

# Jobs in Apps

Mobile Economy in the Nordics  
A Catalyst for Economic Growth

Technical annex

June 2017



# Preface

The following is the technical annex accompanying the report “The Nordic App Economy” prepared for the Developers Alliance and Google by Copenhagen Economics.

## Chapter 1

# Input-output analysis

### 1.1 The methodology used to estimate the number of supported jobs

In this report, we use input-output (IO) modelling to estimate the number of jobs supported by app developers throughout the economy in the four countries covered by the study, namely Denmark, Finland, Norway and Sweden.

We refer to three different types of effects in the impact assessment, namely the direct, indirect and induced effects.

*The direct effect* includes the number of jobs supported directly by the App Economy. The directly supported jobs in app development include software engineers, but also positions in management, mechanical and electrical maintenance and repair, IT and systems technicians, and hardware operations will be included as direct employment, if they work at companies directly working with app developers.

*The indirect effect* includes the economic impact through suppliers also supported by the app developers' purchases of domestic goods and services. The indirectly supported jobs can include positions in security, catering, cleaning and in the construction and supply industries, as well as at suppliers in upstream industries across the economy.

We refer to *the induced effect* as the supported economic impact that occurs when employees at the app developers and their supplier industries spend their wages throughout the economy. The *induced jobs* are primarily service-related jobs in industries such as retail trade, transport, accommodation, restaurants, housing and finance.

We estimate the indirect and induced effects for each country separately to account for differences in the national economics. To ensure comparability between the sectors in each country, we use input-output tables from the same source for all four countries. This source is the World Input-Output Database (WIOD), which includes input-output tables for 43 countries, including all 28 EU member states. However, we also need information on the number of employees as well as the total wage bill in each industry to be able to estimate the number of jobs supported in the economy. This data has not yet been released by WIOD, and we do therefore have to rely on information from the national statistics agency in each country on the number of employees and the total wage bill.

### 1.2 Using national sources to obtain labour force statistics on a sectoral level

As mentioned, we have combined the WIOD IO tables with information on the number of employees and their salaries from the national statistics agency in each country. As the source and level of aggregation for this data vary between countries, we outline the nature of this data for each country separately.

For Denmark, we have used the data on the number of employees and their salaries from the IO tables published by Statistics Denmark. The most recent data available is for 2013, and in this table, the economy is split in 117 sectors.

For Finland, we have used data on the number of employees and their salaries from the IO tables published by Statistics Finland. The most recent data available is for 2014, and in this table, the economy is split in 64 sectors.

For Norway, we have used data on the number of employees and their salaries from the IO tables published by Statistics Norway combined with register based statistics of the labour force. The most recent data available is for 2015, and in these statistics, the economy is split in 62 sectors.

For Sweden, we have used data on the number of employees and their salaries from the IO tables published by Statistics Sweden combined with register based statistics of the labour force. The most recent data available is for 2014, and in these statistics, the economy is split in 62 sectors.

For each of the four countries, the data provided from the national statistics uses a more disaggregated sectoral classification than is used in the WIOD table, where only 56 sectors are included. We have therefore aggregated the categories used in the respective domestic IO tables to match the number of sectors in the WIOD IO table, using the official ISC sector hierarchy.

By using the employment data outlined above in combination with the IO tables from WIOD, we are able to estimate the supported employment contribution of the App Economy in the four Nordic countries, using an input-output model.

### **1.3 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 each of the Nordic countries, the national statistics report how each of 56 industrial sectors: i) relies on the other 55 sectors for inputs to their production; and ii) supplies its products and services to each of the remaining 55 sectors.

Input-output models provide a consistent and intuitive way of measuring the economic effects of an activity in any given industry or company. 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 assume that the technology and resource mix (ratios for inputs and production) is the same for all firms in each industry, i.e. within each of those 56 industrial categories reported in the official national statistics input-output table. As such, our analysis describes average effects.

*Second*, 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.

*Third*, we assume that firms can increase their use of labor and capital as needed to meet the additional demand for their products from the app developers 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 thus refer to our estimated impact as *supported effects*, because they indicate the potential effects if the resources are readily available in each of the Nordic countries.

*Last*, we assume that the structure of the economy in each of the Nordic countries remains unchanged, looking as in 2014 (the year of the latest available input-output table). Any structural changes in the respective economies since 2014 will therefore lead to changes to the multipliers – which could be implemented once the official national statistics agencies release updated input-output tables.