Quality of jobs and innovation generated employment outcomes

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DATA EVALUATION REPORT:

AN EVALUATION OF THE MAIN EU DATASETS FOR ANALYSING INNOVATION, JOB QUALITY AND EMPLOYMENT OUTCOMES

QuInnE Working Paper No. 14

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QuInnE - *Quality of jobs and Innovation generated Employment outcomes* -is an interdisciplinary project investigating how job quality and innovation mutually impact each other, and the effects this has on job creation and the quality of these job.

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Quinne project brings together a multidisciplinary team of experts from nine partner institutions across seven European countries.

Project partners:

CEPREMAP (Centre Pour la Recherche Economique et ses Applications), France

Institute of Sociology of the Hungarian Academy of Sciences, Hungary

Lund University, Sweden

Malmö University, Sweden

University of Amsterdam, The Netherlands

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University of Warwick, United Kingdom of Great Britain

Work Package 3

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Executive Summary

The European Commission wants to improve both innovation performance and job quality in the EU and recognises that there might be mutual benefits, including employment outcomes, from their relationship. However it needs research to explore that relationship. The purpose of QuInnE is to provide that research. QuInnE's empirical research is both qualitative, centred on organisational-level case studies, and quantitative, with statistical analyses using existing data.

This Report focuses on the quantitative research of QuInnE. There is no existing integrated dataset that allows for analysis of the relationships between innovation, job quality and employment outcomes. Instead there are datasets that can be used for each and, to some extent, used in combination. This report reflects on QuInnE's experience of using the available statistical data, evaluates that data and makes recommendations as to how it might be improved in the future.

The report has three main sections. The first outlines the research design of QuInnE. The second evaluates the main statistical datasets used in the quantitative research. AT the EU levels, these datasets are: the Community Innovation Survey (CIS), European Working Conditions Survey (EWCS), European Social Survey (ESS) and European Company Survey (ECS). To conducted firm level research in France, Germany and Spain, national datasets were used. These datasets are: for France, the Community Innovation Survey (CIS), Déclaration Annuelle des Données Sociales (DADS) and Fichier Approche des Résultats d'Esane – Fichier de Comptabilité Unifié dans Suse (FARE-FICUS); for Germany, the IAB Establishment Panel; and for Spain Encuesta de Estrategias Empresariales (ESEE). The final section summarises the evaluation and makes a series of recommendations about improving EU innovation and job quality data, including how this data might be futureproofed.

The CIS is a dataset dedicated to innovation and designed to capture data on innovation within EU countries. There are few datasets that allow for a comparative analysis of job quality in EU countries. The two best adapted to do so are the EWCS and ESS. The ECS has data on company policies and practices across EU countries. It can include data on innovation and has some data on job quality.

The general strength of existing EU data is the existence of harmonised cross-national surveys. These surveys are generally of good quality, cover all EU28 countries, and have been repeated periodically to allow longitudinal analysis. One general limitation relates to the accessibility of some parts of these databases, more specifically microdata. Access to this microdata has to be requested and approved by Eurostat.

That a dedicated dataset for EU innovation exists and is administered every two years is very useful. There is relatively good data on technological innovation and which has evolved. However it existing innovation datasets still need further refinement. There are still type biases in the measurement of innovation. Despite revision based on evolving conceptualisation of innovation, the CIS tool is still dominated by questions focused on technological innovation. That this issue has yet to be resolved transposes the problem over to other surveys, most obviously the EWCS and ECS, which both lack precision in articulating and measuring organisational innovation.

Likewise, the evaluation of the EWCS is mixed, and as with innovation, measurement of job quality ought to be improved. Although lacking a dedicated dataset, there is still good data available at the individual level in what has become a substitute for the dedicated data – the EWCS. As with the CIS and innovation, the EWCS has become the 'go to' source of data on job quality in the EU. Importantly, its data covers the QuInnE job quality framework. There can be good complementary sources, that is, the ESS. The EWCS and the ESS both constitute invaluable sources of data about the nature of and trends in job quality in the EU. However, reliance on the ESS is difficult given the continuous

uncertainty about its periodicity. The periodicity of the EWCS has also been debated, more specifically whether the current five-year gap is too long. The key weakness with the EWCS and ESS data is that they both have small sample sizes at country level. This smallness disables necessary disaggregated analysis and needs to be addressed.

From this evaluation, four obvious points of consideration arise: data for measuring both innovation and job quality, raising awareness of the innovation-job quality-employment outcomes nexus through data communication and access. The following five recommendations are made:

- Recommendation 1: that the European Commission develop better conceptualisation of organisational innovation and its measurement. To do so, and working with the OECD, the Commission might establish a short life expert group to develop this conceptualisation and measurement, seeking consensus for them across the academic and policy communities. Its recommendations should then be adopted and incorporated into the CIS and other relevant EU surveys.
- Recommendation 2: that the European Commission adopt a standardised approach to measuring job quality, preferably the approach developed for QuInnE. The European Commission might also encourage Member States to adopt this approach also for standardisation and enable cross Member State comparability.
- Recommendation 3: to improve its analysis utility, the dataset that can be used to populate the QuInnE approach to job quality – the European Working Conditions Survey – should have larger national sample sizes, and, for a fixed period, might also be administered more frequently.
- Recommendation 4: that the European Commission consider continuing and developing further a data communication tool, preferably based on the QuInnE map – and allocating responsibility for it to an agency of the Commission.
- Recommendation 5: that the European Commission explore working with organisations within and outwith the European Union to develop guidelines on the use by researchers of Big Data in order to improve and futureproof analyses of innovation and job quality. Eurostat might lead this effort.

Addressing the four considerations will produce better research that in turn can help the European Commission develop more effective policy to lever the benefits of the Innovation-job quality relationship and its potential employment outcomes.

Introduction

The EU's growth strategy *Europe 2020* (EC 2012) notes the lack of innovation dynamism in the EU. Innovation is regarded as important because it generates growth, competitiveness and employment, and improving the EU's innovation performance forms a key policy aspiration of the European Commission, expressed through its flagship *Innovation Union* initiative (EC 2011). The European Commission recognises that improving job quality is also important. The quality of jobs features in the European Employment Strategy (EC 2008) and is included in another European Commission flagship initiative – *An agenda for new skills and jobs* (EC 2010). This inclusion rests on the EU needing better, not just more, jobs if its economy is to recover and grow (EC 2012). Moreover synergies are believed to exist between job quality and the other objectives of the European Employment Strategy – namely full employment, labour productivity and social cohesion and inclusion (EC 2008, 2012).

Although in the past, there has been a tendency to treat innovation and job quality as important but separate policy concerns (Makó et al. 2016), the European Commission now recognises that linkages between innovation and job quality might be mutually beneficial. It also recognises that these linkages are under-researched. The Horizon 2020 programme aims to redress this problem, stating explicitly that 'it is essential to understand better the conditions under which innovation fosters growth that benefits the whole society through high quality jobs' (EC 2014: 10). QuInnE responds to this challenge. It is an interdisciplinary research project that investigates the relationship between innovation and job quality, and the effects this relationship might have on employment outcomes, these outcomes being social inclusion and equality.

QuInnE's empirical research is both qualitative, centred on organisational-level case studies, and quantitative, with statistical analyses using existing data. This Report focuses on the quantitative research of QuInnE. There is no existing integrated dataset that allows for analysis of the relationships between innovation, job quality and employment outcomes. Instead there are datasets that can be used for each and, to some extent, used in combination. This report reflects on QuInnE's experience of using the available statistical data, evaluating the utility of the datasets. It outlines those datasets, identifying their strengths and weaknesses in relation to the QuInnE project, and, as appropriate, suggests how data might be improved in the future to better analyse innovation, job quality and employment outcomes. This task is important because it is only with good data that good scientific understanding is generated from which good policy can be developed.

The next section of the Report outlines QuInnE's research design generally then focuses on the quantitative analysis. The following section then presents an evaluation of the datasets used for each of the research objectives of this analysis. The concluding section includes recommendations for dataset improvement.

Outline of QuInnE research design

The overall research design of QuInnE adopted a mixed methods approach in order to explore the potentially mutually-reinforcing relationship between innovation and job quality and its impact on employment outcomes. There are three main strands of empirical research. The first strand involves policy analysis through examination of secondary, including grey, literature and at both EU and Member State levels. The second strand involves quantitative research undertaken at both the aggregate (EU-level by country and industry) and firm level (using German, French and Spanish data). The third strand involves comparative case studies using qualitative research methods. By mixing policy analysis, quantitative analysis and qualitative analysis, the research is intended, cumulatively, to consider the dynamics between the core concepts (i.e. innovation, job quality, employment outcomes) in terms of correlations and causation.

The quantitative research explores the statistical relationships between innovation and job quality, and their relationship's potential social inclusion and equality employment outcomes. Analyses include simple correlations (at the country, industry, firm or worker level) to causality (at the firm level only). In examining inclusion and equality, specific attention is given to issues of workers' skill/education level, migrant status, class, gender and age.

The research had a number of objectives:

- To establish at the aggregate-level, the links between innovation and job quality, and employment, social inclusion and social inequalities using empirical data to address the dual policies of the EU of increasing innovation and creating more and better jobs.
- To explore at the aggregate-level, the correlations between innovation and job quality, and employment from both cross-national and industry perspectives to identify those countries and industries where the presence of high innovation and high job quality configurations exist with high employment outcomes observed, producing and populating a novel typology.
- To identify at the aggregate-level, the existence of different national regimes of innovation and job quality, and employment and analyse the relationships among them.
- To analyse at an aggregate-level, the relationships between innovation and job quality, employment and the social inclusion for marginalised groups of workers (female, older, younger, migrant and low-skilled workers).
- To analyse at the aggregate-level, the relationships between forms of work organisation that are innovation and job quality high and their impact on in-work social inequalities (class, gender and age).
- To analyse at the firm-level, the causal relationships between innovation and job quality, and employment in order to disentangle under which conditions innovation and job quality might contribute to more and better jobs.

Analysis relied on broad and multi-dimensional definitions of both innovation and job quality (for details, see Warhurst et al. 2018). Innovation is defined in accordance to the Oslo Manual (OECD 2005) and includes four main types of innovation (product, process, marketing and organizational) aggregated into two broader categories (technological and non-technological). Reviewing existing research, job quality is defined as a multidimensional concept, encompassing six main dimensions: wages, employment status, working conditions, education and training, employee participation and representation, work-life balance (including in some analyses gender equality (for discussion of the derivation of these six dimensions, see Warhurst et al. 2017 and Wright et al. 2018).

As Table 1 below highlights, the datasets used belong to two different categories:

- European databases for data on innovation, job quality and employment indicators: Community Innovation Survey (CIS), European Working Conditions Survey (EWCS), European Social Survey (ESS) and European Company Survey (ECS), supplemented by the Labour Force Survey (LFS), European Structure of Earnings Survey (SES) and the European Statistics on Accidents at Work (ESAW).
- National databases for three countries in which relationships between innovation, job quality and employment outcomes are explored at the firm level: for France, the Community Innovation Survey (CIS), Déclaration Annuelle des Données Sociales (DADS) and Fichier Approche des Résultats d'Esane – Fichier de Comptabilité Unifié dans Suse (FARE-FICUS); for Germany, the IAB Establishment Panel; and for Spain Encuesta de Estrategias Empresariales (ESEE).

Table 1: Datasets sets used by level of analysis

Level of analysis	Datasets
country	CIS, ECS, EWCS, LFS, SES, ESAW, ESS
industry	EWCS, ECS
firm	ECS, CIS, DADS, FARE-FICUS, IAB Establishment Panel, ESEE
worker	EWCS

The four main sources of data are the CIS, ECS, EWCS and ESS. The CIS contains detailed information about innovation such as the share of innovating firms, and product, process, organisation and marketing innovations. The ECS contains information on innovation, work organisation, skills and training, working time arrangements and social dialogue. The EWCS contains information about working conditions that can be transposed to the six dimensions of job quality.

An initial task for the quantitative analysis was to use existing data to help identify potential industries that are high innovative and high job quality as one component to guide selection of industries for case studies for the qualitative research. This task was internal to the project, producing an internal set of data. The remaining quantitative analysis' objectives were translated into a number of open access working papers. These working papers and the datasets used to support their research are outlined in Table 2 below.

Table 2: The objectives, working papers and data sources for the quantitative research

Objective	Working Paper	Data Source/s
To explore the correlations between innovation and job quality, and employment from both cross-national and industry perspectives to identify those countries and industries where the presence of high innovation and high job quality configurations exist with high employment outcomes observed to produce and populate a novel typology	Muñoz de Bustillo et al. (2016) *Innovation and Job Quality: An Initial Exploration*, QuInnE Working Paper No. 5	EWCS
To identify the existence of different national regimes of innovation and job quality, and employment and analyse the relationships among them	**Erhel and Guergoat-Larivière (2016**) *Innovation and Job Quality Regimes: A Joint Typology for the EU*, QuInnE Working Paper No. 3	CIS, EWCS, LFS, SES, ESAW
To analyse at the firm-level the relationship between innovation and job quality to explore the nexus between innovation and job quality	Muñoz de Bustillo et al. (2017) An approximation of job quality and Innovation using the 3rd European Company Survey, QuInnE Working Paper No. 4	ECS
To analyse at the firm-level the causal relationships between innovation and job quality, and employment in order to disentangle under which conditions innovation and job quality might contribute to more and better jobs (in France, Spain and Germany)	Duhautois, R. et al. (2018) *The employment and job quality effects of innovation in France, Germany and Spain: evidence from firm-level data* QuInnE Working Paper No. 7	CIS, DADS, FARE-FICUS IAB Establishment Panel ESEE
To analyse the relationship between national innovation regimes innovation and the social inclusion and job quality of marginalised groups of workers (female, older, young, migrant and low-skilled)	Hunt, W. et al. (2018) *Innovation regime and vulnerable workers' labour market inclusion and job quality*, QuInnE Working Paper No. 13	EWCS, ESS
To analyse the relationship between forms of work organisation that are innovation and job quality high and their impact on in-work social equalities (class, gender and age)	Gallie, D. (2018) *Quality of work and innovative capacity: implications for social equality*, QuInnE Working Paper No.8	EWCS

After making broad points about the strengths of weaknesses of this existing data generally, the main EU and national datasets used for these working papers are evaluated below. Each is outlined and then their strengths and weaknesses in relation to utility for QuInnE utility indicated.

Evaluation of the available data

This section outlines and evaluates each of the main datasets used in QuInnE: the CIS, EWCS, ESS and ECS. The CIS is a dataset dedicated to innovation and designed to capture data on innovation within EU countries. There are few datasets that allow for a comparative analysis of job quality in EU countries. The two best adapted to do so are the EWCS and ESS. The ECS has data on company policies and practices across EU countries. It and can include data on innovation and has some data on job quality.

The general strength of existing EU data is the existence of harmonised cross-national surveys. These surveys are generally of good quality, cover all EU28 countries, and have been repeated periodically

to allow longitudinal analysis. One general limitation relates to the accessibility of some parts of these databases. This accessibility is variable: aggregate data is directly available from the Eurostat website but access to micro-data can be complicated. Beyond these general points, each dataset has specific strengths and weaknesses.

The Community Innovation Survey (CIS)

CIS data was used in Erhel and Guergoat-Larivière (2016) to develop a typology of innovation and job quality regimes in the EU and in Duhautois et al. (2018) as part of the French analysis of the employment and job quality effects of innovation at the firm level.

The CIS is hosted by Eurostat.[1] It is the main source of EU innovation data and used to measure innovation in the EU. As part of the body of EU science and technology statistics, the CIS is intended to provide information on the innovativeness of sectors based on enterprise level information. This information includes the different types of innovation and various aspects of the development of innovations within these enterprises, such as objectives, funding sources and innovation expenditure.

Member State national statistical offices administer their respective surveys, sampling all establishments by size, sectors and, in some cases, intra-country regional location. In practice, all large establishments receive a questionnaire in most countries. In this respect the methodology involves both a sample survey and census of relevant enterprises. In some countries participation is mandatory, in others it is voluntary. The aim is to use a web-based survey, though in CIS 2014 some countries still used a paper-based on, and some a mixture of both. Sample sizes and response rates vary by country. Moreover not all countries include all of the questions recommended by Eurostat and some countries add their own 'non-core questions (Unit G 4 n.d).

Scope and coverage

Data for the CIS is potentially collected by every EU member state. However, because participation by Member States is voluntary, different surveys cover countries. In CIS 2014, all EU28 Member States participated plus Iceland, Norway, Macedonia, Serbia and Turkey. The target population for the questionnaire was private sector enterprises with 10 or more employees. The quality of the data and the response rates did though vary.

The questionnaire covers the main themes listed in the Oslo Manual. As such the CIS collects information about the four types of innovation outlined in the Oslo Manual: product and process innovation, as well as organisational and marketing innovation. Using a broad set of indicators, the survey covers areas such as new or significantly improved goods or services; the introduction of new or significantly improved processes, logistics or distribution methods; and methods of protecting intellectual property rights. It also includes data on the nature and main obstacles to innovation. It therefore offers a means of understanding innovation and the innovation process at enterprise level and the effects of innovation on the economy. Micro-level data can be disaggregated by type of country, type of innovations, economic activities and size classes.

Accessibility, periodicity and sample size

The first CIS was conducted in 1992, with eight subsequent surveys being administered, the last in 2014. Since 2006, harmonised surveys have been conducted very two years. Data frequency is useful.

Most countries provide online open access to data, though a sizable number (N=6) do not. However access to microdata is restricted and granted for scientific purposes only. Researchers need to apply to Eurostat for access to it and access is only granted to authorised research organisations/entities.

[1] https://ec.europa.eu/eurostat/web/microdata/community-innovation-survey

New microdata is normally released two and a half years after end of survey reference period. Micro data can be accessed via CD ROM (anonymised data) and in the Safe Centre at Eurostat's Luxembourg premises (non-anonymised data).

Strengths and weaknesses

Having a dedicated harmonised EU dataset that at least intends to offer a standardised typology of innovation and which is administered frequently is very useful. Moreover, response rates for the CIS are generally high and most countries now use the online survey version, improving data quality. For some types of innovation, i.e. the technological, data can be good (see below).

However there are weaknesses. The first relates to access. Microdata access, which is only released two and a half years after data collection, requires an application to and approval from Eurostat. Most Member States enable this access. However a sizable number (N=9) do not. Moreover approval can be lengthy, adding further time lag between data collection and data availability for independent researcher analysis.

Second, there are some general weaknesses with the data in terms of coverage. Firstly in this respect, in relation to the geographic coverage of the dataset, the outcome of Member States' voluntary participation is that different survey years have different countries involved, meaning that data consistency for the EU, as well as some countries, can be a problem. Moreover, sample sizes vary by country. Second, for most countries, data does not cover the whole economy but only some industries (NACE Rev. 2 sections B, C, D, E, H, J, K and in the NACE Rev. 2 divisions 46 and divisions 71, 72 and 73) which are traditionally considered as innovative in a technology-orientated understanding of innovation. Table 1 in Appendix A highlights the variations by country in this respect. However, innovation, especially non-technological, exists in all industries – with non-technological innovation in fact being more prevalent across industries than technological innovation (Toner 2011). Third, a further limitation relates to enterprise coverage. The survey only covers establishments with 10 or more employees, which creates comparative problems because of the different composition of firm sizes in EU countries.

There are also more specific weaknesses related to the emphasis placed on the types of innovation within the questionnaire. The CIS collects information on an enterprise's innovations and innovation activities during the three years 2010 to 2012 inclusive. An innovation is the introduction of a new or significantly improved product, process, marketing or organisational method within or by the enterprise. An innovation must have characteristics or intended uses that are new or which provide a significant improvement over what was previously used or sold by the enterprise. The first issue is that inclusion of the four types of innovation outlined in the Oslo manual is relatively recent. Early surveys focused on technological innovations – product and process; as perhaps befits pursuit of science and technology statistics. As the concepts used to define innovative firms have developed over time, the four types have been incorporated into the survey but the four types of innovation outlined in the Oslo Manual are only available separately in 2012. Analysis of the non-technological types of innovation – marketing and organisational – is possible therefore only from this data; likewise any analysis which rests on comparing the four types.

When the questionnaire does turn to organisational innovation, further detailed weaknesses are apparent. The first is that the framing of it can be unhelpfully broad. In articulating organisational innovation, CIS 2012 asks:

> … did your enterprise introduce new business practices for organising procedures (i.e. supply chain management, business reengineering, knowledge management, lean production,

quality management, etc.), new methods of organising work responsibilities and decision making (i.e. first use of a new system of employee responsibilities, team work, decentralisation, integration or de-integration of departments, education/training systems, etc.), new methods of organising external relations with other firms or public institutions (i.e. first use of alliances, partnerships, outsourcing or sub-contracting, etc.)?

The list of examples is long and broad. Distinguishing it from process innovations that encompass 'improved methods of manufacturing good or services' can be conceptually difficult. As such, they can be treated as synonymous by survey respondents (Warhurst et al. 2018). Indeed, Eurostat recognises that enterprise respondents to the CIS struggle sometimes with the survey questions, having practical difficulty assessing their activities as innovative or not (Unit G 4 n.d).

As if this initial respondent difficulty was not enough, the indictor of organisational innovation used in the CIS differs from that used in other main EU surveys used by QuInnE (Duhautois et al. 2018; Erhel and Guergoat-Larivière 2016; Muñoz de Bustillo et al 2016, 2017), whilst each survey yet draws on the same Oslo Manual typology, as Table 3 below demonstrates. These differences create ambiguity. It could be that different practices are being reported by respondents and measured by researchers, though all such practices purporting to constitute organisational innovation.

Table 3: Variables used to measure organisational innovation in EU surveys

Survey	Variable
CIS	'An organisational innovation is a new organisational method in your enterprise's business practices (including knowledge management), workplace organisation or external relations that has not been previously used by your enterprise. · It must be the result of strategic decisions taken by management. · Exclude mergers or acquisitions, even if for the first time.'
EWCS	Organisational innovation means 'substantial restructuring or reorganization was carried out'
ECS	'Any organizational change (new business practices for organizing procedures, new methods of organizing work responsibilities and decision making, new methods of organizing external relations with other firms or public institutions)'

This ambiguity about organisational innovation is compounded by the light emphasis accorded this type and the marketing type of non-technological innovation in the CIS. The CIS 2012 survey data used by Erhel and Guergoat-Larivière (2016) is drawn from a questionnaire that has six sections dedicated to the two type of technological innovations: product and process. Across these sections, 17 questions are asked about these two types. Data collection for these two types of innovation is therefore relatively good (though note the criticism of how technological innovation is measured by Janger et al. 2017). There are only two sections dedicated to the two non-technological innovations: one each for marketing and organisational. However each of these two sections only has one question about that type. In total therefore only two questions are asked about non-technological innovation. CIS 2014 is little better. Its questionnaire has five sections dedicated to the two type of technological innovations, with 14 questions asked in total for these two types. Two sections dedicated to the two non-technological innovations, one each again for marketing and organisational. As before, each of these two sections only has one question so that, in total, only two questions are again asked about non-technological innovation.[2] The paucity of data on these two types of non-technological innovation is problematic in any attempt to measure of innovation – or action to improve innovation performance

[2] https://ec.europa.eu/eurostat/web/microdata/community-innovation-survey

– because they are more prevalent within enterprises than technological innovations (Toner 2011), and, as the OECD (2010) and Battisti and Stoneman (2010) both note, enterprises frequently combine technological and non-technological types of innovation to synergic effect.

There is a further weakness with the two questions asking about the two non-technological types of innovation: both questions have only a binary yes/no answer, which disables any understanding of about the impact and novelty of the innovation introduced. In terms of impact, an innovation can fail or take time to prove itself. The data reveals nothing about impact or even the continuance of the innovations. Even if it succeeds, an innovation can be incremental or radical. The difference can be significant as Orlikowski (1991: 5) notes: 'The former [incremental] implies a linear, cumulative change in a process or product … while the latter [radical] are nonlinear, paradigmatic changes, representing significant departures from existing practice or knowledge.'

The data weakness around non-technological innovations is a particular problem for analysis of organisational innovation. Research by Jensen et al. (2007) suggests that it is this type of non-technological innovation that provides the synergistic gains in relation to product innovation. Moreover in debates about how best to conceptualise and develop the concept of organisational innovation, one argument that is gaining traction centres on the promotion of employee-driven innovation. Høyrup and his colleagues (Høyrup 2010; Høyrup et al. 2010) argue that this innovation is not a type but rather a mode of innovation that, whilst resonating with organisational innovation, might be sufficiently distinct and might underpin all four types of innovation outlined in the Oslo Manual (for discussion, see Warhurst et al.2018). If so, there is even more reason for there to be greater emphasis and more questions in the CIS that foreground the working practices that currently are listed but for which no data is currently collected.

The European Working Conditions Survey (EWCS)

As the key datasets for analysing job quality in the EU, EWCS data is used extensively in QuInnE: Erhel and Guergoat-Larivière (2016); Muñoz de Bustillo et al. (2016), Gallie (2018) and Hunt et al. (2018).

The EWCS is conducted by the European Foundation for the Improvement of Living and Working Conditions (Eurofound).[3] It is a sample survey that focuses on the working conditions and quality of work of both employees and the self-employed. It primarily focuses on the work and employment characteristics of jobs. In addition to collecting data on work and employment on a harmonised basis, its aims are to:

- monitor the progress on the improvement of working conditions over time in the EU;
- identify groups of workers at risk and the issues that raise concern;
- through this information, contribute to EU policy development on the quality of work and employment.

Waves of the EWCS are conducted every five years. In each wave a random sample of workers (employees and self-employed) is interviewed face-to-face. The fieldwork procedures follow the same principles across the EU. In all the countries the sample is stratified by region and size of settlement, and interviews are clustered by geographic proximity. The actual selection of households is done by the random walk method. Within the selected household, one employed individual is randomly selected for interview.

[3] https://www.eurofound.europa.eu/surveys/european-working-conditions-surveys

Scope and coverage

Intended to provide data about working conditions to inform EU policy making, the EWCS has a 'political' mission that affects its coverage in each wave. It has provided data for all EU countries since 1990 – hence the number of countries has varied over time over time with changes in EU membership. It has also increasingly covered potential (and associate) members, see Table 2 in Appendix A. The first survey in 1990-1991 included the EU-12 countries. The second survey, conducted in 1995-1996, covered the EU 15 countries, that is, adding Austria, Finland and Sweden to the original set of 12. The third survey in 2000 included the EU 15 countries but also Norway, the 12 accession countries (from Eastern Europe plus Cyprus and Malta) as well as Turkey. The fourth wave in 2005 included the EU-27, Croatia, Turkey, Norway and Switzerland. The fifth survey in 2010 added in Albania, Macedonia, Kosovo and Montenegro but did not include Switzerland. The sixth and most recent survey (EWCS 2015) included all of the previous survey countries with the exception of Kosovo but extended the coverage to Serbia and Switzerland.

The current remit of the EWCS focuses primarily on measures relating to employment status, working time arrangements, work organisation, learning and training, physical and psychosocial risk factors, health and safety, worker participation, work-life balance, earnings and financial security, work implications for health. In the early surveys, in the 1990s, there was a heavy focus on indicators relevant to the manufacturing sector – with very substantial batteries of questions on physical health risks for example. From 2000 its questionnaire has gone through considerable evolution to make it better adapted to covering the experiences of the wider workforce and to address the types of risk factors that have been found relevant for psychosocial as well as physical health. In its early days, there also seems to have been quite strong resistance to including 'subjective' measures to capture employee responses to their work environment. This position has also changed in recent surveys; additional items have been included that increase its ability to address the 'well-being' agenda, which has gained increased policy and research salience. The survey does continue to be limited in its ability to address work-family conflict issues, which ideally require quite extensive collection of information about non-work demands on the family. This position is more understandable given the prime purpose of the survey and questionnaire space restrictions.

Accessibility, periodicity and sample size

The EWCS is administered every five years. The surveys are consistent across different waves and comparable across countries. There are six waves of data publicly available. The first wave was conducted in 1991 and the sixth and latest wave was conducted in 2015. Different countries of Europe have been covered in each of the waves. (see Table B in the Appendices). The sample size of each wave varies depending on the number of countries included. The sample of the EWCS is representative of all working members in the households of all EU Member States (and some European non-Member States). The sample size of the survey is determined by the aim of making adequate estimations at national and EU levels. Although there is some variation among country samples in particular years, and some countries boost their sample size, in general the EWCS provides a sample of around 1000 per country.

Strength and Weakness

The EWCS is a rich source of information on working conditions and the quality of work. It is the best available source of information about working conditions for the EU countries. The main advantages of the EWCS are: first, its wide coverage of the different dimensions of job quality with a single set of questions for all the countries of the sample. Items within the survey are well designed and strictly comparable across countries, while the materials are also well documented. Its topic coverage is good, and from EWCS 2015 able to accommodate QuInnE's six dimensions of job quality. Second, it offers

detailed indicators to measure job quality at the micro level. It asks both objective and subjective questions related to work and conditions of work. As the information is collected through face-to-face interviews, the response rate is high.

Data is relatedly consistent over time and can be easy downloaded from a repository (but only after Eurofound releases the first report on the data), which can take two years from data collection to public data availability. There is some debate about the desirability of the EWCS's current periodicity. Given that analyses of job quality indicate that it is not subject to sudden changes, the five-year gap between each EWCS is not a problem according to Muñoz de Bustillo et al. (2011). However Leschke et al. (2008: 8) regard the five year gap as a 'downside' to the survey and imply that more frequent surveys would be preferable.

The EWCS has some weaknesses. Firstly, the data on wages could be improved. At present, use has to be made of complementary datasets to achieve good information of wages, for example the European Structure of Earnings Survey (EU SES) or European Union Statistics on Income and Living Conditions (EU-SILC). This weakness seems to be part of the politicisation of the content and orientation of the EWCS and might be resolved if the UK exits the EU. Secondly, some questions are not held constant in successive surveys. In terms of the QuInnE's research, the 2010 wave included a question of innovation that was deleted in the 2015 wave, limiting Gallie's (2018) analysis of innovation-conducive job quality to 2010. Even so, the articulation of innovation in EWCS 2010 is vague and does not wholly align with the Oslo Manual typology, instead offering broad measures – share of workers declaring that 'new processes or technologies were introduced'; 'substantial restructuring or reorganisation was carried out', which proved challenging for the analysis undertaken Christine Erhel and her colleagues to help identify potential case study industries for QuInnE's qualitative research by capturing the heterogeneity of innovation and job quality at the industry and country level (see Jaehrling 2018). However as it now stands, the EWCS now fails to provide with any information on innovation which has an important point of intersection with job quality and working conditions – see comment above on the weakness of the CIS in relation to organisational innovation and current interest in the working practices that underpin employee-driven innovation. Thirdly, the EWCS has been cautious to date about including information about the wider organisational context, for instance the role and influence of worker representatives, although such context is important for understanding the factors affecting job quality (Warhurst et al. 2018). Fourthly, the very substantial country coverage changes to the EWCS restricts long-term trend analysis: research redesign is confined to a choice between covering a relatively small number of countries over the full life of the survey series or a wider number of countries for a shorter period. In practice, given that the East European countries provide an interesting extension to the range of institutional and cultural factors that can be included in analysis, comparative work is probably best restricted to the period 2000 to 2015.

However, fifthly, the single biggest shortcoming of the EWCS is the size of country samples. The small sample size for each country disables adequate disaggregation of the data by occupation and industry for example. Disaggregation by industry*country is only possible at the NACE one-digit level because of sample size problems. Moreover it provides a fragile basis for analysing inequality differences between key groups of policy concern. For instance, temporary workers are a relatively small proportion of the workforce, but there has been a great deal of concern about the nature of their work conditions and the way it may affect future life chances. It is difficult currently to make robust estimates of their job characteristics, particularly given that there is reason to believe that it is important to examine the potentially rather different experiences of men and women in temporary work and of high and low skilled temporary workers.

European Social Survey (ESS)

Hunt et al. (2018) used data from the 7th Round of the ESS (2014-15) in order to examine employment and unemployment rates in the EU. This data was used in conjunction with that from the EWCS in order to analysis the impact of innovation regime on marginalised workers' labour market inclusion and job quality.

The ESS is directed by a Core Scientific Team led by City University in London in the UK.[4] There are six other partner institutions. The ESS has been less restricted by political constraints that the EWCS but has suffered in its coverage because of the more fragile funding base for national studies. EU support in the past been primarily directed at supporting the 'core' management team at City University, while associated researchers have had to seek national sources of funding for their country studies.

It is a cross-national survey that has been conducted across the EU since 2001. It generates household and individual-level micro data. The ESS sample is representative of all persons aged 15 years and over (no upper age limit) resident within private households in each country. The survey measures the attitudes, beliefs and behaviour patterns of diverse populations in more than thirty countries. It is a cross-national survey measuring a wide range of attitudes, beliefs and behaviours. It consists of questions in two main parts: a core section and a rotating section. It involves strict random probability sampling, a minimum target response rate of 70 per cent. The hour-long face-to-face interview includes (amongst others) questions on family, work and well-being, health and economic morality.

Scope and coverage

The first survey, round one, covered 22 countries; EU with Switzerland. The last survey in 2016, round eight, covered 23 countries, mostly within the EU adding the Iceland, Israel, Norway, the Russian Federation and Switzerland. However which countries participate in each round varies. Some countries have participated consistently, e.g. France and Germany. Other countries participate occasionally e.g. Italy and Cyprus. Some countries seem to have stopped participating e.g. Latvia and Luxembourg. In practice, the ESS has taken a fairly broad view of the countries that constitute Europe and covers countries that are neither in the EU nor are being considered for membership. It has included Albania, Iceland, the Russian Federation, the Ukraine and Israel under the 'European' umbrella.

The ESS provides information on individual employment and unemployment status from which employment and unemployment rates can be estimated at national level. However it is not exclusively focused on work and employment. The 7th round covers a broad range of topics including: television watching, political interest, subjective wellbeing, social exclusion, perceived discrimination, health and fruit, vegetable and alcohol consumption and smoking behaviour. It also includes the socio-demographic profile of the household composition and respondents plus partner and parents.

The primary interest of the ESS has been with trends in subjective experiences and social attitudes. It is expected to cover a very wide range of social life. It has sought to meet its multiple demands by adopting a core-module structure. Each round includes a range of common questions covering the main spheres of social life: demographic (personal and family characteristics); economic (employment status, participation at work, unemployment experience); political (political efficacy, political trust, political participation, party allegiance, socio-political orientations); the media and general social trust; subjective well-being and values (value priorities, life satisfaction, social exclusion, perceived discrimination, religion and national and ethnic identity). The remainder of the survey consists of two specialised (rotating) modules, which change from survey to survey – but which the survey

[4] https://www.europeansocialsurvey.org/

management team hope to repeat at unspecified time intervals. Over the eight rounds of the survey, between 2002 and 2016, the modules have included topics as diverse as immigration; citizen involvement; health and care; economic morality; family, work and well-being; the timing of life; personal well-being; welfare attitudes; ageism; justice; democracy; social inequalities in health; and public attitudes to climate change. Although, the modules were conceived as 'rotating modules', it has not been possible to date, even with two modules to each survey, to implement this for more than a subset of modules. However, the first repeat module was that on 'Family, Work and Well-Being'.

Accessibility, periodicity and sample size

It is a cross sectional sample survey which is repeated every two years. There are eight rounds of data available starting from 2002 and continuing to 2016. The seventh round of data used by Hunt et al. consisted of a sample of 40,185 individuals surveyed in 21 countries in Europe. The Norwegian Centre for Research Data manages the data archive and distribution of ESS data. The data is available without restrictions for not-for-profit purposes.

Strength and weaknesses

The main strength of the ESS is that it provides high-quality cross-national comparative data for European countries. The broader scope of the ESS, however, makes it possible to address both issues about the development of work itself and also questions about its implications for other social issues. For instance, the 2010 'Work, Family and Well-Being' module was not only able to analyse in some detail the factors underlying work-family conflict (which is difficult with the EWCS), but it was also able to examine the important question of the implications of the severe decline of work and labour market conditions in many countries, associated with the economic recession, on levels of political trust and attitudes to democracy, using the items in the core sections of the survey. Potentially the two-module structure could lead to interesting new research agendas by exploring the linkages, not just with indicators from the core, but between the indicators provided by the modules for different issue areas.

The strategy of covering a wide sphere of social life through modules has benefits and drawbacks. These benefits being that the modules are competitive and are therefore proposed by academic teams with considerable expertise in the subject – including up-to-date knowledge of existing research, an understanding of the theoretical value of particular lines of enquiry and experience of the quality of indicators that have been used.

Although the ESS is not intended to measure job quality, when the module is included, it provides information on working conditions and job quality. This rotating section studying working life and family includes, for example, indicators for atypical work, skill upgrading and work-life balance. Unlike the EWCS, the ESS survey also covers all members in the households and, therefore, can be used to measure labour force participation rates. The survey also provides detailed information on respondents' primary activity.

Another strength of the ESS in relation to the EWCS is the question formatting, with significant differences between the EWCS and the ESS in the way many questions are asked. Although the approach has been changing over time, many key indicators in the EWCS have binary (yes/no) response sets. This practice dates to the early history of the survey, when it was perhaps less equipped to draw on methodological expertise. The difficulty is that, once questions have been asked in a particular format, it is very costly to change later because it makes rigorous trend analysis difficult. Even small changes in questions can alter the distribution of responses, making it difficult to know whether apparent changes over time are real or artefactual. The ESS on the other hand has had, from its inception, a very strong on methodological adequacy, both drawing on outside expertise and

carrying out methodological studies of its own. One consequence has been that it predominantly adopts question response formats that provide a measure of intensity or frequency.

To give an example, both surveys have measures of task discretion (sometimes called 'autonomy'), which is understandable given its demonstrated predictive importance for work attitudes and health. In the EWCS respondents are asked whether they are able 'to choose or change' their order of tasks and their methods of work, with responses for each being 'yes' or 'no'. The ESS asks respondents how much management allows them 'to decide how your own daily work is organised' and 'to choose or change your pace of work', with responses on a ten-point scale from 'I have no influence' to 'I have complete control'. The ESS clearly provides a much finer degree of differentiation. This more fine-grained analytical capability may be not be crucial for broad country comparisons. The two surveys provide very consistent pictures on many job quality indicators of the countries that come out as having high or low levels of task discretion (see the detailed analysis in OECD 2017). However the smaller the internal differentiation within response categories, the greater the likelihood of missing important changes of level that do not constitute a shift from one side to another of a dichotomous choice. Greater differentiation is also likely to provide greater power in explanatory analyses.

The ESS has three main limitations: periodicity in terms of collecting job quality data; the fluctuation of country coverage; and the sample size per country. With respect to the first, the drawback to the rotating module approach is that while the rotating module on 'Family, Work and Well-being' provides rich data, it is not administered with each round of the survey. Periodicity is therefore a problem with an infrequency of data collection on working life. This problem is compounded by the second weakness and the problem of the irregular participation of some countries in ESS. If a country is unable to find the financial resources to cover a particular year in which there is a repeat module, then there can be no trend analysis for that country on the more detailed indicators for that particular topic (and it may be six or more years before the next occasion on which data can be collected). For instance, when the Work, Family and Well-Being module (originally conducted in 2004) was repeated in 2010, the Italians were unable to fund their national survey – leaving a severe gap in analyses of the implications of the economic crisis for Southern European countries. Second, even for countries that regularly participate, there is a long gap before data can be updated and trends identified. Third the objective of accommodating two modules in each survey necessarily imposes severe restrictions on space with respect to any one topic. Thirdly, and related, over the period of its existence, 36 countries have been involved in the survey. A much smaller number have been consistent participants. Indeed only 15 were in each wave between 2002 and 2016. This erratic participation pattern, combined with the surveys modular structure (to be discussed later), restricts serious trend analysis to less than a half of the overall number of countries that have been involved (ie a much smaller number than the EWCS over the same period of time).

As with the EWCS, the single biggest shortcoming of the ESS is the size of country samples. The ESS in 2010 had overall sample sizes varying between 1500 and 3000. The ESS covers those outside the labour market as well as the workforce, so sample numbers for studying work are generally less than half of these overall figures. One consequence and the same point made about the weakness of the EWCS in relation to its capacity to monitor 'at risk' groups of workers in the face of technological change also holds for the ESS. The more general consequence is that, as with the EWCS, the size of the ESS sample is not large enough to conduct analysis at the country level.

The European Company Survey (ECS)

ECS data is used in Muñoz de Bustillo et al. (2017) to explore the nexus between innovation and job quality at the firm level.

The ECS is conducted by Eurofound, though the next one, due to be conducted in 2019, will be jointly carried out and managed by Eurofound and Cedefop. Its purpose is to collect information on company policies and practices across Europe on a harmonised basis. The survey analyses the relationships between company policies, practices and structures and their impact internally. It has a particular focus on social dialogue. It now contributes to the *Europe 2020 Strategy* through the mapping and understanding of company policies and practices that might impact smart, sustainable and inclusive growth, as well as development of social dialogue in companies.

It is a questionnaire-based representative telephone survey of establishments with at least 10 employees. The next survey (ECS 2019) will change format to become a web-based survey after initial contact with respondents by telephone. There are two intended questionnaires. The main questionnaires involve (usually) managers responsible for personnel/human resources in establishments, with a second survey, when possible, with an employee representative identified by the manager. Response rates from the two questionnaires varies by country, ranging between 18-62 per cent for the manager interviews and 39-83 per cent for the employee representative interviews.

Scope and coverage

The geographic coverage of the ECS has increased with each survey. In the first wave 21 countries were covered: the EU15 plus Cyprus, Czech Republic, Hungary, Latvia, Poland and Slovenia). The second wave had 30 countries: the EU27 plus Croatia, the Former Yugoslav Republic of Macedonia and Turkey. The third wave covered 32 countries: the same as the second wave with the additions of Iceland and Montenegro.

The focus of the ECS varies with each wave. The first wave (2004-05) focused on working time arrangements and work-life balance at company level. Second wave (2009) focused on flexibility, including working time flexibility, contractual flexibility, variable pay and financial participation, as well as human resources measures, and the nature and quality of workplace social dialogue. The third wave (2013) focused on work organisation, human resources management, employee participation and social dialogue. It also captured a range of variables on the structural characteristics of the establishment, as well as workplace wellbeing, establishment performance and innovation.

Accessibility, periodicity and sample size

The survey is conducted every four years since its inception in 2004-05 as the European Establishment Survey of Working Time and Work-Life Balance (ESWT). Third wave of the survey in 2013 had a sample size of 29,950 across the 32 participating countries. Individual country sample sizes ranged from 300 to 1650. Information gathers micro level data with stratified sample by sector and establishment size. AS with the EWCS, the constructed data base has two different levels of presentation and analysis:

- aggregate results by country and activity of the selected variables;
- at the individual level, to allow analysis at the level of the worker.

Datasets made available no later than two years after the completion of the fieldwork. Datasets are stored with UK Data Service (UKDS) and data is available free of charge for non-commercial purposes. Eurofound authorises requests for access to data. Data can be easy downloaded from a repository, the UK Data Service – though only after Eurofound releases the first report on the data, which creates a time lag between data collection and access for independent researcher analysis.

Strengths and weaknesses

The strength of the ECS is that it can provide very good data on each wave's particular subject focus. Information about innovation in the ECS 2013 is encapsulated in a single question asking whether in the last five years (since the beginning of 2010) the establishment has introduced innovation in four

areas: product, production processes, marketing and organisation. In doing so, the survey follows closely the four types of innovation outlined in the Oslo Manual. This type coverage is good. However, as in the CIS, the questions addressing the different types of innovation have only a binary yes/no answer, which disables any understanding of about the impact and novelty of the innovation introduced (see Warhurst 2018).

If the strength of the ECS is that has a subject focus, this strength can also be a weakness: with a different subject focus in each wave there is no data consistency. Thus, whilst the third wave (ECS 2013) focused on innovation and job creation, the next wave (ECS 2019) does not include innovation. Trend analysis is therefore disabled. Moreover, there is only very basic information on job quality.

Two other weaknesses centre on the ECS survey scope and sample size: first, it only covers establishments with 10 or more employees and, second, there is a small sample size for many countries. As with the CIS, the first creates comparative problems because of the different composition of firm sizes in EU countries. The second means that detailed analysis by country (in terms of occupation, activity etc.) is limited.

National datasets

National datasets were used to evaluate the impact of innovation on job quality and employment at the firm level in France, Germany and Spain (Duhautois et al. 2018). Funding limited the analysis to those three countries. The intention of the analysis was to try to capture causality. To do so requires having information on innovating and non-innovating firms. With information on employment limited in the CIS, the research had to match CIS data with other sources (with the analysis for France) or use other national firm-level databases that include information on both employment and innovation (for the analyses of Germany and Spain).

France

For the analysis of France, different firm-level databases were used: the CIS 2012), DADS and FARE-FICUS. The CIS 2012 sample for France includes about 23,000 enterprises in the private sector. DADS are administrative data on employment, collected every year on the basis of firms' compulsory declarations. It includes firm-level information on employment, by occupation and gender, as well as working hours and types of contracts (fixed-term or permanent) and their duration. FARE-FICUS include standard accounting data used by the administration to collect taxes. These three databases can be merged at the firm level (sample of 14,204 firms). However, some waves of CIS include a much smaller sample of firms, for example the French CIS 2006 includes only about 6000 firms.

Germany

For Germany, the analysis used from the Institute for Employment Research (IAB) Establishment Panel, which is an employer representative survey on occupational measures and employment. Approximately 16,000 establishments from all industries and all establishment sizes are surveyed nationwide annually. The IAB Establishment Panel was first conducted in 1993 in West Germany and from 1996 in East Germany. It offers extensive and unique longitudinal data at the firm-level in Germany. To provide better temporal comparability with French data, the IAB panel is delimited to the years 2009 to 2013, whereas innovation is captured in the years 2010, 2011 and 2012. This limitation means that only firms for which there is balanced data over 5 years can be used in the analysis. With panel attrition and item or unit non-response, the overall sample size then consisted of 9416 firms.

Spain

The Spanish analysis used the business strategy survey, ESEE. The survey was developed to study the strategic behaviour of Spanish manufacturing firms. The ESEE is annual, first administered in 1990. The analysis focused on the period 2002-2010, which is the period for which the database has the highest-quality information (with no discontinuities and comprising all the required variables). The ESEE consists of a panel of manufacturing firms, with a sample averaging 1857 firms and with an average response rate of 91 per cent. The scope of the survey is manufacturing firms in Divisions 10 to 32 of NACE 2009 excluding 19 (Manufacture of coke and refined petroleum products) with 10 or more employees. All firms over 200 employees are included in the sample, while smaller firms are selected by stratified sampling. The analysis uses two intervals of time, 2002-2006 and 2006-2010, which include 1603 firms with 2298 firm-year and 4596 firm-year observations respectively. The survey contains information on product, process and organisational innovation, though in the latter case only for the interval 2006-2010.

Strengths and weaknesses

The national databases used in the three countries enable us to have good comparability of innovation definitions and concepts, as they all use the typology of the Oslo Manual and distinguish between product, process and organisational innovation. For the French and German analyses there was additional information was available about the novelty of product innovation (new to the market or new only to the firm). This novelty aspect of invocation is flagged elsewhere (Warhurst et al. 2018) as important in understanding innovation and its omission is a weakness of the Oslo Manual measures. In terms job quality and the dimensions with indicators adopted by QuInnE (see Warhurst et al. 2018), coverage is limited. As a consequence only a few of the preferred dimensions and indicators of job quality could be included in the analysis. All that could be analysed are wages and employment quality (type of contract). Omitted from the analysis are working conditions, health and safety, work-life balance, and voice and participation. In terms of employment, there are some country specificities, most obviously for Spain only manufacturing is included. However the same basic information is available across the three countries about: employment levels in the firm with some decomposition by gender, occupation or skill level; the type of contract; and wages or hourly labour costs.

It should also be noted that the methodology of the surveys varied by country. The Spanish and German analysis rely on a panel survey whereas the CIS in France is a cross sectional survey. The same time period can be analysed for France and Germany. With the French analysis, it is difficult to reproduce the same analysis for other time periods because of changes in the variables (either in the CIS survey before 2012 or in the DADS survey). More significantly, in order to use better data, the period analysed for Spain differs from that of France and Germany (2002-10 vs 2009-13).

Whilst the data that could be compared across the three countries is of good quality, in addition to the omission of small forms and some industries, the missing job quality data highlights the limitations of using these national datasets. Not having good job quality data at the firm level, in terms of the items that needed to be analysed, both constrained the analysis but also restrained the originality of QuInnE in terms of being able to use its bespoke framework of job quality, intentionally developed to bring a coherence to the study of job quality that has hitherto proved both scientifically elusive and disabling in terms of policy development (Warhurst 2017). In addition, whilst the three countries datasets used the Oslo Manual typology of innovation, the limitations of this typology are transposed to the national datasets. And attempt to provide more nuance to measures of that typology in France and German serves to highlight the lack of consistency and hence comparability across EU Member States' measurement of innovation. The different indicators used to measure innovation, job quality and employment outcomes varied across the three countries, as the tables in Appendix B show.

Concluding remarks and recommendations

This section briefly summarises the evaluation of the main datasets used in the QuInnE research before using this evaluation to identify and recommend changes that could be made to improve EU data for research centred on the relationships between innovation, job quality and employment outcomes.

The CIS is the dedicated database for EU innovation at the enterprise level. That a dedicated dataset for EU innovation exists and is administered every two years is very useful. There is relatively good data on technological innovation and which has evolved. Use of this data by Erhel and Guergoat-Larivière (2016) and Duhautois et al. (2018), however, reveals that existing datasets still need further refinement. Delays and access to data availability can impede analysis. No doubt the measurement of innovation in CIS data has improved over time with the inclusion of non-technological innovation. However there are still type biases in the measurement of innovation. Despite revision based on evolving conceptualisation of innovation, the CIS tool is still dominated by questions focused on technological innovation (for more detailed discussion of this point, see Makó et al. 2016). That this issue has yet to be resolved transposes the problem over to other surveys, most obviously the EWCS and ECS, which both lack precision in articulating and measuring organisational innovation. Moreover whilst the survey tool has likewise evolved to be more inclusive of industries other than manufacturing, coverage by industry remains relatively limited (although some countries now make unilateral decisions to collect data for a larger number of sectors) because of this type bias. Beyond QuInnE, this residual type bias leads some to suggest that it maintains an existing industry bias and, with the different composition of industries in EU countries, creates an additional country bias in its measurement operationalisation (Janger et al. 2017).

Likewise, the evaluation of the EWCS is mixed, and as with innovation, measurement of job quality ought to be improved – although for different reasons. Although lacking a dedicated dataset, there is still good data available at the individual level in what has become a substitute for the dedicated data – the EWCS. As with the CIS and innovation, the EWCS has become the 'go to' source of data on job quality in the EU. Importantly, its data covers the QuInnE job quality framework. There can be good complementary sources, that is, the ESS, but reliance on it is difficult given the continuous uncertainty about its periodicity. The periodicity of the EWCS has also been debated, more specifically whether the current five-year gap is too long (see, for example, Leschke et al. 2008; Muñoz de Bustillo et al. 2011). Resonating with this debate, the new set of recommendations to the UK Government about creating more good work suggest that annual measurement is needed in order to more quickly discern progress or otherwise in this aim (Measuring Job Quality Working Group 2018). The key weakness with the EWCS and ESS data is that they both have small sample sizes at country level. This smallness disables necessary disaggregated analysis and needs to be addressed.[5] The EWCS and the ESS both constitute invaluable sources of data about the nature of and trends in job quality in the EU.

There are, however, some important gaps in both sources of data. The most obvious in the context of current policy debates about the new digital technologies and its purported impact on the future of work, is that neither provide very strong indicators of technology. Such measures are very difficult to construct in a way that makes them applicable in a general survey of the workforce, but it should

[5] The European Labourforce Survey (EU-LFS) does not have these sample size limitations but includes only a few indicators of job quality, insufficient to populate the QuInnE framework. The proposed solution to this problem in the UK is to attached a bespoke module using its version of the framework to the LFS (see Measuring Job Quality Working Group 2018).

be possible to get leverage on at least some aspects of key developments highlighted by analysts of the digital transformation. Also neither dataset includes good measures about innovation at work. The EWCS is the most useful in this respect (which, together with the issue of country coverage) is why it was selected as the data source for Gallie (2018) in the analysis of the distribution of innovation-conducive job quality. However the removal in the 2015 survey of the question asked in 2010 on whether new processes/technologies had been introduced in the workplace in the last three years has weakened what was already an inadequate section of the questionnaire.

If the impact of technological change on the work and the workforce is to be monitored rigorously, there needs to be a considerable investment in enhancing the size of the EWCS (and perhaps ESS) – an issue that has been recognised by the French statistical authorities. It also should be remembered that the current data sources are cross-sectional, although causal arguments can only be properly addressed with longitudinal data. There is then a strong case for complementing the existing surveys with a longitudinal panel. One solution might be to link the EWCS to a revamped ECS, which also solve the missing and important data in the EWCS on organisational context.

Based on reflections of QuInnE's experience of using the available statistical data and evaluating the utility of the main relevant EU datasets, Table 4 below summarises the strengths and weakness of the innovation and job quality data. The summary cuts across the EU datasets. Input from the national datasets' evaluation appears in parenthesis.

Table 4: summary of the strengths and weaknesses of innovation and job quality EU datasets

	Strengths	Weaknesses
Innovation	• Has a dedicated dataset • Good periodicity • Good technological innovation data	• Time lag in data availability • Innovation data not always consistent over time • Can be bias towards larger organisations • Non-comprehensive industry coverage • Type bias towards technological innovation remains • Under-developed conceptualisation of organisational innovation • Varying and ambiguous operationalisation of organisational innovation • Weak question framing for organisational innovation • Can be data access restrictions • (Can be methodological and indicator variations in national level data sources)
Job quality	• Rich data available even without a dedicated dataset • Mostly data consistency over time • Some good question framing	• Time lag in data availability Questionable, even weak periodicity of the data • Data lacks organisational context • Small country sample size • Trend analysis constrained by the varying country participation over time • (Can be methodological and indicator variations in national level data sources)

Linking innovation and job quality is another challenge, particularly at the firm level – which is fundamental for the analysis of innovation. Linked employer-employee data would be helpful. Datasets such as Relations professionnelles et négociations d'entreprise (RESPONSE) or Changements organisationnels et informatisation (COI) in France or the Workplace Employment Relations Study (WERS) in the UK are the obvious type of useful datasets in this respect, both

providing detailed information about employees' jobs and information about innovation in the firm. However WERS, the periodicity of which already fluctuated (Wright et al. 2018), is unlikely to be administered again in the foreseeable future. Being able to longitudinally study firms and employees on a few years using panel survey data would also allow better identification of effects of innovation in quantitative studies.

At firm level, some of the data gaps can be plugged through the generation of qualitative data. This type of research would also be able to explore linkages and potential generative mechanisms between innovation, job quality and employment outcomes (Silverman 2011). Indeed the task was at the core of the case study research of QuInnE (Jaehrling 2018). In addition, quantitative data often benefits from being complemented by qualitative data QuInnE – in other words, and rather simplistically, such mixed method approaches enable complementary understanding of not just what is happening but also how and why (Malina et al. 2011). However such qualitative data generation is currently confined to organisational case studies. QuInnE, for example, was able to explore the generative mechanisms by which innovative might boost job quality or job quality might boost innovation through organisational case studies using interview techniques (see Jaehrling 2018). Although very useful and able to provide important insights, scalability can be a challenge with qualitative research.

Overall, some good data exists but is insufficiently comprehensive and needs to be made fit for European Commission purpose. At the moment, the European Commission is pursuing policy that seeks to enhance both innovation and job quality and assumes that there is a positive relationship between innovation and job quality (EC 2014). However insufficiently rigorous and comparable statistical data is available currently that would allow analysis of that relationship as well as its links to employment outcomes. As a consequence, it is difficult to discern if policy aspirations are being delivered or indeed are deliverable. In short, data availability is running behind policy evaluation needs.

However existing statistical datasets can be improved and it would be preferable for the European Commission to recognise that the available statistical data can be and need to be improved to better align with its policy development and delivery needs. Arising from QuInnE, there are four obvious points of consideration in this respect: data for measuring both innovation and job quality, raising awareness of the innovation-job quality-employment outcomes nexus through data communication and access.

First, if the European Commission wants to improve innovation performance in the EU (EC 2011, it needs to better capture the types of innovation that exist. Covering the four types of innovation outlined in the Oslo Manual, the CIS has become a stable of analyses of innovation within Europe (Smith 2013). However it is not without weaknesses. The most obvious weakness, and one that hampered QuInnE, is its measurement of organisational innovation. Two issues are apparent within this measurement. First, that the single question asked about organisational innovation is too blunt, yielding little useful information. Second, and relatedly, more items need to be explored in relation to organisational innovation.

The problem of type bias is most acute with respect to organisational innovation. If analysis of the different types of innovation or comparability of types of innovation across time or across the different datasets/surveys is problematic, this problem is especially true for organisational innovation. In addition, there needs to be a move away from binary response questions that are unable to capture, for example, the novelty or success of organisational innovations. In short, more and better questions need to be incorporated into the CIS in order to better capture organisational

innovation. This improvement should then provide for better consistency across other EU surveys, such as the EWCS and ECS, that at least occasionally seek to include measures of organisational innovation.

Improvement of the CIS is necessary because, as we noted earlier, research by Jensen et al. (2007) demonstrates that the Science, Technology and Innovation (STI, and covering the product and process innovation types) and Doing, Using and Interacting (DUI, and encompassing organisational innovation) approaches to innovation can not only co-exist but can be synergistic to the benefit of firms. As a concept organisational innovation is ambiguous in policy documents and research, and is measured in different ways in the different main EU surveys. Indeed, Lam (2013: 138) goes so far as to state that, as a concept, it is too often used in 'a rather loose and slippery manner'. Part of the problem, as Warhurst et al. (2018) point out is that organisational innovation is part of a family of related concepts which have many overlapping features.

The need to address this problem is not just conceptual but practical. This type of innovation, or family variants of it, are highlighted in research as particularly important, perhaps even underpinning other types of innovation (see Warhurst et al. 2018). Policy at present recognises the benefits of both the STI and DUI modes of innovation. However, in practice – perhaps because of the perceived greater ease in measuring it – it is the STI mode that still dominates policy thinking. The framework of analysis developed for QuInnE (see Warhurst et al. 2018) extends the conceptual basis of the DUI mode of innovation. What is true of the DUI also holds for the new mode of innovation developed by QuInnE – that the STI and this new mode of innovation can and indeed should both be promoted and supported, and measures developed. As Jensen et al. argue for the DUI mode, developing these measures is not an insurmountable task; it just requires the political will (see also Mako et al. 2016). Applying the framework of analysis developed for QuInnE to empirical research should go some way to indicating what those new measures might be.

Given that organisational innovation is the more prevalent type of innovation and, it can be argued, cast as employee-driven, might underpin the other types, the measurement weakness needs to be addressed. In doing so, the challenge is not to go beyond the CIS, as Smith suggests, but to improve it. He is right though to caution against overloading the survey instrument to the detriment of response rates. Eurostat and the OECD are working on a new edition of the Oslo Manual and which should be made public soon. During this updating process the innovation research community express a hope that the new edition might 'shift the focus from R&D as a privileged driver of innovation' to place equal value on design, creativity, innovation stimulated by collaboration' (Roper 2016: n.p). This shift would mark a major improvement.

In making this improvement, QuInnE recognises that organisational innovation is also currently poor defined. What is required is concept clarification and agreement from which measures can be derived and added to the CIS. Better conceptualisation and operationalising of the measurement of the latter should be pursued by the European Commission if economic growth is to be stimulated.

Recommendation 1: that the European Commission develop better conceptualisation of organisational innovation and its measurement. To do so, and working with the OECD, the Commission might establish a short life expert group to develop this conceptualisation and measurement, seeking consensus for them across the academic and policy communities. Its recommendations should then be adopted and incorporated into the CIS and other relevant EU surveys.

Second, if the European Commission wants to create better jobs (EC 2008, 2010, 2012), it needs to have a better conceptualisation of job quality. This conceptualisation would allow understanding of what comprises job quality and, from that understanding develop indicators and measures and ensure that a dataset or datasets exist onto which the measures can be applied.

Currently different measures and indictors of job quality are used across different agencies of the European Commission and even within agencies of the European Commission. Whilst the research that underpins these approaches is valuable, the variety of approaches is unhelpful and hampers effective policy development. Given that the European Commission wants to improve job quality, creating better jobs (EC 2008, 2010, 2012), it needs a single, fixed measure and set of indictors.

The QuInnE framework of job quality based on six dimensions emerges from a review of the multi-disciplinary research in the field and the identification of core work and employment features (centred only on the job) across this research. The latest wave of the EWCS now provides the data to populate these dimensions. The framework is therefore well positioned both within the field of study and in terms of data availability to become the standard approach in the EU to measuring job quality. For these two important reasons, it is recommended that the European Commission adopts the QuInnE approach to job quality to have a standardised approach across and within its agencies. Versions of this approach are already gaining traction within business practitioner and policy-making communities within Europe, see CIPD (2018) and Taylor Review (2017) respectively. The European Commission should also encourage its adoption by Members States, as they too increasing develop policies to encourage 'decent work' or 'fair work' and so seek to improve job quality. These Member States might then also boost the sample sizes within the EWCS so that within-country analysis of job quality is also possible, disaggregatable, for example, by industry, region and the demographics of respondents. In addition, the Commission might want to consider making the survey more frequent. It is currently administered every five years. Existing analyses of data from these surveys shows little aggregate change over these five-year periods (e.g. Muñoz de Bustillo 2011). However if the European Commission is to now actively intervene with policies that seek to improve job quality then it is reasonable to want to be able to discern the impact of those interventions within a five-year period. Indeed, with the Brexit vote driven by UK voters in the worst jobs, it can be argued that, there is a pressing political need to see improvement in job quality for those workers in the worst jobs much sooner (Warhurst 2017). The European Commission might therefore consider administering the full or a truncated version of the EWCS every two years for a fixed period – say ten years. Investment in the EWCS (or ESS) would also help the European Commission not only better assess its relationship to innovation, it would also support monitoring of the new effort by the European Commission to encourage upward coverage of working conditions (Mascherini et al. 2018).

Recommendation 2: that the European Commission adopt a standardised approach to measuring job quality, preferably the approach developed for QuInnE. The European Commission might also encourage Member States to adopt this approach also for standardisation and enable cross Member State comparability.

Recommendation 3: to improve its analysis utility, the dataset that can be used to populate the QuInnE approach to job quality – the European Working Conditions Survey – should have larger national sample sizes, and, for a fixed period, might also be administered more frequently.

Third, with better and, perhaps more frequent data on innovation and job quality, the European Commission then needs to consider how to disseminate and communicate this data. An obvious point to make is that the microdata needed to undertake good statistical analysis is currently

restricted. It can be granted for scientific purposes but only to recognised research organisations such as universities, research institutions or research departments in a public administration. Making access easier and quicker would be a start. More broadly, if the profile of job quality is to be raised amongst the European public and practitioners, then good data availability will be important.

The principles proposed in the final report of the Measuring Job Quality Working Group (2018) are useful in this respect. Drawing upon the work of the QuInnE team (see Warhurst et al. 2017) this Group recommends that data should be:

- Comprehensive, free and publicly available. It suggests a well-designed and user-friendly website with all data accessible and with a memorable URL.
- Quickly and easily understood, meaning with good visuals, such as graphics and charts, and accompanied by key messages.
- Updated at a consistent point in time. It suggests annually to build into news cycles, to which might be added policy cycles.
- Segmented easily according to are of interest. In other words, capable of being disaggregated by, for example, country, sector, industry and, at least in the case of job quality, the demographics of respondents.
- Interactive, with the possibility of users being able to drill down into data on the range of indicators collected.

QuInnE has already moved in this direction with the construction of an interactive web-based map – see http://tools.quinne.eu/quinnemap/ – drawn from QuInnE Working Paper No. 3 (Erhel and Guergoat-Larivière 2016). It is a tool that enables users to see how 22 EU countries perform for the three foci or 'parameters' of the project: innovation, job quality and employment outcomes. Each of the three parameters is comprised of a number of variables taken from available EU and OECD surveys. The range in each parameter is then divided in quartiles: low/low; medium/low; medium/high, and high/high. Each country's performance is placed in a quartile allowing comparison between countries at this level. In addition, users can explore each parameter in terms of the variables of which it is comprised in order to gain more in-depth understanding. The tool can be developed further, particularly in terms of its signposting and URL name, but does show that reasonably complex data can be presented and be made comprehendible and manipulatable in a user-friendly way.

The European Commission might consider ensuring the developed continuance of this tool. If it is to be carried forward as a legacy from QuInnE, the data supporting is likely to come from two agencies: Eurofound and Eurostat. One these agonies, or both jointly, might assume responsibility for it and ensure that it is regularly updated as data becomes available. These agencies could update it directly in-house or, alternatively, indirectly through a sub-contract to another party. It should also be promoted by the host agency or agencies as tool for policymakers, the media and researchers.

Recommendation 4: that the European Commission consider continuing and developing further a data communication tool, preferably based on the QuInnE map – and allocating responsibility for it to an agency of the Commission.

Fourthly, going forward, the European Commission might seek to futureproof its innovation and job quality data collection by exploring the potential of Big Data. Although Big Data is still loosely defined, it has three key facets: volume, variety and velocity (Laney 2001). With the first, involves any large dataset that powerful computing technology to be processed and analysed. The second can be structured or unstructured and, with the latter, requires algorithms to be ordered. (the third

relates to the speed at which the data is generated. Traditionally data used to measure job quality and innovation is retrospective; now real time data can be available. Big data can be generated, held and used by public and provide organisations. The private sector is leading the way currently with real time data, whilst public sector organisations are focusing on linking (retrospective) administrative data.

This dichotomy does not have to hold; there is no reason, for example, why governments cannot use real time vacancy data to analyse the stat of labour markets (Autor 2000; Cárdenas Rubio 2018). Big Data can offer efficiencies in the use of existing types of data and create new types of data. There might be ways, for example, in which data about job quality at the individual level might be generated using government-collected administrative data about health, tax and education. Linked, this data could provide information on, for example, wages and benefits associated with each job, the qualifications levels held by individuals in particular jobs, and of physical and psychosocial injury by job type. The self-employed, a group difficult to capture in existing job-related surveys, would also be able to be included and analysed using this linked administrative data.

As Elias (2014) notes, the European Commission has long desired to create a European Research Area that overcomes language barriers to promote cross-border access to and use of social and economic microdata. In pursuit of this ambition, a key challenge in developing an enabling harmonised legislative framework has been balancing the sharing of such data with protection of personal information. The right to privacy is enshrined in the 1950 European Convention on Human Rights, although there can be exceptions based on national security and national economic well-being needs. Significantly, trust in national public authorities in the EU to protect personal information is high (TNS attitudes survey from 2011 cited in Elias). Trust in private sector organisations is much lower. For example, 'total trust' in public authorities is 70 per cent whilst only 32 per cent for mobile phone companies and as low as 22 per cent for internet companies. Nevertheless, different Member States however have more cautious and open approaches – Germany and the Netherlands respectively – to data access, and even within members States there can be differences, for example in Germany between Länder.

The development of electronic communications in the 1970s and more recently with the internet has resulted in some European countries re-examining the right to privacy. The General Data Protection Regulation (GDPR), implemented in 2018, required Member States to ensure that consent is provided for data use and the removal of data in consent is withdrawn. Elias believes that this approach has resulted in the balance between achieved between use of personal data and public benefit.

Eurostat is a pinch point for these developments. While Member States are required to provide the agency harmonised data, which is then made available to the public in aggregate form, access to microdata remains subject to national laws. Some countries do not release this data and there can also be variations by country in what data is available. This situation was one that QuInnE had to negotiate in order to analyse the relationship between innovation and job quality at the firm level, see Duhautois et al. (2018). Whilst data for the required countries was made available by agreement with organisations in the countries of study, that data was not wholly comparable. It also slowed the analysis. Commission regulation (EU) No.557/2013 now oversees requests for cross-border data but Eurostat, as access facilitator, needs to consult with national statistical authorities. If one authority denies access data for this country is excluded from the analysis but cannot now prevent access to other, consenting countries' data.

Nevertheless, major obstacles still exist at the national level in researchers securing good transnational data, Elias (2014) contends. Even with the GDPR, access is still likely to be 'slow and cumbersome' (p.188). However he believes that the challenges at the EU level should not t prevent Member States from attempting to link administrative datasets held by both public and private organisations, and efforts should be made to improve efficiency in access and that the time is right now for the development of ethical guidelines for the governance of the research use of data, particularly he says, data from administrative systems, customer databases and monitoring and communications devices. These guidelines might help develop end futureproof analyses of innovation and, if at the level of the individual, job quality (as well as many other economic and social policy challenges). The European Commission, working with the OECD for example, can help coordinate these efforts, Elias suggests.

Recommendation 5: that the European Commission explore working with organisations within and outwith the European Union to develop guidelines on the use by researchers of Big Data in order to improve and futureproof analyses of innovation and job quality. Eurostat might lead this effort.

Addressing these four considerations will produce better research that in turn can help the European Commission develop more effective policy to lever the benefits of the Innovation-job quality relationship and its potential employment outcomes. It will enable the European Commission to have more comprehensive understanding of what and where the policy challenges lie in better levering those benefits, for example sector, industry or country or what particular aspects of innovation and/or job quality are creating blockages to policy deliver. It will help identify, firstly, how those challenges might be addressed, most obviously through market, regulation or education measures, and, secondly, who or what has responsibility for addressing the blockages – employers, trade unions, civic or other interest groups or the state for example. Good data provides the baseline for more effective policy development and evaluation, but it also provides the jump off point to support material improvements, in this case to the EU's innovation performance and capacity to create more and better jobs.

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Appendix A

Table 1: Data availability for 'share of innovative firms as a % of total firms' by country*industry, CIS 2012

Country	A	B	C	D	E	F	G	H	I	J	K	L	M	N
AT		X	X	X	X			X		X	X			
BE		X	X	X	X		X	X		X	X		X	
BG		X	X	X	X		X	X		X	X		X	
CY		X	X	X	X		X	X		X	X		X	
CZ		X	X	X	X		X	X		X	X		X	
DE		X	X	X	X			X		X	X			
DK	X	X	X	X	X	X	X	X	X	X	X	X	X	X
EE		X	X	X	X			X		X	X			
EL		X	X	X	X			X		X	X			
ES	X	X	X	X	X	X	X	X	X	X	X	X	X	X
FI		X	X	X	X			X		X	X			
FR			X		X		X	X		X	X		X	
HR		X	X	X	X	X	X	X	X	X	X	X	X	
HU		X	X	X	X		X	X		X	X		X	
IE		X	X		X			X		X	X			
IT		X	X	X	X	X	X	X		X	X		X	
LT		X	X	X	X	X		X		X	X			
LU		X	X	X	X			X		X	X			
LV		X	X	X	X		X	X		X	X		X	
MT	X	X	X			X	X	X	X		X	X	X	X
NL			X		X		X	X		X	X		X	
NO	X	X	X	X	X	X	X	X		X	X		X	X
PL		X	X	X	X		X	X		X	X		X	
PT		X	X	X	X	X	X	X		X	X		X	
RO		X	X	X	X		X	X		X	X		X	
RS	X	X	X	X	X	X	X	X	X	X	X	X	X	X
SE			X	X	X		X	X		X	X			
SI			X				X	X		X	X		X	
SK		X	X	X	X	X	X	X		X	X		X	
TR		X	X	X	X		X	X		X	X			
UK		X	X	X	X	X	X	X		X	X			

Table 2: The six waves of the EWCS with sample sizes and country range

Wave	Year	Sample size and country range
1	1990/1991	12,819 workers in the EC12 were surveyed.
2	1995/1996	15,986 workers in the EU15 were surveyed.
3	2000	EU15 and Norway were surveyed with a sample size of 21,703 in a first phase, with the survey being extended to cover the 12 'new' Member States in 2001, and Turkey in 2002 in a second phase. The sample size in the second phase was 11,051.
4	2005	29,680 workers were surveyed in EU27, plus Norway, Croatia, Turkey and Switzerland.
5	2010	43,816 workers were surveyed in the EU27, Norway, Croatia, the former Yugoslav Republic of Macedonia, Turkey, Albania, Montenegro and Kosovo.
6	2015	survey of 43,850 workers in the EU28, Norway, Switzerland, Albania, the former Yugoslav Republic of Macedonia, Montenegro, Serbia and Turkey.

Appendix B

Variables and data sources in analysing innovation, job quality and employment outcomes at the firm level in France, Germany and Spain (Duhautois et al. 2018).

Main variables and databases used for France

Innovation (CIS)	Source	Availability	Type of innovation
Introduction of product innovation	CIS	2004-2012	Product
Introduction of process innovation	CIS	2004-2012	Process
Innovations of products new to the market	CIS	2004-2012	Product
Organisational innovation	CIS	2010-2012	Organisational

Employment and job quality	Source	Availability
Number of employees at the end of the year	DADS	2004-2013
Number of employees at the end of the year by occupation	DADS	2004-2013
Number of employees at the end of the year by sex	DADS	2004-2013
Number of employees on permanent contracts at the end of the year	DADS	2009-2013
Number of employees on fixed-term contracts at the end of the year	DADS	2009-2013
Total payroll (gross)	DADS	2004-2013
Total payroll (net)	DADS	2004-2013
Total payroll by occupation	DADS	2009-2013
Total payroll by sex	DADS	2009-2013
Total number of hours worked (workplace level)	DADS	2004-2013

Other firm-level data	Source	Availability
Fiscal and financial data	FARE-FICUS	2004-2013

Main variables and databases used for Germany

Innovation (IAB)	Availability	Type of innovation
Introduction of product *or* service innovation	1993; 1994; 1998; 2001; 2004; 2007 to 2014	Product
Innovations new to the market	1993; 1994; 1998; 2001; 2004; 2007-2014	Product
Innovations new to the firm only	1993; 1994; 1998; 2001; 2004; 2007-2014	Product
Percentage of turnover related to improved products (in the last year)	1998; 2001; 2004	Product
Percentage of turnover related to completely new products (in the last year)	1998; 2001; 2004	Product
Production process innovation (have noticeably improved production processes or services)	2007-2014	Process
Production process innovation and distribution channels and/or innovation in customer relations in the last 2 years	1995; 1998; 2000; 2001; 2004; 2007; 2010; 2012; 2014	Process
Sum of all *investments* (in the previous year)	1993-2014	
Share of *expansion investments* in all investments (%)	1997-2014	
Areas of investment (Real estate, EDP, Production facilities, transportation)	1993-2014	
Research and Development department (y/n); number of employees	1998; 2004; 2007; 2009; 2011; 2013	Product & process
Organizational innovation in the last 2 years: quality management; team work; employee responsibilities; restructuring; introduction of units	1995; 1998; 2000; 2001; 2004; 2007; 2010; 2012; 2014	Organisational

Employment	Availability
Number of employees on *30th June*	1996-2014
Workers flows - inflows (vacancies to be filled immediately)	1993-1998; 2000-2014
Workers flows – outflows	1993-2014
Workers flows - outflows only women	1997-2014
Workers flows (inflows) by *qualification needed*	1993-1998; 2000-2014
Workers flows (outflows) by reason for the termination of contract	1993-2014
Expected ratio of workers inflows and outflows for the next year	1993-2014

Job quality	Availability
Number of employees on 30 June by unskilled jobs, skilled jobs, directors/managers, apprentices	1993-2014
Number employees on 30 June by sex	1993-2014
Number of employees on permanent contracts on 30 June	1996-2014
Number of employees on permanent contracts on 30 June by sex	1996-2014
Number of employees on fixed-term contracts on 30 June	1993-1994; 1996-2014
Number of employees on fixed-term contracts on 30 June by sex	1993-1994; 1996-2014
Number of temporary agency workers on 30 June	1993-1998; 2002; 2004-2014
Number of freelancers under contract for services on 30 June	1993-1998; 2002-2014
Number of "One-euro-job" holders on 30 June	2005-2014
Number of interns on 30 June	1994-1998; 2002-2014
Total amount of gross pay effected in the month of June 2014	1993-2014
Number of employees with a gross monthly salary between 451 EUR and 850 EUR on 30 June	2003-2014
Proportions of working hours per week	1996-1999; 2001-2003; 2006; 2008; 2010; 2012; 2014
Number of employees in *part-time* equivalent (full-time computable with v25fri; v28ges; v28voll; v26tz)	1993-2014
Number of employees in *part-time* equivalent by sex (full-time computable with v25fri; v28ges; v28voll; v26tz)	1993-2014

Main variables and databases used for Spain

Innovation	Availability
Introduction of product innovation	2002-2010
Introduction of process innovation	2002-2010
Organisational innovation	2007-2010

Employment and job quality	Availability
Number of employees at the end of the year	2002-2010
Number of employees on permanent contracts at the end of the year	2002-2010
Number of employees on fixed-term contracts at the end of the year	2002-2010
Number of high-educated employees contracts at the end of the year	2006-2010
Number of medium-educated employees contracts at the end of the year	2006-2010
Expenditure on external training per worker	2002-2010
Hourly labour costs (Euros at 2010 prices)	2002-2010