Working Party on National Accounts

APPROACH TO RE-DEVELOPING NATIONAL ACCOUNTS IN THE UNITED KINGDOM

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APPROACH TO RE-DEVELOPING NATIONAL ACCOUNTS IN THE UNITED KINGDOM

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ABSTRACT

The UK National Accounts, and more widely, Economic Statistics have been the subject of a number of external reviews in recent years against a backdrop of a long-running development programme. These reviews together with the implementation of ESA 2010 / BPM 6 have led to the demand for an expansion of the current production framework to include products like Supply and Use Tables in previous years' prices and Extended Financial Accounts including 'Whom to Whom' Accounts.

In order to address these new requirements, a fundamental review of the production process used to compile the accounts has been carried out which has lead to a new architecture being developed. This review includes changes to the methods, processes and systems used to compile the accounts to meet today and tomorrow's needs.

This paper sets out the re-developments, process and progress to date.

1. BACKGROUND

The Office for National Statistics (ONS) have been in an ongoing process of re-developing the data sources, methods and systems used to compile the National Accounts and other integrated outputs1 for many years. This was first set-out in an article in 2004 (Tuke and Aldin, 2004) which led to the introduction of a new time series platform (CORD2). As a consequence of the relocation of the National Accounts Team from London to Newport and the major classification change to ISIC Revision 4, the platform was first used properly in 20113.

However, whilst the GDP and Supply and Use Tables system moved over the new CORD platform, the Sector and Financial Accounts and Balance of Payments stayed on the old system. Further progress in re-platforming was put on hold due to the build-up to the introduction of the SNA 2008/ESA 2010 and BPM6 for the UK.

Along with many other countries, the ONS faces pressure to reduce budgets at the same time as increased demand for new, and more detailed, statistical information. Two external reviews have been held in recent years covering Economic Statistics (Barker and Ridgeway (2014) and Bean (2016))4. These

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1 The ONS is the main producer of Official Economic Statistics in the UK and produces National Accounts, Government Finance Statistics, Balance of Payments, Short Term Indicators and Regional Accounts. These outputs are all integrated and consistent. In this article, National Accounts is used a short-hand for the wider conceptual framework.
2 CORD stands for Central ONS Repository for Data, reflecting the early aim of the platform. It is now the strategic platform for aggregate level time series data
3 The CORD Platform was introduced for the production of Supply and Use Tables compilation initially in 2008.
4 A further review, focussed on prices (Johnson (2015)), was published in the intervening year.
covered a large number of priorities including productivity, measuring the digital economy, the service sector and intangible assets. The focus of this paper covers:

- the need to improve the volume measurement of GDP (through the introduction of Supply and Use Tables in Previous Years’ Prices (SUT-PYP));
- increase detail in the financial sector (through detailed Flow of Funds presentation); and
- exploit the use of administrative and other Big Data.

The UK government has funded the Economic Statistics Transformation Programme to take this work forward.

2. REASONS FOR REVIEW

Against the backdrop described above, the mixture of platforms for compiling the National Accounts has led to the production process being overly complex, inefficient, difficult to run and time consuming – especially the currently manual processes of balancing the accounts and the alignment issues presented by quarterly seasonally adjusted data. The complexity also leads to them being inflexible, making simple changes more difficult and fundamental changes extremely challenging.

The current production process and publication schedule for many parts of the accounts has been in place since the early 1990s, when the preliminary estimate of UK GDP around 25 days after the quarter was introduced. When the new requirements were assessed, it was clear that the current approach was not sustainable and a new design was required.

Another driver for the review is the aim of using more automation tools to optimise the balance between quality and processing time. This is particularly important with the increased requirements of producing and balancing Supply and Use Tables in previous years’ prices to supplement the Supply and Use Table in current prices.

The use of rules based balancing within the production process has recently been agreed. Work is continuing to prototype and to develop the models and approach that will be used. The UK is part of a group of countries working collaboratively to share experiences in this area. Regular discussions have been held with the Netherlands, Australia and New Zealand.

3. APPROACH

In developing the design of the target production process we considered the following:

- Lessons learnt from the processes already undertaken via the CORD platform.
- How new statistical products should be integrated into the production process.
- How the principles of Enterprise Architecture, the Common Statistical Production Architecture (CSPA) and the Generic Statistical Business Process Model (GSBPM) could be applied to introduce modularity and re-usability.

The statistical production process for National Accounts has been split into key stages which are built up from lower level building blocks. Each building block sets out the data, methods, physical systems, processes and people required to transform a set of input data to an output, in an agreed format and to a

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5 See UNECE, 2015 for more details
6 See UNECE, 2013 for more details
required standard of quality. When combined, the statistical process at a basic level carries out the following:

- Take data from a wide range of sources.
- Create from input data the National Accounts concepts.
- Analyse and balance the concepts through a set of accounting frameworks.
- Produce the outputs required for dissemination

4.1. High-Level Production Process

In developing the target production process, a generic staged approach has been developed, based on the GSBPM. The process sets-out eight key stages but the National Accounts process is not linear and will involve iterations, for example, as a result of data validation or balancing. This is set-out in Figure 1.

Whilst produced independently, this has a great similarity to the steady states approach presented at the OECD NAWP Meeting in 2015 by Statistics New Zealand.

4.2. Building Blocks Approach

The high-level production process stages shown in Figure 1 simply set-out the capabilities needed. It is the building blocks defined below that level that are used to create the production process. Building Blocks bring together People, Process and Technology to realise a business need. Once built, they can then be integrated together to form the business process. The approach taken will mean that the overall process can be flexible and the process adapted to meet business needs.

Figure 2 illustrates how the GSBPM, Production Process, Building Blocks and Services fit together.
Figure 1 - Summary view of Production Process

0 COLLECT DATA
Collect data from various internal and external data sources – this is numbered as zero as it is considered to be outside of the National Accounts production process.

1 INPUT & PRE-PROCESS
Map input data to National Accounts classifications, aggregate or pro-rate to required classification detail, pre-process to create a complete dataset to the required frequency and apply adjustments for error corrections, quality adjustments and conceptual adjustments (cut-off and exhaustiveness).

2 COMPILE UNBALANCED
Compile unbalanced and unconstrained data by National Accounts concepts (e.g., transactions and assets) and then generate unbalanced accounts (Supply and Use Tables and Sequence of Accounts).

3 BALANCE ACCOUNTS
Balance accounts in current prices using manual and automatic rules based balancing on quarterly data. Then derive Supply and Use Tables in previous years’ prices.

4 ALIGNMENT
Apply seasonal adjustment to balanced data and then align data across quarters for accounts.

5 DERIVED OUTPUTS
Derive outputs from balanced data for more detailed breakdowns (i.e., COICOP, Non-Financial Assets, Geographic) and alternative presentations (i.e., Balance of Payments).

6 FINALISE OUTPUTS
Interpretation of output data and production of analysis for publication purposes. Application of disclosure controls.

7 DISSEMINATE
Prepare data for dissemination both domestically and international transmissions.
Figure 2 - Summary of Building Block Approach
4.3. High-Level Development Process

In order to implement changes to the production process (i.e. from new data sources and methods, system re-design and process changes) it is managed via a generic development process that has been used for several years. Such a managed process is important for the UK, as there are a significant number of updates each year to the accounts including benchmarking often affecting many years. The numbers of teams involved and the interaction between methods and systems means that the process needs careful, and orderly, management of the development through to implementation phase.

The process follows the high-level structure, with mappings to the GSBPM as shown in Figure 3:

Figure 3 - Development Framework

Each of the statistical definition and systems development stages has a specific set of deliverables and quality assurance processes.

4.4. Supply and Use Tables Balancing

In the UK, the Supply and Use Tables framework is presently used for setting the level of GDP for annual data in current prices. Under the Target Production Process, this framework will be extended to balancing in previous years’ prices and on a quarterly basis. The current approach for balancing GDP in volume terms is as follows:

- GDP (O), the short-term production measure of GDP (which uses output as a proxy for GVA), is used as the best estimate of short term movements in the economy.
- However, as GDP (P) (based on estimates of gross value added derived from intermediate consumption deducted from output) is only calculated in current prices for annual data. Thus GDP (E) is the determinant of annual benchmarked volume growth.

The future approach will produce a fully balanced volume measure through the Supply and Use Tables framework on a quarterly basis, making the best use of all available data.

In order to be able to achieve this each quarter, automatic rules-based balancing will be used alongside manual balancing. As noted earlier, the UK is collaborating with other countries on this to share experiences and learn lessons.
4.5. Institutional Sector Accounts

Another particular feature of the UK National Accounts system is the GDP-centric approach to balancing. The current production process balances the Supply and Use Tables first and then moves onto balancing institutional sectors. However, all subsequent balancing is constrained to the original balanced GDP. This approach will be changed in the target production process so that the full set of Institutional Sector Accounts will feed into the balancing process.

In addition, having developed these tools for balancing Supply and Use Tables, they can also be applied to other areas such as whom-to-whom accounts.

Whilst the UK produces the full sequence of accounts covering both non-financial accounts and financial accounts, including balance sheets for all institutional sectors, users have prioritised the production of detailed whom-to-whom financial accounts. This has led to the development of the Extended Financial Accounts project which has started work on improving the depth and quality of data for the financial sector. This work is being conducted in conjunction with the Bank of England.

The new data sources and methods will be incorporated into the National Accounts over time, with the aim of producing data at a more detailed level.

4.6. Technology Model

Since 2011, the UK has used an in-house compilation platform for producing the National Accounts, where a new platform (CORD) was introduced for processing Supply and Use Tables and GDP, whilst Institutional Sector Accounts and Balance of Payments remained on the old platform (CSDB).

CORD uses a service-oriented architecture to provide a metadata based statistical production platform. It uses Oracle as the underlying database and uses SAS and X13 for time series functions. Figure 4 illustrates this model.

Figure 4 - CORD IT Model

CORD provides the business area with a set of services which can be figured to process and analyse aggregate level time series data. At a basic level, these include:

- Import data from ONS and other sources.
• Process data through using over thirty statistical functions (summarised in Figure 3).
• Data security through user permissions.
• Analysis tools: quality assurance checks, cross-tabs and graphs.
• Export data to SDMX, CSDB, Excel, CSV and PDF.

CORD allows the business area to define a statistical process that run from end-to-end. At the higher level, these processes can be joined together to run an integrated process – for example, the data required to balance the Supply and Use Tables is run as one process across fourteen separate compilation systems. At present, the services provided by CORD are only accessible within the platform.

4.7. Technology Strategy

The ONS plans to move all National Accounts compilation systems to the CORD platform and re-design existing systems to meet the target production process. Under the wider work in the ONS on transformation, CORD is the corporate aggregate time series platform. Other platforms are being rationalised and re-developed for data collection, survey and admin data processing.

A set of principles have been developed to govern how National Accounts:

• use the existing technology available to us, addressing current issues and helping to deliver key elements of the strategy; and
• will consider new technology, in collaboration with our IT department, for any future requirements.

The first set of principles defines what software forms the strategic choice, what is tolerated and when we will look to retire platforms.

The second set of principles governs how we will assess technology solutions and they are considered in the following order:

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<th>Order</th>
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<th>Detail</th>
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| 1     | Reuse             | Where requirements are met, we will reuse technology that we have already identified as strategic and where significant investment has already been made. Key factors included in this assessment would be:  
  • Reduced costs for implementing requirements compared to other options.  
  • Compliance to National Accounts Architectural governance.    |
| 2     | Share             | Share and use technology at three levels:  
  • Where it is available within ONS  
  • Available within Government and be used by ONS  
  • Available within the wider International Statistical Community |
| 3     | Open Source       | To take advantage of and use open source technology, where they meet requirements plus any standards we may have around stability, resilience and security. |
| 4     | Purchase or Hire  | Off the shelf technology solutions where requirements cannot be met by any of the previous principles. |
| 5     | Build in House    | Only to be considered as a final option if requirements cannot be met by any of the previous principles. |
The remaining principles in this area define the boundaries aligning with the other strategic platforms being developed.

4. PLANS AND ORGANISATION

4.1. Plans

The implementation of the new production process and associated new statistical outputs is part of a wider Economic Statistics Transformation Programme. In order to address the issues identified in the recent reviews, the key priorities of this programme are:

- Measurement of National Accounts.
- Measurement of trade and international statistics.
- Measurement of services sector activities.
- Measurement of devolved, regional, and local statistics.
- Measurement of the labour market.
- Measurement of prices.
- Measuring the modern economy – the digital revolution.
- Beyond GDP – broader measures of welfare and activity.
- Understanding the productivity puzzle.

The programme is funded until 2020. In terms of the production process, work is already underway in moving the Institutional Sector Accounts onto CORD as well re-developing the other systems. Rather than adopt a “big-bang” approach to introducing change, improvements will be introduced in an incremental way.

4.2. Organisation

In order to implement this huge programme of work, the development work has been split into a separate directorate from the production area. Agile working has been adopted using multi-disciplined teams across the two areas. Key to this is the involvement of a team member from the production team who acts as the business owner. This helps greatly when introducing the changes back into the production area.

Development teams cover National Accounts methods, business analysts, business system configuration, and testing and project management. The development teams are coordinated through a central strategy and architecture team to ensure that everything is aligned to the target.

One of key objectives is building flexible and modular systems which can adapt to the new business process. This will allow staff to spend more time on analysing the data inputs and outputs rather than contending with running systems and inefficient processes. This is one of the areas where work is ongoing to plan out how this will work in practice and how this will impact on future organisational structures and capability needs.

Given the wider work taking place, an Enterprise Architecture Team coordinates activities across the office.

5. ISSUES / LESSONS LEARNED

Since this work has been ongoing for many years in the UK, there are some useful observations and lessons learned which are worth reflecting on.
• **Conceptual framework**: Setting out your current and target conceptual framework and levels of detail are critical. By agreeing this at the outset, it sets the agenda for data collection, methods requirements, system design, system architecture and publications.

• **Strategy and Vision**: Alongside the Conceptual Framework, a clear strategy and vision is also essential for defining where you are going and how you are going to achieve it. Getting engagement from staff and external stakeholders is also very important if it is going to succeed. As part of this, setting out strategic principles and an approach to prioritisation are useful tools for decision making and gaining a common understanding.

• **Engage production areas**: An important lesson we have found is that developing new methods and systems in a separate development silo tends not to work and can also lead to duplication of effort (in areas such as testing and quality assurance). The use of multi-disciplined teams across the development and production areas has proved to work.

• **Carry out pilots**: One of the main lessons from developing systems on CORD was how this was approached. A simple proof of concept was initially developed but once a base level of functionality was available, a wide range of systems were built. At the time, there were issues with functionality and performance which led to a lot of re-working as we have learned more about how to use the system. The re-working is costly, especially due to the overheads of introducing new systems to the production process. Developing one large complex system initially would have ironed out these issues earlier on.

• **Re-design systems when you re-platform**: There are fundamental differences between the way in which our old system, CSDB, and the strategic one, CORD, work. Therefore, when re-platforming a system it is worth taking the time to optimising the system design to work with the new platform. Especially given the highly skilled and experienced staff it takes to do this.

• **Adopt IT best practice**: One of the strong benefits of CORD is the availability of different environments for development, testing and live. This gives much better control and flexibility over the system development process.

• **Promoting system improvements**: Improving production processes, systems and platforms are only of real internal interest to a NSI. Therefore, when looking to secure funding, it is important to focus on the wider benefits that users will see. This could include: better range of outputs, more detailed outputs, capability to take on more revisions, flexibility to expand the portfolio of outputs, improving publication releases, better analysis and outputs.

• **Share best practice**: There is a lot of good work going on in many countries and international organisations. Sharing best practice, tools, frameworks and approaches as well as collaborating can greatly speed up the development process.

• **A generic National Accounts process** – Using the GSBPM or UN Guidelines for Integrated Economic Statistics\(^7\), for National Accounts presents challenges. The former is geared towards compiling individual statistics or business surveys rather than integrated ones and the latter does not go into the required detail. Developing specific best practice could be useful for other countries.

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\(^7\) See United Nations, 2013 for more information
6. CONCLUSIONS

The re-developments set-out in this paper are a rare opportunity to future-proof the UK National Accounts systems in order to meet the wide range of priorities that our users have. We have an ambitious programme of work ahead but good progress has already been made and we are aware of the big challenges ahead. The UK has a lot of experience in this area and this new programme of work builds on top of the foundations we already have in place.

The key challenges we anticipate will be around:

- Managing the introduction of better methods and outputs across the range of outputs.
- Changing the production process for quarterly GDP to a Quarterly Supply and Use Tables approach.
- Introducing automatic rules based balancing.
- Managing the organisational changes that will evolve from the new production process.
- Integrating the systems together over the coming years.

The UK is interested in the experience of other statistical institutes in this area and collaborating on business process, design and architecture.
REFERENCES


