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Identification Schemes for Traceability Systems

Inspiration and experiences

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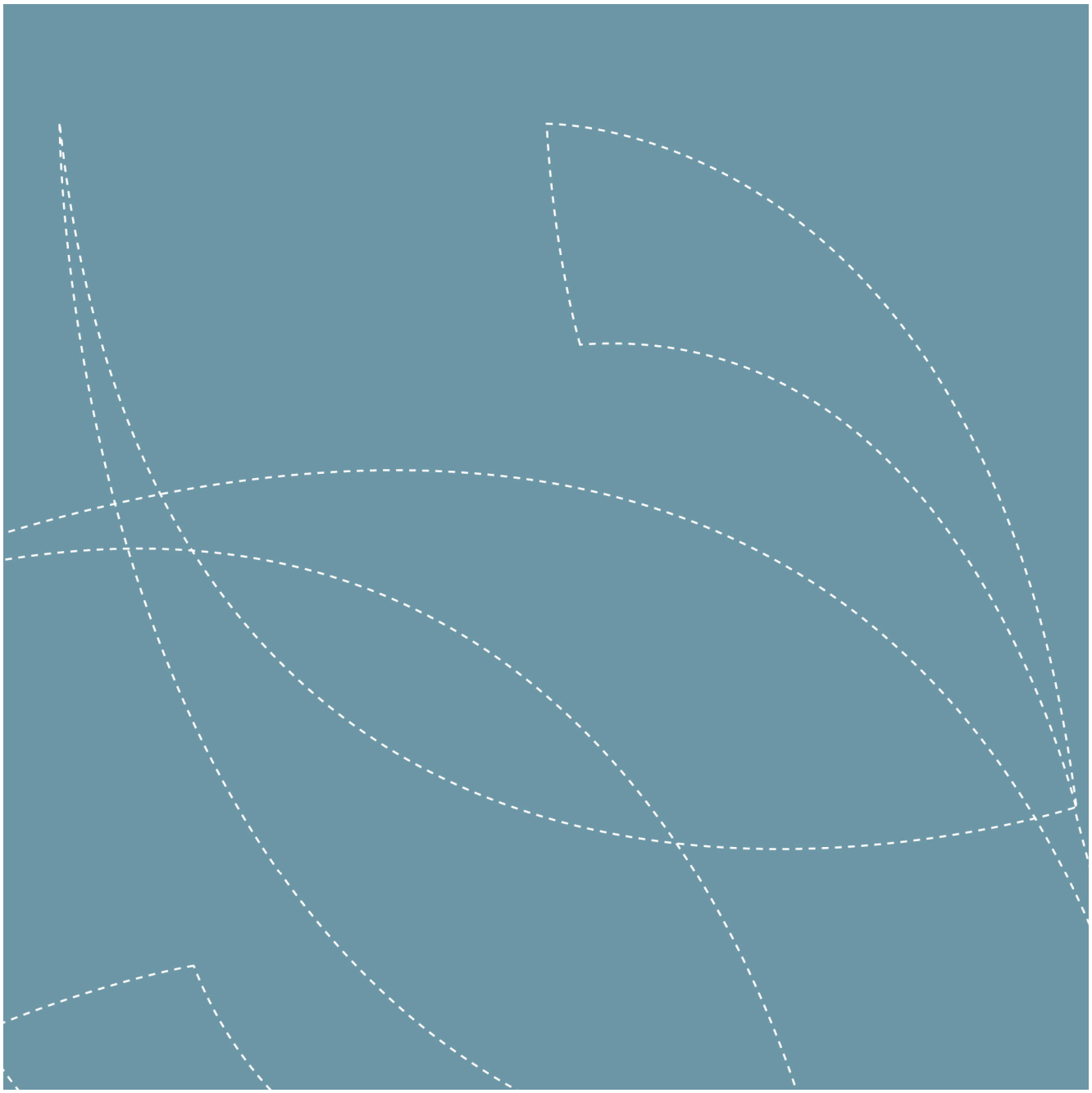

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Summary:

This report gives a brief overview of available information on the use of identifications (ID's) in traceability systems.

The main points arising form this analysis are:

- Standardisation (such as standards published by the international organisation for standardisation (ISO)) is important for the success of a cross sector project.
- GS1's standards are widely referred to and suggested for use in many countries, often in combination with another national identification system.
- Databases and systems should be able to adapt and cope with future demands and expectations.
- Multiple sectors have many inter-connected databases which need to be integrated with the eventual introduction of a national database.
- The owners/managers of the national database should be a 'not for profit' organisation with a constitution which recognises the need problems associated with privacy and commercial interests.

Foreword

This work has been carried out as part of the Norwegian national traceability project (eSporing). The authors would like to thank ‘eSporing’ for giving them the opportunity to carry out this important research into what ID systems are suggested for traceability around the world.

Tromsø 4.3.2009

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1 Introduction

The Norwegian eSporing (electronic tracing) initiative has been established as a response to various food safety incidents and an increasing need for a common traceability system (eSporing, 2009; Bakken *et al*., 2007). The project is a cooperation between the Norwegian Authorities, the Norwegian Food industry and relevant research institutions. The overall aim of the project is to develop and implement a national electronic traceability infrastructure for food stuffs by 2010.

Nofima Market, on behalf of the Norwegian eSporing initiative, has found it necessary to construct an overview of available information on the use of identifications (ID's) of food items and businesses in traceability systems in the world. Areas of investigation were:

- whether any countries have attempted to implement ID systems of food items and businesses across all foodstuffs
- who administers the ID's
- is there one system throughout the entire supply chain, or multiple systems which run in parallel

In this report we first outline the method used, then present the findings and discuss them. Finally, a summary of important considerations for the eSporing project are presented as well as important further work.

The data presented here is an overview and not an in-depth research document. This document draws heavily on various national consultation documents and personal communications. This is due to the fact that many countries are only just beginning processes related to implementing food traceability.

2 Method

A literature survey was carried out. Internet searches and personal communications have been included. In this report we have attempted to examine what literature exists and is accessible. The authors must point out that as many of the sources are internet documents there is a question with regards to quality control of data. There is also a bias because clearly the authors were not able to access documents not available publicly or not available in an appropriate language.

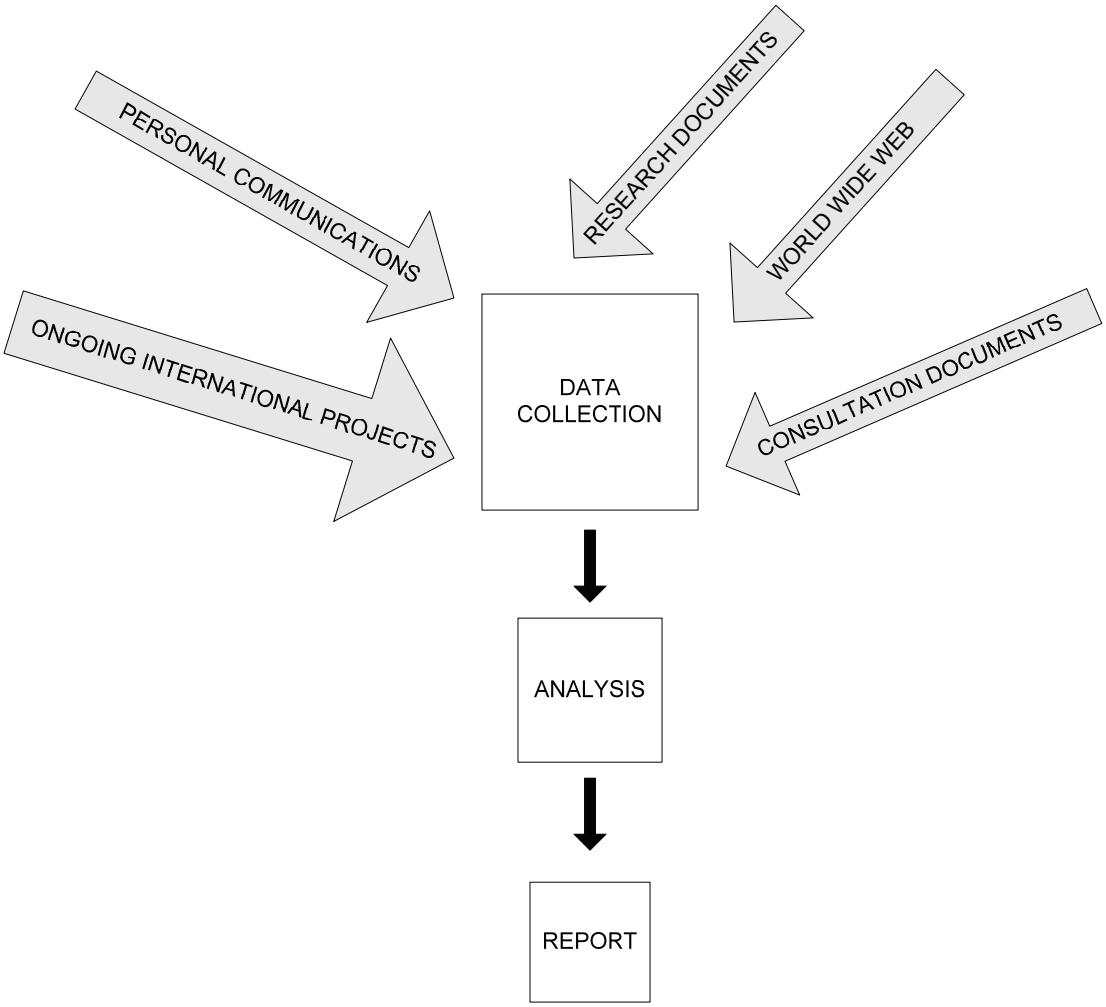

Figure 1 Diagram showing method used in this report

3 Results and Discussion

The aim of this study was to construct an overview of available information on the use of identifications (ID's) of food items and businesses in traceability systems in the world.

3.1 International identification schemes

Some articles exist which examine a general review of the requirements for traceability see Schwägele (2005) and Smith *et al.* (2005) in the scientific literature there is little, if any examination identification systems.

3.1.1 Global Standards One

One internationally recognised and used number series are the Global Standards One or GS1 (GS1, 2009) series which can identify both businesses and items. However, it has been observed that this numbering system is not used consistently throughout different national and global food supply chains and that it is often absent from the primary production end of the supply chain and most prevalent at the retail section of the supply chain (Karlsen & Senneset, 2006; Karlsen *et al,* 2009). An observation from Egypt supports this despite the availability of systems widespread adoption has not been achieved especially at the producer level (Smith, 2008)

Solutions for identifying products and processes can be achieved using various technologies. Depending on the choice or constraints of each trading partner, items may be tracked and traced at different levels of precision: generic, by batch or serialized. GS1's barcodes and Radio-Frequency Identification (RFID) can be used to automate data capture. "One up, one down" is often considered as the information exchange model to achieve full chain traceability. Yet some supply chains choose to go further because of specific objectives.

The GS1 Global Traceability Standard is a business process standard describing the traceability process independently of the choice of enabling technologies (GS1, 2009). It defines minimum requirements for companies of all sizes across all industry sectors and corresponding GS1 Standards used within information management tools.

The GS1 Global Traceability Standard has been developed to meet important business needs, including regulatory compliance. In outline it:

- addresses the entire supply chain and can be applied to any product.
- is based on current business practices used in over 150 countries by a large majority of supply chain partners; allowing companies to leverage existing investments and more easily implement the standard as part of broader product quality system.
- is one of many systems that taken together will help companies continue and add to their ability to meet consumer expectations for safe and high quality products.
- maximises the use of globally established and implemented GS1 System tools.
- describes the creation of accurate records of transactions.
- meets the core legislative and business need to cost-effectively trace back (one step down) and track forward (one step up) at any point along the whole length of the

supply chain, no matter how many trading partners, business process steps, national and international borders are involved.
- is the framework for companies to go beyond these minimum requirements if relevant in their context and sector.
- enables trading partners to exchange data on a real time basis with a network of data bases.
- is compatible with ISO standard 2205 for traceability.

The standards which have been identified so far, as part of the eSporings project, is summarised at http://esporing.gs1.no/. The web resource includes the standards referred to here and some additional and not necessarily relevant standards.

Work on mapping the status of traceability of food stuffs has shown that GS1 codes and were not common throughout the supply chain particularly at the primary producer end of the supply chain (Karlsen & Senneset, 2006; Karlsen *et al*, 2009). However traceability standards such as the CEN workshop agreements on traceability for both farmed and wild caught fish recommend the use of GS1's codes (CEN-a, 2003 and CEN-b, 2003).

It must also be noted that a central point made by many of the 'traceability consultation' documents examined here, is that the standards used should be open source and not something which must be paid for such as the GS1 infrastructure.

3.1.2 International "super standards"

Some attempts have been made at establishing open (and therefore free) international "superstandards" which may incorporate many existing national and international naming or numbering schemes.

An example is ISO/IEC 6523-1 (2009) "Structure for the identification of organizations and organization parts" which is based on the fact that practically all governments and many large organizations already have their own national numbering/identification scheme. For instance in Norway, Foretaksregisteret assigns the Norwegian 9-digit "Organisasjons-nummer" to all companies and relevant organizations.

In other countries, there are similar national registers and numbering schemes. There are also similar numbering schemes within some large companies and in particular sectors within or across countries. In its simplest form ISO/IEC 6523 specifies a numbering scheme where a 4-digit number (International Code Designator or ICD) is added in front of the "local" number to make it globally unique. For instance ICD prefix 0023 means "What follows is a UNINETT (NORDUnet) organization number", ICD prefix 0043 means "What follows is a HydroNETT organization number", ICD prefix 0167 means "What follows is the organization number for an ATM", etc.

Similar prefix-based "superstandards" may be implemented to support co-existing numbering schemes for different animals or for different types of food products.

3.2 Are there any national schemes?

So far we have examined some international 'schemes'. The actual experience form around the world we hope will give an indication about which methods if any have been used in practice.

3.2.1 Canada

The national traceability initiative in Canada 'Can-Trace' (a Canadian national traceability initiative) identified the need for both identification standards and also the need for non proprietary standardized sets of traceability data (CANTRACE, 2008). The Canadian Food Traceability Data Standard (CTDS) 'encourages' the use of EAN.UCC (now known as GS1) for product, party and location identification. CTDS also suggests that existing identification schemes can be linked to the GS1 standards further down the supply chain, thereby solving the problems related to the lack of consistency in the use of GS1 standards throughout the supply chain.

3.2.2 Japan

In Japan there are no identification strategies which cover all sectors. There are no integrated national traceability databases. However, there are some sector specific national databases such as those described for cattle in the EU (NLBC, 2009). With regards to unique ID systems there are reported to be two competing organisations GS1 Japan and the uID center (NBLC 2009; Sakai pers . com 2009.)

3.2.3 Norway

A survey carried out in Norway concluded that few standardized identifications where used to identify the food items (Karlsen *et al.*, 2009).

3.2.4 Korea

The Korean government has introduced the possibility for all producers to be involved in a national traceability scheme (for details see Smith, 2008). In the Korean system nationally unique ID's are used (not GS1). The reported experience from Korea highlighted the need for continous support and training when carrying out implementation of traceability (Smith, 2008).

3.2.5 United Kingdom

In the United Kingdom (UK) the numbering system for health/ identification marks for meat, fish and dairy products differs between establishments, it is approved by local authorities and those establishments (slaughterhouse, cutting plants etc) approved by the Agency (B.Drennanpers.com.)

Establishments approved by the Food Standards Agency (FSA) are allocated a 4 digit number, with each Administration (Scotland, Wales, Northern Ireland & England) responsible for allocating approval numbers for new establishments in their respective areas. It is possible to broadly identify an establishment's region from its allocated number:

- 1000 series: Scotland (allocated by FSA Scotland)
- 2000 series: Northern England (allocated by FSA England)
- 4000 series: Midlands and West (allocated by FSA England)
- 5000 series: Eastern England (allocated by FSA England)
- 6000 series: South Eastern England (allocated by FSA England)
- 7000 series: Wales (allocated by FSA Wales)
- 8000 series: South West England (allocated by FSA England)
- 9000 series: Northern Ireland

Where as, establishments approved by FSA would normally take a two letter alpha prefix followed by a 3 digit numeric suffix. The alpha prefix is allocated centrally by the FSA, but the allocation of the 3 digit suffix is left to individual local authorities to allocate as an when establishments are newly approved in their area.

In the case of "wholesale markets" (such as Billingsgate or Smithfield Markets), market establishments are allocated an overall approval number, with secondary numbers added to the main number to indicate individual units within the market. (B. Drennan pers. com.)

3.2.6 USA

The United States Department of Agriculture (USDA) emphasizes the need to have 'separate systems' both between states and sectors, but also highlights the need for these systems to be able to 'speak' to each other when necessary (USDA, 2009). This allows existing databases to be incorporated into each other and promotes the saving of time and money since implementation of an entirely new system is not required. They state that this decision also allows them to maintain a certain degree of flexibility. The USDA also emphasis the need to standardize the data elements (registered in the various animal databases) in existing disease programmes as they believe that this will improve emergency response capabilities. Work on such standardisation has also been addressed i European projects such as Tracefish (CEN, 2003-a; CEN, 2003-b) and Trace, see for example Donnelly *et.al.* (2008). An open Source approach will also ensure compatibility between different regions and contexts.

3.3 Sector specific schemes

There are numerous examples of sector specific nationally operated ID systems. In some countries these have been established for many years while in others, such as New Zealand, implementation is just beginning. Some examples and experiences from the livestock sector are presented below.

Following Bovine Spongiform Encephalopathy (BSE) cattle registers have become important tools both nationally and internationally. In the EU, cattle are required to be identified with ear tags that give them a unique identity within the national herd. Cattle born since 1 July 1996 must also be accompanied by a cattle passport confirming both identification details (sex, breed, date of birth, identification of the mother) and a record of it's movement history.

Table 1 Comparison of international trends in cattle identification and traceability (MAF, 2009)

Area	System type	Depth	Precision	Comment
EU	Mandatory	Traceability from place of origin to retail sales	Individual identification	The EU is leading the introduction of traceability systems world wide and is a major driver in establishing world standards
Japan	Mandatory	Traceability from place of origin to retail sales	Individual identification	While the traceability system is directed at domestically produced cattle, there are indications that it may be extended to imported cattle. Japan is one of the largest importers of beef and many of its supplier's are being forced to introduce traceability in order to supply Japanese supermarkets
Korea	Mandatory	Traceability from place of origin to retail sales	Individual identification	Like Japan, Korea has also passed legislation requiring mandatory traceability of domestically produced cattle from 'farm to fork.' Cattle can to be tracked from place of origin through to primal cuts at supermarket
Canada	Mandatory	Traceability from place of origin to slaughter	Individual identification	Cattle in Canada must be identified when they are moved from the farm where they were born to another farm, slaughter house or export.
Australia	Mandatory for export	Traceability from place of origin to slaughter	Individual identification	Traceability can be used to verify the origin and other attributes of beef for both domestic and export markets, though it is more commonly used in the export market.
Uruguay	Mandatory for export	Traceability from place of origin to slaughter	Individual identification	Uruguay is moving towards a mandatory individual identification system on cattle through ear tags
Brazil	Mandatory for export	Traceability from place of origin to slaughter	Individual identification	Traceability along the food chain is only required for producers and processors exporting premium beef.
Argentina	Mandatory for export	Traceability from place of origin to slaughter	Individual identification	As of mid 2004 all properties and feedlots registered for export in Argentina had to identify all cattle with a tag for traceability purposes
USA	Voluntary	Potential for traceability from place of origin to slaughter	Potential for individual identification.	Animal identification systems in the US have just become mandatory from January 2009

3.3.1 Australia

In Australia the National Livestock Identification System (NLIS) database is the central repository for electronically recorded movements for cattle in Australia (Animal Health Australia, 2009). The database is run by Meat & Livestock Australia (MLA) on behalf of SAFEMEAT, the industry/government partnership responsible for red meat safety and hygiene.

3.3.2 Canada

In Canada the Canadian Cattle Identification Agency (CCIA) is a non- profit organization that was incorporated to establish a national cattle identification programme and it maintains all the associated databases.

3.3.3 New Zealand

In New Zealand, with regards to a livestock database, they have proposed the allocation of unique numbers for cattle identification which can be then linked to other industry databases. The proposal document suggests that the national database should be run by a stand-alone body with statutory backing. This body must also have a constitution in order to protect the information it contains and ensure that the costs of providing it are met. The consultation document noted strongly the desire for a 'harmonization with international standards' (MAF animal identification and tracing, 2009). The most recent information is that New Zealand plans to have a mandatory animal identification system in place by 2011 (MAF animal identification and tracing, 2009) it is thought that a centrally administered ID and tagging system will run parallel with existing systems until it eventually replaces it. They also stated that for animals it is clear that systems should be in accordance with OIE standards.

New Zealand is not included in tab. 1 as they are considering suitable national identification systems 'tv nz' has as recently as January 2009 reported that it will not commit to the new animal identification scheme until later this year. Further the article goes on to state that New Zealand is playing catch up with the EU, Canada and Australia (tvnz 2009).

3.3.4 United Kingdom

In the United Kingdom (UK) details of all births, movements between holdings (farms, markets and slaughterhouses) and deaths of individual cattle must be notified, as they happen, to the central Cattle Tracing System (CTS) computer database run by the British Cattle Movement Service (BCMS) of the Rural Payments Agency (RPA) (DEFRA, 2009).

Similar registers exist for all livestock and each country in the European Union, that is not to say that they are standardised or totally identical. For all countries exporting cattle to the EU must also be able to show these details for imported meat though.

4 Conclusion

The Norwegian eSporing initative has been established as a response to various food safety incidents and an increasing need for a common traceability system (eSporing 2009; Bakken *et al*., 2007). The aim of the project is to develop and implement a national electronic traceability infrastructure for food stuffs by 2010. The aim of this document was to construct an overview of available information on the use of identifications (IDs) of food items and businesses in traceability systems in the world.

We can conclude, from the sources accessed in this report, that there are no schemes which cover the entire food supply chain. There are schemes which cover single sectors, this is well exemplified in the cattle sector. In many actual cases and the proposed cases the administration of the ID schemes for traceability was a governmental or non profit making organisation.

These are some important conclusions for the eSporing project, with regards to the work on unique ID systems:

1. Standardisation (such as standards published by the international organisation for standardisation (ISO) and open source (Open source software (OSS) can be defined as computer software for which the source code and certain other rights remain in the public domain) Implementing these solutions face some major challenges.
2. GS1's standards are widely referred to and suggested for use in many countries, often in combination with another national identification system. This is in direct conflict with the first point because GS1 standards are not free and open source.
3. Databases and systems should be able to adapt and cope with future demands and expectations.
4. Multiple sectors have many inter-connected databases which need to be integrated with the introduction of a national database.
5. The owners/managers of the national database should be a 'not for profit' organisation with a constitution which recognises the need problems associated with privacy and commercial interests.

It is clear that eSporing will have to address the challenges listed in points one to five. Most importantly when considering a system that will cover many sectors would seem to be the challenge of creating schemes which are flexible over time and which can integrate multiple ID systems.

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