



Statistics and Indicators on the Labour Market in the eEconomy

Will the Convergence of NACE and NAICS in 2007 Solve eWork Measurement? Problems

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Chapter 1

Introduction

1. Background

This paper has partly been written in response to the call from Eurostat for contributions to the debate over the major revision to NACE due in 2007. It has also been written as an initial discussion document for Workpackage 3 of the STILE project. With core funding from the European Commission's Information Society Technologies (IST) Programme, STILE aims to provide innovative methodologies and content for the statistical monitoring of the European labour market in the eEconomy.

Workpackage 3 of the STILE project aims to examine the problems that currently exist with coding eWork activities in terms of NACE Rev 1 and ISCO. It is intended that 150 descriptions of establishments' activities, and 150 descriptions of occupations will be developed, that are known to illustrate challenges to the current classifications. These descriptions will be translated into the project partners' languages and then submitted to their National Statistical Offices for coding. The problems encountered, and any divergence in final classifications, will be examined to determine national and systemic problems with coding eWork activities.

The introduction of NACE Rev 1.1 in 2003, and the proposed major revision of NACE in 2007, obviously impacts on the work of Workpackage 3. This is especially the case as many of the changes and proposals are aimed at dealing with eWork and related problems. The most important of which will be the creation of an 'Information sector' in NACE paralleling the NAICS classification as used by the US, Canada and Mexico. Indeed, the planned major revision of NACE in 2007 is being used as an opportunity to more widely converge NACE and NAICS, with a parallel revision of ISIC the International Standard Industrial Classification.

This paper outlines the relevant changes in NACE Rev 1.1 and the changes proposed in terms of the convergence of NACE and NAICS in 2007. There will probably be some additional changes to NACE over and above those caused by the convergence, however these have yet to reach the proposal stage. This means that the proposed new NACE, which has been referred to as NACE 2007 in this paper, at this stage is only defined in terms of the convergence criteria. In practice NACE 2007 will probably be called NACE Rev. 2 and contain additional revisions. Any additional revisions will be at a lower level than required for the convergence, and as the only area not defined below the two digit level for the convergence exercise is wholesale and retail trade, this is the main area for potential further major revisions in NACE 2007.

2 The importance of sectoral classifications

Sectoral classifications have a relatively long history with many revisions to national classifications. At the same time increasing international comparability has become an important criteria in determining the pattern of revisions. There are a number of advantages associated with classifying business data on a sectoral basis. These include:

- making a mass of data more manageable and thus making it easier for users
- allowing the publication of data without compromising confidentiality
- allowing individual enterprises or establishments to benchmark themselves against their competitors involved in similar business activities
- providing the basis for sampling and weighting of business surveys
- allowing the linkage and aggregation of data from different agencies.

Internationally comparable sectoral classifications allow these sorts of analyses and comparisons to be more reliably undertaken across national boundaries.

3 Structure of this paper

The paper has three major chapters, the first defines eWork and then examines the challenges that eWork and digital developments pose for sectoral classifications and details the relevant changes in NACE Rev 1.1. At the time of writing the only available documentation for the changes from NACE Rev 1 to NACE Rev 1.1 are contained in an Excel file¹. The second chapter details of the proposed convergence of NACE and NAICS and the theoretical underpinning of the proposed converged classification. The third chapter examines the extent to which the converged structure will meet the digital challenges outlined in Chapter One.

4 A caution

This paper has been written in September 2002 on the basis of the publicly available information about the proposed convergence of NACE and NAICS. On the basis of a joint working party report, Eurostat and the North American statistical bodies are consulting over their proposed scenario for convergence. This means that the full documentation of the proposed new NACE 2007 classification has yet to be finalised. This in turn means that there is a high possibility of change between now and 2007.

¹ http://europa.eu.int/comm/eurostat/ramon/download/nace_rev1_1.zip

Chapter 2

eWork and the digital challenges to sectoral classification

1 What do we mean by eWork

The term 'eWork' is one of many words which have been coined to describe the work practices making use of information and communications technologies which have introduced new forms of flexibility in the organisation of work in time and space. We have chosen to use it here because it is the term which was adopted by the European Commission in its Information Society Technologies Programme and is as a result gaining wide acceptance across Europe, albeit with varying definitions.

eWork: Work practices making use of information and communication technologies to increase efficiency, flexibility (in time and place) and the sustainability of resource use.

Source: E-Work 2001: Status Report on New Ways to Work in the Information Economy

The STILE project uses a more precise definition of eWork derived from the EMERGENCE project.

eWork is any type of work which involves the digital processing of information and which uses a telecommunications link for receipt or delivery of the work to a remote employer or business client.

Source: Huws U (2001) Statistical Indicators of eWork, IES Report 385

The EMERGENCE definition of eWork is further elaborated in terms of whether the form of eWork involves employees in outsourcing, and whether it involves individual or collective forms of work. The first of these is a legal distinction: between work carried out internally (ie by people contracted to work directly for an organisation) and normally covered by a contract of employment, and work that is outsourced, and therefore normally carried out under a contract for the supply of services.

The second is a distinction between work carried out by groups of workers on shared premises (normally a building which could be described as an 'office') and that which is carried out by individuals acting in isolation away from 'office' premises. These people might be working from their homes (wholly or partially), or working nomadically from a variety of different locations, for all or part of the working week.

These variables are summarised in Figure 2.1. When combined, they provide us with a two-by-two cell matrix within which all forms of eWork so far identified by researchers can be grouped.

Figure 2.1: Typology of de-localisation enabled by eWork

Type of workplace	Individualised (away from 'office' premises) Collectivised (on shared 'office' premises)	Contractual	
		Internal/employees	Outsourced
		Employed tele-homeworkers Mobile employees	Freelance teleworkers or mobile workers
		Remote back offices/call centres Employees working in telecottages or other third party premises	Specialist business service supply companies Outsourced call centres

Source: Huws U, 2001

In practice the individual forms of eWork can be readily captured by population or household surveys such as the Labour Force Survey. Workpackages 2 and 5 of the STILE project examine the measurement of these individualised forms of eWork. Workpackage 2 of STILE examines how the national aspects of the Eurostat LFS can be used to measure eWork. Workpackage 5 has developed a module that can be added to the LFS and other surveys to obtain further information on individualised eWork.

The impact of eWork on establishment work practices is complex and it is difficult to take all the factors into account. Workpackage 4 of the STILE project addresses these problems. The first part of Workpackage 4 is an inventory of existing survey instruments identifying blind spots and existing good practice. The second part develops a series of recommendations for questions covering eWork that can be used in a range of contexts.

On the other hand the collectivised forms of eWork are much more difficult to capture since the use of a telecommunications link for receipt or delivery of work is rarely included in business surveys. However, it is the collectivised forms of eWork that pose the greatest challenge to existing sectoral classification systems and as such these forms will be the main focus of this paper. Further, given the absence of information about the use of telecommunications links to receive or deliver work the focus of this paper will be on digitalisation that enables such links. Therefore, some of the discussion and examples are about potential eWorking situations rather than pure eWork.

The next sections examine how eWork's underlying digital information and communication technologies, and the other elements of the concept, combine to generate digital challenges to sectoral classifications.

2 Digital challenges

There are six main types of challenges to sectoral classifications:

- digital convergence
- digital mobility and flexibility
- digital uncoupling
- digital quality and value
- digital embedding
- digital innovation.

These are dealt with in turn below, with examples where appropriate.

3 Digital convergence

The problem of digital convergence covers the impact of increasingly digitised products which are easily transformed from one format to another eg newspapers and news-websites. Digital content of, for instance, newspapers which were in the printing sector part of manufacturing, can easily move over to internet providers in the telecommunications sector that was part of services. There were similar problems with the digitised content of software publishers. In NACE Rev 1. software is within the business services area, although in practice many of the features of part of the industry in terms of copyright and economies of scale put software into the publishing sector.

The most important area to result from the digital convergence of the telecommunications sector and the computing sector is the internet. The internet and associated industries, partly due to its infancy in the early 1990's when NACE Rev 1 was formulated, is poorly served by NACE.

It is these problems created by digital convergence that create a major area of problems with eWork and sectoral classifications. The type of problems are explored in the next few sections. Section 2.3.1 examines the problems caused by computer games; section 2.3.2 examines the book publishing sector; section 2.3.3 examines the problems caused by information products for the concept of product sector linkage, while; section 2.3.4 examines the issues surrounding software consultancy and supply.

3.1 The computer game example

An example of this problem that is often used is that of computer games manufacturers who sometimes can be classified in the Toys and Games Manufacturing sector, and sometimes in the Computer software sector (Aufrant & Nivlet, 2002). Strictly, this problem has been solved in NACE Rev 1.1 where sector 36.50 'Manufacture of games and toys' explicitly excludes computer games software, which should be classified in 72.21 'Publishing of software'. In part this distinction has been enabled by the creation of the publishing of software sector in the revision of NACE Rev 1 to Rev 1.1 (see Section 2.3.4 for more details of this new sector). However, since in Rev 1 NACE sector 36.50 explicitly included the 'manufacture of electronic games: video games, chess etc.', this does represent a product that has moved from a 'manufacturing' sector to a 'service' sector. Equally, although the decision to reallocate these products to the services sector can be justified in terms of product similarities, the transition can be seen as essentially arbitrary. It is also a good example of a digital product that clouds the separation between manufacturing and services. (this is divide is covered in more detail in Section 2.5.2).

3.2 The book publishing example

Implicit in the convergence of digital products is that there is no longer a clear linkage between products and sectors. A book can be produced in a paper format which would mean its inclusion in the NACE Rev 1.1 'Publishing of books (22.11)' sector, which in turn is part of the manufacturing sector. However, the same digital text sent to the printing press can also be sent to a website where the book would be classified as part of the NACE Rev 1.1 'Database activities (72.40)' sector. This is, of course, as long as the book was not also published in a paper format when the online version would paradoxically be classified in the book publishing sector.

Table 2.1: Description of sector 22 Publishing, printing and reproduction of recorded media

'The printing activities print products, such as newspapers, books, periodicals, business forms, greeting cards, and other materials, and perform support activities, such as bookbinding, plate making services, and data imaging. The support activities included here are an integral part of the printing industry, and a product (a printing plate, a bound book or a computer disk or file) that is an integral part of the printing industry is almost always provided by these operations.

Processes used in printing include a variety of methods used to transfer an image from a plate, screen, or computer file to some medium, such as paper, plastics, metal, textile articles, or wood. The most prominent of these methods is to transfer the image from a plate or screen to the medium (lithographic, gravure, screen, and flexographic printing). A rapidly growing new technology uses a computer file to directly "drive" the printing mechanism to create the image and new electrostatic and other types of equipment (digital or non-impact printing). Though printing and publishing are often carried out by the same unit (eg a newspaper), it is less and less the case that these distinct activities are carried out in the same unit.

This division includes publishing of newspapers, magazines, other periodicals and books.

This division excludes publishing of software, see 72.21.

On-line publishing, not in connection with other publishing, is in 72.40.'

Source: Eurostat (2002) Nace_rev1_1_en.xls on the Ramon server

3.3 The product sector linkage

Currently, there is a very strong relationship between NACE and Eurostat's Classification of Products by Activity (CPA). The CPA is used to classify products and provides 'the basis for preparing statistics of the production, distributive trade, consumption, foreign trade and transport of such products' (Eurostat, 1998). The first four digits of a CPA code are based on NACE codes. This means that for most products they are implicitly linked to a single four digit NACE class. Although, there are currently some exceptions to this rule it is one of the guiding principles of the CPA classification system.

Unfortunately, digital products, for instance the book example in Section 2.3.2, can often be produced by a range of sectors. Partly, because digital products usually do not require sector specific technologies to create them, it is relatively easy for establishments to produce them with their existing capital stock. This means that digital products, especially those with a large information content, can be produced by a range of sectors. Given the approach of the CPA this obviously causes problems.

3.4 Software consultancy and supply

The 2002 revision of NACE from Rev 1 to Rev 1.1 splits the 'software and consultancy and supply' group into two classes. These new classes are 'publishing of software' (72.21) and 'other software consultancy and supply' (72.22). This will enable the subsequent transfer of software publishing to the proposed NACE 2007 Information sector. The details of these two new sectors are given in Table 2.2.

Table 2.2: Description of NACE Rev 1.1 class 71.21 software consultancy and supply

Code	Description
72.21	Publishing of software
	This class includes:
	– development, production, supply and documentation of ready-made (non-customised) software
72.22	Other software consultancy and supply
	This class includes:
	– analysis, design and programming of systems ready to use:
	• analysis of the user's needs and problems, consultancy on the best solution
	• development, production, supply and documentation of made-to-order software based on orders from specific users
	• writing of programs following directives of the user
	• web page design
	This class excludes:
	– reproduction of non-customised software, see 22.33
	– software consultancy related to hardware consultancy, see 72.10

Source: Eurostat (2002) *Nace_rev1_1_en.xls* on the Ramon server

4 Digital mobility and flexibility

One of the key elements of the eWork definition was the concept of flexibility in time and place. ICT enables many types of flexibility. Sometimes it is in terms of the location of work (Section 2.4.1), the location and type of work (Section 2.4.2), or flexibility in terms of sector the establishment is operating in (Sections 2.4.5), the country it operates in (Section 0). These aspects of digital flexibility are discussed below.

4.1 Teleworking and mobile working

The measurement of patterns of work, such as teleworking and mobile working, where mobility or relocation are enabled by ICT, is an important aspect of understanding eWork. However, these are essentially individualised work practices and are unlikely to impact on sectoral classifications. Self-employed teleworkers can perform different services for different clients and be considered to operate in a number of sectors. However, the principle that the activity that generates the greatest added value determines an establishments sectoral classification would apply in this situation.

Defining teleworking and mobile eWork, as well as developing a LFS module to capture and characterise these forms of work, is being carried out as Workpackage 5 of the STILE project.

4.2 Call centres

Another example of the flexibility and mobility enabled by digital technologies is in call centres where calls originating in one region or country can just as easily be answered in other regions or countries. Call centres house telephone operators, usually with computer assistance, for either dealing with incoming telephone calls or initiating outgoing calls. Call centres historically caused problems as they were considered to be in the sector of their parent bodies. For instance, a telephone banking call centre would be considered to be in the financial services sector, while a call centre handling payments to an electricity company would be considered part of the utilities sector. This did not take account of the significantly different nature of the work undertaken by a call centre compared with their parent bodies. Equally, there were problems with call centres operating in a number of sectors or as a business service to a number of companies involved in different business activities. The following example in Section 2.4.3 covers a call centre operating in a range of sectors.

4.3 The utility call centre example

The EMERGENCE project which is examining the relocation of employment due to the adoption of eWork practices, discovered an interesting case study which challenged the existing NACE classifications. One of the case studies involved 'Lecky' involving six separate call centres, digitally linked to create one large virtual call centre (Flecker and Kirschenhofer, 2002). In practice, this meant that call centre workers at any particular establishment were switched from answering calls for one sector to another on the basis of demand. This meant that technically the sector that they were working for could change dynamically during the day (Huws, 2001). This example is also a specific case of digital uncoupling covered in Section 2.5.

4.4 NACE Rev 1.1 and call centres

The 2002 revision of NACE Rev 1 to NACE Rev 1.1 created a new four digit sector (74.86) for 'Call centre activities', within the 74.8 miscellaneous business activities n.e.c. sector. This solves many of the problems caused by call centres by separating them out as a unique activity. For instance, the previous example of a call centre dynamically changing sector no longer applies as it will always be a call centre regardless of the sector it is operating for.

Table 2.3 gives the description of the new NACE Rev 1.1 Call Centre Activities class.

Table 2.3: Description of new NACE Rev 1.1 Class 74.86 'Call centre activities'

<ul style="list-style-type: none"> — client relation and client service related technical intermediary services for the account of others: — inbound call centres, answering calls from clients by using automatic call distribution, computer telephone integration or interactive voice response systems <ul style="list-style-type: none"> placing orders providing product information dealing with complaints — outbound call centres, dealing with sale and marketing activities directed towards clients <ul style="list-style-type: none"> market research direct marketing address verification

Source: Eurostat (2002) *Nace_rev1_1_en.xls* on the Ramon server

While this change may solve the specific problem of call centres, it also arises with other functionally specialist establishments locationally distanced from their parent company. Such outsourced functions (included in the bottom right hand quadrant of the matrix in Figure 2.1) can include training centres and data entry centres *etc.*, which in some cases can trade with companies other than their parent. Here the issues becomes when does an establishment acquire the sectoral classification of its main activity, rather than that of its parent.

4.5 B2B brokers and eCommerce

In terms of the value of transactions Business to Business or B2B eCommerce is much more significant than Business to Consumer or B2C eCommerce. Various estimates suggest that B2B eCommerce is far larger, at least in turnover terms, than the other forms of eCommerce (OECD, 2002). However, there used to be no clear home for this form of trading.

4.6 NACE Rev 1.1 and eCommerce

The addition of eCommerce to NACE Rev 1.1 has been handled by the explicit addition of eCommerce to existing NACE classes. Retail eCommerce have been included in 52.61, while some types of B2B eCommerce have been included in the 51.1 division.

Table 2.4: Description of NACE Rev 1.1 Class 52.61, Retail sale via mail order houses

<p>This class includes:</p> <ul style="list-style-type: none"> – retail sale of any kind of product by mail order. Goods are sent to the buyer, who made his choice on the basis of advertisements, catalogues, models or any other means of advertising <p>This class also includes:</p> <ul style="list-style-type: none"> – direct sale via television, radio, telephone and internet
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Source: Eurostat (2002) Nace_rev1_1_en.xls on the Ramon server

The definition of NACE class 52.61 'Retail sale via mail order houses' has been modified to include the internet amongst the television, radio and telephone as technologies used for direct sales.

NACE Rev 1.1 also adds the concept of 'activities of wholesale auction houses, including internet wholesale auctions, including internet wholesale auctions', within NACE 51.1 'Wholesale on a fee or contract basis'.

In practice, in the past most eCommerce probably has been allocated to these groups, but it helps to have the allocation to these classes made explicit. There potentially remains a problem with B2B eCommerce operators in more than one sector, although they would probably be allocated to NACE Rev 1.1 51.19 'agents involved in the sale of a variety of goods'.

Table 2.5: Description of NACE Rev 1.1 division 51.1 'wholesale on a fee or contract basis'

<p>This group includes:</p> <ul style="list-style-type: none"> — activities of commission agents, commodity brokers and all other wholesalers who trade on behalf and on the account of others — activities of those involved in bringing sellers and buyers together or undertaking — commercial transactions on behalf of a principal, including on the internet. <p>This group also includes:</p> <ul style="list-style-type: none"> — activities of wholesale auction houses, including internet wholesale auctions.
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This group excludes:
 — wholesale trade in own name, see 51.2 to 51.9
 — retail sale by agents, see 52
 — activities of insurance agents, see 67.20
 — activities of real estate agents, see 70.3.

Source: Eurostat (2002) Nace_rev1_1_en.xls on the Ramon server

4.7 Cross-border eCommerce

Cross-border eCommerce enabled by digitalisation causes problems for the measurement of trade, especially international trade (OECD, 1999). Although, many countries have introduced surveys which measure the extent of eCommerce the data often does not distinguish between domestic and international sales.

Apart from the B2B brokers covered in Section 2.4.5 these measurement problems are mainly not related to sectoral classifications. The only problem in terms of that which sometimes occurs is deciding whether the trade is wholesale or retail. Within NACE the distinction between wholesale and retail trading is based on the nature of the customers. If the customers of the trading include individuals then the trade is considered to be retail, while if the customers are solely businesses then the trade is considered to be wholesale. With eCommerce it is sometimes difficult to establish the status of customers which in turn makes it difficult to decide whether the trade is wholesale or retail. This is less of a problem with NAICS as the wholesale and retail divide is determined by the nature of the establishment rather than its customers. This means that in NAICS any eCommerce establishment which is closed and can only be accessed by nominated businesses, rather than anyone through the internet would be considered wholesale. This conceptual difference between the two classifications has been avoided in the convergence process by simply converging at an aggregate of retail and wholesale. There may be a case in the future for examining the NACE retail and wholesale definitions to ease any problems posed by eCommerce.

5 Digital uncoupling

Given the lower cost and general purpose nature of much ICT capital stock it is possible for a single establishment to provide a range of goods and services as if it belonged to a range of sectors. This aspect has already been illustrated by the example of a call centre changing in Section 2.4.3. However there is a more general problem of digital fixed assets enabling activity by a single establishment in multiple sectors. Sometimes, this may simply be a result of a manufacturer also offering product support (Section 2.5.1); in other cases there are other examples of an establishment bridging the manufacturing services divide (Section 2.5.2); while sometimes it is a result of the ambiguous nature of some outsourcing agreements (Section 2.5.3).

5.1 Product support and other services

Increasingly, manufacturers are also offering a range of product support services for the product range the manufacture. Sometimes, this involves only supporting the products they sell, but there are cases where they also offer another, often overseas, manufacturer's products that complement their own products. Therefore, a manufacturer can also be a service provider, for instance, by offering installation, repair or maintenance services for their products or those of other manufacturers. If a manufacturer also offers the products of another manufacturer as a complement to their own range they are also acting as either a wholesaler or retailer.

5.2 The manufacturing/services divide

One of the earliest classifications divided economic activities into three groups:

- primary productions — including agriculture and mining
- manufacturing
- services — including Government.

Despite this it is clear that many establishments are now engaged in a combination of activities that cross these divides. To a degree this is a general problem, especially when employees report the sector of activity of their employer when they are interviewed. This is particularly a problem when proxy respondents report the activity of the employers of other members of their household as they can with the Labour Force Survey. However, this general problem is exacerbated by digital technology as the greater flexibility they enable means that these sorts of combined activities become more common.

5.3 Outsourcing internal business functions

Another of the manufacturing/services splits can be bridged is as a result of outsourcing. Specifically, what is an internal business function can be offered as a business service to other external clients. Section 2.4.3 gives an example of a call centre which offers excess capacity to other sectors. However, many other types of business services are also offered by establishments whose main function is not in the business service sector. In part, this is due to the widespread dispersion of IT professionals in sectors other than the core IT sectors of software or computer manufacture (Millar & Jagger, 2001). This means that the capacity to generate digital products is widely dispersed beyond the core IT sectors. The EMERGENCE survey has shown that a wide range of business services can and are delivered via a telecommunications link (Huws and Regan, 2001).

These services can form a significant element of some elements of eWork (see Figure 2.1). However, they often bear no relation to the official sectoral classification of the establishment derived from the main activities of the establishment. As such the confusion due to multiple activities in a single establishment can arise. Technically, this problem is handled by the rule about the establishment belonging to the sector generating the highest proportion of added value (see Section 2.5.4). However, this is an area of potential concern, particularly where an establishment covers a range of activities, the largest of which may account for under a half of the total added value.

5.4 Sector hopping and NACE

As already mentioned, the problem of sector hopping is already handled within NACE as the classification of an establishment is based on the principal activity of the establishment. This is defined as the activity which contributes the greatest share of the establishments added value. Table 2.6 gives the definition used by Eurostat.

This is potentially a difficult definition as often an employee does not know which of the many activities an establishment may be engaged in generate the most added value. An employee is more likely to know the activity that management attaches the most importance to or the activity that generates the most turnover. Both of these of course need not be the activity that generates the most added value.

Table 2.6: Definition of a principal activity of an establishment

<p>In practice the majority of units carry on activities of a mixed character. One can distinguish between three types of economic activity:</p> <ul style="list-style-type: none"> ▪ Principal activity: The principal activity is identified by the topdown method as the activity which contributes most to the total value added of the entity under consideration. The principal activity so identified does not necessarily account for 50% or more of the entity's total value added. ▪ Secondary activity: A secondary activity is any other activity of the entity that produces goods or services. ▪ Ancillary activity: Principal and secondary activities are generally carried out with the support of a number of 'ancillary activities', such as accounting, transportation, storage, purchasing, sales promotion, repair and maintenance etc. Thus ancillary activities are those that exist solely to support the main productive activities of an entity by providing non-durable goods or services for the use of that entity.
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Source: Ramon citing — NACE Rev. 1, Statistical Classification of Economic Activities in the European Community, Introduction, Eurostat, May 1996, P. 14-15, Council Regulation (EEC), No. 696/93, Section IV B1 and B4 of 15.03.1993 on the statistical units for the observation and analysis of the production system in the Community and Eurostat

5.5 The photocopier example

A photocopier as a result of the adoption of digital image processing can often also function as network printer or network scanner. At the same time photocopiers are often sold or leased with a service contract. Sometimes many of the maintenance functions are undertaken by the end-user following advice from the manufacture generated as a result of online diagnostics. Given practices of discount pricing it is possible that a greater part of the added value generated by a photocopier manufacturer, especially if the establishment is providing imported photocopiers, can be the result of the repair and maintenance contracts. In this case an establishment which would appear to be a photocopier manufacturer (NACE Rev 1.1 sector 30) could in practice in terms of their added value be in the maintenance sector (NACE Rev 1.1 72.5). Table 2.7 shows that the definition acknowledges the potential for this problem, but does not resolve it.

Table 2.7: Definition of a NACE Rev 1.1 sector 30 manufacture of office machinery and computers

<p>The manufacture of office machinery (e.g. photocopiers, cash registers, etc.) and computer equipment (e.g. computers, word processors and peripherals), is considered to include installation, but not maintenance (72.5), software design (72.2) or the manufacture of electronic components (32.1).</p> <p>These machines are often leased (71.3: Renting of other machinery and equipment), but if they are leased by the manufacturer, this is simply a form of sale of production.</p>
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Source: Eurostat (2002) Nace_rev1_1_en.xls on the Ramon server

5.6 Business registers and sector instability

Many countries maintain business registers as a by-product of administrative processes, such as businesses registering for taxation or social security purposes. Generally, as part of the process of registering, businesses are assigned a sectoral classification and then the registers are used a sampling frame for a wide range of business surveys.

In the context of changing and evolving businesses it is felt that eWork will lead to a greater pace of sectoral change given the multi-functional nature of computers. There needs to be mechanisms to regularly review the sectoral classification of businesses on these registers given the greater potential for sector hopping.

In this context it should be noted that a sectoral classification that is based on 'production' rather than 'commodities' will have a lower rate of sector hopping when businesses use their existing productive capacity to produce different products.

6 Digital embedding

Software, and other digitally enabled features, can add greater functionality to a wide range of products outside of the traditional digital product list. Increasingly software is being embedded in other products. This represents a potential complication for any definition or understanding of eWork that is focused on digital processes. Increasingly cars, industrial and office machinery, washing machines, and even refrigerators, have digital processors and software embedded in them.

At the same time the extent of embedding can cause problems with the definition of the principal activity based on the most added value (Section 2.5). A product can be so enhanced due to embedded software that in practice the greatest portion of added value generated by an establishment may be due to the embedded software, rather than the basic product itself. This could be especially the case if the establishment buys in a basic product and enhances it by embedding additional digitally based functionality.

This problem is most apparent with physical products which are not delivered via a telecommunications link. Therefore, this is not likely to be a problem with the EMERGENCE definition of eWork (see Figure 2.1). However, this can be a problem with broader definitions of eWork.

6.1 The digital car tuner example

Many cars, especially upmarket cars, have a number of embedded microprocessors that control a range of functions. The parameters of these functions are often contained in specially produced computer chips. An industry has emerged where establishments offer 'up graded' performance chips, with or without the car manufacturer's consent, which change the performance of the engine, suspension or other aspect of the cars digitally controlled performance. These establishments are obviously not car manufacturers NACE Rev 1.1 34.10 (Manufacture of motor vehicles); but are they NACE Rev 1.1 34.30 (Manufacture of parts and accessories for motor vehicles and their engines); or NACE Rev 1.1 31.61 (Manufacture of electrical equipment for engines and vehicles n.e.c.), or even NACE Rev 1.1 72.22 (Other software consultancy and supply).

7 Digital quality and value

7.1 Price changes with quality improvements

One of the consequences of digital embedding (Section 2.6), and the pace of digital innovation (Section 2.8), is that the nature, and hence quality, of digital and other products improves. This causes problems with measuring the change in price of these products. To ignore the quality changes can seriously overstate the price changes from year to year. This is turn can cause output and productivity measures to be understated. A paper by Wyckoff (1995) showed that differing methods of taking account of quality changes in the 'Office machinery and computer manufacture' sector lay behind virtually all the differences in productivity measures for this sector between nine OECD countries. More recent work by Schreyer (2001) suggests that these differences do not cause major differences to the

aggregate estimates such as GDP, or overall labour productivity, despite the differences at the disaggregated level. In part, this is because of the introduction of 'Chain weighting' methods (Steindel, 1995) for calculating GDP. It seems that the use of hedonic measures is to a degree counteracted by the use of chain weighting (Schreyer, 2001).

7.2 Hedonic price indexes

Hedonic prices indexes represent a statistical approach to measuring price increases in the context of rapid multi-dimensional quality improvements. Essentially, the technique uses regression to link the prices of products with as many quantifiable descriptions of their qualities as possible. This enables the changing quality of the products to be removed leaving behind the underlying price increases (or decreases) (Landefeld & Grimm, 2000). This technique gets round the problem of trying to generate the more traditional measures by looking for identical products from one year ago and comparing their prices. The criticism of the technique is that it might overstate the quality improvements by simply measuring the change in technical elements. Similarly, it is argued that if the quality improvements are unused or unwanted, hedonic measures might again overstate the quality improvements. Despite these problems the hedonic approach is the only method that can cope with rapid technical change with many new product introductions.

The major limiting factor against more widespread adoption of the hedonic method is that it requires relatively costly data collection and econometric analysis. As a result, Eurostat has recently established the European Hedonic Centre as described by Konijn et al., (2002) to examine whether a shared European approach is possible.

8 Digital innovation

An inevitable problem for sectoral classifications is that technical change and innovations can make sectors and their definition redundant and create new sectors not covered by the classification. Indeed, many of the changes from NACE Rev 1 to NACE Rev 1.1, as well as the proposed changes to NACE 2007, are the result of such technical changes creating new sectors and changing the nature of existing sectors.

Technical and institutional change can lead to creation of significant numbers of establishments which are poorly covered by the existing classifications. The difference with digitally based developments is that the pace of innovation and technical change can be much faster than previously experienced. This means that when eventually it is time to further revise NACE 2007 to create a putative NACE Rev 3 or 4 it is likely that ICT based developments will underlie many of the changes that will be necessary. This in turn suggests that the intervals between revisions may have to be reduced. However, as more countries use NACE there is a conflicting pressure to increase the intervals as more discussion and links with national systems and priorities need to be taken into account. In part, the problem can be mitigated by using very generalised descriptions of technologies rather than specific technologies such as WAP phones which probably will be superseded by newer technologies. Similarly, the mechanisms for determining NACE case law (Eurostat, 2001) can and should handle many of the new technology based challenges to the classification.

8.1 The telecommunications example

Telecommunications networks used to be based on analogue switching technologies, however over the last decade digital switching technologies have become pervasive. The increasing digitalisation, de-regulation, privatisation and the adoption of internet technologies has allowed a transformation of the traditional telecommunications sector. Today there are companies operating in the telecommunications area which operate only on the basis of leased lines or in terms of a virtual network. Similarly, there are Internet Service Providers (ISPs) that don't own their network and Internet Content Providers that don't own their internet

connection. This wide range of businesses with very different capital structures and business strategies currently all co-exist within the single telecommunications sector.

8.2 Need for a theoretical underpinning

The ability to incorporate new technology based challenges to the NACE classification would be greatly helped if there was a clear theoretical underpinning to NACE as there is with NAICS. NACE evolved from a series of historical classifications and in parts is defined in terms of inputs and elsewhere in terms of outputs. The development of NAICS on the other hand was preceded by a series of theoretical papers from the Economic Classification Policy Committee (ECPC, 1993a, 1993b, 1993c, 1994a, 1994b, 1994c) that underpin the classification. This means that NAICS is consistently based on a 'production orientated' or 'supply based' approach. Taking this consistent approach simplified the process of assigning some establishments to sectors during the development of NAICS. A similar theoretical underpinning for NACE would not only assist future revisions, but could also act as the basis for deciding NACE case law.

Chapter
3

Convergence of NACE and NAICS in 2007

This chapter provides the background on the planned convergence of NACE and NAICS in 2007. The chapter starts by examining the conceptual basis of NAICS, and then introduces the work that has occurred so far on developing a converged classification. In terms of eWork, the most important development is the creation of the 'Information Sector' within NACE 2007 paralleling the similar development in NAICS 2002. Therefore, this new sector, and its impact on eWork measurement, is examined in detail in the next section. This is followed by other sectors where the convergence has eWork measurement implications. These are:

- the computers, communications equipment and electronic components sector
- professional services
- the public private sector split
- establishment versus enterprise data.

1 Conceptual underpinnings of NAICS

One of the strengths of the NAICS system, especially in the context of convergence, is its conceptual underpinning. By contrast the current structure of NACE is a result of many revisions, but no explicit conceptual underpinning. The conceptual underpinning of NAICS is a result of work undertaken by the Economic Classification Policy Committee (ECPC).

1.1 The work of the ECPC

As part of the process leading up to the introduction of NAICS in 1997, an Economic Classification Policy Committee (ECPC) was established, with a brief to develop a theoretical underpinning for new economic classifications taking into account users requirements. Their first report (ECPC, 1993a) drew on an international conference in Williamsburg in 1991. The ECPC examined the relative merits of classifications based on the supply side or 'production orientated' classifications versus the demand side or 'commodity orientated' classifications. The production orientated approach was considered to be the easiest to implement and the most useful in terms of linkage to other data (ECPC, 1993a and 1993c). They examined a range of aggregation structures placing similar sectors into a tree like hierarchical structure (ECPC, 1993b). Given the historical lack of disaggregation in the services sector, they paid special attention to this area (ECPC, 1994a). To help them determine the structure of the sectoral classification they also developed an approach which measured the heterogeneity in term of inputs and outputs of sectors (ECPC, 1994c).

Using these tools and approaches, the ECPC worked with the Canadian and Mexican statistical bodies to develop the original NAICS. The committee were also involved in the 2002 revisions.

2 Operation 2007

Operation 2007 describes the planned revisions of the US/Canadian/Mexican NAICS (North American Industrial Classification System) classifications with NACE (Nomenclature générale des Activités économiques dans les Communautés Européennes or General Industrial Classification of Economic Activities within the European Communities) and ISIC the International Standard Industrial Classification. The aim is to use the planned revisions of all of these classifications to converge them and increase the international comparability .

2.1 NAICS 2002

The NAICS classification system represented a major break for the US as the previous SIC (Standard Industrial Classification) had a single services sector and was based on a structure derived from the 1930's (a useful history and summary is contained in Murphy (1998)). NAICS has a structure based on their production or supply functions, with early preparatory work undertaken by the Economic Classification Policy Committee (ECPC) (see Section 3.1.1 for more information).

2.2 NACE 2002

There have been some changes to NACE Rev. 1 agreed in 2002 for implementation as NACE Rev 1.1 in 2003. As these changes are not widely known, and because some of them have important implications for the measurement of eWork, they have already been covered in this paper. This discussion of NACE Rev 1.1 is embedded within the previous chapter covering the digital challenges to sectoral classifications.

In summary the main relevant changes between NACE Rev 1 and Rev 1.1 were:

- clarification of the software sector
- transfer of some software activities to publishing
- the creation of a call-centre sector.

These new sectors resolve some of the clearest outstanding problems with eWork and sectoral classifications. They are also critical for the proposed convergence of NACE and NAICS in 2007.

2.3 NACE/NAICS 2007 Convergence

A joint working party involving Eurostat, as well as the US, Canadian and Mexican statistical bodies, was set up to examine the potential for convergence between NACE and NAICS. It was realised that these discussions would also have implications for the planned revision of ISIC (the International Standard Industrial Classification) and, therefore, observers from the UN and OECD statistical bodies were also included on the working party.

Given the number of differences, both in terms of concept and detail, between NACE Rev 1.1 and NAICS 2002 a complete convergence between the two classifications was considered to be more costly than justifiable. Therefore, the joint working group proposed a compromise which gives compatibility at the detailed level where practical and justifiable, while elsewhere acknowledging that the only convergence possible is at the highest level (UN, 2002). Most of the changes will have to occur with NACE, but as many of the changes are otherwise desirable, the similar changes would probably have been implemented anyway.

The following sections go into the detail of the proposed converged sectors concentrating on those which have the greatest implications for the measurement of eWork. These are:

- the NACE/NAICS information sector
- the computers, communications equipment and electronic components sector
- the professional services sector, and
- the administrative and support services sector.

3 The NACE/NAICS information sector

A major innovation for NAICS 2002, and the proposed NACE 2007 is the creation of an 'information sector'. This covers book, newspaper, internet and other forms of publishing and well as film, video and sound recording, broadcasting and other forms of distribution. Additionally, the sector also includes tele-communications, internet infrastructure and other internet services. The adoption of an information sector on the NAICS 2002 lines was one of the objectives for the convergence working group. As such, it is not surprising that the NAICS 2002 concept has been adopted virtually wholesale.

Table 3.1: Proposed common high level structure for the information sector

Code	Description
I 1	Publishing industries (except Internet)
I 2	Motion Picture and Sound Recording Industries
I 3	Broadcasting (except Internet)
I 4	Internet Publishing and Broadcasting
I 5	Telecommunications
I 6	Internet Service Providers, Web Search Portals, and Data Processing Services
I 7	Other Information Services

Source: UN (2002a) convergence of classifications

Table 3.1 gives the high level classification of the proposed 'information sector'. Annex A gives more detail of each of these categories, along with all the other converged sectors. The main area of proposed disaggregation below this level which is of interest in terms of classifying eWork is the telecommunications sector, which is examined below.

3.1 The NACE/NAICS telecommunication sector

Currently, within NACE Rev 1.1 the telecommunications sector is non-disaggregated as 64.2 within the post and telecommunications (NACE 64) sector. This reflects the institutional origins of many European telecommunications bodies as originally part of postal, and then telegraph, authorities. In the proposed new NACE/ NAICS structure postal services are transferred to the transport sector and telecommunications to the information sector. Additionally, telecommunications is disaggregated in to six sub-sectors reflecting the range of businesses that changing telecommunications technologies now allow. Details of these sub-sectors are given in Table 3.3.

Table 3.2: Proposed common structure of the computing, communications equipment and electronic components sector

Proposed common structure	Description
F2	Computers, Communications Equipment, Electronic Components
F2.1	Computers and Peripherals
F2.2	Communications Equipment
F2.3	Consumer Electronics
F2.4	Electronic Components
F2.5	Measuring, Testing, Navigating and Control Equipment
F2.6	Electro-medical and Electro-therapeutic
F2.7	Optical Instruments and Equipment
F2.8	Reproduction Blank Magnetic and Optical Media
F2.9	Manufacture of Magnetic and Optical Media

Source: UN (2002a) List of hypothetical changes to NACE Rev 1.1 which would allow further convergence with NAICS 2002

4 The computers, communications equipment and electronic components sector

An important NAICS concept that will have implications for eWork measurement in NACE is the clear separation of electronic products from electrical products. This is clearest in the proposed computers, communications equipment and electronic components sector. Table 3.2 gives the proposed breakdown of this sector.

Table 3.3: Proposed common structure of the telecommunications sector

Proposed Code	Description
I 5.1	Wired Telecommunications Carriers
I 5.2	Wireless Telecommunications Carriers
I 5.3	Telecommunications Resellers
I 5.4	Satellite Telecommunications
I 5.5	Cable and Other Program Distribution
I 5.6	Other Telecommunications

Source: UN (2002a) Convergence of Classifications

By putting all the electronic products and components in one sector the issues around digital embedding, quality and value, as well as the pace of innovation, are concentrated in one sector. This has advantages in terms of developing price indexes and in containing any future changes due to technical change and innovation. The main impact as the working groups report notes will be on the definition and international comparability of the definition of high technology manufacturing sectors (Jagger, 1997).

4.1 A potential content sub-sector

There are a series of papers, largely by French statisticians that argue in favour of a 'Content' sector (Nivelt 2001, Aufrant 2001 and Aufrant, Nivlet 2002). Essentially, they argue that the information sector can be split into an 'information technology sector' and an 'information content sector' (Aufrant, Nivlet, 2002). The information technology sector has parallels with the OECD's 'Information and Communication Technology' or ICT concept. The authors argue that maintaining this split, in essence, maintains the manufacturing/services split, and has greater intellectual coherence than a combined information sector.

5 The professional services sector

The main emphasis in the proposed converged structure in terms of business services is to split them into professional services and 'administrative and support services' (see Section 3.6). The details of the proposed professional services sector are given in Table 3.4. In practice, this creates minimal changes to NACE, with the bulk of interest in terms of eWork focussing on the 'computer services' sector. The converged computer services sector, in practice, is identical to the existing NACE Rev 1.1 'computer and related activities' sector.

Table 3.4: Proposed common structure of the professional, scientific and technical services

Code	Description
M 1	Legal Services
M 2	Accounting Services
M 3	Architecture and Engineering Services
M 4	Technical Testing and Analysis
M 5	Computer Services
M 6	Management Consultancy Services
M 7	Research and Development
M 8	Advertising Services
M 9	Market Research and Opinion Polling Services
M 10	Photography Services
M11	Translation and Interpretation
M12	Design Services
M13	Management of Companies and Enterprises
M14	Other

Source: UN (2002a) List of hypothetical changes to NACE Rev 1.1 which would allow further convergence with NAICS 2002

6 Administrative and support services sector

A series of changes will be needed to both NACE Rev 1.1. and NAICS 2002 to produce a converged administrative and support services sector. Currently, this area is undeveloped in NACE and the creation of this sector will involve the creation of a series of new sectors.

Proposed common structure of the administrative and support services sector is given in Table 3.5.

Table 3.5: Proposed common structure of the administrative and support services sector

Code	Description
N 1	Office Administrative Services
N 2	Facilities Support Services
N 3	Employment Services
N 4	Business Support Services
N 5	Call Centres
N 6	Travel Arrangements and Reservation Services
N 7	Investigation and Security Services
N 8	Services to Building and Dwellings and Industrial Cleaning Services
N 9	Packaging and Labelling Services
N 10	Convention and Trade Show Organization Services
N 11	Other Support Services

Source: UN (2002a) List of hypothetical changes to NACE Rev 1.1 which would allow further convergence with NAICS 2002

Apart from call centres, for which a sector was created in the 2002 revision to produce NACE Rev. 1.1, this proposed convergence will require the creation within NACE of three new sectors. These are:

- office administrative services
- facilities support, and
- travel arrangement and reservation services.

The first two represent completely new ideas, while the travel arrangement and reservation services come from the NACE Rev 1.1 transport sector.

7 The public private sector split

There is a problem with privatised public services, and differing institutional structures, in different countries. For instance, private fire services in some countries are always considered 'public' services while in other countries they would be considered business services. The working party decided that the only way to deal with this variable public/private boundary was to define a series of functions which are always considered to be 'public' regardless of the institutional nature of the performing body. At the same time it was recognised that the widely varying institutional structures meant that any converged sub-sectors would be impossible.

Proposed 'functions' of public administration (UN, 2002) include:

- Activities related to the determination of public policy, including the making of laws
- Activities related to the state's monopoly over the use of force
- Activities related to the provision of public goods

Examples of the first would include: parliaments and legislatures; central banks; policy-making activities of government departments and agencies; regulatory activities of governments; and could include regulatory activities of private entities, where authorised by law, for example law societies.

Examples of the second would include: courts; police and military; prisons; and could include private entities performing these activities

Examples of the third could include: operation of activities with significant positive externalities, such as national parks (UN, 2002).

This definition of the public sector means that in the proposed converged NACE/NAICS classification changes will occur. Private contract operation of prisons will move from NACE Rev 1.1 75.25 to a facilities support classification.

8 Establishment versus enterprise data

Establishments can either be classified in terms of their principal activity or in terms of the principal activity of the enterprise that they belong to. An establishment basis is easier to establish and allows a more detailed picture of the structure of the economy. The main drawback of the establishment approach is that it is often difficult to link this data to the accounting data which is usually reported on an enterprise basis.

NACE use an establishment basis for its sectoral classification. A similar basis was adopted by NAICS when it was set-up, although previous US classifications had been based on enterprises. This meant that NAICS when it was introduced in 1997 had to adopt the new concept to US sectoral classifications of a company management sector.

8.1 Cross border enterprise data

There is a problem of aggregating national enterprise data to create a EU total. The National Statistical Agencies necessarily collect data on a national basis which includes the count of enterprises operating in their country. These data are passed to Eurostat which produces an aggregate figure for the number of enterprises in Europe. However, many of these enterprises can actually be duplicates as parts of a single enterprise operating in multiple countries can be reported by each of the countries as a separate enterprise.

Another problem exists with the potential misclassification of national enterprises if they are not seen in the context of the international enterprise. For instance, a car manufacturing company may only have sales outlets in countries outside of its national base. These national sales outlets level could be recorded as part of a car manufacturing enterprise at the international level but at the national and establishment level they are in the retail sector. Obviously, this example depends on the national sales operations not be established as separate bodies in legal and accountancy terms where they would be separate enterprises.

9 Implications for CPA 1996 and productivity measures

9.1 CPA classification

The product classification used by Eurostat CPA 1996 (Classification of Products by Activity) (Eurostat, 1998) is closely linked to NACE Rev 1, such that the first four digits of the six digit product codes are NACE Rev 1 four digit class codes. This means that every product is considered to be an output of a single NACE Rev 1 sector. Importantly, the CPA classification covers services as well as goods.

There will implicitly need to be a restructuring of the CPA to take account of the changes to NACE. However, the convergence working group has identified further problems. 'The scenario implies ... the relaxing of a strict one-to-one relationship between detailed industry classes and classes of the CPA ...' (UN, 2002a). Given the extent to which digitally based services appear to be produced by a wider range of sectors than a strict one to one relationship would imply (see the Digital uncoupling Section 2.5), this is another potential area of benefit. At this stage of the convergence process the full implications for the CPA have yet to be elaborated, but this is obviously an issue to be watched.

9.2 Breaking the product sector linkage

The NAICS classification is based on a production function whereby each sector uses similar inputs. This, in turn, means in theory, and in practice, that some products could be made using different inputs by different sectors. On the other hand NACE has at its core the idea that individual products can only be produced by one sector. The convergence working party recognised that one of the consequences of convergence will be moving towards the NAICS model where products might have a normal sector of production but that they are not limited to that sector.

9.3 The introduction of NAPCS

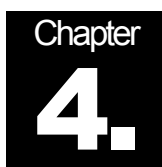
North American Product Classification System. (NAPCS) is a project derived from the adoption of NAICS, and involves the development of a common product classification designed to complement NAICS. Powell-Hill, (1997) outlined the problems associated with developing a product classification system once it is accepted that products can be produced by more than one sector. Despite this de-linking so far the NAPCS has been developed on a sectoral basis by sector basis, with the 'information sector' one of those sector covered so far. Since NACPS has a built in linkage to the World Customs Organisation's Harmonised System

(WCO, 2002). This suggests that NACPS may act as the basis for a new converged product classification that replaces the CPC.

10 Linkage to ISIC Revision 3

The UN have a parallel process under way which will see a major revision of ISIC (the International Standard Industrial Classification) in 2007. This will become ISIC Revision 4. UN and OECD observers have been sitting in on the NACE/NAICS Convergence Working Group.

The UN has also surveyed countries and international agencies about potential features of ISIC Rev 4. One of the questions dealt with the concept of an information sector. Of the 46 responses to the survey, 34 had a view about the information sector, and 94 per cent of these were positive responses. Japan has also recently adopted an Information Sector (Matsuo, 2002) in their recent reclassification of JSIC (Japanese Standard Industrial Classification). This suggests that the forthcoming changes will bring ISIC into line with the converged NACE/NAICS in this regard. It is also likely that further aspects of the converged NACE/NAICS will be incorporated into the ISCI revision.

Chapter
4.

Conclusions

This chapter draws together the discussion of the challenges to sectoral classifications posed by eWork in Chapter 2, and the relevant details of the proposed convergence of NACE and NAICS in Chapter 3. As such this chapter aims to examine the extent to which the proposed converged classification meets the challenges posed by eWork.

1 The contribution of NACE Rev 1.1

Before moving on to discuss the impact of convergence the contribution towards the better measurement of eWork of the changes to NACE introduced in 2002 as part of Rev 1.1 need to be noted.

NACE Rev 1.1 introduces a sector for 'Call-centres' which deals with a significant digital challenge to NACE Rev 1. At the same time the wholesale and retail sector definitions are updated to account for B2B eCommerce and B2C eCommerce.

2 General issues

2.1 The information sector

The proposed convergence of NACE and NAICS was in part driven by the European desire to adopt an information sector. The creation of an Information sector addresses a range of eWork related problems with the existing classifications. Essentially, the sector brings many of the problems together into one sector. This means that the particular problems posed by digital content can be addressed in this sector. By bringing together most of the digitised content producing areas into one sector issues such as sector hopping, and measuring the changing value of products, are simplified.

The concept of an information sector is not without its critics but the problems it creates are generally seen as being outweighed by its benefits. The major issue is that the concept of an information sector implies the de-linking of products and sectors. This is addressed in more detail in section 4.2.2 below.

Another issue that the information sector will create is that it will no longer be possible to create a manufacturing/services split using two digit data. This is a problem, but it should be recognised that this split is no longer clean in practice with many business services already substituting for processes that were previously classified in the manufacturing sector. Equally, the split used to be more relevant given the absence of detailed comparable data covering the services sector.

2.2 De-linking products and sectors

An important feature of the proposed converged NACE and NAICS is the de-linking of products to single sectors. This is seen as an inevitable result of the creation of an information sector. The de-linking creates some problems with the creation of National Accounts, specifically linking the trade data which is collected using a product classification to enterprise, or establishment data collected using a sectoral classification. The example of NAPCS shows that a robust product classification is possible without the insistence on a one to one relationship with sectors as with the CPA classification.

In the context of a converged sectoral classification there will obviously need to be a parallel revision of the CPA classification. It is likely, if only to maintain comparability with NAPCS, that the revised CPA will also allow some products to be produced by more than one sector. This in turn will need some consideration as to how data coded using a revised CPA is integrated with National Accounts data.

3 Digital challenges

Chapter 2 introduced a series of digital challenges to sectoral classifications. This section revisits each of these challenges and examines the extent to which the proposed convergence of NACE and NAICS addresses these challenges.

3.1 Digital convergence

The increasing tendency for digitised content to transfer from one format to another and in the process transfer from one sector to another. The examples given in Section 2.3 mainly come from the information sector where this phenomena can be more clearly identified. By putting most of the converging sectors within the information sector this will keep the problem contained within a high level categorisation. Although this does not eliminate the problem it does reduce the impact on aggregate data and exercises such National Accounts.

3.2 Digital mobility and flexibility

The main examples of the challenges posed by the mobility and flexibility enabled by digitalisation in Section 2.4 involved call centres and eCommerce. In many ways the most glaring problems of both call centres and eCommerce were dealt with in NACE with the revisions to create NACE Rev 1.1. The separate call centre sector in continued into the proposed NACE/NAICS converged structure. However, given the differing concepts underlying the definition of wholesale and retail between the two classifications, the proposed converged structure simply aggregates wholesale and retail sales into a sales sector. While this eliminates some potentially costly changes to NACE and NAICS this does mean that there is less pressure to clarify the boundaries between B2B eCommerce and B2C eCommerce in both classifications. This will remain an issue that will have to be addressed in the future.

3.3 Digital uncoupling

The concept of digital uncoupling refers to the ability of an establishment to operate in a number of sectors given the low entry costs caused by multi-purpose digitised capital goods (see Section 2.5). Essentially, establishments are more likely to have multiple activities that fall into multiple sectors. Although, digitalisation makes this easier this is a problem that has long been recognised and applies to whatever sectoral classification that is adopted. As such, the convergence of NACE and NAICS is not going to affect this problem. The only exception is due to the extent that the creation of an information sector reduces the problems due to convergence and means that most of the hopping occurs within this new sector.

There will remain problems with business registers and establishments sector hopping. As a result, there will have to be increased efforts to ensure that sectoral classification assigned to an establishment in the registers are checked on a regular basis.

3.4 Digital embedding

The added functionality enabled by digitally embedded features can cause problems for sectoral classifications as outlined in Section 2.6. The potential of embedding means that the added value created by manufacturers may increasingly be due to the embedded hardware and software in the product rather than the non-enhanced product. The sectoral classification is based in the business activity of an establishment that generates the most added value. This means that it is more than possible that many traditional manufacturers may need to be reassigned to the electronics or software sector.

This problem of embedding is going to occur whatever the classification system that is used. As such, the converged NACE/NAICS will make no difference. However, there may be a case for recognising the increasing ubiquity of embedded hardware and software and refocus the classification of establishment onto the primary products produced through the manufacturing process rather than the added value embedded into the product through digitalisation.

3.5 Digital quality and value

There are recognised problems (see Section 2.7) with measuring the value of digital products as a result of the rapid and discontinuous change in quality of the products. It is also increasingly recognised that hedonic measures are the best way to address this problem. However, it is also acknowledged that hedonic measures are more difficult, and hence more expensive, to produce than the traditional measures.

The proposed converged structure for NACE/NAICS offers advantages in this area. The creation of a new 'computers, communications and electronic components carefully separates out the non-digital office machinery products and the non-active electronic components. This means that the deflators for the new sector based on hedonic measures from digital products will not be submerged by non-digital products. Not only will this make the hedonic measures a more accurate reflection of changing values within the sector it will also enable fewer hedonic measures to be used.

Similarly, the new information sector (Section 3.3) and within it the new telecommunications sector (Section 3.3.1) allow greater clarity in generating deflators. The telecommunications sector allows the differing industries now operating under the telecommunications umbrella with their differing inflationary pressures to be separately accounted for. On the other hand the information sector by bringing together producers of products using similar production processes (Section 3.1) enables the more widespread coverage of specific digitally based deflators. More generally the production based approach of NAICS means that the cost pressures from the inputs are likely to be more homogeneous. This means that any deflators applied to these sectors are more likely to be reflected across the sector.

3.6 Digital innovation

The remaining digital challenge to sectoral classification is the rapid pace of digital innovation. This causes a range of problems outlined in Section 2.8, centred on the pace of creation of new products, processes and types of establishment. In part this problem can be addressed by writing deliberately open ended and non-technology constrained sectoral definitions. The process can also be eased by ensuring that there is a consistent theoretical underpinning to the classification as mentioned in Section 2.8.2. Both of these approaches eases the process

of identifying the correct existing sector for new development and enables the need for any new sectors to be more clearly identified.

There is nothing specific about the proposed NACE/NAICS structure apart from the clearer theoretical underpinning that will make dealing with the pace of digitally enabled innovation easier to deal with. However, NAICS is committed to a five year cycle of revision and at this stage it is not clear whether the convergence will in the long run commit NACE to a similar revision cycle. If NACE does adopt a five year cycle then this will ensure a more consistent and rapid pattern of revision than in the past.

4 Terminology

Terminology is still an issue and there will remain unsolved problems that will still need to be addressed. NACE and NAICS use the terms 'sector', 'division' and 'class' to refer to differing levels of their classifications. This means that throughout this paper the term 'sector' has been used to refer to a consistent grouping of establishments rather than a specific level of classification. There will be a requirement to establish a common terminology to avoid confusion between the two classifications.

5 Overall

Overall, the proposed convergence of NACE and NAICS will solve, or at least address, most of the problems that eWork causes for the existing NACE classification. Most of the remaining problems are unlikely to be solved by any sectoral classification system. However, there remain some features of eWork and digital developments that will have to be closely monitored to ensure minimal impact.

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Annex A: NACE-NAICS Convergence Project

Convergence scenario #1 – Same structure option

A Agriculture, Forestry, Fishing and Hunting

A1 Agriculture

A1.1 Crop Farming

A1.11 Vegetable, Greenhouse, Nursery and Other Horticultural Farming

A1.12 Fruit, Nut, Beverage, Spice and Other Crop Farming

A1.13 Other Crop Farming

A1.2 Animal Farming

A1.21 Cattle Ranching and Farming

A1.22 Hog and Pig Farming

A1.23 Poultry and Egg Production

A1.24 Sheep and Goat Farming

A1.25 Aquaculture

A1.26 Other Animal Farming

A1.3 Mixed Farming

A1.4 Support Activities to Agriculture

A1.41 Support Activities to Crop Farming

A1.42 Support Activities to Animal Farming

A2 Forestry

A2.1 Forestry and logging

A2.2 Support Activities to Forestry

A3 Fishing, Hunting and Trapping

A3.1 Fishing

A3.2 Hunting and Trapping

B Mining

B1 Mining and quarrying of energy-producing materials

B1.1 Mining of coal and lignite; extraction of peat

B1.2 Extraction of crude petroleum and natural gas

B1.3 Mining of uranium and thorium ores

B2 Mining of metal ores, except uranium and thorium

B2.1 Mining of iron ores

B2.2 Mining of non-ferrous metal ores, except uranium and thorium

B3 Quarrying and other mining

B3.1 Quarrying

B3.2 Mining of chemical and fertiliser minerals

B3.3 Other quarrying and mining, n.e.c.

B4 Support activities for mining

B4.1 Support activities for mining and quarrying of energy-producing materials

B4.2 Support activities for other mining and quarrying

C Utilities

- C1 Electric Power Generation, Transmission and Distribution
- C2 Natural Gas and Other Gas Distribution
- C3 Water Supply and Irrigation Systems
- C4 Steam and Air Conditioning Supply

D Construction

- D1 Building construction
 - D1.1 Residential
 - D1.2 Non-residential
- D2 Civil Engineering Works
- D3 Special Trades

E/F Manufacturing

- E1 Food, Beverages and Tobacco
 - E1.1 Food
 - E1.11 Meat
 - E1.12 Fish
 - E1.13 Dairy Products
 - E1.131 Dairy (except frozen)
 - E1.132 Ice Cream and Frozen Desserts
 - E1.14 Prepared Animal Feeds
 - E1.15 Other Foods
 - E1.151 Sugar
 - E1.152 Cocoa and Chocolate
 - E1.153 Tea and Coffee
 - E1.154 Condiments and Seasonings
 - E1.155 Other
 - E1.2 Beverages
 - E1.21 Mineral Water and Soft Drinks
 - E1.22 Beer
 - E1.23 Wine and Spirits
 - E1.3 Tobacco
- E2 Textiles, leather and apparel
 - E2.1 Textiles
 - E2.11 Fibre, Yarn and Thread
 - E2.12 Fabric Mills
 - E2.121 Knit Fabric Mills
 - E2.122 Other Fabric Mills
 - E2.13 Other Textile Industries
 - E2.131 Carpet and Rugs
 - E2.132 Other
 - E2.2 Leather
 - E2.21 Tanning
 - E2.22 Footwear
 - E2.23 Leather Accessories and other products
 - E2.3 Apparel
 - E2.31 Apparel Knitting Mills

E2.32 Cut and Sew Apparel Manufacturing

E2.33 Apparel Accessories and Other Apparel

E3 Wood Products

E4 Paper Manufacturing

E4.1 Pulp, Paper and Paperboard

E4.11 Pulp

E4.12 Paper and Paperboard

E4.2 Paper Products

E4.21 Sanitary Goods and Toilet Requisites

E4.22 Stationary

E4.23 Other Paper Products

E4.3 Printing and Related Services

E4.31 Printing

E4.32 Printing Related Services

E5 Plastic and Rubber Products

E5.1 Plastic Products

E5.2 Rubber Products

E5.21 Tires

E5.22 Retreading Tires

E5.23 Other Rubber Products

E6 Fossil and Mineral Fuel Products

E6.1 Oil Refineries

E6.2 Nuclear Fuel Processing

E6.3 Other Petroleum and Coal Products

E7 Chemical Products

E7.1 Basic Chemicals

E7.11 Petrochemical products

E7.12 Industrial Gases

E7.13 Dyes and colours

E7.14 Inorganic Chemicals

E7.15 Basic Organic Chemicals, n.e.c.

E7.2 Resin, synthetic rubber and synthetic fibres

E7.21 Resin and synthetic rubber

E7.22 Synthetic fibres

E7.3 Fertilisers, pesticides and other agrochemicals

E7.31 Fertilisers

E7.32 Pesticides and other agrochemicals

E7.4 Paints, adhesives and sealers

E7.41 Paints and printing inks

E7.42 Adhesives and sealers

E7.5 Pharmaceutical and medicine

E7.51 Basic pharmaceuticals

E7.52 Medicines

E7.6 Soap, Cleaning Compounds and Toilet Preparations

E7.61 Soap and Cleaning Compounds

E7.62 Toilet Preparations

- E7.7 Other Chemical Products
 - E7.71 Explosives
 - E7.72 Photographic chemicals
 - E7.73 All Other Chemicals
- E8 Non-metallic Mineral Products
 - E8.1 Glass
 - E8.2 Clay
 - E8.3 Refractory Products
 - E8.4 Other
- E9 Primary Metals
 - E9.1 Iron and Steel Mills, Ferro-Alloy Manufacturing and Steel Product Manufacturing from Purchased Steel
 - E9.11 Iron and Steel Mills and Ferro-Alloy Manufacturing
 - E9.12 Iron and Steel Pipe Manufacturing from Purchased Steel
 - E9.13 Other Iron and Steel Product Manufacturing from Purchased Steel
 - E9.2 Alumina and Aluminium Production and Processing
 - 9.3 Non-ferrous Metal (except Aluminium) Production and Processing
 - E9.4 Foundries
 - E9.41 Ferrous Metal Foundries
 - E9.42 Non-ferrous Metal Foundries
- F1 Fabricated Metal Products
 - F1.1 Architectural and Structural Metals Manufacturing
 - F1.11 Structural Metals
 - F1.12 Ornamental and Architectural Metal Products
 - F1.2 Boiler, Tanks and Shipping Container Manufacturing
 - F1.21 Metal container manufacturing
 - F1.22 Industrial Boilers and Tanks
 - F1.3 Forging and Stamping
 - F1.4 Metal coating and finishing and machine shops
 - F1.41 Metal coating and finishing
 - F1.42 Machine shop and Turned Product and Screw Manufacturing
 - F1.5 Cutlery, kitchen utensils and hardware manufacturing
 - F1.51 Cutlery and kitchen utensils
 - F1.52 Hand tools
 - F1.53 Hardware manufacturing
 - F1.6 Products made of purchased wire
- F2 Computers, Communications Equipment, Electronic Components
 - F2.1 Computers and Peripherals
 - F2.2 Communications Equipment
 - F2.3 Consumer Electronics
 - F2.4 Electronic Components
 - F2.5 Measuring, Testing, Navigating and Control Equipment
 - F2.6 Electro-medical and Electro-therapeutic
 - F2.7 Optical Instruments and Equipment
 - F2.8 Reproduction Blank Magnetic and Optical Media
 - F2.9 Manufacture of Magnetic and Optical Media
- F3 Electrical Equipment

F3.1 Electric Motors and Generators

F3.2 Battery Manufacturing

F3.3 Wiring Devices

F3.4 Electric Lighting

F3.5 Household Appliances

F3.6 Other Electrical

F4 General Purpose Machinery

F4.1 Ventilating, Heating and Cooling

F4.2 Engines and Power Transmission Equipment

F4.3 Lawn and Garden Equipment and Power Tools

F4.4 Pumps and Compressors

F4.5 Material Handling Equipment

F4.6 Arms, Ordnance and Ammunition

F4.7 Other General Purpose

F5 Special Purpose Machinery

F5.1 Agriculture and Forestry Machinery

F5.2 Construction and Mining Machinery

F5.3 Metal Working Machinery

F5.4 Special Industry Machinery

F6 Furniture

F6.1 Furniture

F6.2 Mattress

F7 Miscellaneous

F7.1 Medical and Dental Instruments and Supplies

F7.2 Jewellery and Cutlery

F7.3 Sporting Goods

F7.4 Games and Toys

F7.5 Signs

F7.6 Other Miscellaneous

F8 Transportation Equipment

F8.1 Motor Vehicles

F8.2 Motor Vehicle Parts

F8.3 Aircraft and Spacecraft

F8.4 Railroad Locomotives and Rolling Stock

F8.5 Shipbuilding

F8.6 Other Transportation Equipment

G Wholesale and Retail Trade

H Transportation and Storage

H1 Land Transport

H1.1 Rail Transport

H1.2 Other Land Transport

H1.21 Passenger, Scheduled

H1.22 Passenger, Other

H1.23 Taxi

H1.24 Freight

H1.3 Pipeline

- H2 Water Transport
 - H2.1 Deep Sea
 - H2.2 Inland
- H3 Air Transport
 - H3.1 Scheduled
 - H3.2 Non-scheduled
- H4 Scenic Transportation
- H5 Support Services
 - H5.1 Rail and Road Specific
 - H5.2 Water Specific
 - H5.3 Air Specific
 - H5.4 Freight Arrangement
 - H5.5 Cargo Handling
- H6 Courier and Postal
 - H6.1 Couriers
 - H6.2 Postal
- H7 Storage and Warehousing

I Information

- I1 Publishing Industries (except Internet)
 - I1.1 Newspaper, Periodical, Book and Database Publishers
 - I1.11 Newspaper
 - I1.12 Periodical
 - I1.13 Book
 - I1.14 Directory and Mailing List
 - I1.15 Other Publishers
 - I1.2 Software Publishers
- I2 Motion Picture and Sound Recording Industries
 - I2.1 Motion Picture and Video Industries
 - I2.11 Motion Picture and Video Production
 - I2.12 Motion Picture and Video Distribution
 - I2.13 Motion Picture and Video Exhibition
 - I2.14 Post-Production and Other Motion Picture and Video Industries
 - I2.2 Sound Recording Industries
 - I2.21 Record Production
 - I2.22 Integrated Record Production/Distribution
 - I2.23 Music Publishers
 - I2.24 Sound Recording Studios
 - I2.25 Other Sound Recording Industries
- I3 Broadcasting (except Internet)
 - I3.1 Radio and Television Broadcasting
 - 3.11 Radio Broadcasting
 - 3.12 Television Broadcasting
 - I3.13 Pay and Speciality Television
- I4 Internet Publishing and Broadcasting
- I5 Telecommunications
 - I5.1 Wired Telecommunications Carriers

I5.2 Wireless Telecommunications Carriers (except

I5.3 Telecommunications Resellers

I5.4 Satellite Telecommunications

I5.5 Cable and Other Program Distribution

I5.6 Other Telecommunications

I6 Internet Service Providers, Web Search Portals, and Data Processing Services

I6.1 Internet Service Providers, Web Search Portals

I6.2 Data Processing, Hosting, and Related Services

I7 Other Information Services

I7.1 News Syndicates

I7.2 Libraries and Archives

I7.3 All Other Information Services

J Hotels and Restaurants

J1 Hotels

J2 Other Traveller Accommodation

J3 Foods Serving and Special Food Places

J4 Drinking Places

K Finance and Insurance

K1 Finance

K1.1 Central Banking

K1.2 Depository Credit Intermediation

K1.3 Other Financial Intermediation

K2 Insurance

K2.1 Life Insurance

K2.2 Non-life Insurance

K2.3 Reinsurance

K3 Other Financial Industries

K3.1 Administration of Financial Markets

K3.2 Other Financial Ancillary Activities

K3.3 Insurance Related Activities

L Real Estate and Rental and Leasing

L1 Real Estate

L1.1 Lessors for Real Estate

L1.2 Real Estate Agencies

L1.3 Activities Related to Real Estate

L2 Rental and Leasing

L2.1 Consumer Goods Rental

L2.2 Motor Vehicle Rental

L2.3 Rental of Other Transport Equipment

L2.4 Rental of Office Equipment

L2.5 Commercial and Industrial Machinery and Equipment Rental

M Professional, Scientific and Technical Services

M1 Legal Services

M2 Accounting Services

M3 Architecture and Engineering Services

M4 Technical Testing and Analysis

- M5 Computer Services
- M6 Management Consultancy Services
- M7 Research and Development
- M8 Advertising Services
- M9 Market Research and Opinion Polling Services
- M10 Photography Services
- M11 Translation and Interpretation
- M12 Design Services
- M13 Management of Companies and Enterprises
- M14 Other

N Administrative and Support Services

- N1 Office Administrative Services
- N2 Facilities Support Services
- N3 Employment Services
- N4 Business Support Services
- N5 Call Centres
- N6 Travel Arrangements and Reservation Services
- N7 Investigation and Security Services
- N8 Services to Building and Dwellings and Industrial Cleaning Services
- N9 Packaging and Labelling Services
- N10 Convention and Trade Show Organisation Services
- N11 Other Support Services

O Education

- O1 Primary and Secondary Education
- O2 Higher Education
- O3 Other Miscellaneous Education

P Health and Social Services

- P1 Hospital activities
- P2 Medical practice activities
- P3 Dental practice activities
- P4 Other human health activities
- P5 Veterinary activities
- P6 Social Work Activities

Q Arts, Entertainment and Recreation

- Q1 Museums, Historical Sites and Buildings
- Q2 Botanical and Zoological Gardens and Nature Reserves
- Q3 Gambling and Betting Activities
- Q4 Other

R Sanitation

- R1 Collection and Treatment of Sewage
- R2 Collection and Treatment of Other Waste
- R3 Sanitation, Remediation and Similar Activities

S Repair and Maintenance

- S1 Repair and Maintenance of Motor Vehicles
- S2 Consumer Electronics Repair
- S3 Computer and Office Machinery Repair

S4 Other Commercial and Industrial Machinery Repair and Maintenance

S5 Appliance Repair and Maintenance

S6 Re-upholstery and Furniture Repair

S7 Footwear and Leather Goods Repair

S8 Other Personal and Household Goods Repair

T Other Services

T1 Services of Associations and Organisations

T1.1 Business Associations

T1.2 Professional Associations

T1.3 Trade Unions

T1.4 Religious Organisations

T1.5 Political Organisations

T1.6 Other Associations

T2 Personal Care Services

T3 Washing and Dry Cleaning Services

T4 Funeral and Related Activities

T5 Other Services

T5.1 Extra-territorial Organisations and Bodies

T5.2 Private Households with Employed Persons

T5.3 All Other Services n.e.c.

U Public Administration