

## DEVELOPMENT OF THE STRATFEED INTERNET-ORIENTED COMPUTER SYSTEM (WP6)

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## 1 Introduction

In 2000, the European Commission gave a grant to the STRATFEED project for work on the detection of animal tissue in animal feed, aimed at eradicating BSE in the animal production chain. The scope of the project was intended to support the EU legislation then in force; however, in the past 2 years, identifying the type of animal tissue, not just detection of the presence of animal tissue, has become increasingly important. EU legislation that came force in May 2003 includes the classification of animal tissue according to their sources of origin (mammalian, avian and fish) [13]. The partnership for the project included scientists from 10 research institutes, universities or companies, drawn from five EU Member States; subsequently, three extra institutes from two more Member States and from Switzerland were invited to join. The scientific structure of the project covered three disciplines: classical

microscopy [10,12], molecular biology (PCR) [5] and near-infrared (NIR) technology [4,8,19], each with its own specificity and requirements.

Reliable research material must be available to facilitate good research. This basic requirement led to the development of a sample bank now containing nearly 2,500 pure animal ingredients, and pure or spiked feeds. In addition, within the framework of the STRATFEED project, several special sample sets of authorized material were developed. All the basic data and scientific results need to be stored in a transparent manner and made available to all the partners.

In order to comply with the management, organizational and communication requirements of the project, a dedicated work package (WP) for the development of management and scientific tools was set up. Modern information technology provides the necessary flexibility to

comply with changing demands. The features of STRATFEED – its multidisciplinary nature, the international partnership, the quantity of information to be managed and the huge mass of analytical data – apply to many international projects. In this report, several tools will be described which were developed and are currently available through the project.

## 2 Computer system

The structure of the computer system developed within the framework of the STRATFEED project consists of three parts (**Figure 1**).

The first part relates to data and information collection (**Chapter 3**). The various laboratories involved produce a lot of data on the identification of the samples and from analyses conducted using classical microscopy, polymerase chain reaction (PCR), near-infrared spectroscopy (NIRS) or near-infrared microscopy (NIRM). In addition, each participating team provides information that is useful for the management of the project, such as

project description, partners' details bibliographic references, newsletters, reports, lectures from meetings and European Commission (EC) documents. All these types of information and data (symbolised on the flowchart by flying sheets) are available in various formats.

The second part of the computer system, a project objective, is the database (**Chapter 4**) which gathers and stores all the relevant data and information.

From a well-defined and structured database, any application can be developed; this is the third part of the system. Within the framework of the project, two types of application were developed: an information communication tool (**Chapter 5**) using the website to facilitate exchange among the partners; and data exploitation tools (**Chapter 6**), including a manager specifically for the use of the database administrator, an explorer dedicated to the user to enable exploration of available data, and two decision-support systems (DSS) designed for the classical microscopy.

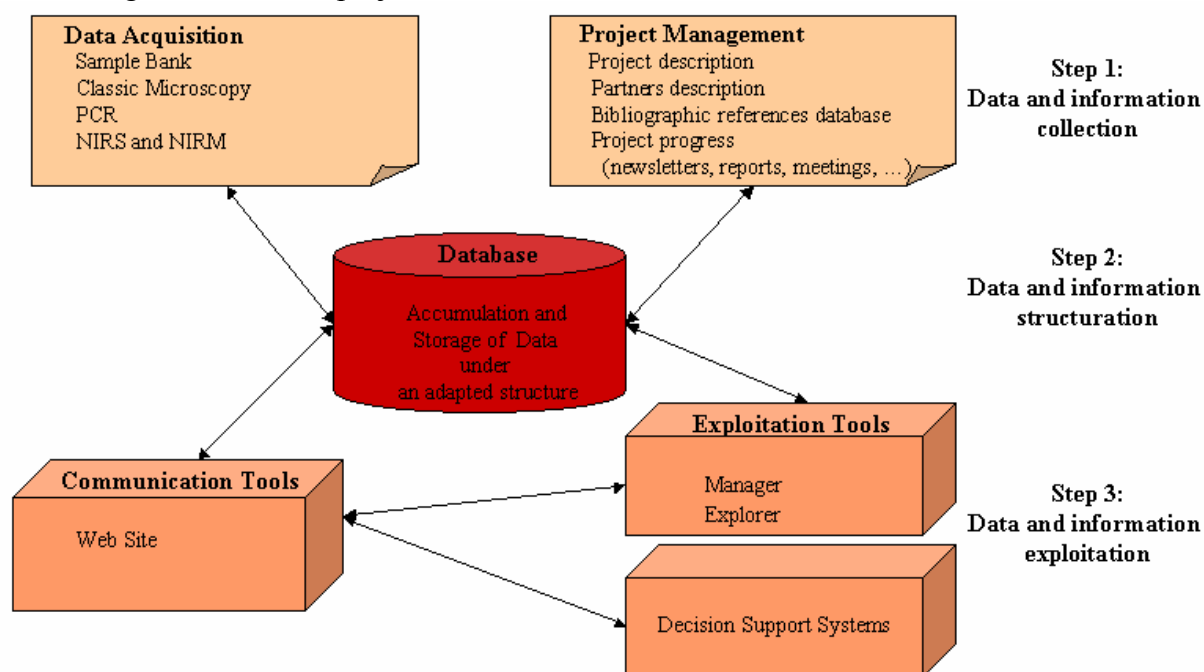


Figure 1: The computer system concept developed for the STRATFEED project.

### 3 Data and information collection

One of the most important aspects of a wide-ranging project is data and information collection. It involves close collaboration between the information technology (IT) team and the scientific research teams. For the STRATFEED project, this task was undertaken by a scientist with dual competence in computer systems and agronomy, who was integrated into the coordination team.

The methodology used to collect data was divided into three phases. Phase 1 consisted of defining the traits of each project topic in order to build the structure

of the database. Phase 2 was dedicated to the data collection itself, based on the traits defined in Phase 1. For each technique, after the data were acquired by each laboratory in accordance with the analytical protocol, the data files were collected by the WP leader for discussion and scientific validation before being validated by the IT coordinator(**Figure 2**). Phase 3 consisted of defining the user requirements for the various applications in order to encourage users to provide feedback on each release on the closed (private) section of the website. In this way, each set of data or information was validated by both scientific and IT experts before being made available on the open (public) part of the website.

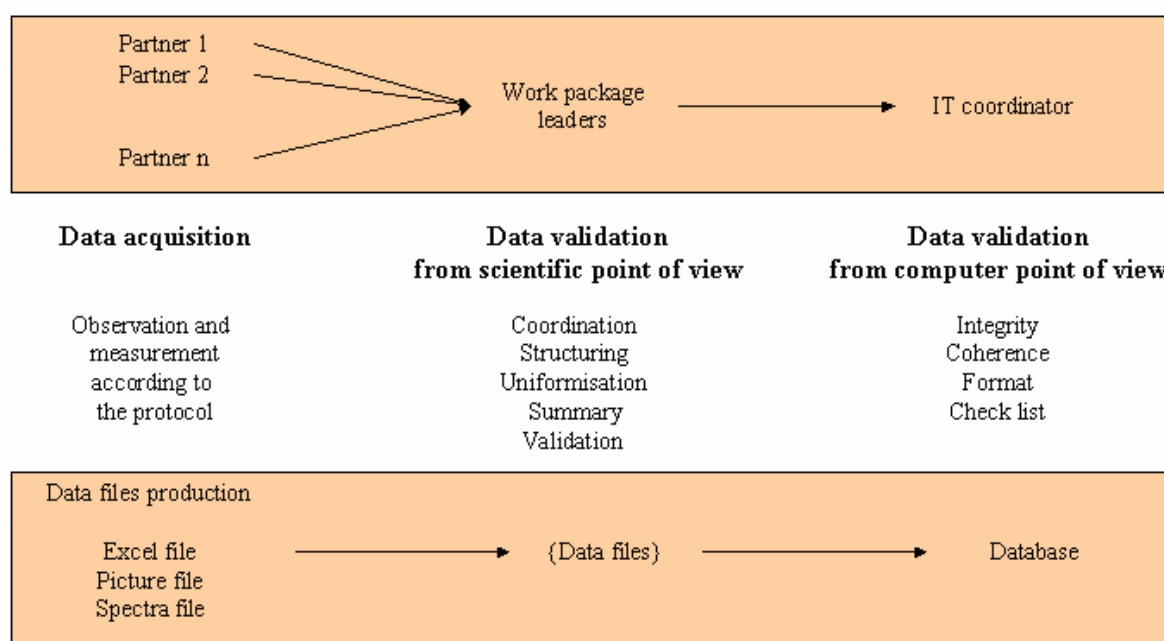


Figure 2: The data collection process used for the STRATFEED project.

### 4 Database

The main objective of a database is to store data in a structure that allows the easy retrieval of specific parts of the data via the

available applications. The MS Access platform was selected to build the database and manage numbers and text as well as figures and files. In order to have maximum flexibility for development, updating and dissemination, tables were

created for each project topic (**Figure 3**). The tables containing the results of each of the scientific disciplines (as numbers, text or images) are connected to the central table with sample characteristics such as origin, source, country and date. In this way, the features of the relational database provided by MS Access are fully exploited. The information about partners and their institutions is given in a table, as are the bibliographic references, using the norm ISO 690 [20]. The formulae of samples in the sample bank are described according to the EC guidelines of the Commission Directive 98/67/EC [22] which amended Council Directive 96/25/EC.

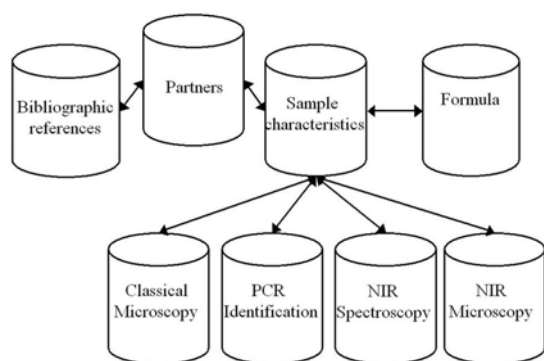


Figure 3: The database structure developed for the STRATFEED project.

## 5 Information communication tools

The website has two main objectives: to provide the public with information on strategies for detecting and quantifying animal tissue in feedstuffs, and to be a platform, used only by the project partners for exchanging data, ideas and information. To implement these two functions, a public and private section of the site was developed. The STRATFEED Internet site is based on a development environment (*Cold Fusion web application server*) that enables the user to create dynamic web pages.

### 5.1 The public section

The public section of the website is accessible through the Home Page (**Figure 4**), which is divided into three frames: the main frame with specific icons for the WPs and/or techniques, placed around a central triangle on which the project title appears; the top frame with the logo and project number; and the left frame with topic buttons as described below. Through each icon, the user can access web pages describing the work conducted, the method used and the results obtained by the WP involved.

The 'Project Description' topic is a web page that outlines the project with Internet links to EC decisions. The 'Participants' topic is divided into four sub-topics: list, consortium, collaborators and invited partners. The sub-topic 'List' displays the name, institution, email address and phone number of each participant in the project. The sub-topic 'Consortium' presents the 10 partners (logo, institute, leader name) arranged around the EU flag according to their geographical position. For both sub-topics, by clicking on different fields, the user has access to various dynamic web pages describing either the institution and its role in the project or the staff, their backgrounds and relevant publications. The sub-topics 'Invited Partners' and 'Collaborators' give information on partners linked to the project by an agreement (invited partners) or otherwise (collaborators). The 'References' topic lists about 190 documents, including publications, books and website addresses referenced in the database. The search tool allows the user to request items in various fields, and provides the author(s), title and year in a new frame. By clicking on a reference, the user can access more information about it and, for example, the abstract.



Figure 4: The Home Page of the STRATFEED website.

The 'Results' topic focuses on project deliverables. Thus, users can access an overview of the results described in a didactic way (**Figure 5**).

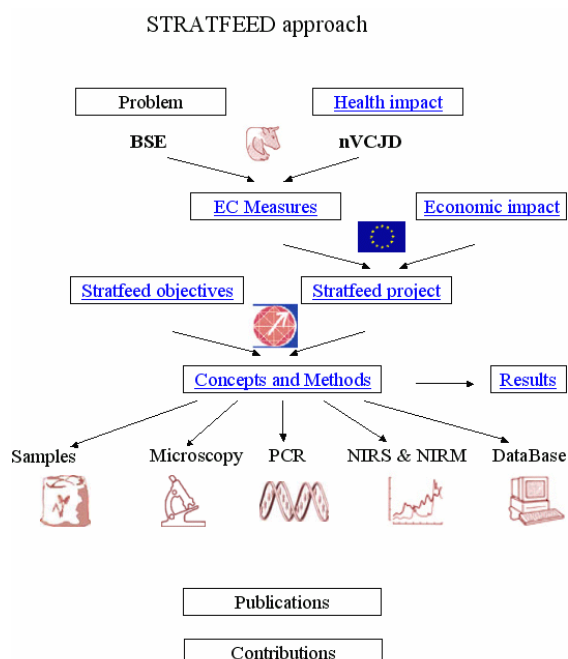


Figure 5: The results overview of the STRATFEED project.

They can run the STRATFEED Explorer to build queries on a database reduced to the samples from set A and B used for the development of the methods. They can test the STRATFEED DSS or have a demonstration of the ARIES DSS. And they can look at the publications produced within the framework of the project.

The 'Services' topic is a web page listing services which open the project to other collaborators. The 'Events' topic is a web page displaying information on important public events related to the project. Users can find, for example, information on the symposium organised within the framework of the project, including information on the venue, background, objectives, organising committee, agenda, poster and exhibition session, proceedings, registration and accommodation. Links are included to access the confidential site and the STRATFEED Home Page.

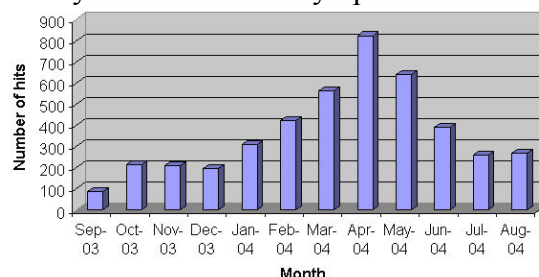
## 5.2 The private section

The private section of the website is accessible from the public Home Page by clicking on the 'Confidential Site' topic. The confidentiality of data and information provided by the partners is assured by the use of a personal login and password system and of a website secure server certificate for proving the identity and ownership of domain names and enabling confidential communication between the web server and the connected STRATFEED users. The installation of the computer system on a dedicated machine (server) protected by a firewall between the Internet and the private section of the website and the implementation of anti-virus software on the STRATFEED server ensure protection of the website. Regular updating of the operating system and periodic changes of personal passwords improve this security.

The Home Page of the private site is built in the same way as that of the public section with, on the left frame, a series of topics. The 'Newsletter' topic refers to a web page presenting the newsletters with links to the documents in PDF format. The 'Meetings' topic refers to a web page listing the meetings organised under the project, with links to the lectures in PDF or PPT format. The 'Reports' topic opens a web page presenting reports written for the EC with links to the documents in PDF format. The 'European Commission Documents' topic informs users about documents relating to European projects and, *inter alia*, about the Technological Implementation Plan (eTIP). The 'Consortium Documents' topic provides information about the administrative documents defining the project working conditions. The 'Databases' topic presents the applications developed by the project – the 'STRATFEED Explorer' and the STRATFEED DSS (**Chapter 6**).

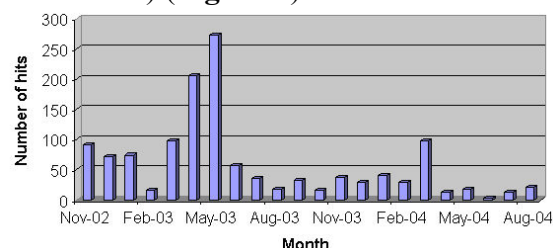
## 5.3 Website access frequency

To evaluate the frequency of access to the site, each connection is registered in specific files in order to produce the relevant statistics. For the public section, only the date of hits on the Home Page is known. Thus, 824 hits were registered in May, as against 565 in May, 421 in February, 311 in January and about 200 in the three previous months (**Figure 6**). This increase is probably due mainly to the online announcement in September 2003 of the symposium scheduled for June 2004 and for which the registration deadline was end of April. The number of hits decreased after this deadline to achieve around 250 hits by month after the symposium.



*Figure 6: Number of hits on the public section of the STRATFEED website between September 2003 and August 2004*

For the private section, the user name used to log in and the date of the login are registered. The number of logins (excluding those from the CRA-W development team) is affected by project events. Thus, many hits were registered in May 2003 (meeting in Aberdeen), in March 2004 (meeting in Geel) and during the periods when yearly reports were being written (December-January 2002–2003 and 2003–2004) (**Figure 7**).



*Figure 7: Number of hits on the private section of the STRATFEED website between November 2002 and August 2004*



## 6 Data exploitation tools

In order to enhance and exploit the database, applications were developed to manage, explore and use the data collected.

### 6.1 The STRATFEED Manager

The STRATFEED Manager aims to manage the data (i.e. add, delete or modify any data provided through the project). Developed using MS Access, it can be accessed only by the database administrator. It provides forms to input data and reports to check data (**Figure 8**).

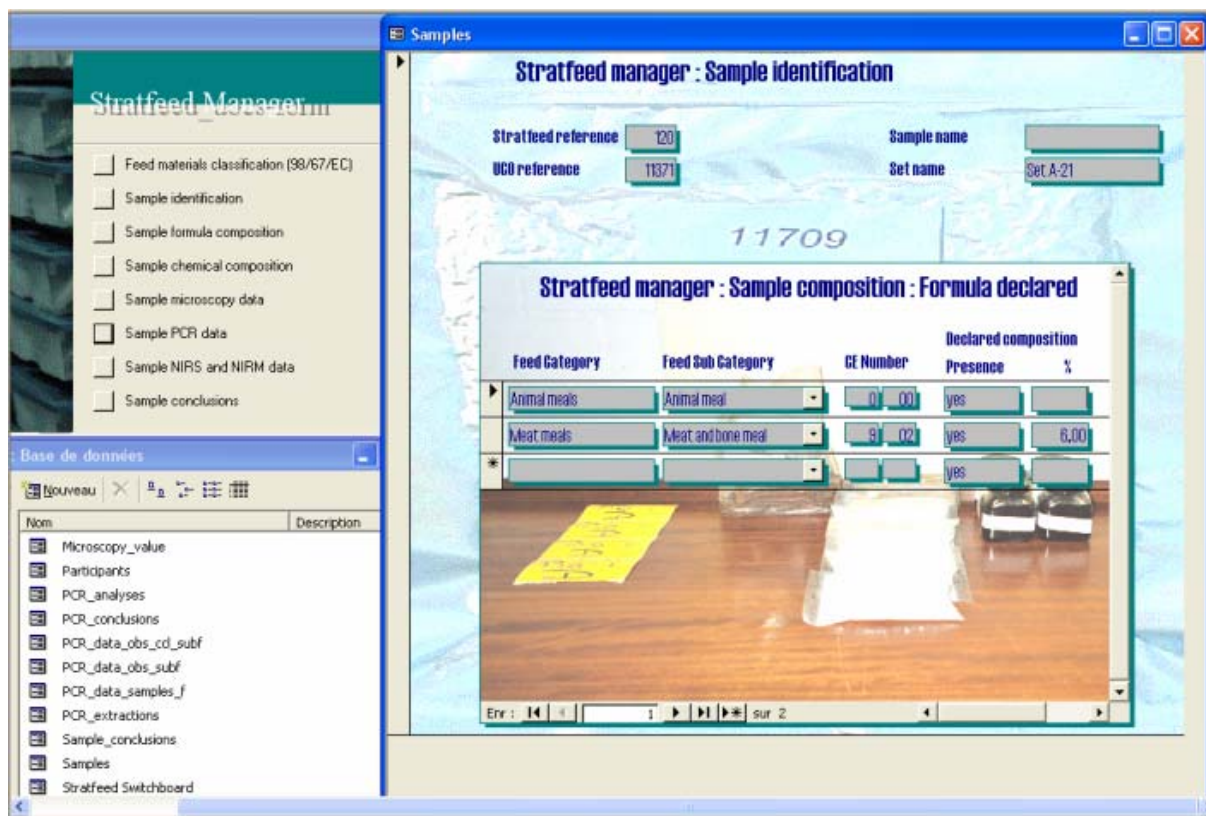


Figure 8: The user interface of the STRATFEED Manager.

### 6.2 The STRATFEED Explorer

Unlike the DSS, which are based on the knowledge and expertise required to help the user identify mammalian tissues, the STRATFEED Explorer is based on sample management and provides the user with the tools to explore the database through queries.

The development of this tool is based on client-server architecture using the Internet to provide the link between the two (**Figure 9**). The client side supports the user interface, which is a web browser (Internet Explorer or Netscape). The server

side supports the web server, the database and the query tool. The query module receives the request from the client (HTML pages), accesses the database and returns the answer to the client via the web server software and Internet protocol.

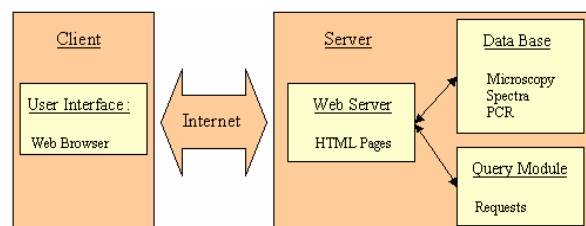


Figure 9: The Internet-based architecture of the STRATFEED Explorer.

With this application, the user can quickly get an overview of the STRATFEED database through pre-determined queries; users with more expertise can build their own queries using various query modules corresponding to the relevant techniques.

The exploration process (**Figure 10**) can be divided in four main steps. After choosing a pre-determined query from the overview module (step 1A), or building of a query from a query modules, by selecting value(s) for one or several criteria proposed (step 1B) (**Figure 11**), the system searches the database for samples answering to the query defined in step 1 (step 2). If the result of the search is not

refined enough, users can refine their query by repeating step 1B (step 3). If the result is refined enough, the sample information, the analyses results and the conclusions are displayed (step 4).

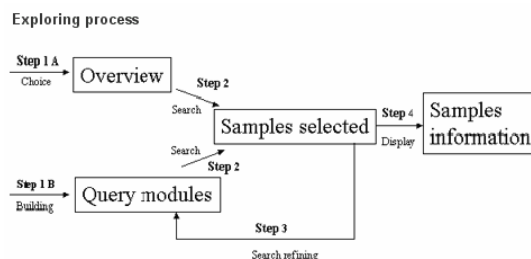


Figure 10: Exploring process of the “STRATFEED explorer”.

**Stratfeed explorer : Query module on sample information**

**Identification**

Str number :

UCO reference :

Partner reference :

From :

Name sample :

Subgroup :

**Classification**

Product :

Destination :

**Status in Sample bank**

Physical presentation :

Packaging :

Quantity :

Conservation Status :

**Composition**

Formula declared :

Chemical composition declared :

**Analyses**

Microscopy :

PCR :

NIRS :

NIRM :

**SELECT - Microsoft Internet Exp...**

**Product**

compound feedingstuffs

feed materials

OK

Search

Figure 11: The query module on sample information provided by the ‘STRATFEED Explorer’.



For each method, criteria were determined by the respective WPs (**Chapter 3**). Those criteria relating to text, pictures or graphs identify the laboratory and describe the analyses. The results of each analysis are displayed according to sample, method and laboratory.

The conclusions are presented on three levels: the laboratory level, the method level and the sample level. They relate to each taxon or species detected, according to the result and its reliability provided by each work group.

The results legend is:

- + Clearly positive for the presence of the taxon or species studied
- +/- Slightly positive for the presence of the taxon or species studied
- Negative for the presence of the taxon or species studied
- ? No clear result

The reliability legend is:

	Single result (only one result is provided in this field)
	Highly reliable result (all results provided are identical)
	Most results provided have the same tendency
	Results provided are contradictory

**Figure 12** shows, for one sample, a summary of the analyses produced for each taxon or species and for each technique studied within the framework of the project. It shows, for example, that the presence of mammal meal in sample 112 was clearly detected using classical microscopy (high reliable result), PCR (single result) and NIRM (single result). In this case, the three techniques gave the same positive results (green). However, the presence of fish meal in sample 112 was clearly detected using classical microscopy (high reliable result) and PCR (single result) but was not detected using NIRM (single result). In this case, the three techniques gave positive but contradictory results (red).

**Stratfeed explorer : Results summary for sample 112** ?

	Analyse by				Conclusion
	Microscopy	PCR	NIRS	NIRM	
Taxon or species detected	Result - Reliability	Result - Reliability	Result - Reliability	Result - Reliability	Result - Reliability
Animal	+			+	+
....Fish	+	+		-	+
....Terrestrial			+	+	+
.....Poultry	-	+		+	+
.....Mammal	+	+		+	+
.....Pig		+			+
.....Ruminant		+			+
.....Bovine		+			+
Vegetal				+	+

[Sample information page](#)

*Figure 12: Results summary for one sample provided by the STRATFEED Explorer.*

Today, the STRATFEED Explorer can be run from the public section of the website on a database reduced to the sets of samples used by the various WPs for

developing the methods. On the private section, the STRATFEED partner can explore the whole database. Each webpage is supported by a help file.

### 6.3 The decision-support systems

Additional exploitation tools that were developed include the DSS. The aim of the DSS is to offer scientists user-friendly assistance in detecting and identifying animal tissues in animal feed through descriptive texts and pictures. They are based on the knowledge and expertise of the project partners, and their structures differ from the described database management system, since the latter is sample oriented, whereas the DSS are type oriented. The development of a DSS requires translating data and results per sample into knowledge (e.g. per type of material). Knowledge may be expressed in the form of conclusions, conditions or character states. The structure in which this knowledge is formally represented depends on the chosen program. This might be a knowledge base or another type of presentation. The method for evaluating the program packages for developing DSS are discussed here, followed by a description of the two DSS developed in the project.

#### 6.3.1 *Evaluation of program packages for developing decision-support systems*

##### 6.3.1.1 *Testing and choosing programs*

DSS or more general expert systems are available in two main forms: rule-based (conditions) or matrix-based (character states). The first type is based on a set of rules. Using this type requires a lot of calculation time for the computer and usually a maximum number of rules applies. The systems based on matrices use a character-by-object table. The matrix-based systems sort and limit the information in the table when more specific information of the sample under study is entered into the system, so as to reduce the number of possible choices. This information can consist of quantitative, qualitative or fuzzy (e.g., “looks like ...”, “mixture of .... and ....”) data. The main advantage of matrix-based systems is that the results can be presented in the form of a percentage which indicates the match between the user observations and the type descriptions. Matrix-based systems also allow a better end-user oriented description of the conclusion. Two matrix-based DSS were chosen for the STRATFEED project.

*Table 1: Overview of the fields of application of different types of expert systems.*

<i>Type: Application:</i>	Database or picture base	Computer- based training system	Decision- support system
Documentation of knowledge	<b>yes</b>	<b>yes</b>	<b>yes</b>
Marketing instrument	<b>limited</b>	<b>yes</b>	<b>yes</b>
Training	<b>no</b>	<b>yes</b>	<b>limited (1)</b>
Objectifying and standardising the decisive elements	<b>no</b>	<b>no</b>	<b>yes</b>
Validating and recording the identification	<b>no</b>	<b>no</b>	<b>yes</b>

*(1) A DSS can be used as a training system. The qualification “limited” means that a computer-based training system can support the trainee and record errors and scores. A DSS does not maintain a database with the correct answers and, hence, is not capable of verifying the answers of the trainee. A DSS usually has the capacity to save a trainee’s output in a file and can support the training process by using this file.*

Computer-based training systems can be used to train analysts and research assistants in developing new skills. They are usually developed using a query-and-answer structure, where the system already knows the answers in order to control the answers of the users. In this way, the system can trace the development of the knowledge of the trainee. A review of the usage of the several types of computer packages for a series of pre-defined goals is shown in **Table 1**.

#### 6.3.1.2 Inventory of the program packages

At the start of the inventory, a list of criteria was developed for checking the applicability of a range of computer packages and programs. The criteria are:

- ❑ Ability to use several identification trees and input screens.
- ❑ Ability to input observations in a random or user-defined order.
- ❑ Presentation of a percentage as a match between the observed characters and the sets of characters defined in the DSS table .
- ❑ Ability to handle text, sound, pictures and movies.
- ❑ Variable size of pictures.
- ❑ Inclusion of pictures in text pages instead of links.
- ❑ Hybrid system that should be able to support web links.
- ❑ Module for generating reports.
- ❑ Ability to customise the system if specific and necessary features are unavailable.
- ❑ Presence of support, training and/or a helpdesk.

For the inventory of the program packages, most developers were contacted to obtain permission to use them for a defined period. The demonstration versions were then installed and tested. The following packages are included in the inventory (**Table 2**).

*Table 2: Inventory of the program packages evaluated*

Package	Type
Acquire	DSS rule based
Aqua-browser	Internet browser
Authorware	CBT
Delta and Intkey	DSS matrix based
Dryade	DSS matrix based
Everest	CBT
Folio Views	Free text-based management system
IBN mushroom database	DSS matrix based
JESS	DSS rule based
Linnaeus II	DSS matrix based
Xpertrule	DSS rule based

#### 6.3.1.3 Evaluation

The two CBT packages Authorware [17] and Everest [15], and the free-text based FolioViews [21,23] are not suitable for the STRATFEED project, since they are not designed to support the identification of objects. As the name indicates, Aquabrowser [18] is an Internet browser that documents and illustrates the user's search paths from web page to web page. Such a path can be compared to a decision tree: at every web page the user has to make a choice which page he/she will choose next. The possibilities are very limited and not suited to the STRATFEED needs and goals. For the real DSS packages the choice is between a rule-based or matrix-based system. Rule-based systems (Acquire [1,6], JESS (Java Expert System Shell [16,24]) and XpertRule [3]) require good knowledge of the development of DSS. Matrix-based systems (Delta [9], Dryade [28], IBN mushroom database [structure identical to 28] and Linnaeus II [11]) can provide equal functionality, but appear to be more transparent in the process of development. An important feature of the matrix-based systems is the percentage that indicates the match between a sample under study and the best fit(s) in the database with sample

types. Of the four matrix-based systems included in this inventory, Linnaeus II displayed the largest range of possibilities. It enables the user to enter data in the database in a flexible way, and provides the unique combination of a database, three identification modules, several additional modules and the integration of text, pictures, sounds and movies. The weaknesses of Linnaeus II are that it cannot be run on the Internet in a browser window, the lack of thumbnails to present lists of images, and the lack of a structure and terminology that fits the discipline of classical taxonomy. A solution to the first drawback was to develop a dedicated identification key as a pivotal part of a DSS, implemented in Java (i.e. Internet compatible). In addition, for the validation

study the second beta release of ARIES was provided to the participants using the Internet gateway program Citrix [7]. It seemed possible to customise Linnaeus II to meet the STRATFEED requirements. An Internet-compatible version of Linnaeus II has been recently published.

### 6.3.2 The STRATFEED decision-support system


The STRATFEED DSS, an Internet-oriented system developed in JAVA by CRA-W in collaboration with RIKILT, provides a stepwise identification of bone particles in animal feed using classical microscopy.

#### Stratfeed DSS : Identification by classical microscopy

### Features of Fish

Bones are small, often parallel-sided, more transparent than mammal and poultry bones; complete vertebrae may be visible in contrast to the other types of animal meals. At higher magnifications bones show lacunae that are usually elongated with a clear fusiform net of canaliculae. There is a large diversity among fish species, the lacunae in cod are linear without visible canaliculae. Fish meal usually contains fish scales. The presented description is very general and a large variation can be found. Cartilage structures of mammals, poultry as well as fish show mostly

**BACK**



Differences	Concordances	Your observations	Tissue Features
1. Colour predominantly white	■■■■■	YES	YES
2. Colour predominantly yellow or brown	■■■■■	YES	YES
3. Particles more or less transparent	■■■■■	YES	YES
4. Sharp edges and points	■■■■■	INTERMEDIATE	INTERMEDIATE
5. Particles more or less globular in shape	■■■■■	NO	NO
6. Particles partly tubular in shape	■■■■■	YES	YES
7. Lacunae elongated or linear	■■■■■	NO	YES
8. Lacunae predominantly elliptical	■■■■■	NO	NO
9. Canaliculae partly visible	■■■■■	NO	YES
10. Canaliculae clearly visible, often spider-like	■■■■■	YES	YES
11. Lacunae in a dense pattern	■■■■■	NO	NO
12. Are egg shells present	■■■■■	NO	NO
13. Are animal hairs present	■■■■■	NO	NO
14. Are feathers or feather filaments present	■■■■■	YES	NO
15. Are fish scales present	■■■■■	NO	YES

<<

Figure 13: The microscopy expertise provided by the STRATFEED decision-support system.



In the first step, there is a list of the types of observation (low magnification, high magnification, bones, additional inclusions) that are supported by the system. The user makes a selection from the list. Depending on this selection, a series of 15 questions, illustrated with pictures, has to be answered by pressing one of the following buttons: 'yes', 'intermediate', 'no' or 'blank'. The program then calculates the fit between the user's observations and the referenced descriptions of mammalian, avian or fish tissue, and presents these findings in descending order. Finally, for each question, the user can check and compare his/her choices with the description of the different types of MBM: mammalian, avian and fish material (**Figure 13**). The system provides a subset of the functionalities included in ARIES and shows the potential power of the DSS as well as the possibility identifying animal protein contamination in feed. It is available, free-of-charge, on the website.

### 6.3.3 The Animal Remains Identification and Evaluation System (ARIES)

The ARIES DSS was produced by RIKILT [25], based on Linneaus II software [11], in collaboration with NUTRECO, LAGC, AFSCA-FVLT, AGROSCOPE, LUFA and DPD. This system provides three identification modules (**Figure 14**): the first is based on text, while the second is based on pictures. These two modules are based on decision trees. Every window shows two or three buttons with choices (texts or images); pressing a button (i.e. making a choice) leads to a window with either new choices or a conclusion. Both modules can produce a report of the identification pathway. The third identification module, which is more powerful, is based on a multiple-entry key (matrix of taxa, characters and character states). Observations can be entered in a user-defined order, and after each input the user is informed about the match of the most probable conclusions. ARIES also provides an introduction to the system, protocol and recipe explanation, a databank with descriptions and images of each MBM type and possible confusing vegetable ingredients, a glossary of terms, a comprehensive gallery of images, and full information on legislation, literature and Internet links.

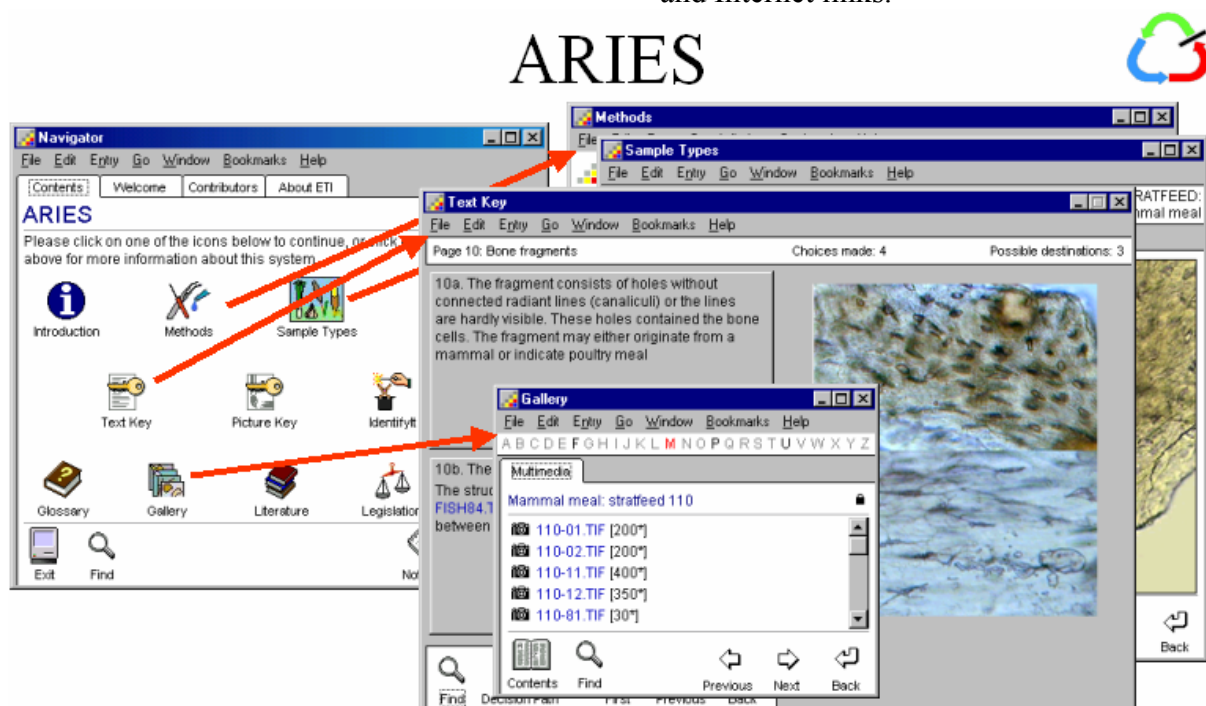


Figure 14: The microscopy expertise provided by the ARIES decision-support system.

ARIES can be exploited as a stand-alone system (the original form of Linnaeus II) and, more recently, on the Internet through a browser window. Internet accessibility could have several advantages. The presence of one program version on a central server allows a continuous process of updating to be made according to most recent information, and difficult installation procedures for stand-alone software can largely be avoided. However, these advantages imply requirements. Maintenance of a software system requires an organisational structure (e.g. an institute or a project team), and resources (time and money). Maintenance will be particularly important once STRATFEED is completed in 2004 since information available on the Internet will be expected to be up to date. However, it is not the task of STRATFEED to initiate support and further development after finishing the project.

A stand-alone system can still function after STRATFEED without any further needs. The developer of Linnaeus II requests a licence fee for both platforms, as well as royalties for each subscription. The break-even number for the stand-alone version appears to be substantially lower than that for the Internet version (about 6 subscriptions versus 19 subscriptions, respectively, according to the fee levels in March 2004).

Another aspect relates to how the programs are executed. The way in which HTML and related languages are interpreted by the browser might result in relatively long execution times or even non-availability during periods of high Internet use. For example, after accessing the JESS demonstration for Reptile identification [14] several times, it was frequently unavailable. Programs designed in C++ or Fortran are linked to libraries and then compiled in run-time versions. This gives a high execution speed, since the run-time version is written in machine language.

A hybrid situation could be worth considering. Technical means exist to set

up and maintain Internet sessions that link a hard disk (or part of one) at a central host to a local computer anywhere in the world, providing the hard disk has a local partition. Programs can be executed locally. The software to build and maintain the gateway will administrate the use of the programs. In this way, Internet accessibility and stand-alone systems can be combined. Several centres of expertise provide software to end-users by using gateway programs for accessing databases and programs. Subscribers to such facilities pay (annual) fees and get a username and password for access.

The second beta release of ARIES (version 0.7) was made available during the validation study of the microscopic method using a hybrid implementation with the program Citrix [7]. It seemed very difficult to get the version of Linnaeus II (version 2.1) used for developing ARIES v. 0.7 running in this environment because of the limited possibilities for file sharing in Linnaeus II and the need for licences for user accessibility. Finally, it was possible to have a multi-user environment available during the validation study running as a batch system directing 10 single-user working areas. An upgrade to Linnaeus II version 2.5 in 2004 for the final release of ARIES v. 1.0 is essential for overcoming the limitations of the current version.

With regard to DSS, the choice of an Internet-based system and/or a stand-alone system needs to be based on an assessment of the strengths and weaknesses of the two systems:

- 1 Web version
  - + easy installation procedures
  - + central position of maintenance facilities
  - need for a supporting organization
  - investment in infrastructure
  - support (helpdesk)
  - regular updates would be expected
- 2 Stand-alone CD
  - + low break-even number
  - + fast and reliable access
  - one release, follow-up unknown

These strengths and weaknesses support releasing ARIES on CD as a stand-alone version, and subsequently developing a web-based version after positive feedback from market analysis

## 7 Management overview

Work package 6 (WP6) of the STRATFEED project regroups the activities undertaken to develop an Internet site and construct a database linked to the query modules. For the integration of data and information to the Internet site, WP6 was closely linked to each WP, particularly to WP3 for incorporating the DSS for classical microscopy.

The first task undertaken within the framework of the STRATFEED project was to develop an Internet site ([www.stratfeed.cra.wallonie.be](http://www.stratfeed.cra.wallonie.be)) [2]. The website, comprising both the public and private sections (**Chapter 5**), was set up at the start of the project and the first release was available in Month 6. All the partners worked to ensure that the site was comprehensive and informative.

The second task of WP6 was to construct the database (**Chapter 3 and 4**), starting in Month 12. After consultation among the partners on defining the data structure, a global database was built around the samples in the European sample bank (WP2). This database now includes the identification, characteristics, quantity available, conservation status, chemical composition and formulae of 2,500 samples, as well as the consolidated results (including pictures and graphs) of the work on developing methods, which involved using 150 samples. Incorporating data and updating the database is facilitated by management tools (**Chapter 6.1**) available to the database administrator.

The third task focused on the exploitation of the data. The STRATFEED Explorer (**Chapter 6.2**), initiated in Month 15, was made available on the private section of the website to test and improve the different queries modules. A full release was shown at the meeting in Aberdeen (Month 29). The final release is now available to the public to explore a reduced database. For classical microscopy, two DSS were created (**Chapter 6.3**). The STRATFEED DSS, Internet oriented and available to a wide public audience, was developed by WP6 in collaboration with WP3 during the second year of the project. The ARIES DSS, aimed at a more expert public, was initiated in Month 1. It was originally published as a demonstration version for all STRATFEED partners, followed by two beta releases for the microscopy partners to facilitate the synthesis and documentation of microscopic detection of animal proteins. Today, it includes all the expertise provided by WP3 during the project. These systems can be accessed via the website.

## 8 Conclusions and perspectives

The Internet-oriented computer system developed under the STRATFEED project now offers the public a wide range of tools to explore the results produced. First, the STRATFEED website aimed to gather general, legislative and scientific information on the project topic and make it accessible to a wide audience.. The private section of the website, however, for information exchange among the project partners, and facilitates the gathering of scientific data with high added value. The STRATFEED database” can be used as a reference for detecting and quantifying mammalian tissues in animal feed and is linked to each laboratory or manufacturer working in the feed sector. This is the first reference database with so much

information on feed samples contaminated or not with animal tissue. By May 2004 the database included descriptions of about 2,500 samples and scientific data from analyses of 150 samples using new methodologies. General applications such as the STRATFEED Manager and the STRATFEED Explorer [28], provide real added value to the STRATFEED Database, improving the management of data and helping to build queries. Specific applications such as the ARIES DSS and the STRATFEED DSS give responses to specific requests. These DSS are the first known systems to be applied to detecting mammalian tissues in feedstuffs in support of current EU legislation.

The website carrying these applications and carefully developed over a 3-year period is now used as the main tool to disseminate and add value to the results of work on detecting MBM in feedstuffs. A wider public can access the database and the linked applications. One indicator of the interest in the project and these results is the increasing number of hits on the website.

The future of the STRATFEED website and its applications [2] is defined in the Technological Implementation Plan. The website will be maintained by CRA-W for at least 3 years. It will also facilitate follow-up on the project. The applications will be maintained and updated as often as necessary, depending on the development of the BSE problem and on the research. Other tools may also be developed around the database. The modular structure of the system, based on the project topics, facilitates updating and favours the development of further tools. The concept developed for the STRATFEED project can be used for other projects and can easily be adapted to meet new requirements.

The exploitation of ARIES [25] will be carried out by RIKILT. The package can

be used to support and document the actual identification in common practice and can be used as a training system. The program will be made available for laboratories and agencies at a price that covers licence fee, royalties, production costs, administration and a small additional fee for support. The knowledge itself will not be charged for, as it was developed through a public-funded project. STRATFEED partners will be charged only for licence fee and royalties. The exploitation will be carried out in two phases: preparation of a commercial ARIES version 1.0 CD release in autumn 2004, and of a web version release in 2005–2006, depending on positive feedback from market research.

The STRATFEED DSS system and the ARIES demo, available on the website, will serve as a marketing platform to illustrate the power of DSS and inform the public about the ARIES system.

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