through a website or a free mobile application. About 250 mashups were submitted. Among the winners was an application that integrates walking paths on interactive maps, and an application that shows electricity power usage of households by geographic location.

In 2008 the British government taskforce on "the power of data" announced a competition “show us a better way” that invited ideas from the public on how to make secondary use, how to provide a visual representation and how to mashup government data. New datasets were opened to the public for the competition and prizes were awarded in the amount of £80,000. Among the winners was an application providing information about waste recycling by geographic areas in Britain and an application with information about cycling routes in interactive maps.

An example of a similar initiative in Israel is the TelAvivApp2U e-Government Competition for developing applications based on government and Tel Aviv municipal datasets that was held in 2012 at the initiative of the Unit for the Improvement of Government Public Services and the Tel Aviv municipality. The competition awarded NIS 85,000 in prizes and was limited to the city of Tel Aviv. Award winners included developers of an application for improving a government or municipal service to the public, and to developers of an application that provides access and enhances information to citizens regarding use of public and alternative transportation services.
8. Government as Data Supplier

8.1 Open government as a significant tool for creating a DDI fostering environment

In 1945 the Executive Editor of the Associated Press, Kent Cooper, coined the term the “people's right to know” to emphasize that the government or journalists should not hide from the public information that may shed light on a certain issue or any other information vital for its wellbeing. In 1766 Sweden was the first country to pass a Freedom of Information Law. 200 years later most countries joined the trend and more than 95 countries worldwide currently have such a law. In 1998 Israel joined the countries that protect freedom of information, declaring that “the right to receive information from public authorities is one of the fundamental rights in a democratic regime and a basic condition for fulfilling freedom of expression and for realizing an individual's political and other rights in all areas of life. Greater access to information will help advance social values, among them equality, rule of law and honoring human rights, and will provide for better public oversight of government actions”.

The Freedom of Information Law is the most basic phase on the road to transparency and the sharing of information with the public. Passing of the law underscores the recognition of the government's obligation to share information with its customers and the ensuing benefits. This is a necessary but insufficient first step, as there is still a long way to go until an advanced open government is fully operational. This chapter will focus on the road that must be travelled.

Sharing government information with the public has social value as well as substantial economic value. In the digital world in which we live information is a basic infrastructure and a source of business, marketing and process innovation.

The state has numerous interfaces with citizens, businesses and various phenomena. Every interface creates extensive data accumulated by various government entities that can drive innovation and economic growth. For this reason, one of the government's central roles in promoting DDI is that of data supplier. Open government is a policy that defines accessibility of public data while encouraging its use.

“Imagine we had a resource available that could stimulate new innovations, a market worth tens of billions of euros, and increase the transparency and governance of public life. We do – it's the data held by Europe's public institutions.” Neelie Kroes21, 2011

Open Government – from a Specific Solution to Opening Datasets

The Israeli family is looking for a quiet apartment in the city of Givataim and would like to know on which streets there will be construction works in the next two years. The Movement for Quality Government in Israel would like to publish a report about the cost of living that is in the hands of one of the government ministries, Moovit Company needs data about transportation in Israel in order to provide advanced services. These are only a few examples of organizations and events that will benefit from an open government.

Open government is an outlook that fosters three values: accessibility of government data to the public based on the assumption (accepted in democratic countries) that government data and data collected by government entities essentially belongs to the public and is entrusted to public representatives; Encouraging public participation that will improve government efficiency and the quality of its decisions; Fostering cooperation between government offices and between them

21. European Commissioner for Digital Agenda and Vice President of the European Commission.
and business entities and the third sector (non-profit organizations).

Data access is the cornerstone of open government and 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.

First level - data released by request
The current Freedom of Information Law anchors the right of the public to request information from a public entity provided it does not harm privacy or national security. The information refers to any data format, from local data through reports to a dataset. According to the current procedure, the public entity responds to the request and is not proactive. Let’s go back to the Israeli family that can take advantage of the Freedom of Information Law and contact the Freedom of Information Law officer in the municipality to request the municipal development plan of the Givataim municipality Planning Division.

Second level – initiated publication of information
Proactive publication of data and reports to the public by the relevant entity. The current law does not require initiated release of data, but many claim that the law should be updated to require public entities and government ministries to publish this information. Since it is not required (except for a few information details such as the state budget), proactive release of data currently relies on goodwill and a broad perspective. An example is the case in which as a result of numerous requests to receive a copy of the conclusions of a committee on education matters, the Education Ministry decided to publish the committee report on the Ministry website.

Third level – opening datasets
Granting public access to datasets of public entities – this is done as part of government policy to provide access to data and to establish open government, not necessarily in response to a request. Let’s get back to Moovit that relies on datasets about public transportation in Israel that were made public by the Transportation Ministry.

Government data can be divided into three groups:

**Statistical data**
- Raw data collected directly or indirectly by public entities.
- Data is processed and analyzed (usually by the Central Bureau of Statistics) in order to serve public entities and the public.

**Information about individuals and businesses**
- Data collected as part of government activities and services.
- Also includes public information about companies and their relationship with the state.
- The extent of disclosure to the public depends on the degree of privacy.

**Data about phenomena**
- Data of measurements conducted by government entities such as weather information, maps, air pollution, etc.
Openness Begins in Government

In the information age in which information is power but also a basic and necessary infrastructure, the discussion about open data, data accessible to everyone, whether collected by the government, businesses or citizens – is inevitable. Promoting and integrating “open government” is at the center of this debate taking place mainly in the public sector.

Dealing in open government as the first stage of the discussion is not surprising when several characteristics of the phenomenon are examined:

- As part of their activities, the government and other public entities collect vast amounts of information about businesses, citizens and other phenomena. This data is usually a “by-product” of the system’s activities and therefore a sunk cost (a cost already incurred that can no longer be recovered).
- In contrast to data sharing of businesses, sharing government data and accumulated knowledge does not endanger a competitive advantage because in most cases the government provides services for which it has a monopoly.
- We mentioned above that it is the responsibility of the public sector to promote social values and economic prosperity. Therefore, social and economic value generated by a third party using open data, and leveraging the capabilities of these entities are also compatible with the goals and interests of the public sector.

It should be emphasized that while government data refers to government offices and bodies, there are other public entities with extensive and relevant information. It is important to consider adding them to entities included under the umbrella of open government, for example the judicial system and public companies.

Interest rate set by the central bank

Although government data is at the heart of the debate about open data and open government, there are non-government open datasets that drive business and process innovation.

An example is the Central Bank of Israel and the process of setting the interest rate. The Bank of Israel updates the interest rate every month, for which vast amounts of data must be updated in real-time and continuously.

The interest rate is set based on several factors, among them inflation conditions, real economic activity and the employment, housing and foreign currency markets. The real activity component has always been difficult to forecast since most data used to assess the state of the economy is published by government entities such as the Central Bureau of Statistics after a long delay, and therefore the Bank of Israel, similar to other central banks the world over, are looking for ways to obtain the most updated information.

In an attempt to develop tools that provide the ability to predict reliably and currently (nowcasting), the Bank of Israel conducted a study that examined the ability of Google search indices to predict market demand. The research studied data generated by Google Insights for Search, and found a relationship between the search of certain subjects on Google and real market activity. Thus, for example, due to the rise in the search for the word combination “unemployment benefits” or “job search”, it is possible to predict a change in the unemployment rate. The study found six prediction categories: human resources, food and beverages, real estate, travel, home appliances, beauty and personal care.

In light of the study, the Bank of Israel Research Division began to use data generated from Google analysis tools to identify market trends, as an indication of demand in certain sectors and as an auxiliary variable for the item “revenue from goods and services”. This practice illustrates another use of DDI by the state that provides huge benefits from the use of a non-government open data resource.
Open Government as a Driver for Creating Economic and Social Values

As mentioned, from the outset open government was intended to strengthen democratic values through transparency and the strengthening of its civil commitment. To maintain a democracy, i.e. to ensure a system of checks and balances and to enable the public to elect its representatives, the public must know what the government is doing. Transparency does not only mean access to information, but also the ability to share and use the information. To understand information it must often be analyzed and presented in a convenient and straightforward format. Therefore, information does not only have to be disclosed, it must be open such that it can be used. While the initial impetus for open government was socially motivated, since information has the power to engender economic growth, it is vital to seriously discuss the role of “open government” in creating economic benefits. The route from information to economic benefits goes through DDI.

Innovation is a fundamental catalyst in fostering economic growth and closing existing productivity gaps.

Information in the digital age is highly valuable and a catalyst for economic activity, from applications for finding the nearest post office through an agricultural organization that uses weather and crop yield data to increase output. Opening government datasets in effect fosters the adoption and use of DDI and enables the realization of its potential. As demonstrated in Chapter 3 (DDI benefits), datasets in general and government databases in particular can be used to build new business models, develop new products and services and improve operational excellence. A study conducted in Europe recently found that opening datasets to the public could increase GDP in the EU28 countries in 2020 by €10 billion, and combined with big data capabilities for data-driven decisions, 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 in 2020, and combined with big data capabilities for data-based decisions would contribute about NIS 7 billion in 2020. Another study conducted by the British government showed that in 2011 the value of government information made public was £ 1.8 billion (Department for Business, Innovation and Skills, 2013). Government information provides fact-based evidence that can support a wide range of decisions in the public and private sectors. Besides the benefits for the latter, that ability to make decisions and promote process, service and product innovation – can have a considerable effect on the public sector. Open government and real-time access to data saved San Francisco $ 1 million in 2012. Real-time access to transportation data decreased the number of SF311 calls by 22% saving the municipality money (Capgemini Consulting, 2013).

In summary, the benefits of open government can be viewed from two perspectives:

**Open Government as a DDI Driver with Economic Benefits**

1. Fosters innovation that leads to the development of business initiatives as well as new products and services
2. Eliminates entry barriers by addressing asymmetrical data
3. Produces economic value for the public sector through operational and service excellence. This includes maximizing output and tapping the potential of existing resources.
4. Sharing information between government entities and enhancing government data through its use will help release quality data to the public.

**Open Government as a Driver of Social Values**

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

This part focuses on “open government” as a leading tool available to the government for advancing DDI that produces economic benefits. Nonetheless it is important to note that implementing the policy proposed further in the report will also provide social benefits not only economic rewards.

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22. SF311 calls connect individuals, businesses and tourists to municipal customer service representatives.
8.2 Open government guiding principles

Open government is first of all an outlook of the government regarding ownership of government information and its accompanying benefits. To maintain an advanced open government it is not enough to have an outlook. This outlook must be supported by government decisions, an enabling policy and allocation of resources. The Open Society Foundation examined the factors for the success of open government in the U.S. and Britain and determined that an ecosystem that supports government policy plays a fundamental role in the strategy for advancing open government. The three tiered approach developed by the Foundation describes the three stakeholders needed in order to promote a successful open government policy:

1. First tier – civil organizations
   Devoted developers, known as civic hackers or hacktivists, aim to demonstrate the benefits and capabilities stemming from open government and to put pressure on government entities to be as open as possible. Many times, at the beginning of the open government process, it is the civic hackers who actually make data accessible to the public by gathering data from the depths of government websites. In Israel, the Public Knowledge Workshop collects, opens and makes accessible public knowledge in the aim of arousing a public debate that will lead to creating new knowledge that will be shared with government. The workshop is comprised of volunteers and is not for profit. Among its output are the Budget Key and an interactive map of changes to the national budget throughout the year based on budget transfers that shows how allocations in the national budget change from year to year.

2. The second tier – professional entities
   Government officials with a budget, a commitment and qualifications to promote the issue. These entities are responsible in practice for maintaining and enhancing datasets and their release to the public.

3. Third tier – Government – top level
   This tier is responsible for establishing an open government policy through regulation and government programs. It may be driven by a belief that they are doing the right thing or may be externally motivated, for example by public pressure.

“Open by default”, quality and quantity, accessibility, innovation and governance - guiding principles for creating open government

The debate about the contours of a successful open government has grown over the past decade, propelled by a variety of entities, from non-profit organizations such as Open Knowledge23 through the Open Government Partnership24. At the G825 countries summit in June 2013, the countries signed an Open Data Charter in which they commit to adhere to principles of open government and to promote leading global practices.

For open government to be a significant tool for DDI advancement and development it must enable the necessary infrastructure for the release of government information grounded in the understanding that the key to DDI is in fact the information itself. To encourage the use of data in general, and to create innovation in particular, the way the data can be accessed is no less important. Data that is not accessible

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23. A non-profit organization that aims to open and share information through advocacy, technology and professional training.
24. An international diplomatic initiative launched in 2011 to encourage foundations of open government throughout the world. As part of the plan governments propose country action plans in which they present the actions they seek to implement within a two year period. Each such action plan is independently assessed by civil society organizations in the country.
25. The group of eight industrialized nations is an international economic organization that includes the United States, Russia, Canada, Japan, Germany, France, Italy and the United Kingdom, comprising 65% of the world economy.
and is not machine readable is difficult to use for advanced purposes. Finally, open government that promotes DDI is a government that fosters the creation of a supporting innovative environment.

The leading principle is a paradigm shift from “closed by default” to “open by default”. Instead of struggling and trying to justify, time and time again, disclosure of a certain to data item to the public, a policy should be adopted that maintains that all data is open by default, unless there is a fundamental reason to restrict access. The main reasons for imposing access limitations are danger to national security and harm to privacy. Open by default is key to promoting DDI since innovation, as its name suggests, is difficult to predict and forecast. We cannot define in advance all the possible uses of data 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 dataset 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 dataset opening due to resource constraints. In such cases top priority should be given to opening datasets that can generate the greatest benefits, as will be explained further in this study.

Raw data is the best format for data that is to be released. First, so as not to invest government resources if it is not necessary; second, every time data is processed unnecessarily may bias the data and hinder expected benefits. Nonetheless, it should be stressed that data processing is vital if there is concern that privacy may be violated. Privacy protection is a paramount value even for those who advocate an “open by default” policy, and using anonymization methods to maintain privacy in dataset items is suitable in order to overcome this obstacle. These methods will be discussed further in the chapter.

8.3 The role of government in promoting open government

Open government is not only a policy that establishes what data will be accessible but also proper access to data – access that fosters a broad perspective of DDI. While the principles of open government define what type of data will be accessible and when, there are additional essential characteristics of open government such as the attributes of shared data and means of dealing with datasets that raise privacy issues.

Characteristics of Shared Data

Not all government data the public can read and even download is open government data. A memorandum prepared by the White House in 2013 established 7 key components that characterize open government policy. These components have been adopted by various countries and schools of thought, and constitute the basic threshold government data must meet in order to be called “open”:

1. **Open** – the most basic condition is a presumption in favor open data (see above);

2. **Accessible** – data is made available by government entities in convenient and machine-readable format that can be processed and analyzed simply, inexpensively and with minimal (data) use restrictions. The more convenient the data processing, the greater the incentive of the private market to use it. For example, a PDF file is not easily processed and it is therefore unlikely that data available in this format will be used;

3. **Making available ‘data about data’** - the more the data also includes its description (metadata) it can be used more accurately and correctly, and users can better understand the nature of the data. For example, when the data is
characterized and will include accompanying details it will be easier to find it and cross-reference it with other data;

4. **Free use** – the data must be made available without any legal or ownership restrictions on its use, and the significant restrictions will have to do with how the data is used and not its availability. **Currently, most data made public in Israel is protected under the definition of ‘all rights reserved’ and is not reusable, which limits the ability to make effective use of the data;**

5. **Raw** – data will be published in its most primary form, unless certain processing is necessary to enable its publication without violating privacy. A good example is anonymization of medical information so it can be used for medical research without disclosing private information, i.e. publishing the data while removing the details that may disclose the specific individuals related to the data;

6. **Timely** – to maintain the value of the data, it should be updated on a regular basis so that the most relevant data is published at any given time. Also, the needs of the main data users should be considered. Thus, for example, a dataset related to the weather that is not updated at least once a day is not relevant and we can reasonably assume that it will not serve as the basis for any initiative. Imagine that data related to public transportation in Israel would not be updated regularly. In this case there would most likely not be an incentive to develop the Moovit application that serves millions of passengers and provides dozens of jobs;

7. **Support and service** – the point of contact between the authority that provides the data and the users must be two-way, so that the users will receive advice and assistance, and the government agency on its part will receive user feedback that it can use to improve in the future.

The data must meet the “open data” standards, but also be available. There are companies in Israel and throughout the world whose main business is the open and available government data revolution. The fact that such companies exist underscores the gap between the fact that the data exists and is open to the public and the ability of the public to consume the data conveniently. Advanced countries contend with this by designing a national data portal. Dozens of countries have already set up portals that bring together all the information the government makes public and it serves as an especially broad platform that consolidates many functions such as: analysis tools, customer service, platforms for developers and blogs. The website Data.gov.il was set up in Israel and is operated by the National Information Technology Unit. The website provides access to datasets, and there are also entities that release datasets independent of the central website. The website is currently undergoing upgrade and reevaluation, and new analysis tools are planned to be added in the future.
New York / the Digital Apple / Smart City

The New York City municipality is considered one of the most advanced entities in the world in opening datasets and in the use of datasets by both local government and the public. NYC.GOV – more than 1,800 datasets are available free of charge on NYC’s municipality information portal. The website presents datasets of about 60 municipal entities in a variety of areas, including: public safety, education, health, leisure and transportation. About 46 million entries have been recorded to date.

In 2013 the municipality published the Open Data Plan that details additional datasets planned to be uploaded to the portal in the coming years based on a target date for each dataset. The plan is updated annually and outlines the timeline of data releases for each municipal agency.

The NYC Developer Portal provides datasets and specific APIs in the aim of fostering innovation and making it easier for the private sector to develop applications that will improve municipal services and the life of NYC residents. The portal also serves as a forum for developers engage with the municipality about information it shares and to suggest enhancements to the way data is currently presented. There are 251 datasets planned to be added to the portal, 100 of them in the coming year.

The municipality holds the annual NYC Big Apps Competition that calls on developers and local entrepreneurs to use datasets developed by the municipality to design applications and tools to solve civic challenges. Owing to this competition hundreds of innovative applications have been developed for the benefit of the public with hardly any cost to taxpayers. Prizes of more than $100,000 have been awarded, including to developers of an application that helps users find employment.

NYC collaborates with many municipalities throughout U.S. and with the federal government to collect and share data on a joint information portal, Cities.data.gov. Such a collaborative effort enables analysis and data-based decisions that were not possible before.

The entities responsible for data in the New York municipality are: the Department of Information Technology and Telecommunication (DoITT) – whose main goals are to promote transparency and sharing of public data and to increase public use of datasets. The department also acts to increase access and digital literacy among city residents and businesses; The Mayor’s Office of Data Analytics (MODA) established in 2013 by the prior mayor of the city, Michael Bloomberg, to promote the use of data for increasing the city’s effectiveness, efficiency and transparency. The office is responsible for ‘marketing’ the aggregation and analysis of data across city agencies in order to reduce crime, increase public safety and improve quality of life issues. The office uses analytics tools to manage risk more strategically, deliver services more efficiently, enforce laws more effectively and increase transparency.

Setting the interest rate – UK government data portal – Data.gov.uk

The UK that was ranked highest on the G8 Open Data Charter for 2015 established a portal in 2010 to present all data from government ministries and authorities. The website publishes all data that is not private, for example: a list of institutions and schools, crime rates and local government performance. It also enables users to cross-check data from different sources and create visual functions to present data. The portal also has arenas and forums for developers to share their insights and ideas about data use.
Fee-based access to government data

Open government means free access to government data, based on the assumption that citizens have already 'paid' for data collection, processing and access through various taxes. However, in certain cases it is government policy to sell the data rather than make it publicly accessible. This pertains mainly to government data that may be of great benefit, but its disclosure may pose a tangible threat to privacy or national security. Therefore, the government may decide to restrict access to this data and disclose it selectively to certain entities for a fee.

The main role of the Israel Central Bureau of Statistics (CBS) is to collect data and present statistics. This government entity holds vast amounts of data that is accessible and offered free of charge to the public. However, in certain cases the CBS charges for the data it holds, mainly for access to classified and detailed personal data or for professional services offered in addition to the open data, for example:

- **Purchase customized data analysis**
  The CBS can process raw data from its surveys and other material for a fee. Customers must define their needs and sign a purchase agreement. Pricing is based on employee time invested in preparing the output. Recurring inquiries and high demand for certain data are incorporated over time into the basic data offered free of charge and accessible to the public.

- **Use research room**
  Researchers can use the CBS research room, located at the Bureau's offices in Jerusalem, for a fee. They receive access to CBS data that is not open to the public, including non-identifiable personal data for research purposes. Use of the research room is restricted to researchers from academia and research institutions, after approval of the Bureau's Chief Scientist. Requests are only approved for research on topics relating to economics and society in Israel and to statistical methodologies. Applicants must pass a security check, sign a non-disclosure agreement and provide a financial commitment letter.

- **Purchase Public Use Files (PUF)**
  These are standard non-identifiable data files available to the public subject to receipt of a standard use license from the CBS.

- **Purchase microdata under contract (MUC)**
  These are non-identifiable personal data files more detailed than PUFs. They are accessible to researchers from academia and research institutions following approval of the government statistician, subject to a limiting contract and license to increase confidentiality protection.

Similar to the research room at the Israel Bureau of Statistics, the US Census Bureau manages Federal Statistical Research Data Centers (DRS). These are secured facilities at which qualified researchers with approved projects can receive secure and access to a wide variety of restricted government data. A varying fee is charged for data access, depending on the requested data. There are currently 19 centers throughout the U.S. Researchers who receive the appropriate approval can come to these centers to receive access to data undisclosed to the public for privacy reasons. Three federal statistics agencies provide data directly to the DRCs, each with a different process for approving requests to access restricted information they hold: the U.S. Census Bureau, the National Center for Health Statistics and the Agency for Healthcare Research and Quality.

The Centers for Medicare and Medicaid Services (CMS), a federal agency in the U.S. Department of Health and Human Services, offers restricted data files on health known as limited data sets for a fee. These files do not contain identifiable personal data but are still considered identifiable because with the use of suitable technological tools it is relatively easy to link the data to specific people. To maintain personal privacy, the government discloses the data for a fee and only to entities that meet certain requirements, for example applicants must demonstrate that data use will ultimately improve the U.S. health system. They must also sign a document to guarantee that the data will remain protected from disclosure to unauthorized entities.
8.4 The united states as an open government leader

Up to now we discussed the importance of open government as a major government tool for promoting DDI and the guiding principles for maintaining proper open government. This part will focus on the U.S. as a case study for a government for which open government is a fundamental guiding principle and within several years has become a model of open government the world over.

Up until 2009 most of the data in the hands of U.S. authorities was not available to the public. The sanctity of privacy in the U.S. in effect did not enable disclosure of most information as a default. Thus, when a citizen or any business entity wanted to review data, they had to request it from the authority and deal with a bureaucratic maze. This had a strong adverse effect on trust in government and obstructed initiatives to use data for varied purposes.

In January 2009, with his election to President of the United States, Obama published two presidential policy memoranda to heads of executive departments and agencies. The first memorandum stated that the Freedom of Information Act should be interpreted in a manner that benefits citizens, and when in doubt should adopt a presumption of favor of disclosure and transparency. The second memorandum established a working assumption that government will be as transparent as possible to the public and that government agencies will take action to disclose information they hold, and established practical measures for publishing data in a readable format that can be implemented.

In December 2009, the White House Open Government Initiative published a directive that specifies how government agencies must act to promote open government. The directive included action guidelines and detailed the obligation of government agencies to publish the data they hold. Following this directive great effort was made to design a strategy for the new initiative, and additional directives were issued specifying what is “open data”, the policy regarding the way data should be published, how to build datasets, how to improve data management and more. Alongside policy formulation, new laws that were passed addressed the technological standards that must be met as well as issues of privacy protection and intellectual property rights in data.

In 2011, the American government took another step to strengthen open government policy by establishing an international partnership for its advancement throughout the world – the Open Government Partnership Initiative. The collaboration was established under the auspices of the UN General Council, and at the outset was between 8 heads of state, headed by President Obama. This collaborative effort aimed to promote open government in many countries, to create data-sharing partnerships and to set uniform standards for government policy on open government. Israel joined the initiative in 2012.

In 2013 an open government policy was officially adopted as a default by the federal government. An executive order issued by President Obama required all government agencies to release all data they hold which will be machine readable and processable and subject to privacy and secrecy laws. In fact, according to this policy, all information that does not harm national security or the privacy of another person became worthy of publishing on the Data.gov website that consolidates all relevant data. Underlying this policy is the recognition of information as a valuable national asset whose value will grow immeasurably when it is made public. The aim – to release previously non-disclosed information to entrepreneurs, researchers and any person that may want to use it to develop products and services, to establish a business or to create new jobs.
As of August 2015 the federal information portal published 158,558 datasets open to the public, most of them machine readable and processable. The website was built by the Office of Citizen Services and Innovative Technologies as an open source website and is managed by this office. It provides access to numerous datasets and applications, including information about more than 74,000 cities, datasets with climate information, a dataset of alternative gasoline stations, and data analysis tools.

In addition to the massive release of datasets in various areas, the U.S. government offers all the tools that agencies may need to make this data available in the necessary formats. Thus for example, they offer software for converting data into formats desirable for publishing, data processing software and even a guide to help government employees publish the data they hold properly and in a downloadable format. This is the government’s way of making it easier for government employees used to working with paper or unusable formats to meet the format standards established for publishing government data.

In order to promote the use of government data and generate both economic and social value, certain types of events are organized, among them: ‘data jams’ for developers in order to enhance the use of data by government agencies; ‘Datapalooza’ events in which the release of new data is announced and celebrated surrounded by a media buzz, and panels are conducted with experts related to the published data; ‘Hackathon’ events where developers try to develop software and innovative applications based on specified datasets.

The Open Government Initiative is managed by a special administration whose aim is to estimate the demand for data and to promote its publication by government agencies. There is also a professional body responsible for building a strategy and consulting to government entities regarding data quality enhancement and increasing its quantity.

### SAP Real Estate Cockpit – reducing ongoing operating costs in real estate assets

An analysis of building costs over time shows that about 80% of the costs are associated with ongoing maintenance costs after the structure is built. Monitoring these costs is particularly difficult because the relevant data is spread across varied multiple data sources (e.g. parts replacement and energy consumption). Faced with similar challenges, a team from the SAP Innovation Center developed software that collects and processes all relevant data and enables real estate managers to gain a holistic view of the management of their asset, including energy consumption, technical infrastructures and revenues. The system combines data from different internal and external data sources, including government sources in real time, processed into easily monitored profitability and expense indicators. This enables asset managers to make decisions based on reliable data received in real time.

SAP used DDI to solve the problem of monitoring project profitability – the data was already available, but asset managers could not use it effectively.
8.5 Open government in Israel

The debate about open government in Israel gained momentum during the term of the former minister Michael Eitan who was 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 Initiative. Since then however the gap between Israel and the advanced countries has widened, and Israel currently lags behind. Government decision 2097 to expand ICT-based government activity areas has energized the discussion about open government in general and the opening of datasets in particular. This section will review the current state of open government in Israel, from the Freedom of Information Law through the opening of datasets.

**Free but Unavailable Data**

"The right to receive information from government agencies is a fundamental right in a democratic regime and a basic condition for fulfilling freedom of expression and for realizing an individual's political and other rights in all areas of life. Greater access to information will help advance social values, among them equality, rule of law and honoring human rights, and will provide for better public oversight of government actions" from the *Freedom of Information Law in Israel, 1998.*
The percentage of approved requests dropped from 66% in 2013 to 61.5% in 2014. Along with growing demand for public information there is a decline in public willingness to accept a negative answer which has led to close to a 10% increase in suits filed following a request that was denied.

Above all, the law in Israel does not address proactive release of information by public entities, except for the requirement of every government office to publish an annual report that includes little information and is not published in digital format. A report of the Freedom of Information Unit stated that: “Initiated publication of data - although the law requires advance publication of an annual report, written administrative guidelines and environmental data, there is non-compliance and a fundamental lack of understanding regarding compliance with the provisions of the law and the regulations, and publication dates required by law are not met. Furthermore, most of the entities lack a broad perspective regarding the use of technological capabilities to expand information accessible to the public, and in doing so strengthening public trust in the government entity and its activities”.

The Freedom of Information Unit recently published a guideline document regarding initiated publication of information, however it has yet to be translated into an operational plan or to receive government backing (as of the date of this document).

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We Set out on a Journey but There is Still a Long Way to Go

“Open data contributes to economic power, to citizen wellbeing and to democracy. Government statements in this decision signal the way for government officials that come in contact with citizens, that it is their duty to release as much public information as possible, so that they become part of the assets the public can put to use for its wellbeing, economic welfare and civic empowerment, all subject to security, privacy and ownership rights”.

Minister Michael Eitan

When open government was gaining momentum in western countries, efforts in Israel to advance the issue were set in motion by former minister Michael Eitan. These efforts began in 2010 with a government decision which established that datasets of value to the public should be opened, and peaked in 2012 when Israel joined the Global Open Government Partnership Initiative. In doing so Israel in effect committed to meet the global standard that includes taking active steps to promote principles of government transparency, accountability and responsiveness to citizens.

Despite these initial small steps, the government in Israel essentially remains closed. A report that examined Israel’s fulfillment of its commitments to the Open Government initiative published in 2014 indicated that the State had taken upon itself only 13 very modest commitments to begin with, of which it had only fulfilled two in full and three others to a large extent (Israel, Progress Report, 2012-2013).
Two distinct signs of Israel's lagging position can be seen in its declining ranking on the Global Open Data Index and the gap between Israel and developed countries in the number of datasets open to the public.

Between 2013-2014 Israel's rankings 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 Index. The Czech Republic for example moved up from 30th to 12th place and India from 27th to 10th place. According to the report, unavailable or insufficient information about legislation and government expenditures in Israel is conspicuously lacking.

Another sign of open government is the availability of datasets and their opening and access to the public. While leading open government countries provide access to tens if not hundreds of datasets through a government information portal (data.gov), only about 300 datasets are accessible in Israel (see Figure 15). Moreover, only 50% of the datasets are machine-readable (as required in a proper open government in order to encourage innovation and technological developments), compared to 90% in the U.S. and 95% in Britain. Some claim that among the datasets opened in Israel most lack any economic or social value and were made public solely for convenience and availability considerations.

Despite (and perhaps because of) difficulties, civil organizations in Israel that demand the state's adherence to transparency and sharing principles have become more vocal and active in recent years. Their efforts, most notably by the Public Knowledge Workshop and the Movement for Freedom of Information, result, among other things, in the opening of one of the most well-kept secrets of the Finance Ministry – the state budget. Since 2010, the Public Knowledge Workshop makes available the state budget in a simple and clear graphic format and presents the main budget highlights as well as growth data, trends and various emphases.
Besides entities promoting social values, companies that offer services and products based on government data are emerging. Companies such as WOBI, Moovit and Madlan create value for customers by providing innovative services based on analytics of public data. Nonetheless, such for-profit companies are few and far between.

**Back on Track**

There have been several developments since the end of 2014 to advance open government in Israel. An updated work document was launched establishing the 2015-2017 work plan for advancing Israel's Open Government Partnership commitments. Some of the steps delineated in the document are very basic and represent a low standard for the existence of open government. At the same time, the government approved a decision to "expand ICT-based government activity areas, foster innovation in the public sector and promote the national initiative ‘digital Israel’". Among other things, the decision mandated the opening of datasets, emphasizing that is the result of Israel’s “joining the Global Open Government Partnership Initiative, and the understanding that by giving access to datasets a platform can be created for developing new initiatives that may ease the bureaucratic burden, provide citizens efficient and convenient service and lower the cost of living”. It also stated that to achieve this an inter-office committee should be established that will set data access policy, recommend ten datasets that will be made public by 2015 and formulate a plan for developing applications.

In order to meet these demands, the national Administration for ICT and Information Systems must, according to the decision, map existing datasets, adapt the main data access technological platforms (Data.gov) and instruct government offices on the issue of data accessibility. It must also update the Justice Ministry of amendments to legislation needed in order to advance these measures.
Is it always beneficial for the government of Israel to publish data in order to enable private entrepreneurs to develop applications for the benefit of the public?

The government does not intend to compete with startups and innovative initiatives, but to enable and encourage them. However, the following two examples of private entrepreneurs in Israel in recent years that developed applications for the benefit of the public based on government databases point to complexities that should be considered:

The rocket attacks on Israel during Operation Protective Edge led to the development of several free applications that warn of rocket alarms and provide information about rocket interceptions and attacks, among them the popular and veteran “Red Color” application. These applications were developed by independent developers and rely on information received from the IDF Homefront Command. The State of Israel took its time providing this essential service and private initiatives mushroomed to offer a response to this burning need. Since these applications were not based on official government information, there were many errors and inaccuracies in the information provided to citizens who in the meantime grew dependent on them. Releasing official datasets that are updated in real time and providing an interface for developers would enable development of reliable applications that could provide better service to citizens in real-time.

Another dilemma arose regarding the Tipat Halav (Baby Wellness Health Clinics) application. As part of a polio vaccination campaign in Israel, the Ministry of Health ordered a smartphone application from the Matrix company for $118,000 that finds the nearest baby wellness clinic. The Public Knowledge Workshop, an organization of volunteers that makes public data accessible, released its own version of the application. It was developed within two days and did not cost the government and the taxpayers anything, except the time of several volunteer developers at the workshop. It also happens to be better than the application purchased by the Ministry. In fact, the Health Ministry agreed to pay Matrix no small amount of taxpayer money for something that could have been done for free and within a shorter period of time.

On the one hand, when public knowledge is available to the public, private entrepreneurs and independent developers can use it to develop solutions and innovations faster, better and cheaper than the government.

However, these examples raise several questions that require further examination. First, the extent of the government’s commitment to provide by itself solutions to challenges it faces and whether the government should rely on private individuals with capabilities or vision, or is it responsible for improving public services on its own? Second, what is the price of the current tender policy that prevents the government from engaging with startups?
8.6 Major barriers to promoting open government in Israel

Despite prior government decisions, well-intentioned declarations of political leaders and the growing sway of civic organizations in Israel, open government is still in its infancy and far from realizing its full economic and social potential.

There are several barriers hindering open government and the opening of datasets in Israel, which can be divided into three groups: process barriers, technological barriers and barriers to realizing DDI. The first two groups prevent the open, available and efficient release of datasets, while the third group makes it difficult for information consumers to process the data in order to generate innovation.

**Process barriers**

**Digital Processes**

Digital processes are the basis for creating and sharing datasets and advancing DDI. In a government that relies on fax and paper, implementing advanced technological or process infrastructures is not possible. For this reason the public sector’s transition to using digital processes, led by the Digital Israel National Initiative, is the foundation without which building datasets of value and the ability to share them will not become a reality.

**The Absence of a Government DDI Policy**

Data based policy is a basic condition for ensuring data availability and enhancement – the CEO of Ockelbo, a leading Swedish company in the retail trade business receives a weekly snapshot describing the company’s sales, inventory, customer abandonment and select operating indicators. The CEO uses this tool to make essential decisions about personnel in the organization, the company’s managerial focus and the development of new products and services. In order to provide this snapshot the company’s datasets are updated daily, providing quality and enhanced data, and no less important available to managers at different levels. The focus of a business entity’s senior management on data as the basis for decision making fosters the availability of relevant and reliable data. Just as this company utilizes data to make the best decisions, and therefore maintains reliable and available datasets, so will government offices make better decisions if they use reliable data found in their datasets.

The government of Israel lacks data driven policy, reflected in the fact that the position of analyst, that is so common in business entities that maintain such a policy, does not exist in government entities. **Data consumption by the government itself, and a requirement that senior level employees adopt a data based policy,** will advance the building of reliable and accessible government datasets which can also be shared with the public. Under the current circumstances, it is difficult to provide government officials with reliable data, not to mention to make it accessible to external sources. To overcome this barrier guidelines must be formulated for building data systems and datasets and use of data must be the foundation for government work.

**Absence of an Internal Government Culture Oriented to Data Release**

The prevailing outlook in the public sector is “closed by default”. 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, exposing them to public oversight. Moreover, even where there is awareness and willingness, opening datasets requires both monetary and human resources and therefore this task, which is usually not top priority and not budgeted – is relegated to the sidelines. For the opening of datasets and an open government to become a reality they must be part of a horizontal government policy. Therefore, required budgets and human resources must be invested and government employees must be mobilized to undertake the endeavor. In the U.S. for example, the open government policy began as a government undertaking with earmarked budgets at both the federal and government agency level. The British harness government bureaucracy to share datasets by providing monetary incentives. Every local government entity is awarded £3,000 per dataset after it is published on the national portal in the correct format (csv) and without restrictions on its use.
Furthermore, whether for internal or external use, opening datasets requires cooperation between several entities, among them the publishing government office, the Justice Ministry, the National Information Technology Unit and the Budget Division in the Finance Ministry. This is a complex bureaucratic process. Since the term of Michael Eitan as the minister responsible for improving government service to the public, open government does not have a “parent”, someone specifically responsible for advancing the issue and coordinating between all stakeholders. It appears that the National Information Technology Unit headed by Yair Frank is once again adopting open government, an issue that was in effect set aside, and advancing its realization. Both the US and the UK are characterized by significant political forces that drive open government initiatives. With the momentum of open government in the UK, a committee chaired by a minister was established, and every entity that does not release data must appear before the committee to explain and account for its actions.

**Technological barriers**

**Data Infrastructures**

Digitization requires an organizational culture that fosters data use and sharing, as well as dedicated technological infrastructures for collecting and storing data. As a first step, data collection and storage must be enabled at the local level (of a public entity) and clear guidelines must be established about the data collection mode and the extent to which data will be saved and accessed.

**Data Integration**

Another barrier in this context is difficulty to integrate data from different datasets of different government entities. There is considerable variance in the language and definitions practiced in every government entity and office, sometimes even within the same office. These differences have implications for cross checking similar data between similar entities. For example, there is no single and precise definition of what constitutes an “apartment”, who is an “at risk child”, and many other fundamental terms. Datasets must be characterized by metadata that describes the terms and definitions so that differences, if found, can be bridged.

Process and technological infrastructures are currently the main barriers. Case in point, the main reason for denying freedom of information requests is the system’s inability to restore and retrieve data. **The main reason for denying freedom of information requests in 2013 and 2014 is that the requested data cannot be found.** Privacy for example made up only 9% of the reasons for denying requests in 2013. This points to the poor condition of government information systems, to the prevailing organizational culture and to the extensive dependence on the human factor (replacing a government employee entails loss of a great deal of data).

**Additional challenges**

The next chapter will discuss additional challenges to establishing open government compatible with accepted standards. These challenges can be overcome with regulatory measures that address among other things, protection of privacy rights and ensuring national security.
The data problem in the real estate market in Israel

One of the barriers facing a government that seeks to use information to increase efficiency and make more informed decisions is the existence of relevant datasets of value that are outdated, or lack of any datasets. A prominent example is an issue that made headlines in recent years - the data problem in the real estate market.

The 2015 State Comptroller of Israel report found outrageous shortcomings in the recording, collection and processing of housing data in Israel. According to the comptroller, data collected by the Tax Authority about housing figures are partial and inaccurate. For example, only 20% of the housing figures input by the Tax Authority do not have mistakes. This is a severe problem because various entities use this data for measuring changes in apartment prices, first and foremost the Central Bureau of Statistics that publishes the housing price index. When the reported data is inaccurate and the report lacking, use of data to establish price indicators harms their credibility and may create a significant bias. As a result, no one really knows by how much apartment prices actually increased in recent years. Due to these housing data deficiencies in Israel, decision makers in effect base their decisions on unreliable data leading them to adopt unsuited policy. The state invests great effort in solving the problem of increasing housing prices, but cannot really estimate whether prices are rising or falling at any given time, and therefore does not know if its actions are achieving the desired results. As the State Comptroller notes, “A relevant and reliable factual infrastructure is a prerequisite for a proper process of decision making and policy formulation”.

9. Government as Regulator and Policymaker

The state plays a critical role in defining the regulatory framework that enables DDI and its advancement among public entities as well as the public sector. In order to create a rich DDI environment optimal conditions must be created for DDI processes to take hold in the economy. Legislation must support the change and the regularization of all technological and legal norms to make this possible. For example, privacy protection and data security legislation that will enable data disclosure without harming privacy by establishing advanced data security technological standards, will allow for the release of extensive data that could not be published in the past only because these standards were lacking. It is the responsibility of the government to implement the regulatory tools at its disposal in order to encourage private entities to share data even in cases in which it in interested in solving market failures or in perfecting the market. Large retail food chains for example now disclose product prices in light of the amendment to the Food Law that enables price transparency; insurance and financial companies provide information about pension funds and provident funds in systems such as the Pension Clearinghouse and Gemel-Net that provide consumers convenient access to information about their money.

This chapter reviews the variety of areas in which regulation has a strong impact on advancing and encouraging DDI by providing regulatory tools that enable the state to fill its role as data supplier and by creating a DDI environment that encourages the private sector to adopt DDI and even develop it.

9.1 Data security and privacy policy

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. Currently, along with the slow pace of legislation, these factors are creating a reality in which regulation is incompatible with the types and quantities of existing data, with people's desire to make some of their data public, and with myriad private entities holding personal data (Amichai-Hamburger and Perez, The Israel Democracy Institute, 2012). As a result, vast amounts of data cannot be published and used in the name of privacy protection or due to inflexibility of current legislation. The classic distinction between personal and non-personal information is now blurred since some of the data can be disclosed without harming privacy. Technological developments now enable adequate and advanced data protection so that this data can be used while maintaining privacy. A contrasting approach claims that a great deal of data is collected by the state "coercively", since the individual cannot prevent data collection, and therefore it is also its responsibility to protect this information.

Since the widespread trend in the western world is publishing information as the default, it is exceedingly important to distinguish between personal data that contains information directly related to the individual, and personal data that is not secret, such as data about apartment buying, car accidents and use of public transportation. This distinction will make redundant the need to submit a specific request to receive data that does not harm privacy.

The challenge: exploit the economic and social potential deriving from the use of DDI, while maximally maintaining the individual interest of each person to protect their privacy

The worldwide debate on the issue spans two poles: at one end the strict European conception that tends towards protecting data and privacy stemming from values of honor and dignity, and at the other end the American conception that takes into consideration the importance of services based on personal data to the
economy and to offering new products, but also views privacy as one of the individual freedoms (Shmueli, The Israel Democracy Institute, 2012). It is important to note that both sides agree that it is now possible to disclose considerably more information due to technological developments that enable partial disclosure of data without harming privacy.

There are cases in which disclosure of personal data could be so significant that the public interest will override the interest of protecting an individual's privacy. For example, the UK Cancer Research Organization built a dataset with data about tens of thousands of cancer patients that enables comparison of the patient to similar patients in terms of the genome, in order to avoid treatments that are unsuitable, to better predict the success rate of a certain treatment and to save costs in the long-term. Another example is the demand of senior managers in large public companies, as part of the Securities Authority Law, to disclose their salaries and employment benefits. This step can be seen as harming individual privacy, yet the state decided that public interest in disclosing data overrides the need to protect the privacy of senior managers.

Thus, the regulatory framework can and should be adapted to maintain the public and privacy interest in privacy protection, at the same time enabling maximum data use. The main characteristics of a policy that encourages DDI along with maximally maintaining privacy and data security are as follows:

1. **Dynamism and flexibility**

   In a study conducted about the desired policy for promoting DDI, one of the prominent characteristics for effective regulation is flexibility. For regulation to be effective and advance use of data it must support rapid technological development through a flexible attitude 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. The government entity that can best apply this discretion is the Israeli Law, Information and Technology Authority (ILITA), as it is responsible for privacy protection and is staffed by professionals rather than political appointees. In Australia the law does not permit researchers from academia to use personal medical data found in healthcare clinics without explicit patient consent. At the same time there is a special exception committee that can grant researchers an exemption from this consent for purposes of treatment, research and statistics.

2. **Full consent**

   Many surveys show that the requirement to receive the individual's voluntary and full consent to use data that they created is ineffective, because most people are neither knowledgeable nor interested in this issue, often acting against their own best interests. This calls for an examination of the commonly held paradigm regarding consent that must be given to use personal data. The classic data disclosure mechanism, the opt-in mechanism, requires the individual's full and active consent to disclose his or her personal information. In contrast, information disclosure is the default in the opt-out mechanism, although every individual has the option to request remove personal data. Many leading DDI countries are transitioning to the opt-out mechanism regarding data that does not endanger privacy or national security. A good example is the relevance principle applied in the EU according to which in cases where it is impractical to obtain the consumer's full consent, the entity using the data can do so for legitimate and relevant purposes, as long as they do not violate basic human rights.

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 use of any data whatsoever (OECD Privacy Guidelines, 2013). A representative example of a restriction that does not exist today is that placed on performing cross-checks, since many entities now have the capability to cross-check data, which may harm privacy.

4. **Anonymization**

   Many activities in the interface between citizens and the state create personal data that is collected by the state about citizens, e.g. when individuals sell an apartment they must disclose the sale details to the tax authorities.
Consequently, the state has extensive data of a personal nature and must therefore ensure privacy protection. However, since this data can be of value, standards should be defined regarding its use, among them data anonymization requirements, so that it can be used without disclosing private information. There are many data anonymization methods that cause minimal harm to the quality of the data disclosed. In other words, some of the data is disclosed such that most of the data can be used and provide benefits, without disclosing personal details. As an example, real estate transaction data can be used to understand market trends or the average price of an apartment in a specific area by using transaction data that includes all the information except for the identity of the buyer or seller or data that reveals the specific entity that conducted the transaction.

Data anonymization is not effective in every situation and there are instances in which even after it is performed privacy may be harmed. Case in point, the Central Bureau of Statistics that provides statistical data that is not entirely private, enabled users in the past to cross-reference the data according to various data items and to reach such a high level of granularity that personal information was revealed. Thus, in the past when we searched for a woman from the Jewish ultra-orthodox sector that serves in a senior management position and earns more than NIS 50,000 a month we could reach such a small number of results that by cross-reference analysis we could be left with one result, easily identifying the specific woman. This problem was resolved when the CBS restricted the level of detail in statistical analyses so as not to disclose personal data, in effect impairing data analysis to avoid harming privacy. This story illustrates the complexity of data disclosure, even if it is completely anonymous. Thus, in order to disclose data while not harming privacy, the risks must be analyzed and mechanisms planned to prevent this, even when the data underwent anonymization.

5. Oversight over data use

One of the necessary components of an effective DDI-promoting regulatory environment is an entity that will oversee data use among private sector entities and will enforce data security standards. Effective enforcement will improve privacy protection which will in turn foster further data disclosure. The Information Commissioner’s Office (ICO) was set up in the UK as an independent authority to uphold information rights in the public interest and to promote openness by public bodies and data privacy for individuals. The responsible entity in Israel is the Israeli Law, Information and Technology Authority whose goals, among others, is to strengthen personal data protection and increase enforcement of privacy violations. The more this authority will establish uniform tools for government agencies regarding the way data is disclosed, and will provide a toolbox for data use, the easier it will be to release data without harming privacy. Creating a uniform standard for anonymization of data to be published, in terms of technology and regulation, will create legal certainty and enable every government office to release data without worrying about privacy violations. Examples of such standards are placing restrictions on granularity of data cross reference (or defining the K as presented below), and requiring entities publishing data to meet certain security requirements.

In addition to an entity that oversees data use and security policy, another body should be established to oversee the essence of the data published by government authorities so that they will not be able to hide information from the public, and at the same time will not publish data that violates privacy or secrecy. In Israel today, every request according to the Freedom of Information Law is handled by a position holder in the specific government office such that there is no external oversight, except by filing a suit in the administrative affairs court. This is not the optimal situation as it overloads the court system and makes it difficult for citizens to obtain the data they want. In the UK there are transparency sector boards that are usually headed by a government minister and comprised of professionals from the sector whose role it is to examine the open government strategy of government offices in the specific sector and to discuss specific requests to receive information. This mechanism reduces bureaucracy, lightens the court load and provides for external oversight by professionals relevant to the specific government agency.

Privacy protection mechanisms in Israel today are not sufficiently effective and are supported by outdated legislation.
that is incompatible with current 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. According to the Privacy Protection Law, every dataset is required to undergo a process of licensing and oversight by the Database Registrar in the Justice Ministry. Millions of datasets fall under the legal definition of a “dataset”, from customer clubs to lists of individuals registered to receive a marketing newsletter. In fact every electronic collection of data that is not for private use is considered a “database” and must be registered with the Database Registrar by means of a hard copy form. According to the law not registering a database is a criminal offense. This law is a perfect example of legislation about data and privacy protection is not up-to-date, since less than 20,000 databases are registered with the Database Registrar and this area remains in effect without effective oversight and enforcement. In the 2014 report about database registration the State Comptroller already warned that privacy protection in them is lacking (State Comptroller report, 2014) and that the registration requirement and the restrictions on information distributors should be narrowed, and other methods should be found. In the U.S. efforts are underway to improve privacy laws and the restrictions on the use of data, as opposed to increased regulation that encumber data publication (Taylor Wessing, 2014).

## Data de-identification methodologies

As part of the need to maintain privacy, various de-identification processes have been developed that enable disclosure of datasets while ensuring data anonymity at the individual level. Several select methodologies are presented below:

1. **K-Anonymity methodology**

   K-Anonymity is one of the basic and widely used de-identification methodologies. It is based on a group of methods and threshold rules aimed at preventing specific identification of observations in a dataset by suppressing or changing values with minimal harm to data quality.

   The letter K refers to the minimum number of similar observations for preventing identification. The larger the K the lower the ability to reach the individual the data represents, yet on the other hand this increases the difficulty entailed in creating the dataset and preserving data rawness. Data suppressed can be fields (e.g. suppressing first name, family name and ID number), a value (e.g. replacing a zip code in the “99999” format to “99***”) or replacing a characteristic of a value to a group of values (for example replacing specific age with an age group”. This methodology is usually used in large datasets, in additional to other methods.

2. **l-Diversity methodology**

   This methodology is in fact a set of tools added to the K-Anonymity method to improve de-identification quality and overcome some K-Anonymity shortcomings. One of the basic conditions of K-Anonymity are that there is no change in the target variable / the sensitive variable, which enabled external entities to identify persons by cross-referencing datasets based on probability assumptions.

   The K-Anonymity method divides observations into groups that include a minimum of k-1 identical observations. The l-Diversity method divides the data into sub-groups so that in each such group there will be minimal representation for every value of the sensitive variable – l. In other words, if there were 4 different values in the sensitive value, in every group created by the K-Anonymity the 4 values would appear, l times. This method is used to prevent unequivocal identification, and the data is therefore divided into sub-groups and the distribution of the sensitive variable in each group is maintained.

3. **T-Closeness methodology**

   Similar to the l-diversity approach, the T-closeness method is a set of rules added to K-Anonymity, improving and broadening it. As noted, K-Anonymity divides the observations into groups that include a minimum of k-1 identical observations, while the
L-Diversity method divides the data into sub-groups, maintaining the distribution of the sensitive value. Nonetheless, de-identification problems were found in both methods, particularly when the sensitive variable is a rare case in which case a specific observation can be identified because there is very little data.

In the T-Closeness method there is minimal data representation for every value in the sensitive variable in each sub-group, but the original distribution is maintained when joining all sub-groups together. For example, if the value “asthma” appears in 50% of the observations in the original dataset and the value “jaundice” appears in the remaining observations, using the T-Closeness method the distribution of the sensitive variable in each group will have to be close to its distribution in the original database, i.e. close to 50%-50%, within a certain T distance.

In contrast to the L-Diversity method, in which the distribution in every sub-group is identical, in this method the distance between the distribution of the sensitive variable in the sub-group and the overall distribution prevents the possibility of translating general knowledge and attributing it to specific observations.

These methodologies, together and separately, are advanced tools used to address the danger of harming privacy when the goal is to release a dataset and permit its use. By using them most data can be published with minimum harm to data quality.

Defining the way data must be published and restrictions on its use combined with a definition of a data security standard, can make possible optimal use of data, and ultimately encourage DDI.

DDI in medicine – contending with complex privacy issues

Medicine is an indicator of the prevalence of DDI while dealing with complex privacy issues. Research data in this area is very sensitive, yet has huge potential economic value. Considerable thought is invested in order to find ways to publish full or partial data for purposes such as research, developing drugs, allocating funds and improving service, in a manner that will enable utilization of the data resource without harming patient privacy.

In Denmark a dataset was established in which all health suppliers upload pseudo-anonymous data (information in which personal details are suppressed), and every supplier can use the data only to improve service to its customers.

Another example is the special committee set up in Australia to approve disclosure of pseudo-anonymous medical data for academic research.

These examples demonstrate that suitable techniques can be used to disclose very sensitive data to reap economic and social benefits. What holds true for medical data obviously holds true for less sensitive data.
9.2 Protecting intellectual property

The issue of intellectual property arises even more strongly with respect to the question who owns the property rights to data found in datasets or in sources used for DDI purposes. Regarding government datasets, one approach maintains that the state is not the owner of the data, but is only entrusted with it for the public who is its real owner. As for private datasets, there is a debate about the rights depending on the type of dataset and the way in which the data is presented. Regulation that will foster DDI must define intellectual property rights that will enable data use with minimal violation of ownership rights.

The current key gap in Israel is lack of regulatory certainty about intellectual property in data, which apparently deters entities from disclosing data and impacts the ability to implement DDI.

Israel lags behind in the regulation of property rights in datasets in both the public and private sectors, resulting in over-deterrence to use data and extensive court proceedings. As noted, good policy that promotes DDI is one that provides certainty regarding data usage rights.

As an example, the UK data portal grants a special license, an “open government license”, according to which data can be freely and non-exclusively distributed, copied, translated, processed and used commercially. A similar license can be found in additional data portals throughout the world. It appears that adopting a similar license in Israel would certainly help create legal certainty and solve current uncertainty on the issue. Regarding data found in non-government datasets, the situation is more complicated since the legislator must establish a uniform definition similar to the legal definition of a “protected work”, and place restrictions that will nevertheless enable use of data subject to the law without violating private ownership rights.

Protecting intellectual property is also anchored in outmoded legislation passed in the days when the world was not yet digital, frequently causing legal complications when using data from datasets. Thus, for example, a dilemma may arise from the fact that a dataset owner invests in data collection, however in most cases data is made public and is accessible to everyone, raising the question whether it can be used. Another dilemma is created when a dataset contains data collected from other datasets which leads to the question as to who owns the rights to this data – does the mere aggregation of data create rights to the data or is it only the owners of the raw data that have ownership rights to this data? These dilemmas and similar ones demonstrate the challenges entailed in defining data property rights in the digital age and the need for clear and explicit legislation that will enable optimal and maximal data use.

9.3 Fostering data disclosure in the private sector

As a regulator the government can also promote DDI through the demand from private sector actors to disclose data. Similar to disclosure of data in the hands of government entities, the data that will be released can help create competition and foster innovation. From the state's perspective this requires only minimal investment of funds (usually a matter of passing regulations) with considerable dividends that will of course be balanced against the potential harm to entities required to disclose the data.

A good example is the passing of the Food Law (price transparency) that requires large retail food chains to publish product prices and update this information regularly in formats that allow for data processing (xls, xml and other formats). Such legislation will enable entrepreneurs to develop price comparison applications and consumers to compare prices and do their shopping at the cheapest retail food chains. The Madlan website currently publishes comparisons of supermarket indices based on data supplied by food retailers, and other websites such as Zap have announced that they are developing price comparison applications that will be ready soon.

While it is too early to assess the effect of this law in terms of market competition, the regulations passed on this issue by the Economy Minister are a good example of the overall characteristics of data sharing discussed above: data disclosure; accessible to the public in convenient formats; publishing data about data; free use of data without legal restrictions; data rawness; updatedness and support needed for its implementation.

Another example is the transparency reform implemented by the Capital Market Division in the Finance Ministry
in 2012 and release of data in the hands of entities that own pension funds, provident funds and other savings products. The main innovation is the building of a digital platform where every citizen can receive full and up-to-date information about all accumulated pension savings. The Finance Ministry published a tender for establishing this platform, known as the “Pension Clearinghouse” that is operated by SwiftNess that won the tender.

The Pension Clearinghouse is currently involved in ensuring the transfer of data from all insurance, pension and provident fund entities to the public and to insurance agents and pension advisors, and in making the data accessible in a format that is convenient, uniform and secured. On the backdrop of the creation of the clearinghouse, new initiatives emerged to increase the efficiency and perfect the pension savings market that for many years was stagnant and lacked transparency.

In addition to the Pension Clearinghouse, the Finance Ministry launched the Gemel-Net system for comparing provident funds and in which provident funds are required to publish the performance of their funds in a uniform format. This enables users to compare returns achieved by the funds and also compare then to select market indicators.

These examples demonstrate that where and when the state is interested in perfecting markets or solving problems such as data asymmetry and too little competition, it must promote the opening of data that in turn drives the development of private initiatives. The latter use this data to fuel innovation which can improve market perfection.

**WOBI – a free system for analyzing and presenting pension information**

The WOBI Company developed a system in which users can request information and the system imports all the data from the Pension Clearinghouse and performs analyses on all data related to the user's request. The analysis presents future management fees to be paid, the total sum that will be accumulated when the individual retires and all the funds in which the customer has savings. If the system finds that the customer is paying high management fees relative to market prices, it offers less expensive options. This system illustrates the considerable advantages of using DDI, considering the fact that before the government released this data could not be used or analyzed for the benefit of the public. Now anyone can find out where their money is found and whether they can reduce management fees.

**Zelicha Committee recommendations –a dataset of used car prices**

One of the recommendations of the Zelicha Committee for regulating the car market, that aimed to create mechanisms for reducing car prices in Israel, was to set up a dataset of used car prices that would enable car buyers to obtain a correct assessment of a vehicle's actual market price. The proposed mechanism is based on collecting data about transactions from the Israel Postal Company regarding transfer of vehicle ownership, and is therefore the most up-to-date and accurate dataset. This model operates in many countries and is another example of the way in which the state can create regulation that will advance DDI and ultimately address market failures.
9.4 Additional regulatory challenges in creating a ddi-fostering environment

The common characteristic of these challenges is that they do not prevent the data release process in general, but certainly hinder the ability to rely on the data to create innovation.

Policy that fosters DDI

Free use of data and information must be possible in order to maintain an advanced open government. The main barrier regarding regulation is the existence of rights regimes that prevent the use of data for developing business innovations and deter entrepreneurs and companies. Two types of common rights regimes that hinder innovation and the creation of business opportunities are described below:

- **Fee-based government data**
  A startup seeking to develop an application based on maps of Israel produced by Survey of Israel, the government mapping agency, will need to pay hundreds of thousands of Israeli Shekel a year. Maps and map-based data are the most frequently consumed form of data (see Chapter 12) and the current high cost of using such maps is a significant entry barrier for small projects. The reason for the high cost is the fact that only 50% of the Israel Survey budget is received from the state, while the remaining cost must be covered by revenue from products and services. Therefore, not only must the Israel Survey agree to release data, the Finance Ministry must agree to cover the entire budget of the organization.

- **Fear of privacy and national security violation**
  In many cases, although data can be released without endangering privacy or national security, entities often choose not to publish the data for these reasons. However, as demonstrated, numerous tools are available to overcome this problem.

These challenges, in contrast to privacy and intellectual property issues, require policy making by the professional and managerial ranks, not passing regulations or enacting laws.
10. Government as an Educating Factor

One role of the government is to educate the public, both as the body responsible for the education system and higher education, and for imparting values and fostering behaviors and practices. In its role as educator the government can act to advance DDI at two levels. First it can ensure sufficient supply of professionals and experts in data and analytics so that the state’s human capital can support DDI. Second, it can raise awareness about the significant value of datasets and data, mainly among traditional industries and SMEs that face barriers to data use that hinder their ability to enjoy its benefits.

10.1 Training the future generation of “data scientists”

Imagine a world in which the State of Israel provides public access to government data, ensures the quality and reliability of the data it holds, acts to assimilate innovative information technologies and succeeds in raising awareness among companies and entrepreneurs regarding the value that can be gained from the use of datasets, but one thing is missing - there are no data and analytics experts. In this world, at the moment of truth, no one will have the necessary skills to analyze and process the data in order to foster innovation and gain insights. It goes without saying that without information science professionals and experts the potential advantages of datasets will not be realized.

There is a severe shortage the world over of individuals with expertise in the information sciences which is expected to worsen in the coming years. In the U.S. for example, information experts make up only 0.5% of the workforce, and according to OECD data there is considerable growth potential for open positions in the field. According to a McKinsey report, by 2018 there will be a world shortage of 140,000 – 190,000 data experts in the United States alone could face a shortage of 140,000 to 190,000 data experts. Studies have shown that lack of data and analysis management skills pose a major barrier to adopting DDI in the health and science fields and in the public sector.

As part of its role as educator the government must ensure a sufficient supply of workers with data skills by establishing specific training tracks for relevant studies in formal education institutions or by creating suitable vocational training frameworks, similar to the array of professional courses offered by the Employment service. For example, as part of its strategy to increase and implement data sharing the UK promotes the qualification of data scientists and statisticians, and has even included support of these training frameworks as one of the three steps in the roadmap for fostering open data (Open Data Roadmap, 2015). Understanding the need for individuals with DDI-relevant expertise, eight years ago North Carolina opened a new Master’s degree track at the University of North Carolina to qualify students with skills in the data field and to prepare them for employment when they graduate (see expanded explanation).

The shortage of talented employees in Australia

Australia has been suffering from a severe shortage of workers with required data skills. The government designed a strategy to train the future labor force to support the advancement of DDI in the country. The diagram describes the actions the government must undertake in each worker training stage (PWC, 2014).

- **Short-Term**
  - Fund study programs that will help narrow the technological skill gap

- **Mid-Term**
  - Identify the best talent in the aim of integrating it into sectors that requiring the specific knowledge it has to offer

- **Long-Term**
  - To develop the relevant skills more focused study programs and more professional teachers are will be needed
How North Caroline is dealing with the shortage of experts in the data field?

In 2007 the University of North Carolina opened a Master's of Science and Analytics program to develop students with data science skills and teach how to gain insights from large datasets. The main goal of the program is to qualify students for work in the field immediately after they graduate during their studies students learn how to deal with real world problems by using datasets provided by government or industry. Program graduates are in high demand and their employment rate after graduation is 95%.

10.2 Educating and training DDI consumers

As described in Chapter 5, one of the results of implementing DDI and its integration in business is increased labor productivity. As part of the attempt to find the sectors in which DDI integration will have the most impact, we discussed the characteristics of low productivity among SMEs and traditional industry in Israel, and the huge potential that can be realized from integrating DDI into these sectors for productivity growth. We showed that integrating DDI in small businesses alone can increase productivity by 8.9%. Therefore, the state must support SMEs and traditional industry in adopting DDI. Lack of relevant knowledge and skills and low awareness of DDI are significant barriers facing SMEs seeking to integrate DDI.

SMEs interface with government mainly through the Small and Medium Business Agency in the Ministry of Economy, which is responsible for providing advisory services to small businesses. The data barrier can be overcome by creating a dedicated advisory route that will help SMEs integrate DDI and enjoy the advantage of available data. Another idea is to offer DDI training and enrichment programs through the Agency in order to increase awareness about the many aspects of DDI. Through these study frameworks SMEs can receive training in a variety of topics such as: data collection and analysis, the importance of data based decisions and setting relevant indicators for the business.

Similar to SMEs, traditional industry in Israel is characterized by very low labor productivity compared to the developed countries, and most productivity growth potential lies in innovation processes. By increasing awareness to the existence of datasets and to the importance of creating innovation in traditional industry, the government can advance productivity in this sector and in the economy as a whole. Access to data will enable companies to identify demand, adjust prices and increase supply chain efficiency. Data processing and analysis lead to process and management efficiency and generate ideas for new product development. Thus, DDI can contribute to innovation processes and productivity growth in the non-technology based sector. Based on this assertion, in Chapter 5 we showed that the potential for productivity growth through DDI is 6.4%, which will have a substantial impact on GDP and the economy.

In traditional industry as well, the main barriers to DDI integration are lack of knowledge and skills in the data field and low awareness. Therefore, to assimilate the use of DDI in traditional industry the government must impart knowledge and raise awareness about the value that can be gained from DDI, especially its impact on productivity. It can do so for example by holding professional conferences and distributing material to relevant industry entities. It can also train workers in data and innovation to facilitate DDI implementation, based on the assumption that low productivity is, among other things, the result of unskilled workers. Another possible training option is to train managers for the change DDI requires in terms of thought patterns and management culture.
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

Open Data Institute

An institute was established in the UK for the sole purpose of assimilating and developing the open data integration field (ODI). Among its offerings this organization develops professional capabilities needed for open data management in companies, third sector organizations and even government. The Institute also conducts research and development in the open data area and supports new initiatives. It is a non-profit organization founded with the support of the British government.
11. Government as Funder

The government functions as a funding entity in cases of market failure, in other words when the market does not operate with economic or social efficiency despite the fact that every stakeholder acts to maximize private gain. For example, the R&D field is characterized by low economic gain for businesses that operate for the most part for the benefit of the economy. Therefore, from a social perspective private investment in R&D is lower than the optimal investment. Due to this market failure R&D is publicly funded in most countries.

Similarly, the state can serve as the funding entity in the DDI field in order to overcome market failure in this area. As in R&D, lack of government involvement creates a situation in which private investment in DDI is significantly lower than the desired level in terms of its social benefits. DDI assimilation in the private sector has huge potential to increase productivity of the Israeli economy (see Chapter 5), however companies and entrepreneurs face barriers that prevent them from investing in DDI at the desired level in terms of the economy as a whole. In order to overcome this market failure government intervention is needed to “compensate” companies and encourage them to adopt DDI. Government support will be able to help companies reduce barriers hindering investment in DDI, and once they have overcome this barrier they will be able to receive a higher return on the DDI investment. The assumption is that public funding to support DDI integration is significantly lower than the expected economic benefit from this investment, as DDI integration in the private sector is expected to generate considerable economic benefit.

Therefore, the state should fund DDI. It can establish a policy that will create incentives for companies and entrepreneurs to adopt DDI in the aim of overcoming the market failure and increasing private sector investment. Government support can take many forms, including grants, tax benefits or technological services such as government computing cloud services and providing demo software.

11.1 Awarding grants

Grants to DDI based businesses

The government body that supports new initiatives in Israel is the Chief Scientist Office, which usually awards grants for projects that have not yet reached the stage where they need to raise capital. This Office does so through a variety of programs such as “Tnufa” that supports companies in their initial stages. To receive support through these programs the entrepreneur must develop or upgrade an innovative product or alternatively establish an initiative in fields such as nanotechnology, biotechnology and the life sciences. In terms of promoting DDI, it may be beneficial to consider DDI based companies as “innovative companies” so that the will be entitled to receive grants along with startup companies supported by the Chief Scientist Office. Second, a specific program should be added for DDI based projects or a criterion added to existing programs that will establish DDI as a field that will entitle those implementing it to receive support grants. The government has already taken a step in this direction in Decision 41/820 of the Ministerial Committee for Social and Economic Affairs that recognized this need and initiated the establishment of an assistance track for innovation projects in the public sector. The track is planned to be operated through the Chief Scientist Office in the Economy Ministry and will be awarded to projects who aim to: improve public-government service, increase efficiency and enhance processes in the public sector, to provide public access to data and to protect public sector information systems.

Grants for Assimilating DDI in Existing Businesses

- Traditional industry

The Ministry of Economy stated that one of its goals is the integration of innovation and R&D in traditional industry and promised to allocate budgets for this purpose. In line with this goal, the Ministry operates a program to encourage innovation in this industry. However, in contrast to leading countries in DDI integration, Israel does not offer specific incentives for promoting or developing DDI. Thus for example, the Chief Scientist Office awards development grants to initiatives with a dimension of innovation, but the criteria for the grant do not indicate use of data or promoting DDI. Therefore, the support program criteria should reflect the importance of implementing DDI and even foster DDI-based developments by
offering grants in this area. In Sweden for example, a specific program was established, SIO Grafen, to generate innovation and a competitive advantage in various fields, including traditional industry which is a very large sector in the Swedish economy. The program that was launched in 2014 aims to create an innovative data-based infrastructure in traditional industry within 10 years, including mines, manufacturing plants and transportation. The program also involves cooperation with academia and the business sector and is budgeted by the Swedish government.

• SMEs
Another barrier facing SMEs, besides lack of professional skills and know-how, is lack of resources. Currently 11% of small businesses perceive funding as the main barrier, and the average score SME owners gave to the ability to receive credit compatible with the needs of the business is 6.6 out of 10 (The Small and Medium Business Agency, 2014). These findings illustrate the difficulty experienced by small businesses in Israel. Therefore, if the state seeks to encourage DDI implementation and integration, it can offer incentives in the form of grants to help these businesses overcome the financing barrier. The grants will be awarded by the Small and Medium Business Agency based on existing platforms. It should be noted that DDI does not require sophisticated systems or expensive hardware and software, so that the grant amounts do not have to be high. In 2014 for example, the British government invested £ 2 million in an initiative for promoting digital presence in small businesses. The initiative information explicitly states that one of its goals is to connect small businesses to the DDI world. Therefore, a desired step in promoting DDI is to establish an incentive mechanism for DDI-based businesses or take steps to integrate DDI into existing businesses. These will be offered by the Small and Medium Business Agency using its existing platforms.

11.2 Indirect support through the tax system
Most OECD countries utilize the tax system as an incentive instrument. A good example that can also be found in Israel is recognizing R&D expenses as a deduction for tax purposes. This form of support has many advantages, among them the relatively low cost of sorting the requests and selecting the recipients since mechanisms are already in place. Tax benefits given to businesses that will demonstrate that they are DDI-based or to businesses taking steps to integrate DDI should be considered, in line with tax benefits for R&D expenses.
11.3 Provide support infrastructures

As presented in Chapter 5, there is a very large DDI gap between large companies and SMEs, despite the fact that SMEs have a better understanding of the value of DDI compared to large companies, and the potential for productivity growth in these companies is also higher. SMEs are also willing to share data in exchange for data in order to improve their DDI use. We also showed that even from a forward looking perspective SMEs will probably not be able to make significant investments in data infrastructures owing to knowledge, funding and technology barriers that may prevent them from promoting DDI in their companies.

In light of these circumstances, in addition to funding support and knowledge the state can help SMEs by providing non-monetary resources such as technological tools that will enable them to make the quantum leap towards DDI implementation and in doing so increase their productivity. This support is very significant, particularly when it is combined with professional consulting and training, since its costs are smaller than direct financial support as it is in a sense “giving a fisherman a rod”.

The significant advantages in providing supporting technological infrastructures are: removing entry barriers for small actors that without it could not invest the needed resources on their own, mitigating the opposition of SME managers to technology and data owing to their fear of committing to infrastructure investments, and offering tools for the future to guide them in developing DDI. A good policy for advancing DDI is one that chooses focuses on this type of support from among the alternatives discussed above.

Several tools the state can use to promote the adoption of supporting infrastructures in small businesses are:

- **Authorization to use government internet infrastructures**
  The state has established significant internet infrastructures, including an advanced and protected server farm and a government cloud with extensive storage capacity. Giving authorization to small business to use the government cloud may enable them to implement innovative technologies they need in order to integrate DDI in their business, and to do so at almost no cost. Authorization can also be given to the content on the cloud and to existing tools such as data analysis software.

- **Distributing a “demo” version of software for DDI purposes**
  The state can support small businesses by distributing a “demo” version of selected software applications needed for DDI integration. The aim is to give these companies “a taste” of the capabilities they offer to motivate them to become a DDI-based businesses.
12. Mapping Government Datasets

In is almost impossible nowadays to find an area that does not involve data. Open government also touches on data in many public sector activities, among them publishing laws, memorandums, information about elected official and opening datasets. This chapter will focus on open government policy pertaining to datasets.

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

Nonetheless, until conditions are ripe for realizing this vision, public servants responsible for opening datasets must prioritize their efforts and actions in favor of releasing datasets with the greatest potential to make the largest impact.

Different countries have defined guiding principles for assessing the importance of datasets. In the U.S. for example, a memorandum published by the Office of Management and Budget in 2009 includes criteria for high value datasets. Similar principles were approved by the government of New South Wales in Australia. It established the following criteria for assessing dataset value. According to the policy paper on opening datasets (based on the U.S. and New Zealand models), a dataset of high value has one or more of the following characteristics if released:

1. Responds to a need and/or demand identified through public or stakeholder engagement, or supports positive social outcomes
2. Has the potential to enhance services or service delivery
3. Furthers the core mission of the agency
4. Increases agency accountability and responsiveness
5. Increases government transparency
6. Will create economic opportunity, generate efficiencies, or reduce costs
7. Will support evidence evidence-based policy-making or research

**Determining dataset value – based on demand**

It is very important to formulate guidelines for what will be considered a significant dataset, yet it may be difficult to predict the economic opportunities embodied in every dataset. Such an assessment may even result in a vast amount of datasets that are in demand. An alternative method of prioritizing datasets is based on demand for such datasets in advanced open government countries. We use this method to examine the datasets with the highest demand and prioritize the publishing of these datasets according to this criterion.

This method has an advantage because the benefits of a dataset cannot be defined unequivocally – particularly with respect to innovation that is inherently difficult to characterize. Thus we are of the opinion that crowd wisdom will provide the proper perspective on the issue.

It should be emphasized that the prioritization presented below is an initial one-time attempt that will serve as a good basis for the opening dataset process. However, a mechanism should be added in the future that will allow for a discussion between the state and civic organization and developer communities that will act to identify additional demand.

**Datasets in Britain**

As part of the effort to promote the vision of open government in Britain, the Data.gov.uk website was established to organize published datasets in a single platform in order to make it easier to search and access data. The website classifies datasets by 12 categories – from government spending and activities through transportation and economic data, up to environment and mapping data. Figure 16 shows the amount of datasets published in twelve categories and the amount of downloads in each category.

It should be noted that the data pertains to the number of visits to the dataset page on the website as well as the number of views – i.e. the number of times stakeholders viewed the dataset on the website, but did not download it. We also chose download data specifically because we think that it is
very representative of the interest people have in the dataset and their opinion about the value they will be able to generate from it.

The figure shows several categories such as Transportation, Economy & Business and Society in which the demand for datasets is very high. Moreover, despite the small number of datasets published in these areas, the number of downloads is very high. From an overall system perspective, datasets in these areas should be given first priority in the first stage of opening government datasets in Israel.

On the other hand, there are also categories for which demand is low, and despite the large number of open datasets in these categories the number of downloads is also small. From an overall perspective, these should be given lower priority.

Further in the chapter we will enhance this analysis in order to find the prioritization mechanism most suited for Israel that will deliver maximum value to its citizens.

An important and significant conclusion from Figure 16 is that most datasets in high demand with a potential to make an impact are public data about which there are no privacy or national security concerns. In other words, although these concerns should not be treated lightly, privacy and national security issues should not be a barrier for realizing the vision of open government since the release of this data will not harm them, while their immeasurable economic potential should not be forgotten. Obviously, there are datasets for which these issues are relevant, however they are negligible, while the release and opening of many datasets will deliver substantial economic value.
Enhancing the Prioritization Mechanism

In-depth examination of the demand for datasets in the various categories adds another important consideration to the prioritization endeavor and to valuable insights to be gained. The table below presents the distribution of demand for various datasets. High demand means over 1000 downloads of the dataset, while 0-200 downloads indicates low demand.

**Demand for databases in the various categories:**

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

The table points to two important phenomena regarding dataset demand with implications for the prioritization process:

- **Datasets in higher demand**
  
  Each category includes a limited group of datasets that are in high demand. Figure 17 shows the importance of datasets in high demand – **they make up only 1% of all datasets published, but generate about 60% of the downloads.**

An important conclusion from these findings, when prioritizing dataset release, is giving first priority to datasets in demand in all categories.

**Figure 17: Distribution of Datasets by Demand versus Download Distribution according to Dataset Type**

### Downloads

- 58%
- 17%
- 25%
- 0%

### Datasets

- 1%
- 2%
- 63%
- 34%
In the first stage datasets in demand in all categories should be opened

- **Datasets with significant demand**
  Another phenomenon observed in all categories is that the majority of published datasets are used by the public, and only a small percentage do not serve the public (33%). **This fact substantiates the need to establish an open by default policy because most datasets are used.**

In the second stage, after publishing datasets in demand, as many datasets as possible should be released, while examining the categories in which datasets deliver significant value (with the highest demand).

Figure 18 presents the average number of downloads for datasets in the various categories, after omitting datasets in demand in all categories (and compared to Figure 19). In contrast to the initial conclusion from the analysis above regarding categories with the highest return, the Transportation category that appeared to be the area for which the most datasets should be published, receives lower priority compared to other categories, with Business & Economy ranked first.

**The second stage in the prioritization process is opening as many datasets as possible, with greater weight assigned to high ranking datasets in Figure 19.**

It is important to remember that the prioritization mechanism examines the economic contribution of datasets in various categories, and provides government entities responsible for open government a tool for evaluating the economic benefits of opening datasets. There are of course datasets of social value that should also be considered in the opening dataset process.
In-depth Look at the Categories – Characteristics and Datasets in Demand

The first stage of the prioritization process, as noted above, is opening datasets in demand that is the datasets that enjoyed an extraordinary number of downloads in the UK. This section will discuss each of the categories and review their characteristics and the benefits that could be gained from them.

Decision 41/820 of the Ministerial Committee for Social and Economic Affairs established that every government office must find the 5 datasets with the highest value for the public. Datasets in demand in every category, and particularly the five with the highest number of downloads, are natural candidates as the leading datasets, and we should look for the Israeli equivalent to the datasets in demand published in the UK and make an effort to publish them as soon as possible. Therefore, for each category a list of the five leading in-demand datasets that were identified are attached, along with the category characteristics and its potential.
Transportation

The transportation category is considered particularly attractive in all matters relating to datasets. Numerous applications have been developed in this area that have had a dramatic impact on many aspects of the travel and driving culture. The potential of this area is particularly high owing to the fact that we spend many hours of our life on the road.

Opening datasets in the transportation area holds very large economic potential. Combined with innovation and new technologies, their opening can deliver significant economic and environmental value, for example: improving traffic flow, encouraging use of public transportation and reducing air pollution.

Based on the potential, this category ranks high in the number of downloads compared to the other categories, with most of the downloads concentrated in several in-demand datasets with tens of thousands of downloads.

**Leading datasets in demand in this category:**

1. Road traffic accidents
   - The dataset with the highest demand - provides details about the number of persons killed or seriously injured in car accidents. Data can be sorted by roads and characteristics of those injured.
2. Live information - traffic on strategic roads
   - A continuously updated dataset that provides traffic information on the strategic road network in England.
3. Road traffic counts
   - Provides statistics on the level of traffic on roads in Great Britain
4. National public access transport nodes
   - Uniquely identifies points of access to public transport
5. Vehicle testing stations
   - Location and information about testing stations throughout the country

**Transport for London**

Data about transportation in London is available for developers and the general public. Many applications were developed based on this data, among them an application that provides information about waiting times until the train or bus arrives, and an application that enables drivers to plan travel routes that avoid heavy traffic and car accidents.

Using these applications drivers can make optimal use of their time, spend less waiting time and make more informed decisions about the fastest route to their destination. Overall, almost 4 million applications based on data about transportation in London were downloaded in the UK. It is estimated that the economic value of the time users saved by using these applications is £ 15 - £ 58 million a year.

**Waze – using crowd wisdom**

The Waze application that was sold for $ 996 million in 2013 is a GPS based navigation application for smartphones. The application relies on GPS and traffic volume data fed by application users (“crowd wisdom”). This application, in contrast to numerous application that only rely on GPS data, provides information in real-time about traffic volume, car accidents, road works and road hazards. All data is transmitted between application users and therefore a massive amount of data is fed into the application and everyone can see the data in real-time. Drivers use the application to select the best travel route at any given time, based on data generated by the other users (Yahoo, 2013).
**Economy and Business**

Datasets in this category contain extensive data about various economic and business indicators: price indicators, price codes, and other data that provide relevant information for all those taking part in economic activity.

The advantage of economy and business datasets is that while in certain areas datasets aim to meet a unique and specific need (e.g., data about transportation that mainly impacts this area), data in this category is highly synergistic with many economic sectors, and its potential impact runs across the economy, rather than concentrated in one narrow area.

The horizontal effect of the datasets may be the reason that there is a significant number of datasets in demand in this category, in addition to a considerable amount of datasets with a high percentage of downloads. Accordingly, even after publishing the datasets in demand, it will be highly valuable to publish as many datasets as possible from this category.

**Leading datasets in demand in this category:**
1. Building price and cost indices
2. Consumer product code dataset
   - These codes are needed for import and export – for finding required taxes, permits, etc.
3. Domestic energy consumption dataset
   - Electricity consumption in the country, with details about specific sectors
4. Lower layer SOA
   - Neighborhood maps and statistics
5. Consumer prices index and retail prices index dataset

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**Toolkit for the small business**

The toolkit enables businesses to stay updated about government programs available to them. The toolkit includes: grants, awards and assistance programs for small businesses.

It provides information about small business support agencies by area and contains useful links for the small business owner.

In fact, the application brings together a set of tools for the small business so that it can gain more benefit from government support and assistance.
**Education**

Datasets in this category contain information about the education and training system in the country. The data published in this category is of great importance for improving training systems and enhancing the knowledge of participants in the labor market about the success in various fields and of institutions.

**Leading datasets in demand in this category:**
1. Learning Aim Reference Service
   - Dataset of initiatives and educational activities
2. Education and training national success rates
   - Segmentation by institutions, success categories and student characteristics
3. NEET statistics
   - A dataset with information about NEET (A young person who is “Not in Education, Employment, or Training”).
4. The share of young people from low income families that continue on to higher education
5. Apprenticeship and training framework success rates

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**Sage – finding schools in New York City**

An application for parents of children who have reached school age to help them find a public school throughout NYC by location in the various neighborhoods.

The application provides vital information for parents about the school–pupil population mix by ethnic origin, study level and test scores, including the institution's rating on progress and development indicators.

The application is based on published government and municipal data.
Society

Datasets in this category contain information about British society with its myriad characteristics (mainly socio-economic datasets), including household income, income per work hour and lifestyle. Information in this category is very important for measuring gaps between various segments of society and highlighting disadvantaged areas.

Published datasets in this category will enable researchers as well as municipalities and local government entities to gain a better understanding of the social landscape of the various geographic areas and set clear metrics for improvement and progress.

This category includes a large number of datasets in demand, with extensive demand for other published datasets, similar to the Economy & Business category.

**Leading datasets in demand in this category:**

1. Estate dataset
   - Information about estates that relatives can claim
2. Index of Multiple Deprivation
   - Measures deprivation level of small areas throughout the country based on 7 indicators
3. Social trends
   - A dataset that combines several information sources and provides a picture of socio-economic trends in the country
4. Household income
   - Segmented by geographic area
5. Passport fees
Datasets in the health category contain varied types of data, for example information about common diseases and their characteristics, about medications, a comparison of hospitals, morbidity statistics, and information about the health system, its various parts and the way it works.

The potential value of datasets about the health system is huge and can lead to significant public health improvements, to developments in medicine and to increased efficiency of the public health system.

**Leading datasets in demand in this category:**

1. Obesity, diet and physical activity
   - Information about physical activity, obesity, food purchase and consumption, health ramifications and more – segmented by age
2. Health survey
   - An annual survey that measures health and health related behavior in adults and children
3. Health organization dataset
   - Surveys health organizations in the country – health authorities, support units and the various institute and clinics
4. Doctors and nurses dataset
5. Infant feeding survey
   - The results of a survey conducted every five years since 1975 that provides information about various infant feeding methods as well as breastfeeding statistics.

One of the main types of data in the health field is clinical data from computerized medical records of health organizations, with the aggregate collection used as the basis for R&D and decision making. Based on extensive aggregate data accumulated by various health organizations, and given suitable systems and mechanisms (data documentation, de-identification, transmission, cross-referencing and analysis) new drugs and treatments can be developed, medical processes can be improved, prevention and early detection tools can be developed, as well as decision support systems and evidence-based policy to support decision makers and health organizations.

Clinical medicine datasets are of great value and may accelerate medical research, however because of the exceeding sensitivity of personal information, establishing mechanisms for their use is very complex. In setting policy in this area key questions need to be addressed regarding use mechanisms and that regulators must address – who is permitted to use the data, for what purposes, what types of data and what type of patient consent is required.

It is important to clarify that use of personal clinical data for the patient’s benefit does not require special consent or special data processing. However, what are the rules regulating transfer of the clinical data of a large number of patients to a third party interested in developing a system or a drug for commercial purposes?

In addition to regulatory issues, it is vitally important to have a technological infrastructure capable of handling applications that process data in a manner compatible with established policy, in order to ensure that patient privacy is maintained.

Regulatory processes relating to the use of medical data are still taking shape. Different countries have different regulatory policies. Some permit selective disclosure of medical data under certain restrictions, while others take stricter approach to releasing medical data.

Health organizations in Israel have relatively extensive documentation of data in computerized medical records.
that holds great potential for R&D and can be used to set policy. This advantage is due to the fact that Israel was a leader in collecting computerized medical information, and as a result existing datasets contain historical data. Nonetheless, Israel has a low ranking on the OECD index of access to medical data for research and statistical use. This is not due to lack of quality data or to its scant use by treatment entities, but to the limited access of universities, businesses and other entities to existing data for research and statistical purposes.

Although the significant potential in advancing medical research is found in clinical data, datasets in the health field that do not impose a barrier due to privacy issues may also have a strong impact. For example, publishing various indices about health facilities and the quality of treatment they provide may improve the health system. Releasing datasets that highlight recommended physical activities, food products that can be purchased and service providers could significantly improve public health – without encountering privacy and similar issues.

**UK health Care**

In 2005 data about the mortality rate as a result of heart surgery became available in the UK. Studies attempted to examine the effect this data disclosure had on the outcome of surgery. The conclusions were that sharing this information led to decreased mortality rates.

Explanations of these findings suggested competitiveness between physicians that led to better performance, higher awareness among health experts and public pressure for higher standards.

Estimates are that the economic value of the lower mortality rate, or of the lives that were saved owing to disclosure of this data, exceeds £400 million annually.
Check that Bike

A service based on open data that enables potential secondhand bicycle buyers to check whether the bicycle they plan to buy is stolen.

The service is based on crime data, manufacturer data, information from insurance companies and additional data sources in order to support the algorithm.

This service has strong potential and can be replicated for additional products that could be stolen. It currently also serves car buyers.

Crime

This category includes data about law enforcement and law violations. Data is in the form of statistics about crime and the functioning of law enforcement entities. Data in this category can be used to examine quality of life and residence in cities and localities and to conduct studies about crime and the response of law enforcement agencies. This could lead to substantial improvement in law enforcement and increase the sense of security among citizens.

Leading datasets in demand in this category:
1. Crime statistics
   Data from the crime survey and police records
2. Crime
   Data from all policing agencies in the country, including street policing entities
3. Crime at soccer games
   Statistics about arrests and restraining orders during the soccer season, segmented by type of offence and sports club.
4. Jurisdiction of policing entities
   Contains information about jurisdiction areas of each of the regional policing entities
5. Dataset of complaints filed with the police force
   Quarterly data summary about complaints filed with policing entities. The dataset can be used for statistics about types of offences in various geographic areas.

Reporting from the field...

models for implementing DDI in Israeli companies and organizations

A leading healthcare organization understood that it held a vast amount of medical data from both internal and external sources. The organization decided that the data could be used to help improve the quality of patient service and to reduce treatment costs, and that correct analysis of the data could help identify fraud.

To address these issues financial and operational data was collected as well as records from pharmacies and historical drug prices. The organization used this data to develop an innovative forecasting model, with the help of an external company that standardizes the annual cost for every insured customer based on his/her medical characteristics.

Using the model the organization succeeded in predicting general operational costs and based on this allocated its resources more efficiently. It also predicted recurring hospitalization of patients after treatment, identified incorrect budget allocation as well as embezzlement in the supply chain (manufacturers and suppliers).
**Government Spending**

Datasets in this category provide transparency about government spending. The level of detail about government spending in the UK is very high, and the most downloaded datasets are those that provide in great detail about the spending of government agencies and public entities.

This category has limited potential to create pure economic-business value, however it is of social value and empowers the relationship between public representatives and their employees and the public. It should be emphasized that this type of data could contribute to increased efficiency of public spending and deliver significant economic value (which usually is not measurable).

**Leading datasets in demand in this category:**

1. Spending details of government offices
   - A dataset for every office that details all expenses, from £500 in public entities or certain government offices (e.g. Ministry of Transportation which has the largest number of downloads), to £25,000 in other government offices and public entities (health, education, etc.).

2. Government spending dataset
   - Contains data about government spending – budget spending data enables analysis of public spending and includes data about all government accounts.

3. UK balance of payments
   - The dataset includes data such as: service and goods traded and capital transfers

4. Government advisors
   - Provides details about all special advisors working in the British government

5. Lottery grants
   - The dataset contains all contributions made by the lottery since 2004

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**The budget key**

The Public Knowledge Workshop analyzes the state budget as well as changes in the budget during the year. The website enables users to examine all budget items in-depth and to understand the government’s goals and its key spending items.

Users can explore the budget going back many years and receive information about decision makers in every period.

This government data significantly increases transparency about public sector activities and service delivery.
**Government activities**

In contrast to datasets about government spending, the datasets in this category provide data about government activities such as: senior position holders in the public sector, organizational structure of public entities and other details about the activities of the public sector. These types of datasets supplement details described in public spending datasets and heighten public sector transparency and public trust in its representatives and elected officials.

**Leading datasets in demand in this category:**
1. Tree structure diagrams of government offices and public entities, employee position, scope of employment and even salary (does not include personal details). The website shows tree structure diagrams of many entities and they are downloaded extensively.
2. Roles and responsibilities of local government
   Provides details of the roles of local government
3. Salaries of senior public officials
   A list of UK civil servants earning an annual salary of over £150000.
4. Basic company data
   Basic data about active companies, including company name, address, registration data and similar characteristics
5. Data about PFI (private finance initiative) projects

**Cities and Towns**

Datasets in this category contain data about common diseases and their characteristics alongside the structure of the health system, data and statistics about parts of the system and it’s and operating modes.

**Leading datasets in demand in this category:**
1. Government construction pipeline
   Data about planned government construction projects for the coming years. The dataset contains data about projects valued at about £ 127 million.
2. Release of defense system assets
   Datasets that the defense system is currently releasing and is expected to release in the coming year.
3. Land use
   Divides all land into 9 categories (public buildings, private buildings, roads, paths, etc.).
4. Agriculture land classification
   Classifies farming land into 5 land quality categories
5. Public housing
   The dataset contains all public housing assets in the UK.
Environment

Datasets that contain environment data such as water reservoirs, climate and agriculture activities. Datasets in this category have extensive impact potential on environment issues, as well as on quality of life and leisure culture.

It is important to note that this category includes the agriculture area that has not been developed in the UK and has considerable economic potential. Accordingly, in the beginning of 2015 the British government announced that it expects to open thousands of datasets about agriculture during the year in order to exploit this potential. Although agriculture does not appear in full force among the datasets in demand in this category, numerous studies show that release of datasets about agriculture may provide significant economic value and efforts should therefore be made to publish them.

**Leading datasets in demand in this category:**
1. Water reservoirs
   - Data about water reservoirs in the country
2. Climate
   - Historical data (since 1853) from meteorological stations, including temperature and precipitation.
3. Farm rentals
   - Estimates of average farm rental prices by farm type
4. Public rights of way
   - A network of paths on which individuals have rights to travel while using them.
5. Nature reserves
   - Information about nature reserves in the country

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**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, and even select a residential area or a vacation route based on the information.
Real Estate and Land

Datasets in this category release to the public geographic data that has accumulated in the public sector. These datasets expand real estate and development options, and enable users to learn about land characteristics in various geographical areas.

Publication of datasets in this area has the potential to generate significant value for real estate, such that data in this category combined with crime, school and economic data, drastically narrows the vast data gaps in the real estate market – particularly for real estate buyers. Publication of datasets and narrowing data asymmetry perfects the real estate market and increases its efficiency.

The real estate category traditionally lacks data since assessing the value of an asset for example must take into consideration extensive data dispersed in many places. Therefore, DDI in this category can generate considerable benefit. A study conducted by PWC found that the contribution of DDI in the real estate category in 2013 alone accounted for about £1.7 million and that this is one of the ten areas in which DDI can generate the most value (PWC, 2014). For this reason innovative initiatives developed in recent years have completely changed the market, leading sellers and buyers to change their perspective about the value of their assets and the way they are assessed.

Leading datasets in demand in this category:
1. Property transactions
   Details about property transactions and the price paid. There are very many datasets in this area with a history of tens of thousands of downloads.
2. Lower Layer Super Output Area (LSOA) boundaries
   A dataset that presents the boundaries of lower layer super output areas (SOA – a geography for the collection and publication of small area statistics). The dataset is downloaded extensively.
3. Government property and land
   A dataset that contains data about central government property and land.
4. Postcode
   A dataset of Royal Mail Postcode Addresses.
5. 3-D geographic data
   Maps based on LIDAR technology that accurately measures land level.

Zillow – Asset Valuation Platform

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

The website uses 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 company aims to create full transparency about real estate information and to provide advanced analytics tools that will 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 in the real estate market to online price estimates. The study used house price estimates from the Zillow website and found that online price estimates can have a strong and direct impact on real estate price dynamics (Lee & Sasaki, 2014). This points to the significant impact of DDI on the real estate market.
Defense

Datasets in the defense category contain data about the armed forces including details about armed forces personnel. In light of the geopolitical situation of Israel and its defense needs, publishing datasets in this area may clash with national security interests and with the goal of providing security to Israeli citizens.

Additionally, an examination of the demand for datasets in the defense category in the UK shows that only a small number of datasets are in demand (only 1 dataset that exceed the 1000 download threshold), and even among the other datasets with low demand this dataset has a very low ranking.

We can see that the most important characteristic in the functioning of the defense system, i.e. its budget – is not included in this category and is published as part of the Government Spending category, along with the other budget components. It appears that the contribution of the datasets to the economy of Israel or to its democratic values is small, and therefore that consideration should be given as to whether the potential damage of publishing them justifies their release.

Leading datasets in demand in this category:

1. Armed forces personnel
   - Quarterly statistics about personnel serving in the British armed forces.
2. Senior officers of the Armed forces
   - Data about senior officials that includes position, salary, contact details and sometimes name.
3. Statistics about the armed forces
   - Annual publication that contains various statistics about the armed forces (in PDF format).

Open Data from Local Government – NYC Open Data

Use of open data is increasing in the municipal area as well, Alongside Smart Cities developments that use the data to improve public services.

The most viewed data in the municipal area, in contrast to data in government datasets, is data related to everyday life and the close surroundings. Some of the most popular data on the NYC open data website is: list of authorized taxi drivers, dataset of inquiries to the city call center, dataset of motorcycle accidents, dataset of job offers and a list of traffic tickets issued in the previous year.
13. Conclusion

DDI is a necessary and required step if the State of Israel seeks to be a modern state with social and economic fortitude. As we showed in this report, DDI can make a significant contribution to the economy of Israel and is the key to growth and prosperity. It is not surprising that many countries have decided to focus their attention on DDI and have established a policy that encourages the creation of an environment that recognizes that data is a vital infrastructure and innovation is a national growth driver.

Continuous erosion of labor productivity in Israel is a stumbling block in Israel’s ability to compete worldwide and to contend with significant issues such as a high cost of living. As the report has shown, creating a DDI-fostering environment will certainly lead to significant productivity improvement, particularly among SMEs and non-technology based sectors. This will result in considerable economic growth. An interesting and new insight that emerged from the study is that the more a business implements DDI, the higher its revenues and the greater its labor productivity, respectively.

The State of Israel joined the Open Government Partnership Initiative three years ago with the aim of advancing open government policy, among other things in order to assimilate innovative data technologies that will enhance public services and the flow of data to the public. However the number of actual databases opened to date in Israel is significantly lower than the amount required to create an optimal environment for DDI to take hold. A successful policy that is found in leading countries that advance DDI is based on meaningful steps in a variety of areas, including legislation, opening datasets, education and incentives for the public to generate data based innovation.

Digitization is the cornerstone of the use of DDI outputs by the government and for government datasets to have an impact. Where fax and paper prevail an innovative culture based on DDI cannot take hold, processes for the existence of advanced datasets will not take place and benefits of DDI will not be realized. Just as an innovative country needs an innovative government, a DDI-rich country needs a government that realizes DDI and creates the suitable conditions for its implementation.

Our study examined the expected benefits from DDI for a modern economy and used advanced methods to quantify the economic contribution of DDI to the Israeli economy. We examined how the state can create an environment that enables the realization of the DDI potential. We did this by presenting the ways in which leading DDI countries addressed the myriad challenges on the way of becoming a digital and innovative state. We went on to present the prevailing conceptions regarding regulation so that privacy and intellectual property can be protected, while still promoting innovation and use of data. We examined how the state can raise awareness about DDI in sectors that do not yet comprehend its myriad benefits and can encourage the public to generate and consume DDI products. Finally, we mapped the datasets in demand, those datasets that should be released first to the public in order to enjoy the wide ranging benefits they offer.

Throughout the document we interspersed many success stories from the public and private sectors in various countries in order to provide a glimpse of DDI’s huge potential. Among these success stories we presented business initiatives that generate innovative outcomes that stand out in perfecting the market in which they operate, create new jobs and enhance the quality of life of millions of people worldwide. We showed how use of data can improve medical service, increase the ease of searching for schools towards the beginning of the school year, and enhance transportation services and much more.

We believe that combining the abilities we have and for which we are known as the ‘Start-Up Nation’ along with the opening of government datasets and creating the conditions for DDI, will usher the Israeli economy towards progress and growth and will create the conditions for endless innovative initiatives. Adding such a vital resource to the economy in which the level of innovation and entrepreneurship is among the highest in the world, will undoubtedly expand their scope and increase their impact.

The first main challenge facing the state is recognizing that data is a valuable national resource. This report and the study conducted within its framework provide the foundation that unequivocally supports this assertion.
We would like to thank the many experts who help us prepare this document for their immeasurable contribution of time, expertise and professional experience, and for sharing their expert insights (sometimes without compensation). Throughout the process it became explicitly clear that there is both agreement and a belief about the correct path that should be taken regarding an open data policy and in advancing DDI. The sense of a mission and a strong desire to help advance the issue in Israel is also more than evident.
**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 Israel's 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 compared to the developed countries and the U.S. impedes its global competitiveness and poses an obstacle to addressing cost of living and other vital issues.

In this study we reviewed the huge potential found in DDI for the 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 vital issue by establishing a DDI-enabling policy. Such a policy will lead to the growth of existing businesses, to the development of new information industries and to the closing of gaps between economic sectors. Its impact on the entire Israeli economy will be pivotal and consequential.

The following diagram illustrates the government's DDI roles and the expected benefits from filling them effectively.
14. Annexes

14.1 Description of sample

<table>
<thead>
<tr>
<th>Sector</th>
<th>Company size (based on number of workers)</th>
<th>Company size (based on revenue)</th>
<th>Ratio of revenue to worker</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industry</td>
<td>43% Small-medium</td>
<td>50% Small-medium</td>
<td>Up to 500 M</td>
</tr>
<tr>
<td>Commerce</td>
<td>28% Large</td>
<td>50% Large</td>
<td>Above 500 M</td>
</tr>
<tr>
<td>Service</td>
<td>26%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public</td>
<td>4%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Decision rules for enhancing the following variables:

1. Number of employees and revenue:
   - Company financial statements as published on the Maya website: [http://maya.tase.co.il/bursa/indeximptoday.htm](http://maya.tase.co.il/bursa/indeximptoday.htm)
   - BDI data received for a fee
   - Average/upper limit/lower limit of the subject’s answer
   - Financial/other websites (e.g. company website)

2. Sector – every company was classified into one of 4 sectors by company business:
   - Services
   - Commerce
   - Industry
   - Public

3. Foundation year
   - Data was taken from the company’s financial statements or from data websites

4. Technological complexity – every company was assigned a technological complexity level as follows:
   - 0 – No technological complexity
   - 1 – communications, financial companies or companies that use technology for industrial manufacturing
   - 2 – high tech companies and companies that use up-to-date technology

   A technological company was classified as such if it manufactures or uses up-to-date technology (categories 1-2)

Study Challenges:

During the questionnaire collection stage we encountered several challenges: a problem finding senior decision makers from large companies that would agree to participate in the survey as they were not available. In order to motivate them we offered to send them the study findings, after which positive responses increased significantly.

A lower than average response on the email survey, mainly due to manager emails that were not up-to-date.

Response percentage rate: telephone survey – 2.5%; email survey – 0.2%.
## 14.2 List of Interviewees

### Government offices and public sector

<table>
<thead>
<tr>
<th>Name</th>
<th>Organization</th>
<th>Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adv. Yoram Hacohen</td>
<td>Ministry of Justice</td>
<td>Former head of the Israeli Law, Information and Technology Authority</td>
</tr>
<tr>
<td>Adv. Rivki Dabash</td>
<td>Ministry of Justice</td>
<td>Director of the Freedom of Information Unit</td>
</tr>
<tr>
<td>Uri Gabai</td>
<td>Ministry of Economy</td>
<td>Head of Administration for R&amp;D Policy and Finance</td>
</tr>
<tr>
<td>Yuval Admon</td>
<td>Prime Minister’s Office – The National Economic Council</td>
<td>Acting Cooperation Team Leader, Strategy Division</td>
</tr>
<tr>
<td>Maya Adulami</td>
<td>Prime Minister’s Office – National IT Unit</td>
<td>Open data activity area manager</td>
</tr>
<tr>
<td>Dr. Yair Schindel</td>
<td>Prime Minister’s Office</td>
<td>CEO of the “Digital Israel” National Bureau</td>
</tr>
<tr>
<td>Dror Margalit</td>
<td>Prime Minister’s Office</td>
<td>VP Technologies, “Digital Israel”</td>
</tr>
<tr>
<td>Ofri Ben Avi</td>
<td>Prime Minister’s Office – National IT Unit</td>
<td>Head of E-government</td>
</tr>
<tr>
<td>Raz Heiferman</td>
<td>Prime Minister’s Office – National IT Unit</td>
<td>Acting government CIO</td>
</tr>
<tr>
<td>Osnat Sharabi</td>
<td>Central Bureau of Statistics</td>
<td>Head of Information Division</td>
</tr>
<tr>
<td>Yael Navon</td>
<td>Central Bureau of Statistics</td>
<td>Information Administrator</td>
</tr>
<tr>
<td>Mirit Hochman Cohen</td>
<td>Central Bureau of Statistics</td>
<td>Content Manager, CBS website</td>
</tr>
<tr>
<td>Ayelet Shaked</td>
<td>Ministry of Justice</td>
<td>Minister of Justice</td>
</tr>
<tr>
<td>Micha Perlman</td>
<td>Ministry of Finance – Budget Division</td>
<td>Higher Education and R&amp;D Coordinator, Budget Division</td>
</tr>
<tr>
<td>Michael Luria</td>
<td>Ministry of Finance – Budget Division</td>
<td>Advisor to the Head of Budget Division</td>
</tr>
<tr>
<td>Charlie Solomon</td>
<td>Ministry of Transportation</td>
<td>Senior Deputy General for Economic Planning</td>
</tr>
<tr>
<td>Dafna Ein Dor</td>
<td>Ministry of Transportation</td>
<td>Director, Economic Planning Division</td>
</tr>
<tr>
<td>Dr. Yossi Rosenblum</td>
<td>Maccabi Healthcare Services</td>
<td>Head of Medical Informatics</td>
</tr>
<tr>
<td>Prof. Ran Balicer</td>
<td>Clalit Health Services</td>
<td>Director, Clalit Research Institute and Director, Health Policy Planning Department</td>
</tr>
</tbody>
</table>
## Business sector

<table>
<thead>
<tr>
<th>Name</th>
<th>Organization</th>
<th>Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prof. Yossi Matias</td>
<td>Google</td>
<td>Director, R&amp;D Center, Google Israel</td>
</tr>
<tr>
<td>Amir Winstok</td>
<td>Madlan</td>
<td>Owner and founder</td>
</tr>
<tr>
<td>Simon Hannan</td>
<td>Deloitte UK</td>
<td>Director</td>
</tr>
<tr>
<td>Adv. Noga Rubinstein</td>
<td>Goldfarb Seligman &amp; Co</td>
<td>Head of the Regulation and Competition Department</td>
</tr>
<tr>
<td>Adit Shroitman</td>
<td>The Central Bottling Company</td>
<td>CIO</td>
</tr>
<tr>
<td>Yossi Levi</td>
<td>Union Motors</td>
<td>CFO</td>
</tr>
<tr>
<td>Guy Tal</td>
<td>Strauss Water</td>
<td>AVP Finance</td>
</tr>
<tr>
<td>Israel Amid</td>
<td>Pelephone</td>
<td>CFO</td>
</tr>
<tr>
<td>Erez Antebi</td>
<td>Gilat Satellite Networks</td>
<td>CEO</td>
</tr>
<tr>
<td>Ronen Zaretsky</td>
<td>Israccard</td>
<td>CIO</td>
</tr>
<tr>
<td>Ronen Agassi</td>
<td>Harel Insurance</td>
<td>CFO</td>
</tr>
<tr>
<td>Ofer Koren</td>
<td>Bank Hapoalim</td>
<td>VP Strategy</td>
</tr>
</tbody>
</table>

## Third sector and academia

<table>
<thead>
<tr>
<th>Name</th>
<th>Organization</th>
<th>Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prof. Niva Elkin-Koren</td>
<td>University of Haifa</td>
<td>Director, Haifa Center for Law &amp; Technology</td>
</tr>
<tr>
<td>Dr. Sharon Bar-Ziv</td>
<td>University of Haifa</td>
<td>Research Fellow, Haifa Center for Law &amp; Technology</td>
</tr>
<tr>
<td>Shevi Korzen</td>
<td>The Public Knowledge Workshop</td>
<td>Director General</td>
</tr>
<tr>
<td>Dr. Tehilla Schwartz Altshuler</td>
<td>Israel Democracy Institute</td>
<td>Head of the Media Reform Project and the Open Government Project</td>
</tr>
</tbody>
</table>
14.3 List of sources

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