

Australian Bureau of Statistics

Implementation of Semantic Web
Technology

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Concepts, Sources & Methods (CSM) Ontology Project

- An ABS R&D project conducted in 2010/11
- Collaboration between
 - Macroeconomics and Integration Group (MIG)
 - statisticians / business customers
 - Technology Services Division
- Developers
 - Michael Mecham
 - Arupa Sarkar
- Business Sponsor
 - Peter Meadows

Overview

- Business need
- Our solution
- Proposed future directions

Why document

Concepts, Sources & Methods (CSM)?

- **Principle 2.** To retain trust in official statistics, the statistical agencies need to decide according to strictly professional considerations, including scientific principles and professional ethics, on the methods and procedures for the collection, processing, storage and presentation of statistical data.
- **Principle 3.** To facilitate a correct interpretation of the data, the statistical agencies are to present information according to scientific standards on the sources, methods and procedures of the statistics.

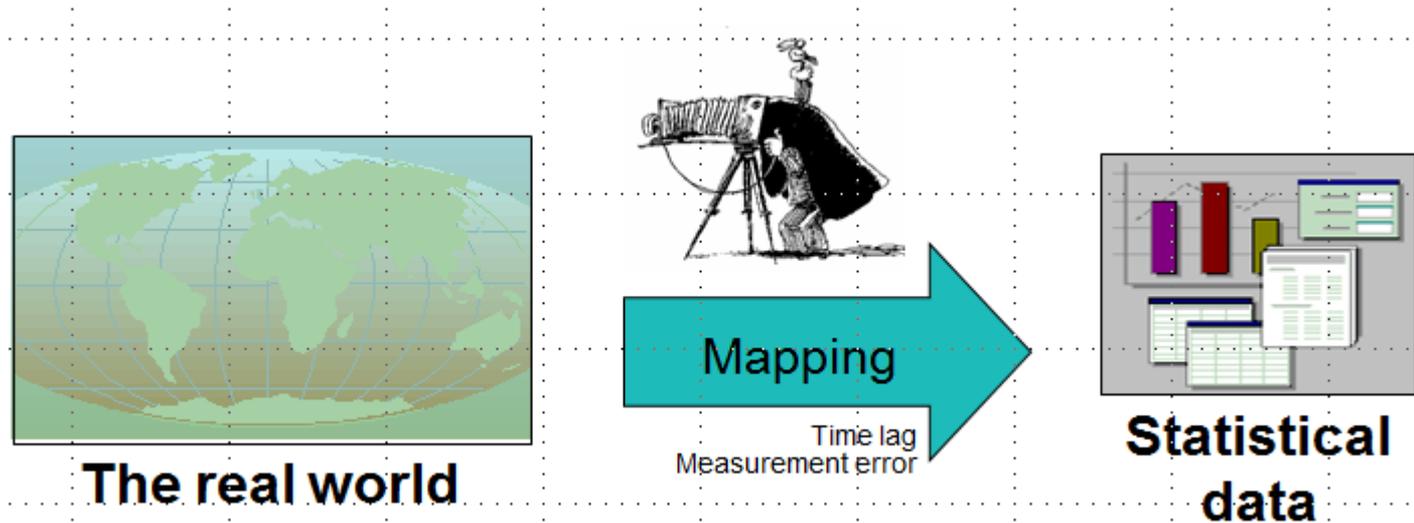
Source: Fundamental Principles of Official Statistics, United Nations

What we were modelling

Very high level definitions:

- Concepts underpinning statistics
- Sources of data for surveys
- Methods = how to

“Concepts” and CSM



A statistical framework can be considered a **conceptual** model of a **domain** within the real world (eg “the economy”) for which statistical data can be collected and compiled on a well defined and consistent basis.

The System of National Accounts (SNA) is an internationally agreed statistical framework.

Not all concepts associated with Australian National Accounts data compiled by the ABS will align precisely with the theoretical ideal set out by SNA. The description of Concepts within CSM allows sets of concepts to be understood in relation to each other.

Business needs

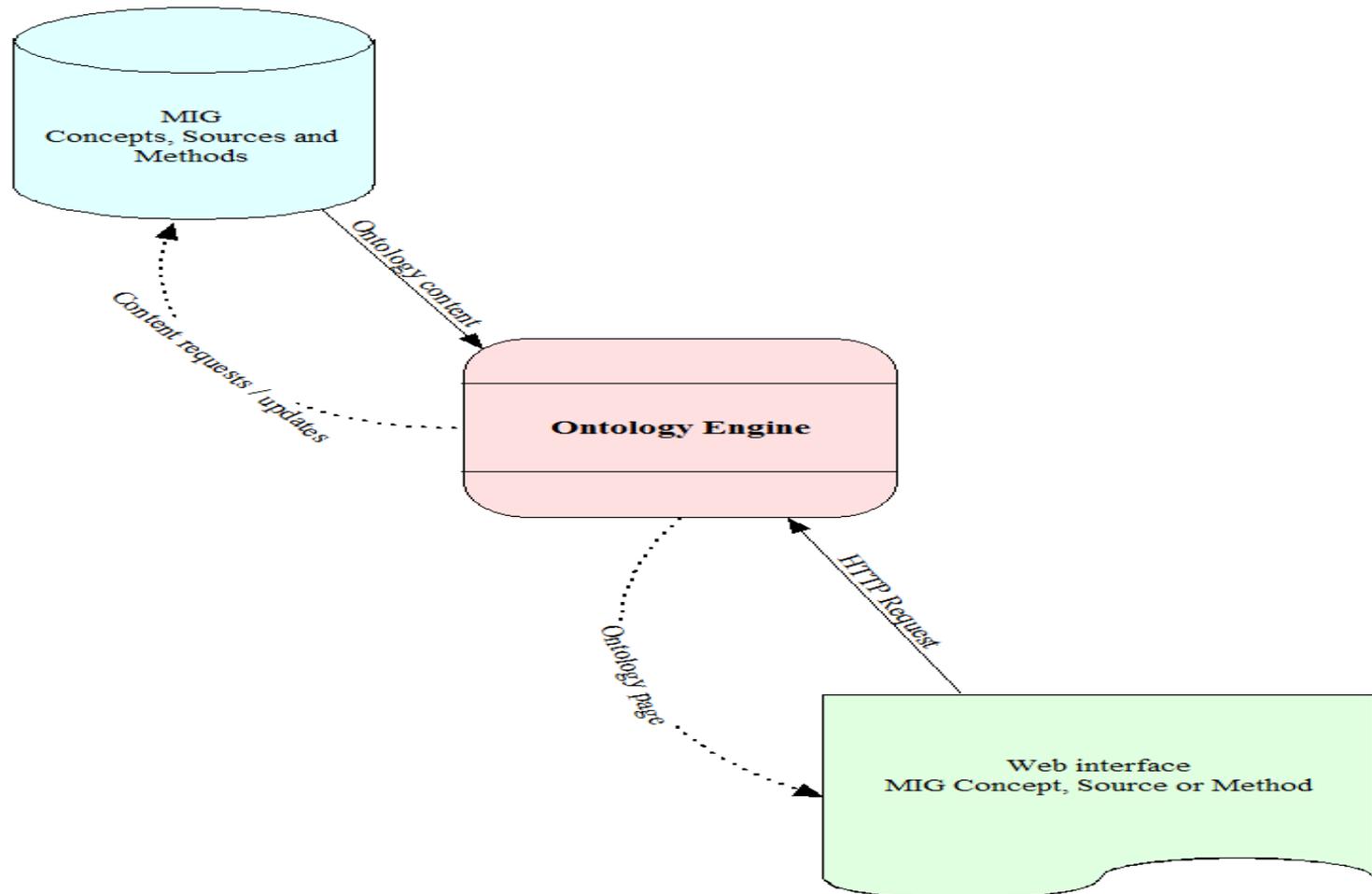
- Key needs:
 - Accessibility
 - Usability
 - Maintainability
 - Extendibility

What we did

- Creation of prototype to model Concepts, Sources and Methods of macroeconomic statistics:
 - First candidate survey: Australian System of National Accounts
 - Made available using a semantic file format (RDF)
 - Use of a familiar open source wiki-style web interface
 - We created separate instances of the CSM ontology:
 - » Pragmatic reasons;
 - Environment 1 - Authoring (dynamic)
 - Environment 2 - Viewing (static)

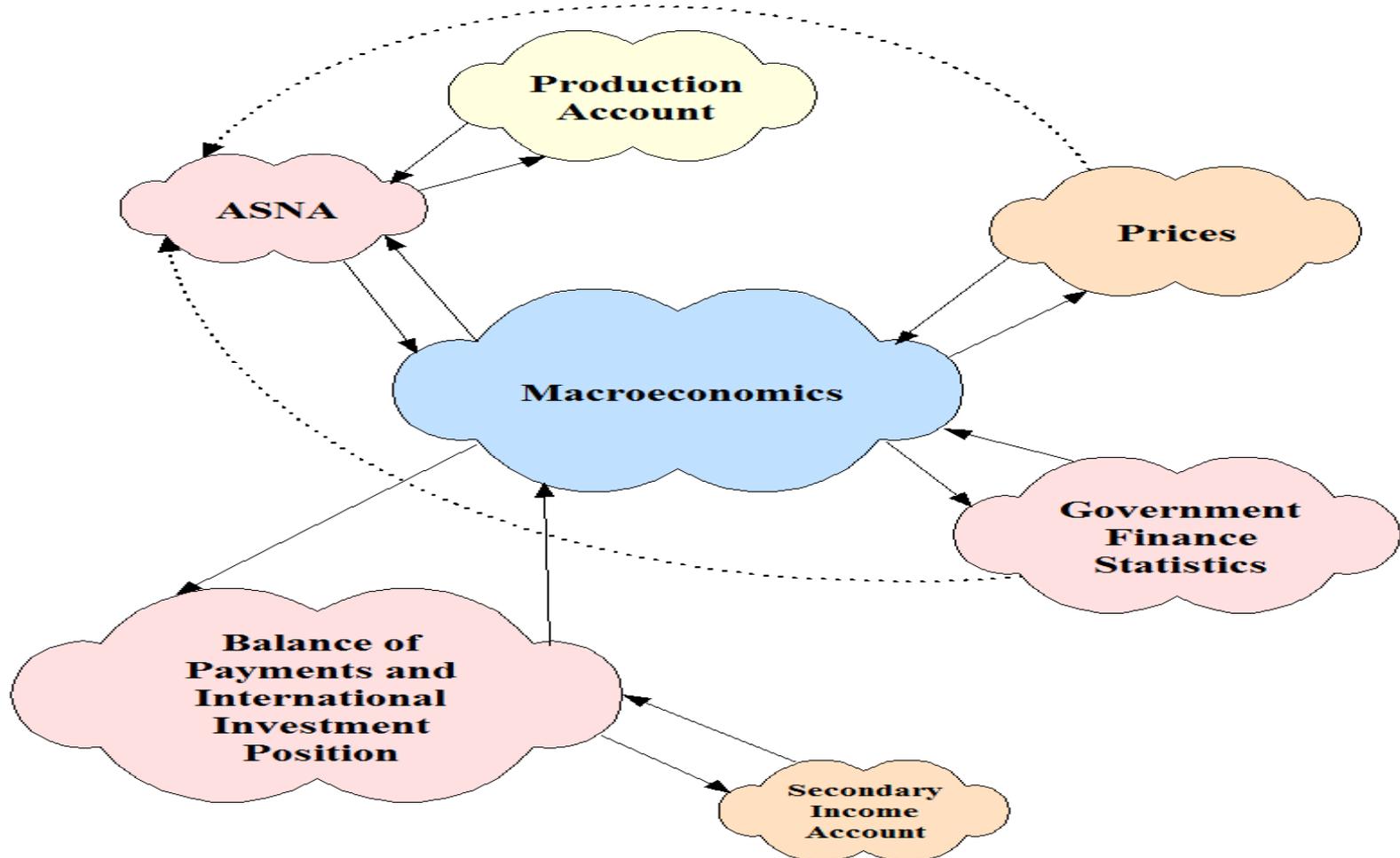
High level implementation design

Overview of MIG Concepts, Sources and Methods Ontology Tool Implementation



High level Macro Economic ontology

Example of Ontology-driven Network of MIG Concepts, Sources and Methods



Our Semantic Solution

- Needed a structure to network the perceivable ideals underpinning a survey:
 - It is conceptual - “Concepts”
 - It’s inputs may be varied - “Sources”
 - It has a methodology – “Methods”

Our Semantic Solution

- Perceivable was key, therefore CSM could be modelled:
 - Developed model using the open source Ontology editor, Protégé → OWL/RDF
 - Our CSM Ontology modelling akin to Object Oriented modelling
 - Our goal was to produce a fully traversable network of CSM nodes for a web-based Wiki interface

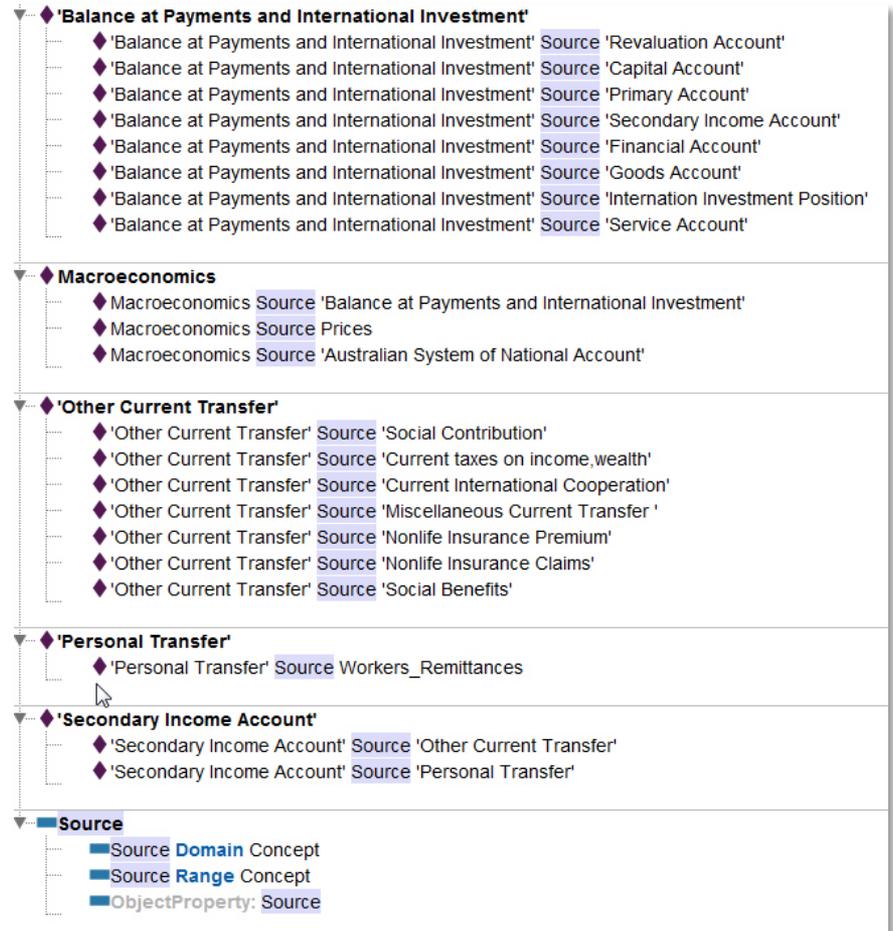
Our Semantic Solution

- Brief technical view :
 - High level design showing CSM linkages to support the goal of a traversable network of nodes

The screenshot displays a semantic editor interface with three main panels. The left panel shows a concept hierarchy for 'Australian System of National Account', including 'Current taxes on income,wealth', 'Revaluation Account', 'Miscellaneous Current Transfer', 'Primary Account', 'Australian System of National Account', 'Concept', 'Concept Scheme' (1), and 'Nothing' (1). The middle panel, titled 'Description: Australian System of National Account', shows the 'Types' section with 'Concept' circled in red. The right panel, titled 'Property assertions: Australian System of National Account', shows several assertions circled in red: 'Inherits From' Macroeconomics, 'in scheme' BOP CSM Example 2010, 'preferred label' Australian System of National Account, 'Concept' The ASNA is, and 'Method' ASNA has.

Our Semantic Solution

- Brief technical view :
 - Source hierarchy

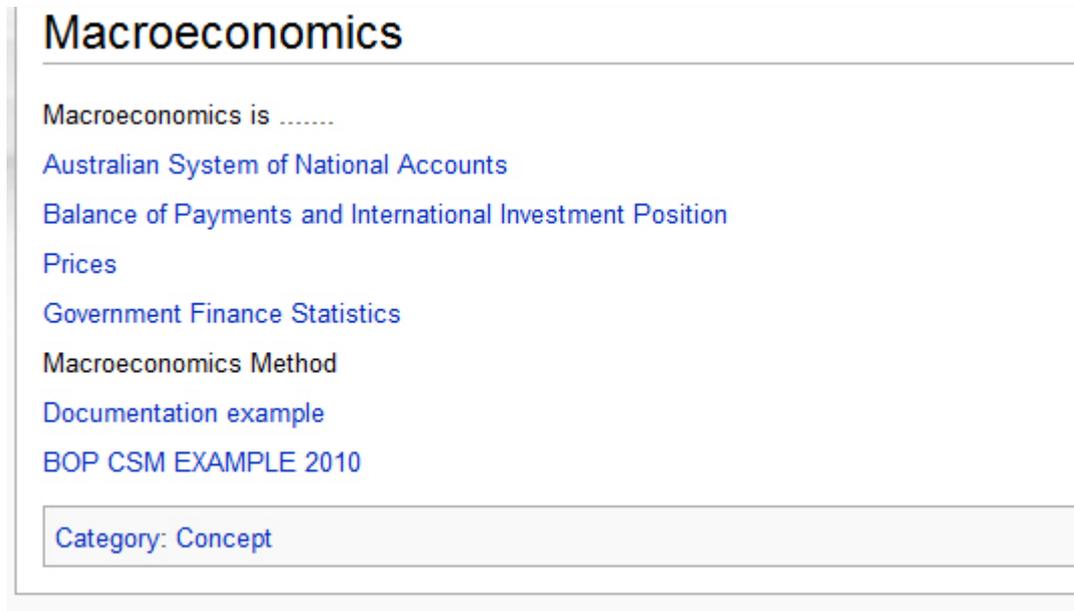


Our Semantic Solution

- Wiki interface:
 - Semantic MediaWiki plugin consuming RDF
 - Benefit: high degree of end-user familiarity
 - Deployment issues
 - ABS intranet
 - Subset available on ABS website

Our Semantic Solution

- Wiki interface example views:
 - Let's traverse some of the ASNA structure



Macroeconomics

Macroeconomics is

- [Australian System of National Accounts](#)
- [Balance of Payments and International Investment Position](#)
- [Prices](#)
- [Government Finance Statistics](#)
- [Macroeconomics Method](#)
- [Documentation example](#)
- [BOP CSM EXAMPLE 2010](#)

Category: [Concept](#)

Our Semantic Solution

- Wiki interface example views:
 - Looks familiar? Great!

Australian System of National Accounts

Contents [\[hide\]](#)

- [1 Introduction](#)
- [2 Components](#)
 - [2.1 Production Account](#)
 - [2.2 Income Account](#)
 - [2.3 Final Consumption Expenditure](#)
 - [2.4 Balance Sheet](#)
 - [2.5 Capital \(Net Lending\)](#)
 - [2.6 Change in Financial Position](#)
 - [2.7 Financial Accounts](#)
 - [2.8 Input-Output Tables](#)
 - [2.9 External Account](#)
- [3 Linked to](#)

Introduction [\[edit\]](#)

The Australian system of national accounts is based on the international standard, *System of National Accounts, 2008* (SNA08). The previous printed version of Australian National Accounts: Concepts, Sources and Methods (Cat. no. 5216.0) was published in 2000. At that time the accounts were based on the 1993 version of the SNA. This version of the Concepts, Sources and Methods has been revised to reflect the implementation of SNA08 in the Australian national accounts, with an emphasis on providing more detail in a user-friendly online format.

Our Semantic Solution

- Wiki interface example views:
 - Scroll to the bottom, there's something special...

Useful references

- [Standards and classifications NA](#)
- [Accounting principles NA](#)
- [Publication NA](#)
- [Sources](#)

Components

- [Production Account](#)
- [Income Account](#)
- [Final Consumption Expenditure](#)
- [Balance Sheet](#)
- [Capital \(Net Lending\)](#)
- [Change in Financial Position](#)
- [Financial Accounts](#)
- [Input-Output Tables](#)
- [External Account](#)

Linked to

- [Macroeconomics](#)

Category: Concept

Sources

Contents [hide]

- 1 Introduction
 - 1.1 ABS
 - 1.2 External
- 2 Linked to

Introduction

ABS

- [Annual Integrated Collection](#)
- [Government Finance Statistics](#)
- [Building and Construction Statistics](#)
- [Census of Population and Housing](#)
- [Household Expenditure Survey \(HES\)](#)
- [Balance of Payments and International Investment Position](#)
- [CCD capital transactions](#)
- [Labour Force Survey \(LFS\)](#)
- [Quarterly Business Indicators Survey \(QBIS\)](#)
- [Retail Business Survey](#)
- [Survey of Employment and Earnings \(SEE\)](#)
- [Average Weekly Earnings \(AWE\)](#)
- [Labour Price Index \(LPI\)](#)

Our Semantic Solution

- Wiki interface example views:
 - Here is where the real power of a CSM Ontology is realised

Category:Concept

[\(previous 200\)](#) [\(next 200\)](#)

Queries for categories

[Ask for all instances of "Concept" and for all instances of its subcategories](#)

Pages in category "Concept"

The following 200 pages are in this category, out of 691 total.

<

- [Construction in the reporting economy](#)

A

- [ASNA Banks](#)
- [ASNA Captive Financial Institutions and Money Lenders](#)
- [ASNA Central Borrowing Authority](#)
- [ASNA Computer software](#)
- [ASNA Currency](#)
- [ASNA Currency and Deposits](#)
- [ASNA Depository Corporations](#)
- [ASNA Deposits](#)
- [ASNA Financial Auxiliaries](#)
- [ASNA Financial Corporations Sector](#)
- [ASNA Financial Intermediaries](#)
- [ASNA Financial Investment Funds](#)
- [ASNA General Government Sector](#)

A cont.

- [Assets](#)
- [Audiovisual and related services](#)
- [Australian Bureau of Agriculture and Resource Economics](#)
- [Australian Institute of Health and Welfare](#)
- [Australian Prudential Regulation Authority](#)
- [Australian System of National Accounts](#)
- [Australian Taxation Office](#)
- [Auxiliary insurance services](#)
- [Average Retail Prices](#)
- [Average Weekly Earnings](#)

B

- [BOP CSM EXAMPLE 2010](#)
- [Balance Sheet](#)
- [Balance at Payments and International Investment](#)

C cont.

- [Cultivated biological resources](#)
- [Currency](#)
- [Currency and Deposits](#)
- [Currency and deposits](#)
- [Current International Cooperation](#)
- [Current International Cooperation model](#)
- [Current Taxes on Income and Wealth](#)
- [Current international cooperation](#)
- [Current price values](#)
- [Current tax](#)
- [Current taxes on income, wealth etc.](#)
- [Current taxes on income, wealth etc. Model](#)
- [Current taxes on income, wealth etc. NA](#)
- [Current transfers from the Commonwealth government to State and local government](#)

Our Semantic Solution

- Wiki interface example views:
 - Aggregation and linking of ASNA CSM, exciting!

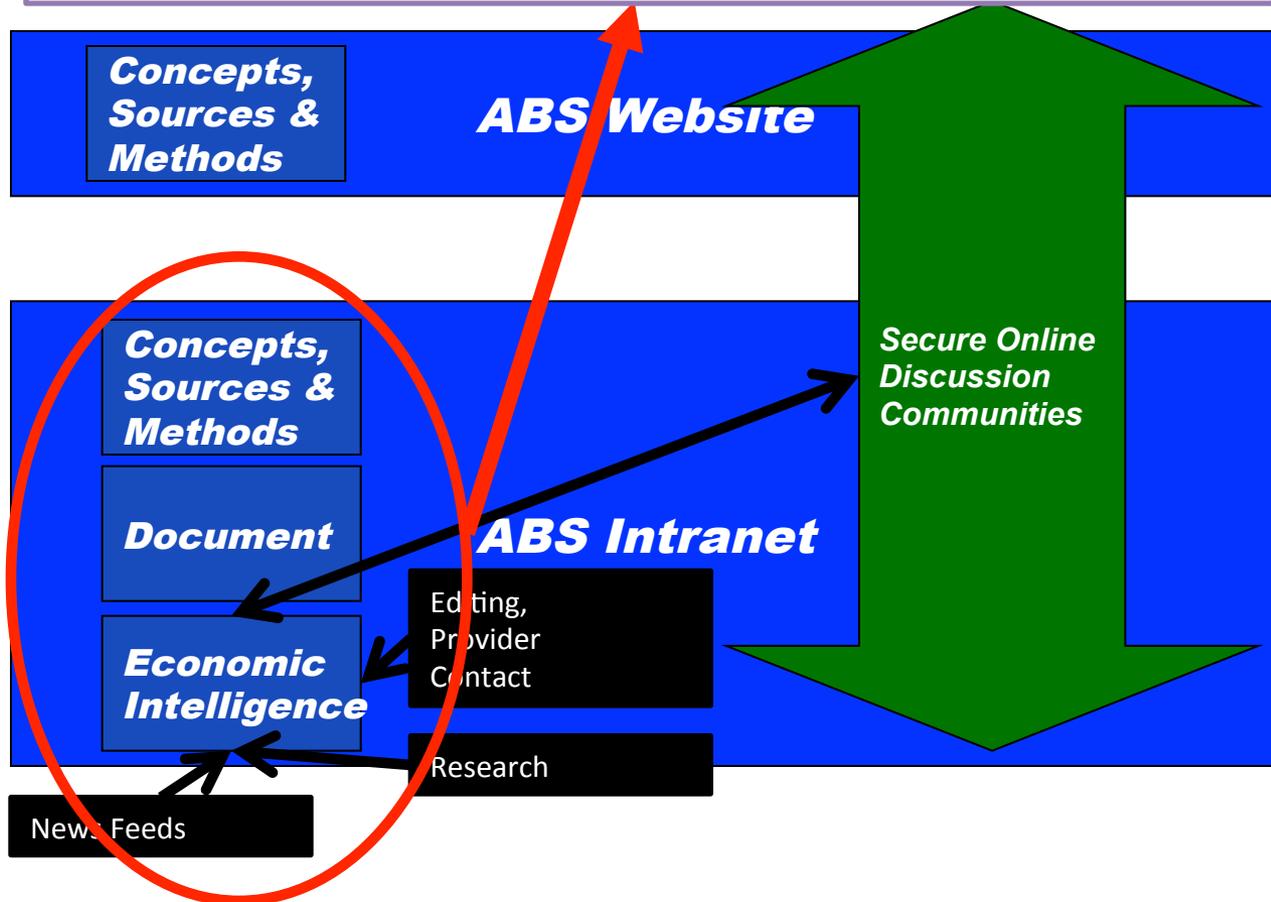
ASNA Sector
Status: Initial draft
Concept
Add text here
Linked to
Australian System of National Accounts Change in Financial Position ASNA Sector
Components
ASNA Non-Financial Corporations Sector ASNA Financial Corporations Sector ASNA General Government Sector ASNA Households Sector ASNA NPISH Sector ASNA Rest of the World Sector
Sources
Add text here
Method
Add text here

Ideas for future direction

- Integration of functionality to highlight contribution of individual components of higher level Major Economic Indicators
 - Hierarchical graph (e.g. tree structure)
- Integration of functionality enabling contribution to ABS CSM from the public
- Supporting ABS research: automation of updating of relevant CSM content (e.g. newsfeeds, external agency datasets....)

Proposal for future capability

Authoring space for external website.
Should be seamless environment for ABS staff.



Fostering International Comparability

- Statistical Frameworks such as SNA are designed to be consistent and shared and applied internationally
- National Accounts data is intended to be comparable around the world
- Shouldn't CSMs be expressed in a readily comparable form?
- International collaboration, harnessing ontologies and other semantic web technologies, could help make this a reality?

Conclusion

- Significant organisational lessons in terms of potentially improved transparency of survey methodologies
- Shared lessons from this foray represent significant potential future value to statistical agencies
- As one of ABS' first attempts in the ontology realm, a positive and successful outcome