

Spatial Analysis of Rural Development Measures Contract No. 244944

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D2.1

Design and development of a data warehouse (month 18)

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Abbreviations

CATS	Clearance of Audit Trail System								
CMEF	Common Monitoring and Evaluation Framework								
CQL	Common Query Language								
CSV	Comma Separated Values (Text File Format)								
EAFRD	European Agricultural Fund for Rural Development								
EC	European Commission								
EU	European Union								
GUI	Graphical User Interface								
GVA	Gross Value Added								
NUTS	French abbreviation for nomenclature des nites territoriales								
	statistiques, a geocode standard for referencing the subdivisions of EU								
	countries for statistical purposes								
RD	Rural Development								
RDP	Rural Development Plan								
SQL	Standard Query Language								
SSH	Secure Shell								



Summary

The SPARD project is aiming at the analysis of the extent of impact of EU rural development measures based on the Common Monitoring and Evaluation Framework (CMEF). In order to do so the SPARD Work Package (WP) 2 task was (at the beginning of the project) to screen available data for their appropriateness, consistency, completeness and processebility for further manipulation in computer programs such as, e.g., spatial econometric modeling tools or statistical software packages. Since the datasets provided by EuroStat and the European Commission (EC) are mostly created for "human" readers, tabular data created for official EU reports come in "human readable" form which makes it difficult to process them programmatically via computer programs in an easy way. WP2's task was therefore to develop a database and corresponding Graphical User Interfaces (GUIs), interfaces and visualisation possibilities to let the project have a deeper look into the existing data and to extract variables for further processing in additional software packages. This report on deliverable D2.1 refers to task 2.1 "Design and development of a data warehouse" and will describe the steps that have been undertaken to create a common SPARD data warehouse, the data structure of the database tables, the Graphical User Interface that has been developed to extract the data and explore data gaps of selected CMEF indicators, as well as the spatial coverage of the RDP measures. Furthermore we will describe the web-based, geographic visualisation possibilities that have been developed and integrated for easy access and quick analysis of the tabular datasets provided by the EU via joining the tabular data to their corresponding spatial entities, in this way showing the spatial coverage of the RDP measures.

The current deliverable version refers to:

- Design and development of the structured indicator base, being consistent with the CMEF guidelines regarding indicators for RDP performance evaluation
- Design and development of a generic CMEF-RDP indicator base interface providing remote access to the database for evaluation programs
- Design and development of an exploration tool of the spatial coverage of measures in order to allow assessing the capability to spatially relate CMEF RDP indicators to certain measure indicators provided through the CATS data base.



1 Introduction

The project SPARD's needs where defined in Description of Work (DoW) as follows:

The data warehouse will provide easy discovery and further sharing of data during the project and beyond. A metadata base will be established with information on lineage, ownership and content. This task will consist of: The data warehouse will be supported by a graphical user interface (GUI) for data upload retrieval & download. The data warehouse will contain NUTS0-, NUTS2- and case study data and will provide the functionality for remote upload, retrieval and storage of these different files containing data for approx 40 RDP indicators.

(Source: SPARD_244944_DOW_150310 fin.pdf, 15.03.2010)

In order to fulfill this task AIT has established a data warehouse consisting of the following software and hardware components:

The SPARD data warehouse is situated on a web-server, running Scientific Linux, Apache 2, Tomcat 5.5 and a PostGreSQL 8.1 as database. The SPARD Data Viewer has been programmed as a Java WebStart application. It is reachable via http://sf5.arcs.ac.at/spard_site/dataviewer/ during the project and might be transferred to a SPARD specific server after the lifetime of the project

The visualization platform is situated on the same server and is connected to a Geoserver 2.1 serving data from the SPARD data warehouse in form of OpenLayer maps, table exports. It has advanced visualisation capabilities like time series representation in Google Earth. All of these components will be described in detail in the next chapters.

2 CMEF Data Processing

2.1 Import of Official European Data Sets into the SPARD Data Warehouse

As described in Deliverable D2.2 the data representing CMEF indicators are provided as tables to be read visually and not as tables to be used directly for data processing. The following figure 1 shows a detail of such a table for 2009 containing indicators and variable names as multiple headers and with additional comments in the fields.



_	CU2	- f_{sc} Change in Structure of the Econo	my						
	Α	В	С	D	CN	CO CP	CQ C	R CS C	CU
1	cmefid					C191a	C191b	C191c	C192a
2	Indicator					Context 19 - Structure of the Economy	Context 19 - Structure of the Economy	Context 19 - Structure of the Economy	Change in Structure of the Economy
2									-
3	Subindicator								
4	Measurement					% GVA by branch	% GVA by branch	% GVA by branch	% GVA by branch
5	Source					Eurostat	Eurostat	Eurostat	Eurostat
6	Source2					Economic Accounts	Economic Accounts	Economic Accounts	Economic Accounts
7	Year					2007	2007	2007	2002-2007
8									
9	Unit					%	%	%	%
10						00.1001.10	00.1001.10		00.100.10
11	Calculation					DG AGRI -LZ	DG AGHI-LZ	DG AGHI-L2	DG AGRI-L2
12	NUTS code	label	NUTS			% GVA in Primary sector	% GVA in Secondary sect	or % GVA in Tertiary sector	% GVA in Prima
878	FR824	Bouches-du-Rhône	NUTS3			1,2	19,8	79,0	
879	FR825	Var	NUTS3			2,7	13,5	83,8	
880	FR826	Vaucluse	NUTS3			4,1	18,5	77,4	
881	FR83	Corse	NUTS2			1,7	15,7	82,6	-
882	FR831	Corse-du-Sud	NUTS3			0,9	15,7	83,4	
883	FR832	Haute-Corse	NUTS3			2,6	15,7	81,8	
884	FR91	Guadeloupe	NUTS2			3,0	13,7	83,3	-
885	EB910	Guadaloupa	MUTS3	1 1		30	13.7	933	

Figure 1 Layout of an Exemplary "Raw" Table Containing RDP-Indicators (Source: DG AGRI)

Each year the tables have a slightly different structure and layout, which does not allow an automatic data conversion. Such a table cannot be processed directly to copy the data sets into a common data base so it was necessary, to "clean" the table content manually before copying the data into a common database, which can be directly accessed for statistical analysis and mapping. The following figure 2 shows such a "clean" table of NUTS2 indicators for year 2009.

A	В	С	D	E	F	G	Н	1	J	K	L	M	N	0	P	
							BaselineInd	licator_ID						1		
NUTSCc -	SRegioi -	NUTSLe -	DECDGr -	GroupDe -	countryC -	Countr -	A .	2 -	3 -	4 •	5 -	6 -	7 -	8 -	9 -	
AT11	Burgenland	NUTS2	(1) PR	predomina	AT	Austria	8,16167	-0,01176	73,41	4,7	3,701068	0,54	26,1	0,18	25,3	
AT12	Niederöste	NUTS2	(1) PR	predomina	AT	Austria	101,5541	-4,68241	74,09	4,44	3,553616	0,52	61,5	0,33	16,5	
AT13	Wien	NUTS2	(3) PU	predomina	AT	Austria	169,6499	-16,6812	67,84	-1,02	8,31458	2,54	66,1	0,17	30,9	
AT21	Kärnten	NUTS2	(1) PR	predomina	AT	Austria	105,6811	-2,40943	69,79	4,93	3,867609	0,77	42,9	0,27	10,1	
AT22	Steiermark	NUTS2	(1) PR	predomina	AT	Austra	107,4498	-3,60717	71,84	4,61	3,728473	0,54	43,9	0,29	12,3	
AT31	Oberöstern	NUTS2	(2) IR	intermedia	AT	Autria	121,4522	-3,5101	75,31	4,34	3,238253	0,15	47,1	0,55	15,8	
AT32	Salzburg	NUTS2	(2) IR	intermedia	AT	ustria	139,5816	-8,74161	75,54	3,15	3,008596	0,67	49,4	0,46	10,2	
AT33	Tirol	NUTS2	(1) PR	predomina	AT	Austria	129,5589	-3,00502	75,06	6,21	2,761072	0,24	45,9	0,29	11,4	
AT34	Vorarlberg	NUTS2	(2) IR	intermedia	TAT	Austria	129,8536	-4,74968	74,3	4,96	3,599788	1,18	37,7	0,32	17,2	
BE10	Région de	NUTS2	(3)	۵	R	C		-		D			1	F		T
BE21	Prov. Antw	NUTS2	(3)1 Bas	elineIndicat	MEES	CMEEIL	 Indicator 			D		1.	Subindio	ator	1	
BE22	Prov. Limb	NUTS2	(3)2	ion ion ion ion	1.01	01a	Objective	1 - Economi	c Developme	ent			Capitrale	ALION	10	-
BE23	Prov. Oost	NUTS2	(3)3		2 01	Olb	Change in	Economic [Developmen	t						
BE24	Prov. Vlaan	NUTS2	(3)4		3 02	02a	Objective	2 - Employm	ent Rate	20 S.						
BE25	Prov. Wes	NUTS2	(3)5		4 02	O2b	Change in	Employme	nt Rate							
BE31	Prov. Brab	NUTS2	(3)3		5 03	OSa	Objective	3 - Unemplo	vment							
BE32	Prov. Hain	NUTS2	(3)7		6 03	O3b	Change in	Unemploym	nent							
BE33	Prov. Liège	NUTS2	(2)3		7 04	04	Objective	4 - Training a	and Educatio	on in Agric	ulture					
BE34	Prov. Luxe	NUTS2	(1)9		8 05	05	Objective	5 - Age Stru	cture in Agri	culture						
BE35	Prov. Nam	NUTS2	(2)0		9 06	06a	Objective	6 - Labour P	roductivity in	Agricultur	e					
BG31	Severozap	NUTS2	(1) 1	1	10 06	O6b	Change in	h Labour Pro	ductivity in A	griculture						
BG32	Severen ts	NUTS2	(2) 2	1	11 07	07a	Objective	7-GFCF in	Agriculture							
BG33	Severoizto	NUTS2	(2) 3	1	12 07	O7b	(Objective	7) - GFCF ir	n Agriculture	3						
BG34	Yugoiztoch	NUTS2	(2) 4	1	13 07	07c	Change in	n GFCF in A	griculture							
BG41	Yugozapag	NUTS2	(3) 5		14 08	08a	Objective	8 - Employm	ent Develop	ment of P	rimary Secto	r				
BG42	Yuzhen tse	NUTS2	(2) 6		15 08	O8b	(Objective	e 8) - Employr	ment Develo	opment of	Primary Sect	tor				
1 I	102101100		7		16 08	08c	Change in	n Employmer	nt Developm	ent of Prin	hary Sector					
			8		17 09	09a	Objective	9 - Economie	c Developme	ent of Prim	ary Sector					
			9	1	18 09	O9b	(Objective	9) - Econom	nic Developr	nent of Pri	mary Sector					
			20		19 09	09c	Change in	n Economic [Developmen	t of Primar	y Sector					
			21		20 012	012a	Objective	12 - Employr	ment Develo	pment in F	-ood Industr	у				
			2		21 012	012b	(Objective	+ 12) - Emplo	yment Deve	lopment in	Food Indus	try				
			13		22 012	012c	Change in	n Employmer	nt Developm	ent in Foo	d Industry					
			:4		23 016	016	(Objective	e16) - Importa	ance of sem	I-subsister	nce tarming i	n New Membe	r States			
			30		26 023	023a	Objective	23 - Soil: Org	ganic Farmir	ng						

Figure 2 Layout of a New "Clean" Table Containing RDP-Indicators, Linked With a Further Table Containing Data Description. (Source: SPARD DB)



2.2 Preprocessing of Tabular Data

In order to transfer the CMEF Rural Development Plan (RDP) Report tables of the various reporting years into the database, AIT has developed a Java program routine to parse the MS Excel sheets semi-automatically, via calculating the row and column positions within the Excel sheets and then transform the data into row based SQL INSERT statements (Figure 3).

	File file = new File("C:/Users/petersj/Documents/_Projekte/SPARD/data/von_Sandra/RD_Report_2010_Regional_Tables_ja
	Sheet sheet = workbook.getSheet(1);
11	Cell a1 = sheet.getCell(0,0); Cell b2 = sheet getCell(1,1);
11	Cell c2 = sheet.getCell(2,1); Cell c2 = sheet.getCell(2,1);
//	String[] indCols = {"F","H","K","M","P","R","U","X","AA","AC","AF","AH","AJ","AM","AO","AQ","AT", "AV","AX","BA","BC
//	/*> 2007!>*/String[] indCols = {"F","I","L","O","R","U","X","Z","AC","AE","AH","AJ","AM","AO","AR","AU","AW","AZ
// //	<pre>String[] indColsInfo = ("G","J","L","N","Q","S","V","Y","AB","AB","AB","AB","AB","AB","AN","AN</pre>
// //	/*> 2007!>*/String[] indColsInfo = ("G","J","M","P","S","V","Y","AA","AD","AF","AI","AK","AN","AP","AS","AV","A ("F","I","L","O","R","U","X", "2","AC","AE","AH","AJ","AM","AO","AR","AU","AZ","BE"
// //	String[] indRows = {"1","2","3","4","5","6","8","10"}; /*> 2007!>*/String[] indRows = {"1","2","3","4","5","6","8","10"};
 	/*> 2006!>*/String[] indRows = {"1","2","3","4","5","6","8","10"};//!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
	/ / 2000. // Solling[] indoitainto = { 8 , 0 , m , r , K , 0 , m , 2],
	/*> 2010!>*/String[] indRows = {"1","2","3","4","5","6","8","10"};//!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
	/*> 2010!>*/ String[] indColsInfo = {"G","I","L","N","Q","S","V","Y","AB","AD","AG","AI","AK","AN","AP","AR","AU
	<pre>System.out.println("indCols.length: " + indCols.length);</pre>
	String notAvailable = "NULL";

Figure 3: Part of the Java ode Used for The Semi-Automated Transformation of Excel Data Into Database

In this way normalizing the data from a column to a row based dataset (Table 1)

Table 1: Normalised RDP Report Database Table

baseline_li	ndic_2009 @spand.p	ublic (loc	calhost) -	Table										and the second second
File Edit Vi	ew Window Help													
import Wi	zard 🔽 Export Wia	rard ¥F	Filter Wiz	ard Grid	View 🗇 F	orm View	1 Memo	🗌 Hex 🛋 Image	Sort Ascending	Sort Descendi	ng 🏠 Remove S	ort 🖬	Custom Sort	
primi nuts_c	o nuts_region_nam	e nuts_let	w oecd_g	gri oecd_gi cou	inti country	base cme	f_suj cmef_id	indicator	measurement	source	source2 year	unit	calculation	indicator_value
109 AT11	Burgenland (A)	NUTS2	(1) PR	predon AT	Austria	13 07	07c	Change in GFCF	in Ag Average annual	growt Eurostat	Agricul 2000-2	2C % pe	DG AGRI - L2	
110 AT12	Niederösterreich	NUTS2	(1) PR	predon AT	Austria	13 07	O7c	Change in GFCF	in Ag Average annual	growt Eurostat	Agricul 2000-2	2C % pe	DG AGRI - L2	0,3
111 AT13	Wien	NUTS2	(3) PU	predon AT	Austria	13 07	07c	Change in GFCF	in Ag Average annual	growt Eurostat	Agricul 2000-2	2C % pe	DG AGRI - L2	-3
112 AT21	Kärnten	NUTS2	(1) PR	predon AT	Austria	13 07	07c	Change in GFCF	in Ag Average annual	growt Eurostat	Agricul 2000-2	2C % pe	DG AGRI - L2	3,1
113 AT22	Steiermark	NUTS2	(1) PR	predon AT	Austria	13 07	07c	Change in GFCF	in Ag Average annual	growt Eurostat	Agricul 2000-2	20 % pe	DG AGRI - L2	1,8
114 AT31	Oberösterreich	NUTS2	(2) IR	interme AT	Austria	13 07	07c	Change in GFCF	in Ag Average annual	growt Eurostat	Agricul 2000-2	2C % pe	DG AGRI - L2	0
115 AT32	Salzburg	NUTS2	(2) IR	interme AT	Austria	13 07	07c	Change in GFCF	in Ag Average annual	growt Eurostat	Agricul 2000-2	2C % pe	DG AGRI - L2	1,7
116 AT33	Tirol	NUTS2	(1) PR	predon AT	Austria	13 07	07c	Change in GFCF	in Ag Average annual	growt Eurostat	Agricul 2000-2	2C % pe	DG AGRI - L2	-5,1
117 AT34	Vorariberg	NUTS2	(2) IR	interme AT	Austria	13 07	O7c	Change in GFCF	in Ag Average annual	growt Eurostat	Agricul 2000-2	2C % pe	DG AGRI - L2	0
118 AT11	Burgenland (A)	NUTS2	(1) PR	predon AT	Austria	88 C18	C182a	Change in Age S	tructu % people by age	e class Eurostat	2000 -	2%	DG AGRI -L2	-1,56
119 AT11	Burgenland (A)	NUTS2	(1) PR	predon AT	Austria	89 C18	C182b	Change in Age S	tructu % people by age	class Eurostat	2000 -	2%	DG AGRI -L2	-0,45
122 AT12	Niederösterreich	NUTS2	(1) PR	TA noberq	Austria	09 C10	C102b	Change in Age 5	tructu % people by age	class Eurostat	2000 -	2%	DG AGRI -L2	-0,46
123 AT12	Niederösterreich	NUTS2	(1) PR	predon AT	Austria	90 C18	C182c	Change in Age S	tructu % people by age	class Eurostat	2000 -	2%	DG AGRI -L2	2,01
124 AT13	Wien	NUTS2	(3) PU	predon AT	Austria	88 C18	C182a	Change in Age S	tructu % people by age	class Eurostat	2000 -	2%	DG AGRI -L2	-0,25
125 AT13	Wien	NUTS2	(3) PU	predon AT	Austria	89 C18	C182b	Change in Age S	tructu % people by age	e class Eurostat	2000 -	2%	DG AGRI -L2	0,28
126 AT13	Wien	NUTS2	(3) PU	predon AT	Austria	90 C18	C182c	Change in Age S	tructu % people by age	e class Eurostat	2000 -	2%	DG AGRI -L2	-0.02
127 AT21	Karnten	NUTS2	(1) PR	predon AT	Austria	88 C18	C182a	Change in Age S	tructu % people by age	class Eurostat	2000 -	2%	DG AGRI -L2	-2,08
128 AT21	Kärnten	NUTS2	(1) PR	predon AT	Austria	89 C18	C182b	Change in Age S	tructu % people by age	e class Eurostat	2000 -	2%	DG AGRI -L2	-0.19
129 AT21	Kärnten	NUTS2	(1) PR	predon AT	Austria	90 C18	C182c	Change in Age S	tructu % people by age	class Eurostat	2000 -	2%	DG AGRI -L2	2,26
130 AT22	Steiermark	NUTS2	(1) PR	predon AT	Austria	88 C18	C182a	Change in Age S	tructu % people by age	class Eurostat	2000 -	2%	DG AGRI -L2	-1,91
131 AT22	Steiermark	NUTS2	(1) PR	predon AT	Austria	89 C18	C182b	Change in Age S	tructu % people by age	class Eurostat	2000 -	2%	DG AGRI -LZ	0,11
132 AT22	Steiermark	NUTS2	(1) PR	predon AT	Austria	90 C18	C182c	Change in Age S	tructu % people by age	class Eurostat	2000 -	2%	DG AGRI -L2	1.8
133 AT31	Oberösterreich	NUTS2	(2) IR	interme AT	Austria	88 C18	C182a	Change in Age S	tructu % people by age	e class Eurostat	2000 -	2%	DG AGRI -L2	-1,97
134 AT31	Oberösterreich	NUTS2	(2) IR	interme AT	Austria	89 C18	C182b	Change in Age S	tructu % people by age	class Eurostat	2000 -	2%	DG AGRI -L2	0.14
135 AT31	Oberösterreich	NUTS2	(2) IR	interme AT	Austria	90 C18	C182c	Change in Age S	tructu % people by age	class Eurostat	2000 -	2%	DG AGRI -L2	1,83
136 AT32	Salzburg	NUTS2	(2) IR	interme AT	Austria	88 C18	C182a	Change in Age S	tructu % people by age	class Eurostat	2000 -	2%	DG AGRI -L2	-1.5
137 AT32	Salzburg	NUTS2	(2) IR	interme AT	Austria	89 C18	C182b	Change in Age S	tructu % people by age	e class Eurostat	2000 -	2%	DG AGRI -L2	-0,1
130 4733	Calabara	AUTER	(7) 10	Internet AT	Accession	00 510	C183+	Channel in Anna	Anosta Managara has been	state Frenchat	1000		DC ACRE 13	



2.3 Derived Database Tables

The preprocessing lead to the following table structure in the database (tables are also showing the range, i.e. min and max values for each field/column)(Tables 2 and 3).

Table 2: SPARD Database Table Structure

table	column	min	max
gva_time_series_new	nuts_id	AT	UKN
gva_time_series_new	nuts_name	land	Zuid-Nederland
gva_time_series_new	year	1995	2008
gva_time_series_new	value	0	200
qva time series new	nace code	TOTAL	TOTAL
qva time series new	_ pk	5373	8956
gva perc diff tot	aid	1	1927
gva perc diff tot	objectid	1	1927
gva perc diff tot	nuts id	AT	UKN05
gva perc diff tot	stat_levi	0	3
gva perc diff tot	nuts0	AT	UK
gva perc diff tot	name	Aachen, Kreis	Zwickau, Kreisfreie Stadt
gva perc diff tot	name asci	Aachen Kreis	Zwickau Kreisfreie Stadt
gva perc diff tot	unit	MIO EUB	
gva perc diff tot	nace r1		
gva_perc_diff_tot		ΔΤ	
gva_perc_diff_tot	u2008 pdif	0	200
gva_perc_diff_tot	y2000_pair u2007_pdif	0	200
gva_perc_diff_tot	u2006. pdif	0	200
gva_perc_diff_tot	y2005_pdif	0	200
gva_perc_diff_tet	v2003_pair	0	200
gva_perc_diff_tot	92004_pdii	0	200
gva_perc_dirf_tot		0	200
	92002_pail	0	200
gva_perc_dirr_tot	92001_pair	0	200
gva_perc_dirr_tot	92000_pair 	0	200
gva_perc_dirr_tot	y1999_pair	0	200
gva_perc_diff_tot	y1998_pair	0	200
gva_perc_diff_tot	y1997_pair	0	200
gva_perc_diff_tot	y1996_pdif	0	200
gva_perc_diff_tot	y1995_pdif	0	200
gva_perc_diff_tot	pk	0	31827
obj_indics_all_years_new2	primary_key	0	69255
obj_indics_all_years_new2	nuts_code	ATI	UKN05
earfd_time_series	year	2007	2010
earfd_time_series	ms	AT	UK
earfd_time_series	paying_agency_code	5040501111	5040501611
earfd_time_series	nuts_id	AT111	UKN05
earfd_time_series	f200	0	56354
earfd_time_series	amount_euro	-812306.63	110852620.42
earfd_time_series	public_expediture	-646876.03	138565776.97
earfd_time_series	area_cov_by_paym_appl_logded	-9154.8	1903562007.36
earfd_time_series	area_cov_by_paym_made	-9164	1902990519.82
earfd_time_series	pk	1	38799
obj_indics_reduced2	nuts_code	AT1	UKN05
obj_indics_reduced2	nuts_region_name	:	Zwickau, Kreisfreie Stadt
obj_indics_reduced2	nuts_level	NUTS1	NUTS3
obj_indics_reduced2	indicator	Change in Economic Development	Objective 6 - Labour Productivity in Agriculture
obj_indics_reduced2	year	2000	average 2005 to 2007
obj_indics_reduced2	unit		% per year
obj_indics_reduced2	indicator_value	-156901	710199
obj_indics_reduced2	report_year	2006	2010
obj_indics_reduced2	pk2	1	375639
obj indics reduced2	nuts id	AT1	UKN05
obj indics reduced2	cmef id	016	0356
	_·-		



chema_na <u>me</u>	table_name	column_na <u>me</u>	data_type	2	e schema name	e schema name table name	schema name table name column name
public	gva_time_series_new	nuts_id	varchar	1	public	public obj_indics_all_years_new2	public obj_indics_all_years_new2 primary_key
public	gva_time_series_new	nuts_name	varchar	1	public	public obj_indics_all_years_new2	public obj_indics_all_years_new2 nuts_code
public	gva_time_series_new	year	varchar	1	public	public obj_indics_all_years_new2	public obj_indics_all_years_new2 nuts_region_name
, public	gva_time_series_new	value	float4		public	public obj_indics_all_years_new2	public obj_indics_all_years_new2 nuts_level
public	gva time series new	nace code	varchar	1	public	public obj_indics_all_years_new2	public obj_indics_all_years_new2 oecd_group
public	qva time series new		int4		public	public obj_indics_all_years_new2	public obj_indics_all_years_new2 oecd_group_description
public	qva time series new	the aeom	aeometru		public	public obj_indics_all_years_new2	public obj_indics_all_years_new2 country_code
	<u></u>		geenneny		public	public obj_indics_all_years_new2	public obj_indics_all_years_new2 country
nublic	gvalinero diffitot	aid	int4	1	public	public obj_indics_all_years_new2	public obj_indics_all_years_new2 baseline_indicator_id
public	gva_perc_diff_tot	objectid	int4		public	public obj_indics_all_years_new2	public obj_indics_all_years_new2 cmet_super_id
public	gva_perc_diff_tot	puts id	varchar			public obj_indics_all_years_new2	public obj_indics_all_years_new2 cmer_id
public	gva_perc_diff_tot	stat levi	int/		public	public obj_indics_all_years_new2	public obj_indics_all_years_new2 indicator
public	gva_perc_diff_tot	putel	varobar		public	public obj_indics_all_years_new2	public obj_indics_al_years_new2 measurement
public	gva_perc_diff_tot	natio	varchar		public	public obj_indics_all_years_new2	public obj_indics_all_years_new2_source?
public	gva_perc_diff_tot	name paras posi	varchar		public	public obj_indics_all_years_new2	public obj_indics_all_years_new2 year
public	gva_perc_diff_tot	name_asci upit	varchar		public	public obi indics all years new2	public obi_indics_all_years_new2 unit
public	gva_perc_diff_tot	urin Iosoo st	varchar		public	public obi indics all years new2	public obi indics all years new2 calculation
public Evelie	gva_perc_diri_tot	nace_n	varchai		public	public obj indics all years new2	public obj indics all years new2 indicator value
public	gva_perc_dirr_tot	geo 	varchar		public	public obj_indics_all_years_new2	public obj_indics_all_years_new2 info
	gva_perc_dirr_tot	92008_pair	numeric		public	public obj_indics_all_years_new2	public obj_indics_all_years_new2 pk
public	gva_perc_dirr_tot	92007_pair	numeric		public	public obj_indics_all_years_new2	public obj_indics_all_years_new2 report_year
public	gva_perc_diff_tot	y2006_pdit	numeric		public	public obj_indics_all_years_new2	public obj_indics_all_years_new2 pk2
public	gva_perc_diff_tot	y2005_pdif	numeric		public	public obj_indics_all_years_new2	public obj_indics_all_years_new2 the_geom
public	gva_perc_diff_tot	y2004_pdif	numeric		public	public obj_indics_all_years_new2	public obj_indics_all_years_new2 nuts_id
public	gva_perc_diff_tot	y2003_pdif	numeric				
public	gva_perc_diff_tot	y2002_pdif	numeric		public	public earfd_time_series	public earfd_time_series year
public	gva_perc_diff_tot	y2001_pdif	numeric		public	public earfd_time_series	public earfd_time_series ms
public	gva_perc_diff_tot	y2000_pdif	numeric		public	public earfd_time_series	public earfd_time_series paying_agency_code
public	gva_perc_diff_tot	y1999_pdif	numeric		public	publicearfd_time_series	public earfd_time_series nuts_id
public	gva_perc_diff_tot	y1998_pdif	numeric		public	public eartd_time_series	public earfd_time_series f200
public	gva_perc_diff_tot	y1997_pdif	numeric		public	public eartd_time_series	public eartid_time_series amount_euro
public	gva_perc_diff_tot	y1996_pdif	numeric		public	public eartd_time_series	public eartid_time_series public_expediture
public	gva_perc_diff_tot	y1995_pdif	numeric		public	public earro_time_series	public jearro_time_series area_cov_by_paym_appi_rogded
public	gva perc diff tot	pk	numeric		public	public earro_time_series	public earro_ame_series area_cov_by_payin_made
public	gva_perc_diff_tot	the_geom	geometry		public	public early time series	public early time series the geom

Table 3: SPARD Database Table Data Types

2.4 Database Table Coverage

The database analysis shows also immediately the poor data coverage (Table 4):

Table 4: CMEF Poor Object Indicator Coverage

schema	tablename	colname	n_distinct	fraction_of_no_data_rows
public	obj_indics_all_years_new2	baseline_indicator_id	0	1
public	obj_indics_all_years_new2	calculation	6	0
public	obj_indics_all_years_new2	cmef_id	47	0
public	obj_indics_all_years_new2	cmef_super_id	0	1
public	obj_indics_all_years_new2	country	0	1
public	obj_indics_all_years_new2	country_code	0	1
public	obj_indics_all_years_new2	indicator	47	0
public	obj_indics_all_years_new2	indicator_value	2086	0.456667
public	obj_indics_all_years_new2	info	64	0
public	obj_indics_all_years_new2	measurement	46	0
public	obj_indics_all_years_new2	nuts_code	1579	0
public	obj_indics_all_years_new2	nuts_id	1579	0
public	obj_indics_all_years_new2	nuts_level	3	0
public	obj_indics_all_years_new2	nuts_region_name	1579	0
public	obj_indics_all_years_new2	oecd_group	7	0
public	obj_indics_all_years_new2	oecd_group_description	0	1
public	obj_indics_all_years_new2	pk	-0.515854	0
public	obj_indics_all_years_new2	pk2	-1	0
public	obj_indics_all_years_new2	primary_key	-0.16704	0
public	obj_indics_all_years_new2	report_year	5	0
public	obj_indics_all_years_new2	source	7	0
public	obj_indics_all_years_new2	source2	15	0
public	obj_indics_all_years_new2	the_geom	-1	0
public	obj_indics_all_years_new2	unit	17	0
public	obj_indics_all_years_new2	year	31	0



3 Development of the SPARD Software Components

3.1 The SPARD Data Viewer

In order to be able to access, explore and retrieve the data within the SPARD data warehouse AIT has developed a GUI designed as a Java WebStart application which can be accessed via http://sf5.arcs.ac.at/spard_site/dataviewer/ (Figure 4).

Spatial Analysis of Rural Development Measures	SPARD
Welcome to the SPARD Data Viewer	
Please click the button below to start the Application:	
솔 Läunch	

Figure 4: Start Page of the SPARD Data Viewer

The data viewer has Secure Shell (SSH) capabilities (Figure 5) enabling it to connect the server via a secured connection and giving the application the possibility of being password protected (Figure 6).



Figure 5: SSL connection to SPARD data warehouse

Figure 6: Password Protection



The first screen of the SPARD Data Viewer lets the user connect to the tables in the database (Figure 7)

SPARD Data Viewer	Character Free and States and Ad	1 101 and 10 10 10 10 10	
	Indicator Chooser Query Result Dr	rag'n Drop	
SPARD	Tables	Indicators	Years
Get DB Tables			
Query Database			
Nuts and Values Only			

Figure 7: Start Window of the SPARD Data Viewer

When the user clicks on "Get DB Tables" her or she is presented a list of available tables (Figure 8)



Figure 8: List of Available Tables



After clicking on one of the table entries the user is presented with the list of indicators contained within this table. He or she has then the possibility of choosing one or more indicators from the list and getting back a list of years for which indicators are present within the table (Figure 9).

	Indicator Chooser Query F	Result Drag	n Drop					
	Tables	i	Indicator	S			Years	
	table_name	Selected	cmef	indicator	numoccurrences	Select	year	
	cmef info		02a	Objective 2 - Employment.	5598		2005	
	measure info	E N	02b	Change in Employment	4024		2006	
Get DB Tables	vars and measures	- T	07a	Objective 7 - GECE in Agri	4722	Ē	2008	
	v cmefid and measures		034b	Change in Net Migration	4024		2007	
	content indic 2006		028c	Change in Employment	4024	Ē		
	content indic 2007		O9b	(Objective 9) - Economic	5598			
Query Database	content indic 2008		029b II	(Objective 29) - Economi	3148			
	content indic 2009		030a	Objective 30 - Self-Emplo	5598			
	content indic 2010	- H	033a	Objective 33 - Developm	5598			
Nuts and	object indic 2006		035a	Objective 35 - Life-Long L	5598			
Values Only	object indic 2007		0300	Change in Self-Employm	4024			
	object indic 2008		028b	(Objective 28) - Employm	5598			
	object indic 2009	ň	04	Objective 4 - Training and	6474	Ē		
	object indic 2010		01a	Objective 1 - Economic D	5598			
	baseline indic 2009	- H	033h	Change in Development	4024			
	context indic all years	- H	027	Objective 27 - Farmers wi	876			
	object indic all years		07h	(Objective 7) - GECE in A	4722	21		
	linkmeasures2ohibaseli		09a	Objective 9 - Economic D	5598			
	wn3_contributionofmeas	- H	012h	(Objective 12) - Employm	5598	H		
	spard view 161822161		023h	(Objective 23) - Soil: Orna	4900			
	spard view 161822161		028a	Objective 28 - Employme	5598			
	spard view 161822161		031a	Objective 31 - Tourism Inf	5598			
	spard view 161822161	- H	034a	Objective 34 - Net Migrati	5598			
	spard view 161532097		030h	(Objective 30) - Self-Empl	5598			
	spard_view_161532097		069	Objective 6 - Labour Prod	6474	H		
	spard_view_161532097		07c	Change in GECE in Agric	876			
	spard_view_161532097	- T	06h	Change in Labour Produ	4024	H		
	nuts codes		016h	(Objective16) - Importanc	876			
	spard view 496147459 1		0299	Objective 29 - Economic	5508	H		
	spard_view_496147459_0		01b	Change in Economic Dev	4024			
	at at	7.	41	Change in Economic Dev	-4024 T			

Figure 9: List of Indicators and Years for Which Data is Available for

After choosing one or more years, the user can click on "Query Database" and get back table containing all indicator values for the chosen years (Figure 10).

SPARD pimany_key inuts_code ruts_region_name nuts_level cecd_group c. b. cmme_l d indicator measurement Get DB Tables 56912 DE25B Roth NUTS3 (1) PR O31a Objective 3. Total number. 57810 AT33 Triol NUTS3 (1) PR O31a Objective 3. Total number. 56664 BE10 Arr. Eeldo NUTS3 (3) PU O31a Objective 3. Total number. 56666 BE10 Arr. Get De Ruxelles-C NUTS3 (3) PU O31a Objective 3. Total number. 56666 BE211 Arr. Antwerpen NUTS3 (3) PU O31a Objective 3. Total number. 56667 BE211 Arr. Antwerpen NUTS3 (3) PU O31a Objective 3. Total number. 56668 BE100 Arr. Turnhout NUTS3 (3) PU O31a Objective 3. Total number. 56671 BE221 Arr. Hasselth NUTS3 (3) PU <t< th=""><th>111</th><th>Indicato</th><th>r Chooser Q</th><th></th><th></th><th></th><th></th></t<>	111	Indicato	r Chooser Q						
Nuts and Values Only DE228 Roth NUTS3 (1) PR O31a Objective 3. Total number. Get DB Tables 56617 BE233 Arr. Eeklo NUTS2 (1) PR O31a Objective 3. Total number. Get DB Tables 66668 BE10 Région de BrurelleNUTS2 (3) PU O31a Objective 3. Total number. Get DB Tables 56666 BE10 Région de BrurelleNUTS2 (3) PU O31a Objective 3. Total number. 56666 BE110 Arr. de Bruxelle NUTS2 (3) PU O31a Objective 3. Total number. 56667 BE211 Arr. de Bruxellen NUTS3 (3) PU O31a Objective 3. Total number. 56668 BE212 Arr. Tumburg (B) NUTS3 (3) PU O31a Objective 3. Total number. 56676 BE221 Arr. Tumburg (B) NUTS2 (3) PU O31a Objective 3. Total number. 56677 BE223 Arr. Tumburg (B) NUTS3 (3) PU O31a Objective 3. Total number. 56676 BE223	SPAR	primary_k	ey nuts_code	nuts_region_name	nuts_level	oecd_group c b	cmef_id	indicator	measurement
Operation AT33 Tirol NUTS2 (1) PR Objective 3. Total number. Get DB Tables 56677 BE233 Arr. Eekin NUTS3 (3) PU O31a Objective 3. Total number. 56665 BE100 Arr. Get BruxelleC.::NUTS3 (3) PU O31a Objective 3. Total number. 56666 BE100 Arr. Get BruxelleC.::NUTS3 (3) PU O31a Objective 3. Total number. 56666 BE211 Arr. Mechelen NUTS3 (3) PU O31a Objective 3. Total number. 56666 BE211 Arr. Mechelen NUTS3 (3) PU O31a Objective 3. Total number. 56667 BE213 Arr. Bornelen NUTS3 (3) PU O31a Objective 3. Total number. 56671 BE222 Arr. Maseik NUTS3 (3) PU O31a Objective 3. Total number. 56675 BE231 Arr. Alast NUTS3 (3) PU O31a Objective 3. Total number. 56676 <td></td> <td>56912</td> <td>DE25B</td> <td>Roth</td> <td>NUTS3</td> <td>(1) PR</td> <td>031a</td> <td>Objective 3</td> <td>Total number</td>		56912	DE25B	Roth	NUTS3	(1) PR	031a	Objective 3	Total number
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		-							
		Expo	It lable to File.	<u></u>					

Figure 10: SPARD Data Viewer Result Table



In order to accomplish a better structure for importing the result data into other software packages it is possible to transpose the table to a so called "values only" table, contain the name and year as the column name, the values as rows for each spatial unit (i.e. NUTS regions) (Figure 11)

	Indicator Chooser Query Result	Drag'n Drop	
SPARD	nuts_code	o31a_2006_value	
	AT1		
	AT11	28292	
Cot DB Tables	AT111	1606	
OCCOD TABICS	AT112	19378	
	AT113	7308	
	AT12	64622	
Query Database	AT121	11860	
	AT122	13964	
	AT123	4434	
Niste and	AT124	14113	
Nuts and	AT125	2107	
values only	AT126	7667	
	AT127	10477	
	AT13	50168	
	AT130	50168	
	AT2		
	AT21	160315	
	AT211	59862	
	AT212	66059	
	AT213	34394	
	AT22	89168	
	AT221	10338	
	AT222	27605	
	AT223	8811	
	AT224	22329	
	AT225	8120	
	AT226	11965	
	AT3		
	Export Table To File		,

Figure 11: Table Containing Values only

The user has further the possibility to export the table to a Comma Separated (CSV) file (Figure 12).



Figure 12: SPARD Data Viewer CSV Export



3.2 The SPARD Online Map Visualisation Platform

In order to provide a possibility to visualise the spatio-temporal coverage of the CMEF data AIT has –in addition to the SPARD Data Viewer- developed an online web-mapping platform (based on Geoserver 2.1 and Open Layers) to explore the quality and completeness of the official datasets. There are several possible entry points to look at the data, each of them providing different functionalities and being open to be implemented for the visualisation of further datasets.

3.2.1 The Gross Value Added Difference Visualisation

The first possibility to explore the CMEF data's spatio-temporal coverage is depicted in Figure 13.



Figure 13: Gross Value Added Difference Visualisation Window

Here it is possible to do a differential percentage comparison between the official EuroStat Gross Value Added (GVA) data and the Cambridge Econometrics datasets for the years 1995 through 2008 by clicking the tick boxes on the layer switcher on the right hand side if the browser widow (by clicking the link "Google Earth Animation" it is also possible to visualise



an animation of the map over the different years). It is available at: http://sf5.arcs.ac.at/spard_site/mapviewer/OpenLayers-2.10/examples/spard_controls.html

3.2.2 The CATS Data Visualisation

The CATS data can also be visualized on a map (Figure 14).



Figure 14: CATS Data Visualisation Window

Here the user has the possibility to either use a dropdown list for choosing the data to be displayed (Figure 15) or her or she might enter a so called Common Query Language (CQL) statement (similar to an SQL statement) to retrieve data to be shown in the map (Figure 16).

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ms = 'NL' D 🕽	Preselection:	year = 2007, measure =	121, nuts = DE, I1	Γ, <mark>SI, NL,</mark> F	R
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Figure 15: Drop Down List for Choosing Data to be Displayed



۲.	S Data:	NU	ITS Coverage	(2006-	2010)				
ıg:	Single tile	•	Transition effect:	None 🔻	Antialias:	Full 🔻	Format:	PNG 24bit 🔻	Styles:
er:	CQL	•	year = 2007 AND	paying_ag	ency_code =	'05040501214'	AND (ms =	'DE' OR ms = 'N	' D ×
				1	r			PAL C	X

Figure 16: CQL Query for Choosing Data

Further the user can click on the map to get the tabular data underlying the (Figure 17)

Scale = 1 : 20M Legend: All Other Values Is Confidential Download Data as CS	SV File	Dov	vnload Data as Excel Fi	e See a t	27384	8.34375, 19670	999.18750	h (has to be installed)	
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earfd_time_series.3660	2008	CZ	05040501113	CZ031	49	147422.71	0.0	0.0	0.0
earfd_time_series.3661	2008	CZ	05040501121	CZ031	13	372823.93	0.0	0.0	0.0
earfd_time_series.3662	2008	CZ	05040501122	CZ031	16	375840.53	0.0	0.0	0.0
earfd_time_series.3663	2008	cz	05040501125	CZ031	0	3907.06	0.0	0.0	0.0
earfd_time_series.3664	2008	CZ	05040501211	CZ031	755	9202087.32	0.0	93040.42	929
earfd_time_series.3665	2008	CZ	05040501212	CZ031	1156	6144837.79	0.0	90454.47	904
earfd_time_series.3666	2008	CZ	05040501213	CZ031	42	82450.77	0.0	0.0	891
earfd_time_series.3667	2008	CZ	05040501214	CZ031	1237	1.236610543E7	0.0	79718.1	119
earfd_time_series.3668	2008	CZ	05040501221	CZ031	106	168425.54	0.0	190.38	198
earfd_time_series.3669	2008	CZ	05040501311	CZ031	0	91528.77	0.0	0.0	0.0

Figure 17: Underlying Table Data

The data can be exported in different formats, e.g CSV and MS Excel. There is, again, the possibility to show the data as an animation in Google Earth. The visualisation is available at:

http://sf5.arcs.ac.at/spard_site/mapviewer/OpenLayers-2.10/examples/spard_cats_data.html

3.2.3 Three Year Map Comparison

Lastly the user can perform a three-year map comparison on a chosen CMEF indicator, reference year and NUTS level. The web page contains of three maps, with a reference map in the middle, accompanied by the maps to be compared to the left and to the right (Figures 18 and 19)





Figure 18: Three Year Map Comparison Window



Figure 19: List of CMEF Indicators to be Chosen From

The page also provides facilities to retrieve the underlying table data via clicking in the map.

It can be reached at: <u>http://sf5.arcs.ac.at/spard_site/mapviewer/OpenLayers-</u> 2.10/examples/spard_map_compare.html.



4 Outlook

The development of the above components shows the capabilities of the data warehouse and the possibilities of the GUIs so far. They have still to be adapted to further meet the needs of the scientific project partners and possible later users outside the project who will be dealing with CMEF analyses. This progress will be depicted in later versions of this deliverable.