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The economic impact of Google's data centre in Belgium

A study prepared for Google
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Executive summary

Google operates one of its three European data centres in Belgium. The data centre is located in St. Ghislain near the city of Mons in the southern part of the Walloon Region. The data centre has gradually expanded. The first facility was constructed between 2007 and 2009 and started initial operations in 2009. The second part was constructed between 2011 and 2014 and becomes fully operational in 2015. Looking ahead, Google is considering an expansion of the data centre with a third and larger facility. The third facility, should it be decided, could be constructed in 2016-2018.

Google has asked Copenhagen Economics to assess the economic impact of the construction and operations to date and to assess the potential impact of the expansion under consideration. This report provides our findings.

What is a data centre?
Data centres are facilities that house large numbers of high-performance computers, known as servers, as well as networking equipment and communication links. The servers in the data centre run Google products such as Search, Gmail or YouTube and support Google users across Europe and around the world.

The St. Ghislain–Mons data centre is unique in being the first Google designed, owned and operated data centre outside the US. It is also unique in being the first Google data centre worldwide to run entirely without refrigeration, instead using an advanced cooling system that draws water from a nearby industrial canal.

Large benefits to the Belgian economy so far
To date, Google has spent a total of EUR 775 million on the construction and operation of the data centre in St. Ghislain–Mons. The vast majority of the construction and operations have taken place in Belgium and with the use of Belgian workers and suppliers. This has generated new jobs, provided additional sources of income in Belgium and entailed significant trickle-down effects to the rest of the economy (*multiplier effects*), i.e. the effect of the data centre in supporting economic activity and employment in other industries such as retail trade, transport, accommodation, restaurants, housing and finance.

We have applied an economic model to measure the impact of Google's data centre on Belgium. All in all, our economic analysis shows that the data centre has made a significant contribution to its local area, to the Walloon Region and to the whole of Belgium. More specifically, we find that the data centre to date has:

- Supported economic activity in Belgium corresponding to around EUR 110 million in **gross domestic product** (GDP) per year on average – or EUR 900 million in total over the whole period from 2007 to 2014 and taking into account both the construction and operations (including direct, indirect and induced effects).
- Supported **new jobs** equivalent to 1,500 full-time equivalents (FTEs) per year on average, including direct, indirect and induced effects. The annual job impact has

ranged between 650 and 1,900 FTEs depending on the intensity of construction. Contrary to expectation, data centres are not filled with PhDs. In fact, a large majority of the operation jobs are performed by medium-skill qualified staff with upper secondary education e.g. a technical/community college certification.
- Provided **income opportunities** throughout the economy. During the construction phase, the data centre has given new opportunities to a broad range of construction workers and suppliers. Combining the impacts of the construction and the operations, we find that the investment made by Google has transcended most sectors of the economy via trickle-down effects.

Even larger benefits ahead

Looking to the future, Google has submitted an application for a third, large facility at the St. Ghislain–Mons data centre. Although a final decision is subject to planning permission and business approval, this future facility could double the Google investment at this data centre, and would entail the following main impacts:

- In the next three years, construction could support an average of 3,900 FTEs per year including direct, indirect and induced effects. Around half of these jobs are those supported in the wider economy (induced jobs in industries such as retail trade, transport, accommodation, restaurants, housing and finance).
- By the completion of its third facility, and looking over the whole period 2007–2020, Google's data centre will support a contribution to Belgium's GDP of EUR 2.2 billion, including direct, indirect and induced effects to the economy.

Furthermore, we have also identified that Google's data centre generates significant broader economic effects, which provide a long-lasting benefit to the Belgian economy. These spillover effects (which are analysed though not quantified in this study) are dynamic in nature and are driven by the productivity-enhancing impacts on Belgian companies. In fact, Google's data centre has fostered training in its supply chain and has added new knowledge and skills to the region. In turn, these new skills and knowledge increase productivity and enable these suppliers to grow. Finally, the large series of investments by Google helps signal to other foreign investors that Belgium is an attractive location to do business (cf. Figure 1). These effects are already in place with the current data centre; they could only become bigger with an increase in the scale of the data centre.

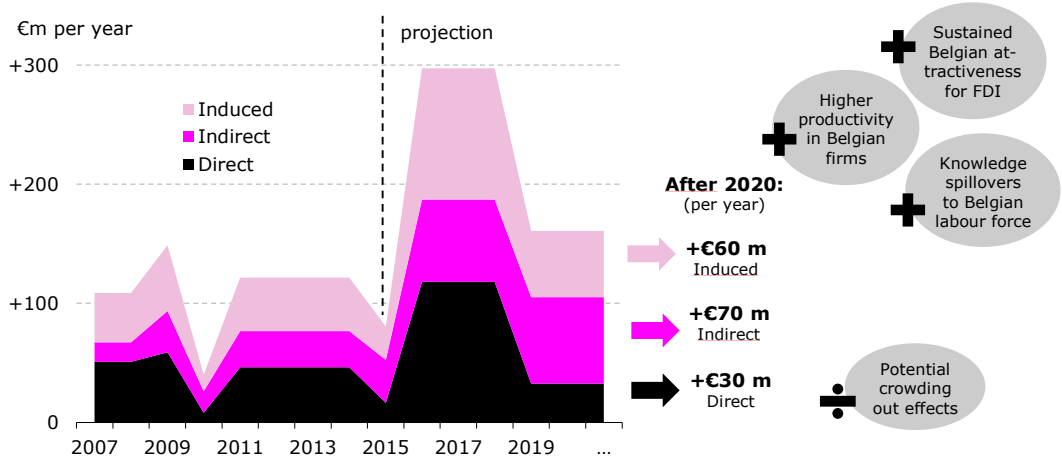
Policy choices will shape the future benefits

To maximise the benefit from investments of this scale and complexity, the region will need to avoid bottlenecks in infrastructure and skills and overheating of certain parts of the labour market. This requires the right skill base in the labour force being available in the region to match the needs of the new investment. The Google data centre has been successful in this respect so far, and this success is in part due to the efforts by the region and its people, with the right mix of skill levels and efforts, to ensure that the right infrastructure services are available locally to match the needs of data centre – including the activities of its many supplier firms.

Local policies do not make it alone. Large-scale data centres like the one in St. Ghislain–Mons are built to serve users across borders and expanding data centres in a few locations

throughout Europe makes business sense only if they can be used to serve Internet users across the whole of the EU (and globally). An open and growing market for digital services across Europe is thus key for the expansion of digital infrastructure like the St. Ghislain–Mons data centre. An open market can enable the most digitally productive countries like Belgium to preserve and grow their role as a digital hub.

Figure 1 GDP contribution supported by the Google data centre



Note: 2014 prices. The figure shows the estimated supported impact on Belgium's gross domestic product (GDP) of the construction and operation of Google's data centre.

Source: Copenhagen Economics, based on own estimates, data from Google and input-output tables from Statistics Belgium

Chapter 1

The data centre in St. Ghislain–Mons

1.1 Purpose and activities of the data centre

When you use Google products such as Search, Gmail or YouTube, the servers in the Google data centres do the work for you, around the clock and around the world. Thus the St. Ghislain–Mons data centre helps provide services to Internet users throughout Belgium, Europe and globally.

Data centres are complex systems with many mechanical, electrical and controls components, as well as networking equipment and communication links. Data centres host a large number of servers, which are high-performance computers that run all the time. They are the core of the data centres, cf. Figure 2.

Figure 2 Inside Google's data centres

Note: *On the left:* Blue LEDs on this row of servers tell Google that everything is running smoothly. *On the right:* Colourful pipes carry water in and out of the data centre. The blue pipes supply cold water and the red pipes return the warm water back to be cooled. The pictures are from Google's data centres in Georgia and Oregon.

Source: Google

The electricity that powers a data centre ultimately turns into heat. Most data centres use chillers or air conditioning units to cool things down, but at St. Ghislain–Mons, Google uses water as an energy-efficient way to cool instead. In fact, the St. Ghislain–Mons facility was Google's first data centre worldwide to run entirely without electrical refrigeration, instead using an advanced cooling system called 'free cooling'. The St. Ghislain–Mons data centre also has an on-site water purification facility that allows Google to recycle water from a nearby industrial canal rather than use the city's water supply, cf. Figure 3.

Figure 3 Google's facilities at St. Ghislain–Mons

Note: Water storage tanks below the cooling towers ensure that Google has water available whenever they need it.

Source: Google

In the middle of the last decade, Google decided to invest in St. Ghislain–Mons. This has reflected the attractiveness of the Mons area for this type of development, cf. Box 1.

Box 1 Why did Google choose St. Ghislain–Mons?

Belgium is centrally located, with an appropriate regulatory environment and a location very close to key markets in Western Europe. The shorter the distance that data must travel between a data centre and the Internet users' devices, the lower the latency. A low latency to users enables a good performance of the Internet services.

Moreover, the St. Ghislain–Mons area has the right combination of energy infrastructure and developable land. The local, regional and national authorities have a strong vision for how the Internet can bring economic benefits and jobs to the area.

Finally, the Digital Innovation Valley project has created a cluster of high-tech businesses and put technology and language skills at the heart of the education system. As a result, Google was supported by a great team of people who were helpful with the initial site selection, initial process and subsequently throughout the data centre development.

Source: Google

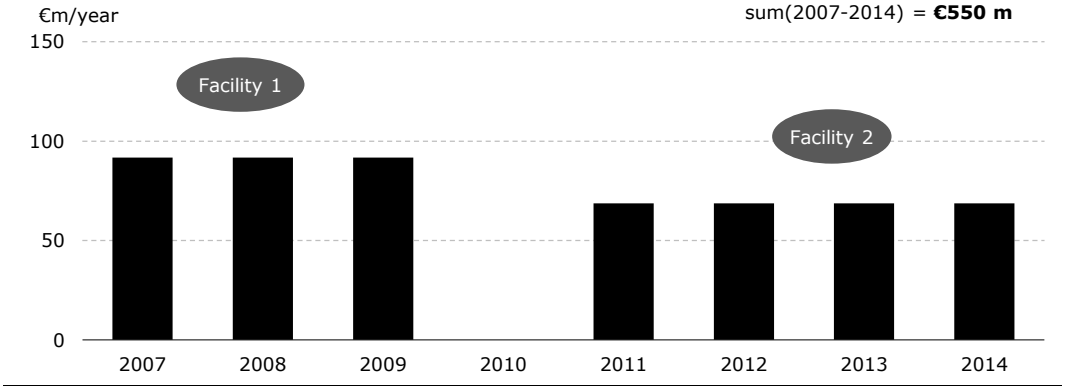
1.2 The investment in building the data centre

Google initiated the construction of its first facility in Belgium in 2007. The facility now serves Google users across Europe and around the world. To meet the increasing demand

for its Internet services, Google expanded with a second facility at the same location from 2011-2014.

The establishment of the first two facilities involved substantial investments. Since 2007, Google has invested a total of EUR 550 million in construction activities, cf. Figure 4.

Figure 4 Google's construction expenditure timeline

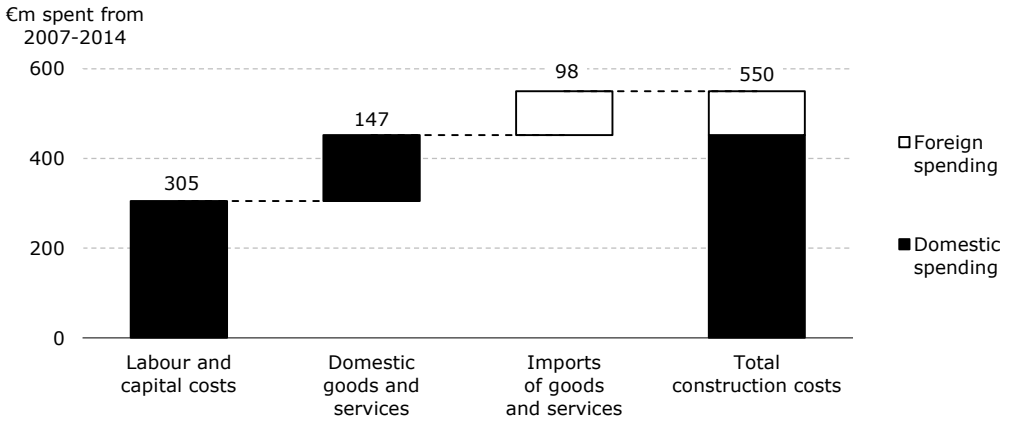


Note: 2014-prices. The amount of expenditure has varied year by year and the figure represents a stylised view, showing an average across the duration of construction (3-year construction for the first facility and 4-year construction for the second facility).

Source: Copenhagen Economics, based on data from Google.

More than 2,000 individuals working for 85 companies contributed to the construction. The vast majority of Google's spending was on Belgian construction work and related supplies, as well as mechanical and electrical work, logistic services and support professionals. Google only spent EUR 98 million of the total construction costs of EUR 550 million on imported equipment from abroad, cf. Figure 5.

Figure 5 Google's construction expenditure, by expenditure type



Note: 2014-prices. Labour and capital costs include: wages, amortisation and gross surplus. Domestic goods and services include all materials and services from Belgium.

Source: Copenhagen Economics, based on data from Google

The major Belgian contractors typically sourced construction materials and subcontractors locally as well as the machines, trailers, cranes and other site-related equipment. Moreover, the total of approximately 3 million man-hours required for a project of this scale were filled to a large extent by local employees, with payroll spending accruing to the local area.

1.3 The operation of the data centre

On top of the construction expenditure, Google has spent EUR 225 million on operations at the two facilities since the start of operations around 2009. A large share of Google's domestic operational expenses are labour costs. Furthermore, Google's domestic operational spend includes a large component which is related to water and power supply, as well as a share dedicated to purchases of other domestic goods and services such as security, transport and repair of machinery and equipment.

Who works at the data centre?

A combination of Google employees and supplier employees collaborate day-to-day to maintain and operate the St. Ghislain–Mons data centre.

The jobs at Google's St. Ghislain–Mons facility include positions in management, mechanical and electrical maintenance and repair, IT and systems technicians, plumbing and water management, and hardware operations; these are the experts who receive, setup, install and manage the physical hardware, cf. Figure 6.

Although running a data centre requires a high degree of expertise, there are jobs for everyone – 90% of Google's positions in Belgium do not require a university degree.

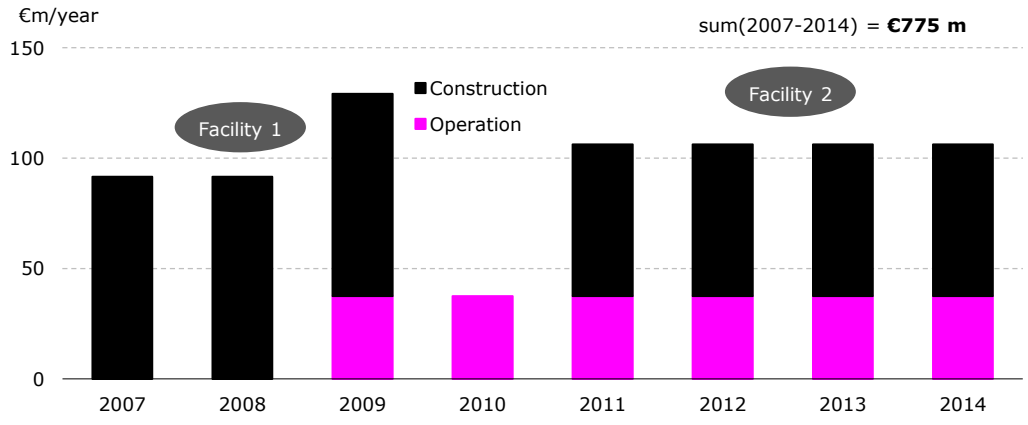
Figure 6 Working at the St. Ghislain–Mons data centre

Note: *On the left:* Matthieu, Hardware Operations, is the quality assurance (QA) lead at the St. Ghislain–Mons, which means he is responsible for installing and testing new machines. *Top right:* Joëlle, Data Centre Facilities Technician, is the mechanical leader of the data centre operations team. She was in charge of the electrical design of the cooling modules during the construction of the facility. *Lower right:* Christophe, Data Centre Technician Assistant, is part of the hardware operations team. He ensures that all the Google services are running properly and that user data is secure. He fixes different types of devices like servers, switches, and optical fibres, and repairs faulty hard drives.

Source: Google

Adding together the construction and operation expenditures, Google's total expenditure over the period sums up to EUR 775 million, as shown in Figure 7.

Figure 7 Google's expenditure in Belgium



Note: 2014 prices. The amount of expenditure has varied year by year and the figure represents a stylised view, showing an average across the duration of construction (3-year construction for the first facility; 4-year construction for the second facility) and assuming a constant scale of operation during the period in which only the first facility was operational (2009–2014).

Source: Copenhagen Economics, based on data from Google.

1.4 The GDP contribution of the data centre

To analyse the economic impact of the investment including both the construction period and the operation period, we have conducted a comprehensive economic analysis using detailed data from the Belgian national statistics office, data from Google about its expenditure on the St. Ghislain–Mons data centre and combined it with our own economic model tools (so-called input-output model). Therefore, the results capture the impact of the Google activities at this data centre, though not the impact of other Google activities in Belgium (e.g. the advertising business activity run from Google's Brussels office).

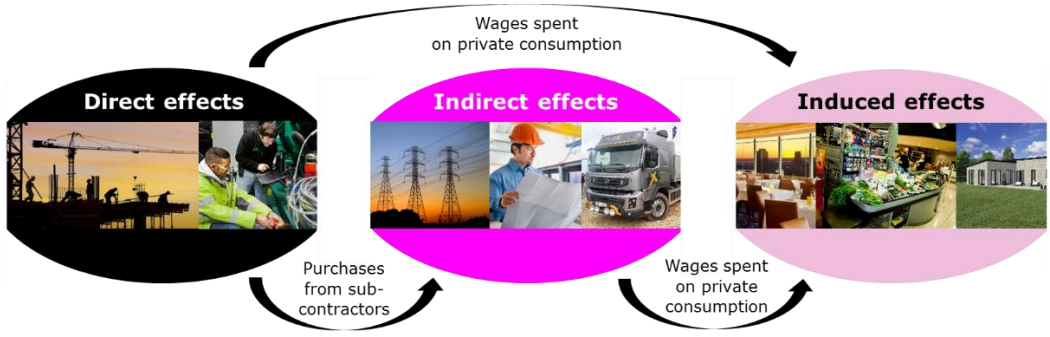
Using our analytical framework, we capture Google's data centre impacts on the Belgian economy via three distinct effects; direct, indirect and induced effects.

The direct effect includes the economic impact supported directly by Google and their key construction contractors. The directly supported jobs in operations include positions in management, mechanical and electrical maintenance and repair, IT and systems technicians, plumbing and water management, and hardware operations.

The indirect effect includes the economic impact on subcontractors, which is also supported by Google's purchases of domestic goods and services. The indirectly supported jobs include positions in security, catering, cleaning and in the construction and supply industries, as well as at a number of upstream suppliers in the economy.

We refer to *the induced effect* as the potential supported economic impact that occurs when Google employees and contractors spend their wages in the economy. The *induced* jobs are primarily service-related jobs in industries such as retail trade, transport, accommodation, restaurants, housing and finance, cf. Figure 8.

Figure 8 Direct, indirect and induced effects of the Google data centre in Belgium



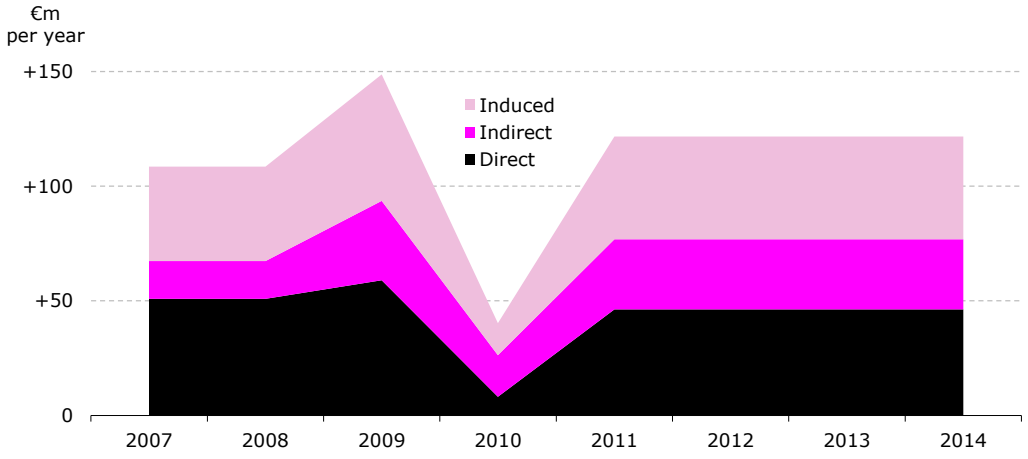
Source: Copenhagen Economics

Our results show that when considering the direct and indirect effects together, the two Google facilities have already supported an estimated GDP contribution of EUR 70 million on average per year since 2007. Induced effects have brought an additional EUR 40

million per year on average, adding up to EUR 110 million per year and a total of EUR 0.9 billion over the entire period.

The yearly impact varies over time depending on the intensity of construction and the phasing in of the operations, cf. Figure 9.

Figure 9 GDP contribution supported by the Google data centre



Note: 2014 prices. The figure shows the estimated supported impact on Belgium's gross domestic product (GDP) of the construction and operation of Google's data centre. This is based on the same time profile as in Figure 7.

Source: Copenhagen Economics, based on data from Google, input-output tables from Statistics Belgium, and own estimates.

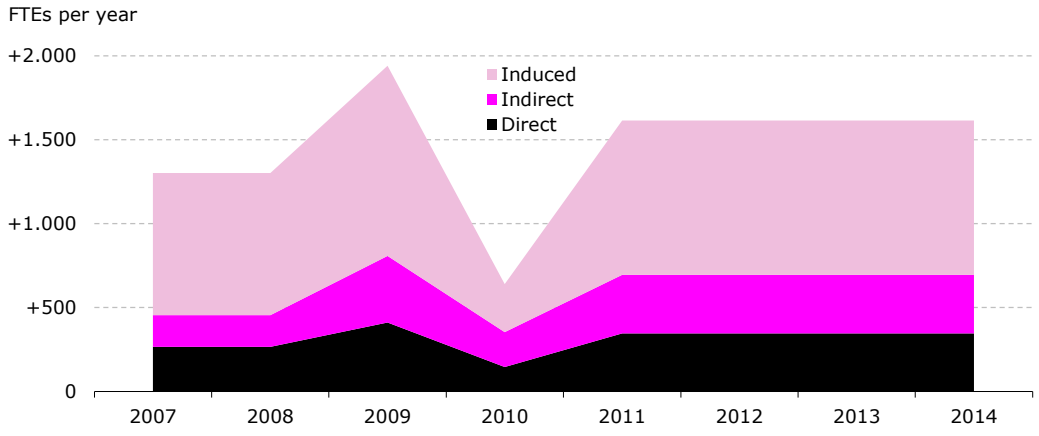
1.5 The employment impact of the data centre

Over the past few years, the direct and indirect employment impact of the Google data centre has ranged between 350 and 800 full-time equivalent jobs (FTEs). This effect has fluctuated due to the varying intensity of construction work required to build and expand the data centre site from one to two complex buildings.

Induced effects have brought an additional 300 to 1,100 FTEs per year, again depending on the intensity of construction work. The combined effect of direct, indirect and induced effects add up to 650-1,900 FTEs per year, with an annual average of 1,500 FTEs per year over the entire period, cf. Figure 10.

Moreover, Google's investment in the St. Ghislain–Mons data centre can make the local region and the whole of Belgium more attractive for investment in both the digital sector and other sectors via the spillover effects that we describe in the following section.

Figure 10 Employment supported by the Google data centre



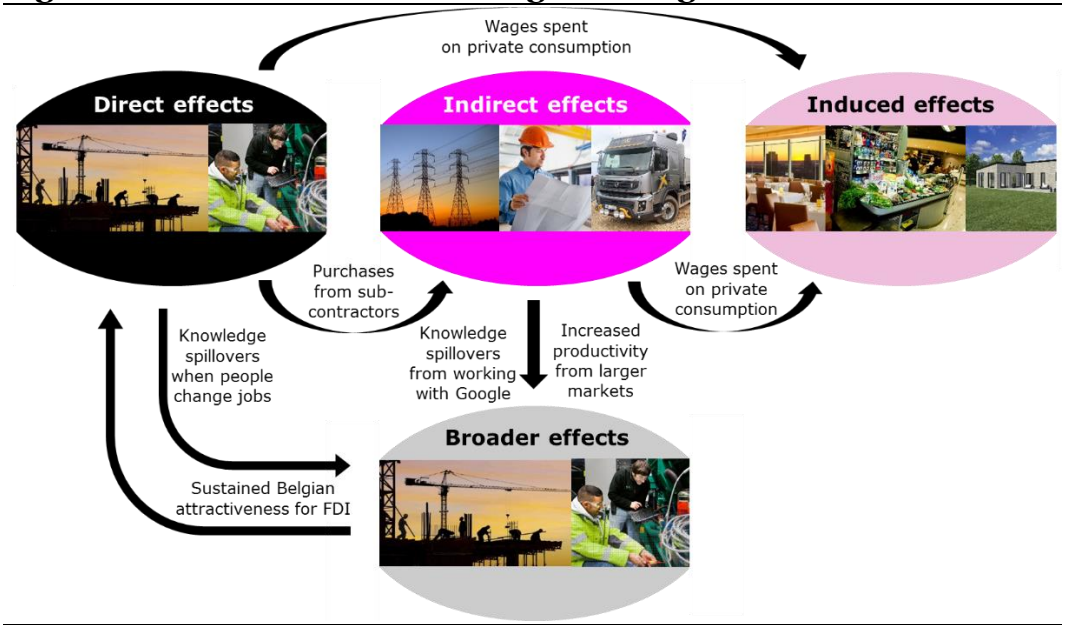
Note: The figure shows the estimated supported impact on employment in Belgium of the construction and operation of Google's data centre.

Source: Copenhagen Economics, based on data from Google, own estimates and input-output tables from Statistics Belgium

1.6 Broader economic impact of Google's investment

Google's investment in Belgium also generates broader productivity-enhancing economic impacts that are longer lasting and more dynamic in nature than the direct, indirect and induced effects, cf. Figure 11.

Figure 11 Broader effects of Google in Belgium



Source: Copenhagen Economics

Firstly, Google holds technical, operational and managerial knowledge that can improve the productivity of other Belgian companies through knowledge spillovers. Google's intensive focus on training both its own employees and the suppliers' staff working at the data centre is an important channel for this type of spillover to the Belgian economy.

Secondly, more productive Belgium companies supply goods and services to Google and win market shares from their less productive competitors. When resources shift towards more productive companies, the overall productivity in Belgium improves, which promotes the ability to export or better compete with foreign suppliers in Belgium.

Thirdly, Google's investment in Belgium makes it more attractive for other multinational companies to invest in Belgium and paves the way for more knowledge spillovers and productivity gains.

When productivity increases, Belgian companies are able to pay higher wages to their employees without harming their competitiveness; in turn the employees will feel an improvement in their living standards. Higher wages also increase tax revenues and allow policy-makers to increase public consumption, reduce tax rates or prioritise other initiatives that rate highly on the political agenda in Belgium. We now describe in greater detail the three main transmission channels that drive the broader economic impact of the Google data centre in Belgium.

Knowledge spillovers make other Belgian companies more productive

Multinational companies, such as Google, generally comprise large amounts of technical, operational and managerial knowledge, which allows them to establish themselves in markets across the world and compete successfully against local firms.[1] Local Belgian companies can benefit from this knowledge when they hire former employees from Google, and when they sell their goods and services to Google.

Labour mobility is a channel of knowledge spillover which is well-documented in the empirical literature. Multinational companies attract some of the most productive workers, and they pay a wage premium to retain the employees and protect their knowledge from diffusing throughout the industry (see Fosfuri, Motta and Rønde, 2001). Multinational companies also improve the knowledge of their employees. Malchow-Møller et al. (2013) find that 75% of the observed wage premium in foreign firms can be explained by the selection of employees, while the remaining 25% is due to other factors, including learning effects.

Labour mobility can be key to match the right skills to the right activity and for workers to develop new skills. Labour mobility applies both between companies and across different jobs within the same company, cf. Box 2.

[1] Markusen (1995) refers to such assets as 'knowledge capital', which includes factors such as superior production processes, technology, management techniques or marketing and advertisement campaigns.

Box 2 Joëlle – Google employee

Joëlle was born in the Walloon Region (Belgium) and lives in the Mons countryside, not very far from the data centre site. She has spent all her life in Belgium and her family includes a daughter and a son. She has studied at the Mons Faculté Polytechnique and graduated as a civil engineer. She has gained experience across a broad set of industries working in the field of automation solutions: she has been project manager in several companies in service industries, steel, iron and glass industries, as well as in nuclear plants.

After having lived several years in Brussels, Joëlle returned to the Mons area. She was involved in developing the monitoring system for the cooling of the data centre. She has since joined the operations team, first in controls, then in systems maintenance. During the latest period of construction, she was involved in the commissioning of the equipment, i.e. checking and testing what equipment was being installed. Her tasks now include supporting other colleagues by training operations workers and teaching them how to handle the equipment.

She has been trained in all the on-site systems, for example the Heating, Ventilation and Air Conditioning (HVAC) systems. The skills thus gained imply that she is now able to handle the case of a breakdown and solve various problems that arise within the operation and management of complex data centres.

From past experience, she knows that the work environment in many production facilities can be not so welcoming for women. She finds this not to be the case at the St. Ghislain–Mons centre. Joëlle enjoys the flat organisation and the flexibility at Google, where it is easy to shift roles internally and try new things. Jöelle also benefits from information sharing with Google colleagues working on other data centres globally, which is an important source of learning and experience building.

Source: Copenhagen Economics, based on interviews

Labour mobility (e.g. when a Google employee moves to another company), implies that knowledge is disseminated and best practice can spread through the economy. Görg and Strobl (2005), for example, find that a local firm is more productive if the owner has previously been employed in a multinational company.

An important finding is that Google is placing a lot of emphasis on supporting the data centre workers with a range of training programmes. This involves not only the Google employees, but very importantly also the employees of the suppliers working at the data centre. Google trains the data centre staff so that they can combine their original specialist skills (e.g. cooling systems) with other specialist skills (e.g. water treatment; or high power electrical distribution). Google has developed a specific training set for the equipment and systems it operates and maintains in the data centre, which is completed by all data centre staff (Google employees and suppliers) via an e-learning platform.

All the staff we have spoken to have undertaken different forms of training, which go from systems and equipment training, to specialised industry certifications to English language courses. All of these benefit the data centre staff, allow them to be more productive in their jobs and to grow professionally. This intensive focus on training is a supporting factor for knowledge spillovers, cf. Box 3.

Box 3 Jacques – employee at construction contractor

Jacques is from the Walloon Region (Belgium) and lives with his family in Quaregnon, a few km away from the St. Ghislain–Mons site. He has a daughter and a son. Jacques went to school at Instituts Saint-Luc Mons, where he completed a technical education in electrical systems.

He works at a specialised construction, systems automation and maintenance company that has supplied Google since its first operations in Belgium. Previously, he worked in the telecommunications industry providing electrical services such as the installation of Internet lines around Mons.

Jacques has worked at the St. Ghislain–Mons site for five years. A key task for him has been installing and maintaining electrical distribution systems. He has been responsible for performing operations such as thermo-graphical inspection, maintenance of electrical systems, exchangers and cooling towers. Since last year, he has been in charge of scheduling and planning tasks and training, thereby improving the quality of the work of his team. For example, he has trained his team in the electrical distribution of the second data centre, which required specialised training.

Jacques has learned a lot from his time at Google. He has been trained in presentation techniques and on how to comply with the administration and reporting systems needed by a large multinational firm, e.g. documentation regarding the electrical installations, as well as in the systems that detect on-site problems, and the fuel systems. These detailed processes have taught him a key learning point: in a complex environment, the smallest details can be the most important. Moreover, Jacques has decided to enhance his education and through evening studies has recently completed a 4-year bachelor programme on automation and regulation of systems.

After working for the St. Ghislain–Mons data centre, the firm he works for has exported services to another Google data centre in Europe, where it has delivered fibre-optic installations. Moreover, the area of work in which Jacques operates is not only of interest to the information and telecommunications industry. In fact, the firm he works for has been able to secure clients in many other sectors including pharmaceutical, sugar and cement production. In doing so, the firm has not only supplied Belgium but also gained export contracts in countries like France, Brazil, Iraq and Romania, where the firm provides electrical distribution, automated systems and industrial informatics.

Source: Copenhagen Economics, based on interviews

Multinational companies often require a high quality of goods and services used in their production, and they are often willing to provide direct assistance to local suppliers to help them tailor their products to the required standards (Görg, 2007).

Google works closely with its Belgian suppliers to ensure a high quality of the deliverables. This includes training and technical assistance aimed at developing advanced and economically more efficient deliverables. These interactions provide another source of

knowledge spillover[2] and Belgian suppliers state that the close contact with Google has promoted their learning, cf. Box 4.

Box 4 Patrick – employee at operations contractor

Patrick is a mechanical expert from the Walloon Region (Belgium) and works for a supplier to Google. He has been working at the St. Ghislain–Mons site for the past six years.

During the course of his work at St. Ghislain–Mons, Patrick has performed many different tasks and learned a set of skills. By interacting with Google staff, the supplier's team and specification manuals, he has learned to maintain and repair large centrifugal pumps, learned to maintain a cooling tower, refrigeration units, pumps and systems in a water treatment pump – which performs the important task of cleaning the water which the data centre uses for cooling its environment.

On the job, Patrick has also learned broader skills and developed his managerial profile. He is now leading the team supporting Google on the operational side and he is in charge of training his colleagues so to comply with the standards and performance needed to succeed in their job as supplier to Google.

Source: Copenhagen Economics, based on interviews

Increased demand enables productive Belgian suppliers to grow

When large multinational companies enter a local market and purchase their inputs locally, they increase the size of the local market. A larger market may allow some of the existing suppliers to benefit from economies of scale, attract new suppliers and spur competition (Markusen and Venables, 1999).[3] With intensified competition, the more productive suppliers will gain market share at the expense of less productive companies (Aitken et al., 1999). This process increases the overall level of productivity in a country.

In fact, Google uses local suppliers intensively in the construction phase. In addition, Google has strong linkages with local suppliers in the operation of the data centre. There are several industries supplying the building blocks of the Google data centre: construction, design, ventilation and cooling, electrical and pumping systems, security, etc. All of these industries benefit from increased demand from Google and thus benefit from a larger market for their services. The wider market for this broad range of industrial services will tend to improve the overall productivity in the economy.

Furthermore, the growth of productivity among Belgian firms is not only based on domestic demand but also on export contracts. Although we do not expect the export impact to

[2] The empirical literature offers extensive evidence of knowledge spillovers through interactions between multinational companies and local firms. Some examples are Javorcik, 2004; Barrios, Görg and Strobl, 2011; and Fons-Rosen et al., 2015).

[3] Görg and Strobl, 2002, and Barrios et al., 2005 find that the entry rate of Irish firms into an industry is positively related to the presence of MNEs in that industry, indicating that the presence of MNEs encourage domestic entrepreneurs to set up new firms, either in supplying or final goods industries (see also Görg, 2007). A study conducted by Barry (2008) on the emergence of the Irish indigenous software cluster adds support to these findings. Barry (2008) argues that part of the reason a strong cluster of Irish owned software firms has emerged over the last two decades is a strong presence of multinationals in high-tech industries in Ireland. These have provided a source of initial demand for software solutions in Ireland and some have even adopted these solutions in their affiliates in other countries, providing the Irish suppliers with access to foreign markets.

be pronounced, we cannot exclude that the learning effects can have positive export effects, cf. Box 5.

Box 5 Alex – employee at construction contractor

Alex is a Mathematics graduate from Bulgaria and now relocated to Belgium. He has long-term plans to live in Belgium and has recently had a daughter born in Belgium.

Alex is a specialist in project management, which is an important role for a supplier to deliver and meet the needs of a large multinational like Google. His company performs a variety of different tasks, which involve piping, installations of fuel systems, machinery, and electrical components. His role at St. Ghislain–Mons is to keep a global view of the project, control costs and manage the project organisation.

To do so, he relies on specialised software. As he learned more about project management during his St. Ghislain–Mons site work, he and his firm have evolved in their use of project management tools and have shifted from Microsoft to Primavera software, which has provided Alex with valuable new software skills.

During his time with Google, Alex has followed training courses in project management. Certifications are sought and gained by Alex and many of his col-leagues, which have obtained clean room-certificate (allowing him to work for the pharmaceutical industry) and certificates for HVAC and fuel approval.

In Alex's experience, working with a company like Google gives a global view of things. During the construction, they benefited from interaction with other partner contractors and learned the standards and processes that were required to satisfy Google's complex needs. Alex is especially impressed with the level of detail and documentation that is necessary to succeed in this environment, which in his experience provides a good structure and understanding of the work.

Alex and his company now understand how to work with clients such as Google – how to interact and manage the client, how to prepare and meet the expectations of a large multinational company in a high-tech industry. Besides Google, his company has currently secured another big project in Belgium, and has been able to secure several projects for companies in France and also exported contracts outside Europe (Algeria, Morocco). Alex's company has used this knowledge to supply a broader set of industries, which includes pharmaceuticals, oil extraction and piping. As a result, the company has significantly enlarged its Heating Ventilation and Air Conditioning (HVAC) department.

Source: Copenhagen Economics, based on interviews

The presence of foreign companies helps attract new foreign investors

Foreign direct investments (FDI) are generally driven by four motives: market-seeking, efficiency-seeking, resource-seeking and strategic.[4] Irrespective of the underlying motive, the presence of Google's data centre in Belgium can pave the way for new inflows of foreign investments:

- **Market-seeking FDI:** Investors establish themselves in foreign countries to reduce transportation costs and improve their market access by building closer relations with

[4] This terminology was originally developed by Dunning, 1998.

existing and potential clients. By raising wages and living standards in Belgium, Google and other foreign investors make it more attractive for other foreign investors to establish themselves in Belgium in order to serve the local market.

- **Efficiency-seeking FDI:** Investors constantly seek ways to lower their costs and improve their profitability and competitiveness. By increasing the size of the local market and enabling local suppliers to benefit from economies of scale, foreign multinational companies in Belgium can lower the unit costs of inputs and make Belgium a more attractive location for other foreign companies that use the same production factors.
- **Resource-seeking FDI:** Multinational companies are dependent on sourcing new talents and technologies to remain competitive. By facilitating knowledge spillovers and raising the productivity of Belgian workers, multinational companies like Google send signals to other foreign companies and make it easier to for Belgium to attract new foreign investors.
- **Strategic FDI:** Strategic considerations about improving the quality of existing products, introducing new products and benefiting from a favourable regulatory framework can also be underlying motives for investing abroad. The fact that Google invests in Belgium – and the prospective scaling up of this investment – signals to other multinational companies that Belgium is a country with attractive features (e.g. high-skilled labour, infrastructure and favourable policy framework).

As Google's data centre in St. Ghislain–Mons gains an increasingly higher profile, this can signal the improvement of the image of Mons and Belgium. This increases Belgium's chances of being the preferred location of new data centres and other types of foreign investments in ICT and other sectors that rely on similar skills and infrastructure.

Chapter 2

An opportunity to increase the Google data centre impact on Belgium

2.1 Growth in data centre capacity: an economic opportunity

Investment in digital infrastructure in the Walloon Region can help further propel Belgium as a digital economy hub. Digital infrastructure consists of data storage, management, access and computation – all elements that enable our increasingly digital culture.

The decision of a global company such as Google on where to locate a data centre (or where to expand existing sites) is the outcome of a competitive process. It ultimately depends on the competitiveness of the countries and local regions that are chosen for the data centre sites.

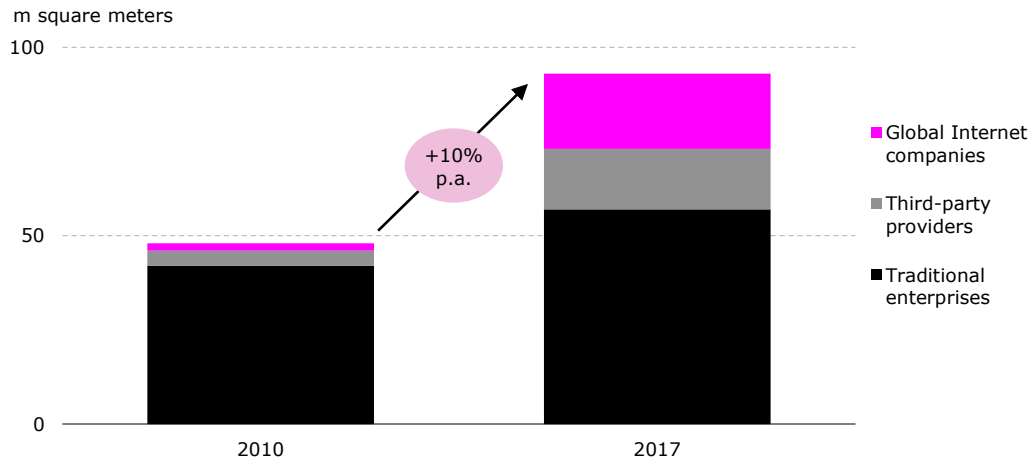
Belgium and its Walloon Region are among the few that have been successful to secure Google investment. In fact, Google owns and operates three data centres in Europe: in Hamina, Finland; St. Ghislain–Mons, Belgium and Dublin, Ireland; a fourth one is currently under construction at Eemshaven, Netherlands, cf. Figure 12.

Figure 12 Google's data centre locations in Europe

Source: Google

Looking forward, the increasing demand for cloud services, such as e-mails, photos and music, means that global Internet companies such as Google, Facebook, Apple and Amazon are amongst the strongest drivers of the global data centre capacity growth, cf. Figure 13.

Figure 13 Global data centre capacity



Source: BCG (2014)

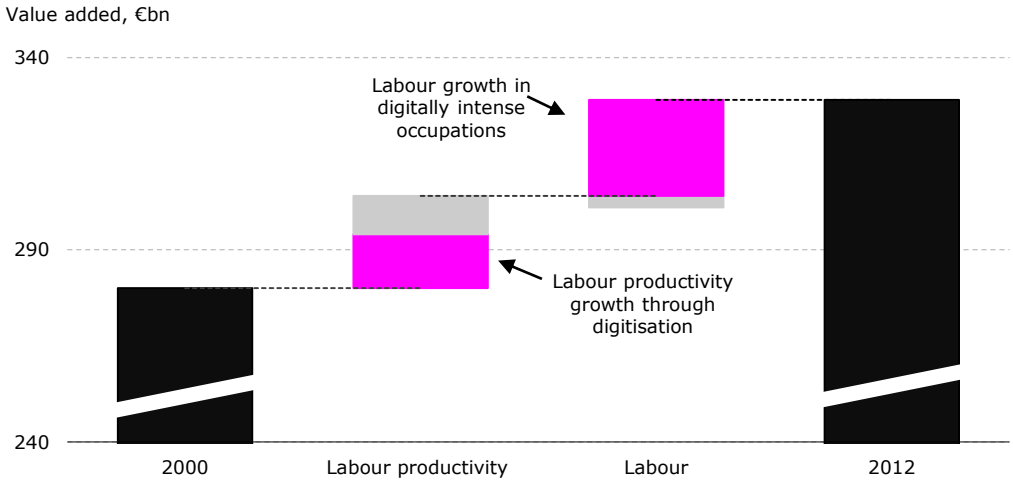
Global internet companies capture scale advantages by consolidating the storage and processing of data in large data centres, thereby shifting the landscape towards larger-scale, purpose-built facilities with a focus on operational costs and efficiency.

In essence, data is cheap to transport and data centres are subject to large scale economies. Concentration of the data keeps the costs of data storage and operations of its services down, which ultimately benefits all Internet users. Moreover, data security is an important aspect and companies focus heavily and invest accordingly to ensure that data is kept safe at their data centres.

However, as we will discuss below, for this efficiency and its benefit to be realised, it is imperative that data can move freely across national borders, for instance between one EU country and another – otherwise the benefits of the larger European market are lost.

The Belgian economy has already experienced a significant boost from the digital sector. In fact, it has benefited both from the productivity boost brought about by digitisation (cf. Figure 14) and because of increased GDP and employment linked to digitally intense occupations, such as the data centre in St. Ghislain–Mons.

Figure 14 The impact of digitisation on the Belgian economy



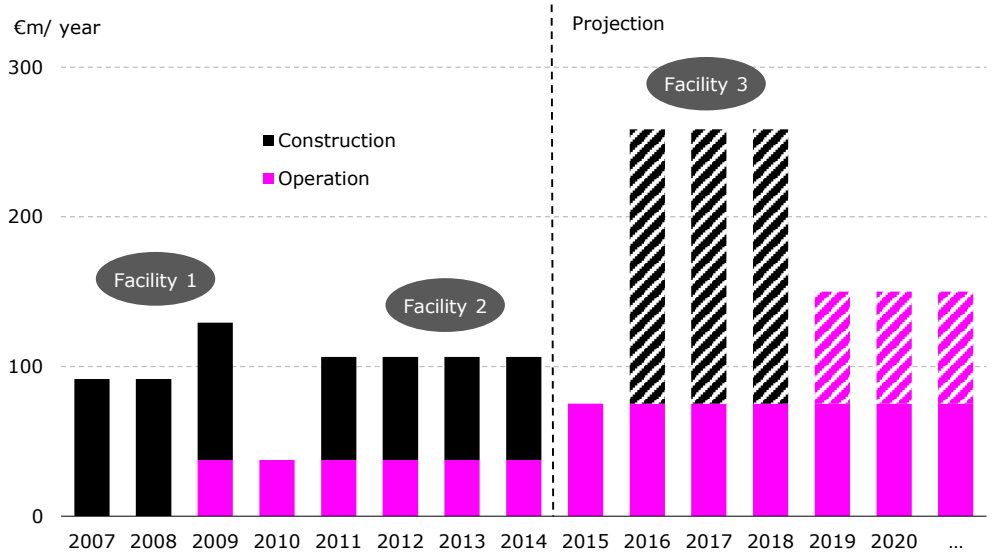
Note: The figure shows the growth of value added in the Belgian economy in 2011 prices. Digitisation is defined here in relation to all information and communications technologies.

Source: Roland Berger (2015)

2.2 The planned expansion at the data centre

The Google investment in Belgium could continue. The company has submitted an application for the construction of a third, large facility in St. Ghislain–Mons. Although a final decision is subject to planning permission and business approval, with an estimated construction cost of more than half a billion Euros, the future potential equals a doubling of the two existing facilities combined, cf. Figure 15.

Figure 15 Google's expected expenditure in Belgium



Note: 2014 prices. The amount of expenditure has varied year by year and the figure represents a stylised view, showing an average across the duration of construction (3-year construction for the first facility, 4-year construction for the second facility; and 3-year construction for the third facility, with a construction start in 2016 – the actual timing may vary). The shaded area is contingent on the construction of the third facility, which is subject to planning permission and business approval.

Source: Copenhagen Economics, based on data from Google

After the construction phase, the operational expenses will continually benefit the local community going forward. Following the construction of the third data centre, the operation cost will increase accordingly. Based on data from Google, we forecast an increase in the ongoing operation expenses to an annual amount around EUR 150 million, a doubling of the current spending. The reason for this is that, upon completion of the third data centre, the total infrastructure to be maintained and operated in St. Ghislain–Mons will also double.

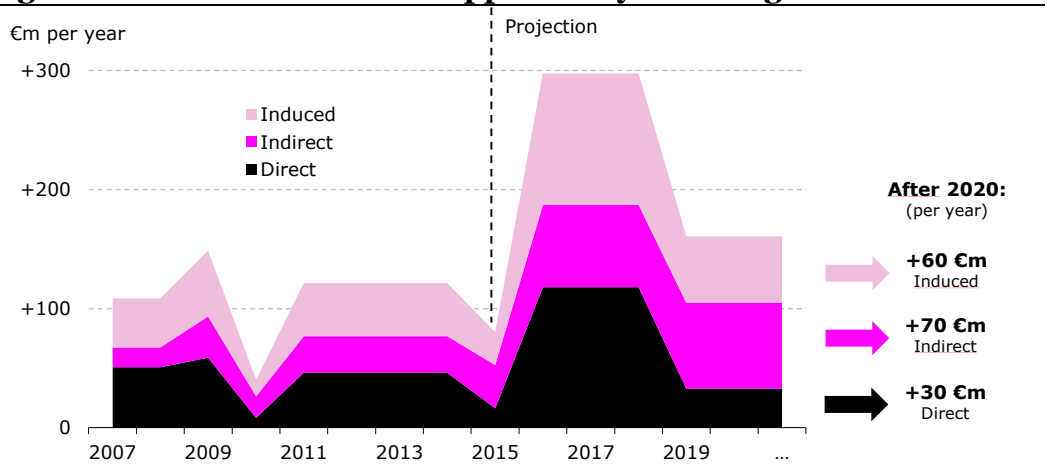
2.3 The GDP contribution of an enlarged data centre

Obviously, a larger data centre would imply a much bigger contribution to the Belgian economy. Looking at the period from 2015-2020, Google's activities in Belgium would support an average contribution to Belgium's GDP of EUR 140 million per year, when including direct and indirect effects.

Induced effects are expected to bring an additional EUR 80 million per year on average throughout the 2015–2020 period. In total, counting the direct, indirect and induced effects, the construction and operation will support an average contribution to Belgium's GDP of EUR 220 million per year.

After the end of construction of the third data centre facility (e.g. after 2020), it is forecast that the operation of a much larger data centre would lead to a contribution to Belgium's GDP of EUR 160 million per year. This includes direct, indirect and induced effects of operations alone, with the breakdown shown in Figure 16.

Figure 16 GDP contribution supported by the Google data centre



Note: 2014 prices. The figure shows the estimated supported impact on Belgium's gross domestic product (GDP) of the construction and operation of Google's data centre.

Source: Copenhagen Economics, based on own estimates, data from Google and input-output tables from Statistics Belgium.

2.4 The employment impact of an enlarged data centre

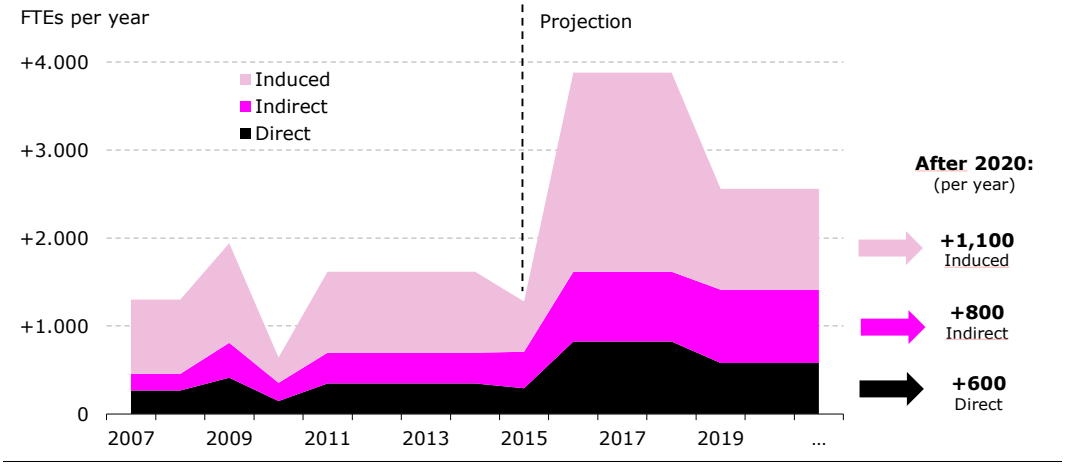
During the forthcoming, planned construction of the third facility, the number of supported jobs would increase to a higher level. For each of these construction years (period: 2016–2018), the data centre could support as many as 3,900 FTEs per year throughout the economy, when including both direct, indirect and induced effects.

When this bout of construction is concluded, construction spend and impact will fade out, while the size and impact of the operation activity is expected to increase. A larger data centre site (at that point including three distinct data centre buildings) would require greater manpower to maintain and operate.

Thus, upon the completion of the third facility, the Google data centre would make an ongoing employment contribution to Belgium of up to 2,500 supported FTEs per year, including direct, indirect and induced effects to the economy (cf. breakdown displayed in Figure 17).

Of these jobs, a large part – 1,100 FTEs per year – would be the induced jobs supported in the wider economy.

Figure 17 Employment supported by the Google data centre



Note: The figure shows the estimated supported impact on employment in Belgium of the construction and operation of Google's data centre.

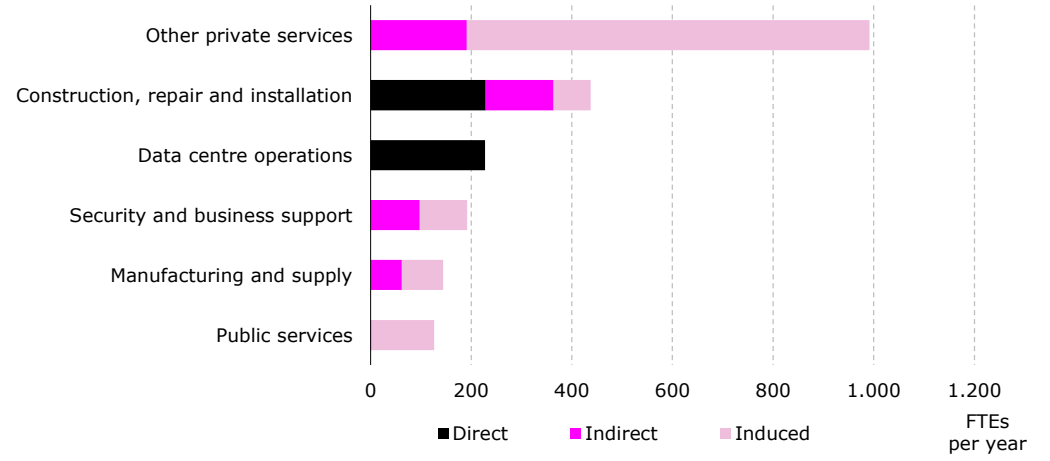
Source: Copenhagen Economics, based on data from Google, own estimates and input-output tables from Statistics Belgium.

We have explored in great detail what types of jobs are supported by the data centre activity. Are these all IT jobs, since the data centre is in the IT industry? Far from the truth. Based on data from Statistics Belgium, we have analysed how the Google data centre activity flows through the economy and supports jobs across all sectors of the economy.

We find that the data centre construction and operation supports jobs primarily in the construction (400 FTEs per year) and security and business support (180) industries.

On top of these, the data centre activity stimulates consumer consumption, as workers spend their wages throughout the economy. These induced effects support jobs mostly in private services, because this is where the employees spend their wages. This mechanism supports up to 900 FTEs per year in private service industries such as retail trade, transport, hotels and restaurants, real estate, and legal, accounting and employment activities, cf. Figure 18.

Figure 18 Employment supported by the Google data centre, yearly average for the period 2007-2020



Note: 'Other private services' include (but are not limited to) retail trade, transport, hotels and restaurants, real estate, and legal, accounting and employment activities.

Source: Copenhagen Economics, based on data from Google and input-output tables from Statistics Belgium.

Some of these industries, such as security, are proximity services and thus certainly in local areas; other goods or services can be supplied from rest of Belgium. The jobs supported by Google will therefore not only support local employment but also employment in other parts of Belgium. Similarly, as supplier firms and workers spend the income obtained from the data centre work on other products and services, the indirect and induced ripple effects extend also to both the local communities and the rest of Belgium.

2.5 The accumulated impact

Counting over the whole period 2007–2020, the supported GDP contribution from direct and indirect effects of both construction and operations sums to EUR 1.4 billion, with EUR 0.6 billion having already materialised and another EUR 0.8 billion to come during the period 2015–2020.

Induced effects are expected to bring an additional contribution to Belgium's GDP of EUR 0.8 billion over the whole period 2007–2020, with EUR 0.3 billion having already materialised and another EUR 0.5 billion to come during the period 2015–2020.

In summary, when considering direct, indirect and induced effects, the accumulated GDP contribution supported by Google is expected to reach up to an accumulated EUR 2.2 billion over the 2007–2020 period.

Chapter 3

Policy challenges and recommendations

As shown in the previous chapters, the Google's St. Ghislain–Mons data centre has supported an accumulated contribution to Belgium's GDP of EUR 0.9 billion in total over the 2007–2014 period, including direct, indirect and induced effects.

Moreover, data centre operations and expansion are expected to spur further growth and economic benefits in the future. Over the period from 2015-2020, Google's activities in Belgium are expected to support an accumulated contribution to Belgium's GDP of EUR 1.3 billion. Thus, looking at the period from 2007 up to 2020, this amounts to a cumulative GDP contribution of EUR 2.2 billion, in total over the whole period.

However, for Belgium to benefit fully and sustainably from the investment, the policy framework can play a decisive role.

In what follows, we discuss first the key role of national policies in promoting the interest of Belgium in a fully functioning and growing market for digitally powered services across Europe. We then discuss how regional policies play an important function in enabling the local economy, labour force and community to tap into the benefits from an investment like the St. Ghislain–Mons data centre.

3.1 An open market for digitally powered services is key

Europe has the capabilities to lead in the global digital economy but, as noted by the European Commission, fragmentation and barriers exist on digital markets that do not exist in the physical markets. This is holding European economies back and bringing down these barriers within Europe could contribute an additional EUR 415 billion to European GDP. This can create opportunities for new start-ups and allow existing companies to grow and profit from the scale of a market of over 500 million people. [5]

Between 2001 and 2011, digitalisation has accounted for 30% of GDP growth in the EU.[6] The digital economy can expand markets and foster better services at better prices, offer more choice and create new sources of employment. The digital reform policies so far implemented in Europe have already led to a long-term impact on GDP growth of above 1%; further reforms to promote an open digital market could lead to an additional 2.1% of long-term growth.[7] Moreover, addressing certain gaps to an open market for digitally

5 European Commission (2015), Communication: A Digital Single Market Strategy for Europe. COM(2015) 192 final.
6 European Commission (2015), Staff working document: A Digital Single Market Strategy for Europe - Analysis and Evidence. SWD(2015) 100 final.
7 Lorenzani, D. and Varga, J., 'The Economic Impact of Digital Structural Reforms', European Commission Economic Papers No 529, 2014.

powered services could lead to employment gains equivalent to over 223,000 jobs created by 2020.[8]

Large-scale facilities like the St. Ghislain–Mons data centre make business sense only if they can be used to serve Internet users across the whole of the EU (and globally). Moreover, they will grow in line with increased demand from users for access to services. This is why an open and growing market for digitally powered services is a necessary precondition for Belgium to tap into the increasing potential for its facilities to serve the whole of Europe.

Demand for Internet services continues to increase quickly and data centres are a key digital infrastructure. If the European market for digitally powered services is broken and fragmented across national boundaries (for instance if other EU countries can impose restrictions on data to stay within national borders), then the countries hosting these key data centres lose one important opportunity to capitalise from the growth in digitisation.

National policies are key to safeguard and enhance Belgium's attractiveness to investment in digital infrastructure. What is decided in other European capitals and at EU level may have an effect on investments in Belgium.

Therefore, we recommend that Belgian policymakers pay close interest to the development of the market for digitally powered services and work with EU representatives and institutions to:

- Ensure that the rapid growth of the EU Digital Single Market is prioritised and that the open nature of the Digital Single Market is safeguarded and strengthened so to function effectively and without intra-EU barriers
- Implement reforms to the market for digitally powered services in a way that enables the most digitally productive countries, like Belgium, to preserve and grow their role as a hub for a bigger, more efficient and successful European digital economy.

This is in the interest of all European Internet users, since it can lead to a more productive and successful European digital economy. Moreover, this is especially in the interest of Belgium, given the economic impact brought to the country by the St. Ghislain–Mons data centre.

3.2 Regional policies play an important role

Regional policies are key to ensure maximum local benefit from the large investment associated with Google's plans to expand the St. Ghislain–Mons data centre. This is because any local economy can fail to obtain the maximum benefit from investments of this scale and complexity, if there may be crowding out effects (bottlenecks and overheating of certain parts of the labour market).

[8] European Parliamentary Research Service (2014).

Crowding out occurs if the skill base in the labour force available in the region does not match the needs of the new investment – or if local services and infrastructure do not match the size of the investment. Therefore, regional public policies are key to make sure that local communities can benefit, both in the short and long term, from large investments.

In other words, large foreign investment can be more or less beneficial to a local economy, depending on the capacity of the economy and its ability to 'absorb' the demand and opportunities the new company brings along. So far, the St. Ghislain–Mons area and the Walloon Region have prepared well to benefit from the data centre investment by fostering the local skill base of the labour force and investing in digital and technology promotion initiatives centres such as those linked to the Agence de Stimulation Technologique–EasyNove, technocITé and The Digital Innovation Valley. Together these efforts help to match the needs of the new activities that companies like Google bring.

Staying on this successful trajectory and scaling up further will require local and regional authorities to continue to engage in a skills partnership so that the long-term skills needed for digital industries are met locally – making sure that there is a good match between demand and supply in the labour market. Moreover, this requires the right conditions and incentives for the labour market to develop and grow and also sufficient flexibility for labour from all over the country to move to where the new opportunities arise. As a result, this can increase Belgium's potential to attract further data centre investments.

In summary, the Google data centre has been successful in this respect so far. This success relies on efforts by the region and its people with a broad mix of skill levels, with a majority of medium-skill workers with technical qualifications (not necessarily a higher degree). This is a good opportunity for local workers, provided they have the right technical skills for this type of work.

It is in the interest of regional and local authorities to continue to ensure that the infrastructure services and educational programmes available locally match the needs of the economic activity of the data centre – including the activities of its many suppliers firms. Ultimately, economic spillovers from a large foreign investment work best when there are local people with the right skills set for this knowledge to spill over to.

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Appendix A
Impact Assessment Methodology

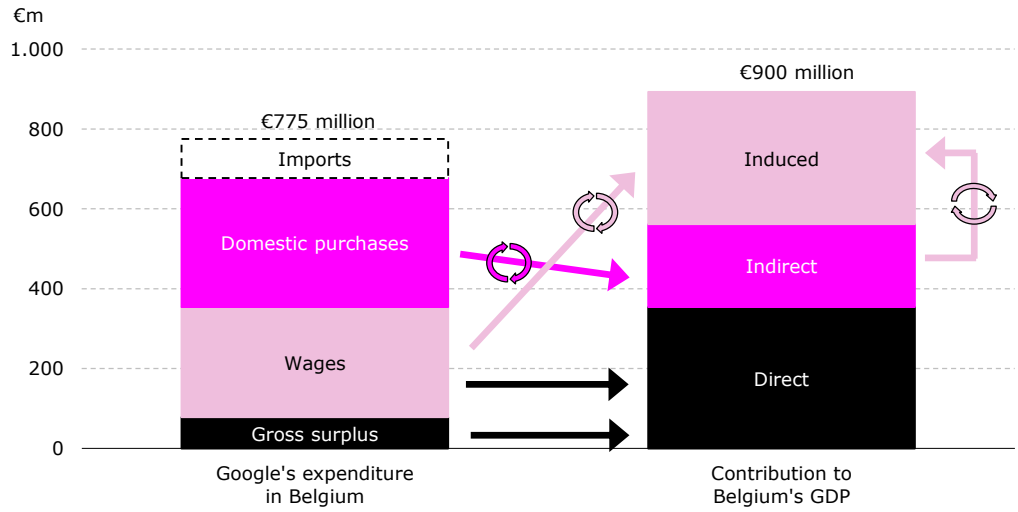
This appendix describes the approach we have applied in the quantitative analysis presented in the report.

The source data for our analysis was data received from Google on their expenditures and employment at the St. Ghislain–Mons data centre. The Google data have not been sourced from audited financial statements and are for illustrative purposes only. They do not seek to represent a complete or true and fair position of financial results. A further source of data was Statistics Belgium, including the most recent input-output table (2010).

We have used this data to estimate the supported GDP and employment contribution of the Google data centre to Belgium.[9]

We find that Google's EUR 775 million investment in St. Ghislain–Mons resulted in an accumulated direct, indirect and induced contribution to GDP of EUR 900 million in the period from 2007-2014, cf. Figure A.1.

Figure A.1 The accumulated impact of Google, 2007-2014



Note: The figure shows the accumulated expenditure and GDP contribution from the construction and operations from 2007-2014 measured in 2014 prices. ○○ indicate multiplier effects

Source: Copenhagen Economics, based on data from Google and input-output tables from Statistics Belgium

Google's expenditure (the left hand column) can be split between purchases of foreign and domestic goods and services, wages, and gross surplus at Google's main construction

[9] The Gross Domestic Product (GDP) is the most popular measure of a country's income. It measures the income generated from the production within the country.

contractors. With the exception of imports, each of these activities influences employment and the GDP in Belgium. Wages and gross surplus at Google, their key construction contractors and their on-site contractors during operations are a part of Belgium's GDP. We define these as the *direct* effect (see the right hand column).

The *indirect effect* reflects how the spend at the data centre site on Belgian goods and services supports a contribution to GDP and employment through increased activity down the value chain of industrial and commercial activities that indirectly benefit from demand from the data centre site.

The induced effect includes the supported economic impact when wages and salaries paid by Google and its contractors are spent in the economy by their employees. The *induced* jobs are primarily service-related jobs in industries such as retail trade, transport, accommodation, restaurants, housing and finance. Throughout this report, we refer to induced effects as the potential amount of economic activity supported by the direct and indirect wage spend.[10]

In practice, displacement in the labour force can reduce the final effect realised and this depends on the skill base and degree of openness in the economy. We have therefore provided separate reporting of the induced effects and the other effects.

The approach to build our input-output model

We estimate the indirect and induced effects using an input-output model. An input-output model reflects how national statistical agencies track the interdependency between all the sectors of the economy. In Belgium, the national statistics report how each of 64 industrial sectors: i) relies on the other 63 sectors for inputs to their production; and ii) supplies its products and services to each of the remaining 63 sectors.

Input-output models provide a consistent and intuitive way of measuring the economic effects of an activity in any given industry or company in any given economy. Because of the underlying approach of this class of models, the results calculated by this method should however be regarded as approximations. Some of the assumptions are most likely to hold in the short run, and others are more appropriate for the long run.

First, we do not observe data on gross surplus (which under national counting rules is counted as part of GDP). In order to provide a conservative estimate, we do not include gross surplus in the operations when calculating the GDP contribution of the data centre.

Second, we assume that technology and resource mix (ratios for inputs and production) is the same for all firms in each industry, i.e. within each of those 64 industrial categories reported in the official Belgian national statistics input-output table. As such, our analysis describes average effects.

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[10] In the literature, the ratio of (direct + indirect) to direct effects is called a *type 1 multiplier*, and the ratio of (direct + indirect + induced) to direct effects is called *type 2 multiplier*.

Third, we assume fixed production and input ratios of companies and fixed consumption shares of households. We do not include extra effects from investments or government spending.

Fourth, we assume that all the ripple effects in the economy take place within one year. Changing the timeframe would not affect the magnitude of the effects estimated.

Fifth, we assume that firms can increase their use of labour and capital as needed to meet the additional demand for their products from Google and their suppliers. Further, we assume that extra output can be produced in one area without taking resources away from other activities. This approach to considering no supply-side constraints is equivalent to an assumption of fixed prices and wages; indeed input-output models are referred to as *fixed-price models*. We will thus refer to our estimated impact as *supported* effects, because they indicate the potential effects if the resources are readily available in Belgium.

Last, we assume that the structure of the Belgian economy remains unchanged, looking as it did in 2010 (the year of the latest available input-output table). Any structural changes in the Belgian economy since 2010 will therefore lead to changes to the multipliers – which could be implemented once the Belgian official national statistics release updated input-output tables.

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