

# **CONCEPTUAL ARCHITECTURE FOR A SUPPORTING SYSTEM OF ASSISTANCE IN DECISION MAKING WITH A VIEW TO ASSESSING THE IMPACT OF STRUCTURAL FUNDS IN ROMANIA- SSD FS PO**

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**Abstract:** The paper intends to present the conceptual architecture and implementation methods of a supporting system of assistance in decision making with a view to assessing the impact of structural funds financing in Romania, a system based on a network of private virtual interconnection on web and a database conceived as a central base distributed to store and share data among users, namely an assemble of calculation sheets for the evaluation and foretelling of the structural funds impact. The system uses a VPN platform with a NeoRouter [1] zero configuration to secure the final users' connections to the database through a virtual LAN network, using an Oracle database which memorizes the main data from the three modules of the Herom analysis model and a set of Excel modules to do the calculations and the graphical representations of the used models.

**JEL classification:** C15, C87, D78

**Key words :** structural funds, Herom Model, processing data, System of Assistance in Decision Making, VPN

## **INTRODUCTION**

An important category of informatics instruments used in solving problems linked to an accurate assessment of structural funds impact on the economic-financial results of economic agents in every operational program is the decision-making assistance systems. They are also called decision-making support systems or SSD (Decision Support Systems). The most helpful are the SSD based on a multidimensional analysis of data, a multiple criteria analysis (multiple attribute and multiple objective), risk management, data mining, advanced statistics. The first two, namely the one based on a multidimensional analysis and the one based on the multiple criteria analysis (multiple attribute and multiple objective), can consider the conflicting nature of the elements that define an accurate assessment.

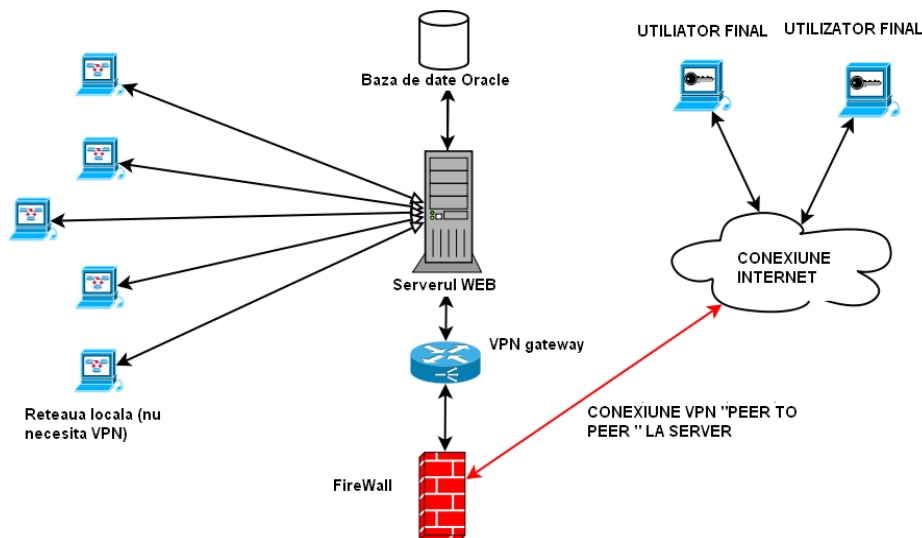
To develop a VPN-type infrastructure in the context of SSD management to facilitate structural funds use in the Romanian economy (SSD FS PO) is the main objective of this paper. I have chosen a detailed preliminary presentation of the three concepts out of which the proposed SSD model is derived.

The IT solution chosen for implementing a SSD model that uses HEROM requires the use of a VPN platform with a NeoRouter-type [1] zero configuration, in order to

secure the final users' connections to the database through a virtual LAN network, Oracle distributed database, which memorises the main data from the three modules of Herom analysis model and a set of Excel modules to do the calculations and the graphical representations of the used model.

## 1 THE SSD FS PO SYSTEM ARCHITECTURE

The system's architecture is shown in the image below:



*Fig. 1 SSD FS-PO Arhitecture*

The system's components are:

- an Oracle database which contains the main values of the HEROM model's indicators over a given period of time.
- a web server which permits advanced users' local connection (in the same room) to the Oracle database to populate, maintain and manage it.
- a VPN application which permits local secure connection from the outside to the server through a PPTP protocol.
- a set of Excel applications for the final users, which extract data from the database and provide for their processing (calculating the HEROM model's equations), along with a series of graphical representations of the resulting time series.

## 2 CONNECTING THROUGH THE VPN

Users who are in another location than that where the system's key components are stored can access the system through a VPN connection, enjoying full security of data transfer owing to the encrypted channel. Locally, specialized users (who maintain the

database) need not use the VPN network because the Oracle server's security is sufficient for data confidentiality.

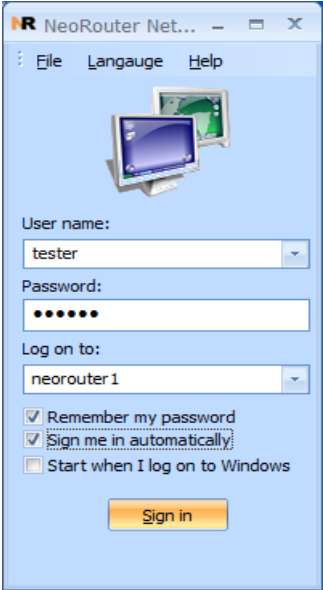


Fig. 2. NeoRouter connection interface

The chosen VPN connection is a PPTP, „Point to Point Transfer Protocol” variant of the NeoRouter Free for Windows system [1], which permits a “remote desktop” secure connection to the Oracle data base server of the application. The private virtual network sees the Oracle server as an Internet server with a specific IP (10.100.200.81), different from the web IP of the computer (169.254.173.10, also see fig.10)

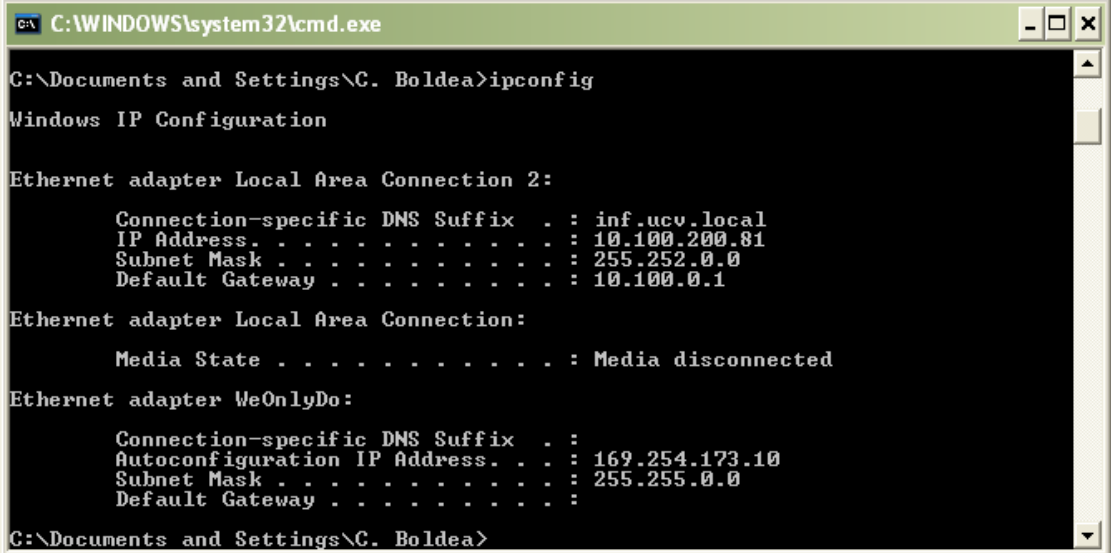


Fig. 3. IPAddress wiithin VNP

The NeoRouter application permits users to configure and manage user accounts, as well as computers accepted in the virtual network (fig.4). Using a Firewall is recommended for any outside connection.

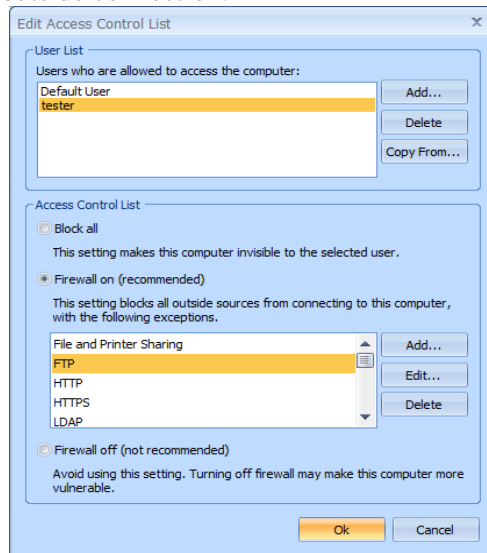


Fig. 4. Access Control in VNP

### 3 THE DATABASE

The application’s database constitutes its central part, supporting the writing and processing of data. It has been implemented with Oracle 11g, using Oracle SQL Developer 3.1.07. The database’s structure is compliant with the HEROM model’s structure described in section 2, with the three modules of Offer, Absorption and Distribution of Income, respectively. The data is grouped in eight indicators’ charts, interconnected inside a relational conceptual model.

The main charts of *Offer* are described in the following figures:

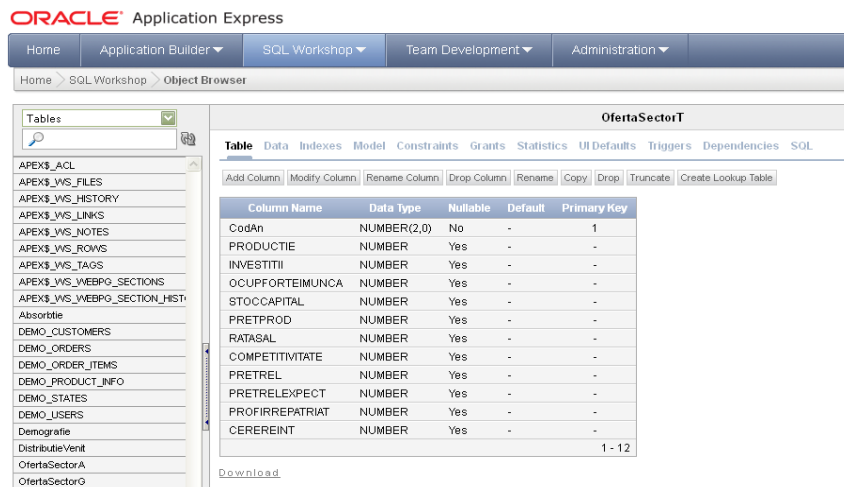


Fig. 5. Indicators of Offer for T Sector

OfertaSectorN										
Table	Data	Indexes	Model	Constraints	Grants	Statistics	UI Defaults	Triggers	Dependencies	SQL
<a href="#">Add Column</a>	<a href="#">Modify Column</a>	<a href="#">Rename Column</a>	<a href="#">Drop Column</a>	<a href="#">Rename</a>	<a href="#">Copy</a>	<a href="#">Drop</a>	<a href="#">Truncate</a>	<a href="#">Create Lookup Table</a>		
Column Name	Data Type	Nullable	Default	Primary Key						
CodAn	NUMBER	No	-	1						
Productie	NUMBER	Yes	-	-						
OcupForteiMunca	NUMBER	Yes	-	-						
Investitii	NUMBER	Yes	-	-						
StocCapital	NUMBER	Yes	-	-						
PretProd	NUMBER	Yes	-	-						
InflatiaS	NUMBER	Yes	-	-						
PretRel	NUMBER	Yes	-	-						
PretRelExpect	NUMBER	Yes	-	-						
CerereIntPond	NUMBER	Yes	-	-						
				1 - 10						

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Fig. 6. Indicators of Offer for N Sector

OfertaSectorG										
Table	Data	Indexes	Model	Constraints	Grants	Statistics	UI Defaults	Triggers	Dependencies	SQL
<a href="#">Add Column</a>	<a href="#">Modify Column</a>	<a href="#">Rename Column</a>	<a href="#">Drop Column</a>	<a href="#">Rename</a>	<a href="#">Copy</a>	<a href="#">Drop</a>	<a href="#">Truncate</a>	<a href="#">Create Lookup Table</a>		
Column Name	Data Type	Nullable	Default	Primary Key						
CodAn	NUMBER	No	-	1						
Productie	NUMBER	Yes	-	-						
OcupForteiMunca	NUMBER	Yes	-	-						
ConsumNSal	NUMBER	Yes	-	-						
InflatiaS	NUMBER	Yes	-	-						
				1 - 5						

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Fig. 7. Indicators of Offer for G Sector

OfertaSectorA										
Table	Data	Indexes	Model	Constraints	Grants	Statistics	UI Defaults	Triggers	Dependencies	SQL
<a href="#">Add Column</a>	<a href="#">Modify Column</a>	<a href="#">Rename Column</a>	<a href="#">Drop Column</a>	<a href="#">Rename</a>	<a href="#">Copy</a>	<a href="#">Drop</a>	<a href="#">Truncate</a>	<a href="#">Create Lookup Table</a>		
Column Name	Data Type	Nullable	Default	Primary Key						
CodAn	NUMBER	No	-	1						
Productie	NUMBER	Yes	-	-						
OcupForteiMunca	NUMBER	Yes	-	-						
Investitii	NUMBER	Yes	-	-						
StocCapital	NUMBER	Yes	-	-						
Amortizare	NUMBER	Yes	-	-						
				1 - 6						

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Fig. 8. Indicators of Offer for A Sector

to which there have been added Demographic charts, with the following structure:

Demografie										
Table	Data	Indexes	Model	Constraints	Grants	Statistics	UI Defaults	Triggers	Dependencies	SQL
Add Column	Modify Column	Rename Column	Drop Column	Rename	Copy	Drop	Truncate	Create Lookup Table		
Column Name	Data Type	Nullable	Default	Primary Key						
CodAn	NUMBER	No	-	1						
CresterePop	NUMBER	Yes	-	-						
Migratie	NUMBER	Yes	-	-						
OfertaFortaMunca	NUMBER	Yes	-	-						
Somaj	NUMBER	Yes	-	-						
RataParticip	NUMBER	Yes	-	-						
										1 - 6
<a href="#">Download</a>										

Fig. 9. Demographic Indicators

and a Chart of correlation between the research years and calendar years (necessary for interconnecting the relational model's charts) with the following structure

Column Name	Data Type	Nullable	Default	Primary Key
AN	NUMBER(4,0)	No	-	1
CODAN	NUMBER(2,0)	Yes	-	-
				1 - 2

Fig. 10. Structure of the correlation chart

(for a correlation with the HEROM model's indicators, see section 2)

The relations in the charts have been created with SQL, after the following model

```
ALTER TABLE "PERIODA"
ADD CONSTRAINT "PERIODA_CON" FOREIGN KEY ("CODAN")
REFERENCES "OfertaSectorA" ("CodAn") ON DELETE SET NULL
ENABLE;
ALTER TABLE "PERIODA"
ADD CONSTRAINT "PERIODA_CON_D" FOREIGN KEY ("CODAN")
REFERENCES "Demografie" ("CodAn") ENABLE;
ALTER TABLE "PERIODA"
ADD CONSTRAINT "PERIODA_CON_G" FOREIGN KEY ("CODAN")
REFERENCES "OfertaSectorG" ("CodAn") ON DELETE SET NULL
ENABLE;
ALTER TABLE "PERIODA"
ADD CONSTRAINT "PERIODA_CON_N" FOREIGN KEY ("CODAN")
REFERENCES "OfertaSectorN" ("CodAn") ENABLE;
ALTER TABLE "PERIODA"
ADD CONSTRAINT "PERIODA_CON_T" FOREIGN KEY ("CODAN")
```

```
REFERENCES "OfertaSectorT" ("CodAn") ON DELETE SET NULL
ENABLE;
```

*Absorption and Distribution of Income* are described in the charts with the same name, with a basic structure defined by SQL codes

```
CREATE TABLE "Absorbctie"
( "CodAn" NUMBER(2,0) NOT NULL ENABLE,
  "VenitPersDispMediu" NUMBER,
  "ConsumMediu" NUMBER,
  "InvestLocuinte" NUMBER,
  "Stoc" NUMBER,
  "VarStoc" NUMBER,
  "Competitivitate" NUMBER,
  "Export" NUMBER,
  "Import" NUMBER,
  "PIBpretpiata" NUMBER,
  "CerereInt" NUMBER,
  "SurplCom" NUMBER,
  "PIBChelt" NUMBER,
  CONSTRAINT "Absorbctie_PK" PRIMARY KEY ("CodAn") ENABLE
) ;
```

and

```
CREATE TABLE "DistributieVenit"
( "CodAn" NUMBER NOT NULL ENABLE,
  "Venit" NUMBER,
  "ImpoziteNete" NUMBER,
  "ImpoziteIndirecte" NUMBER,
  "Subventii" NUMBER,
  "VenitDisponibil" NUMBER,
  "TransferuriSociale" NUMBER,
  "TransfStrainat" NUMBER,
  "TransferitiTotale" NUMBER,
  "BalataPlati" NUMBER,
  "ImprimSectPubl" NUMBER,
  "RataDobaziiDPubl" NUMBER,
  "DatorieSectPubl" NUMBER,
  "DatorieExt" NUMBER,
  "RataDobaziiDExt" NUMBER,
  "ProfituriTotale" NUMBER,
  "ProfituriRetinute" NUMBER,
  "MazaMonetara" NUMBER,
  CONSTRAINT "DistributieVenit_PK" PRIMARY KEY ("CodAn")
ENABLE
) ;
```

resepctively.

Some fields of the charts are taken from the *Offer* charts, for example *Absorption.Competivity* is taken from *SectorToOffer.Competivity* through a “many to many” relationship of the two charts.

A number of supplementary attributes have also been inserted, such as *PubInterestRate* (Public Interest Rate) or *ExtInterestRate* (External Interest Rate), because they were needed for the calculation of some compound indicators (such as *PublicSectorDebt*)

Initially, populating charts with data was done through the Oracle 11g Express’ interface.

Table:	Demografie
* Codan	2
Cresterepop	-0.03
Migratie	-0.08
Ofertafortamunca	0.014
Somaj	0.11
Rataparticip	0.45

Fig. 11. Model for initial data insertion ( subunitary data represent percentages)

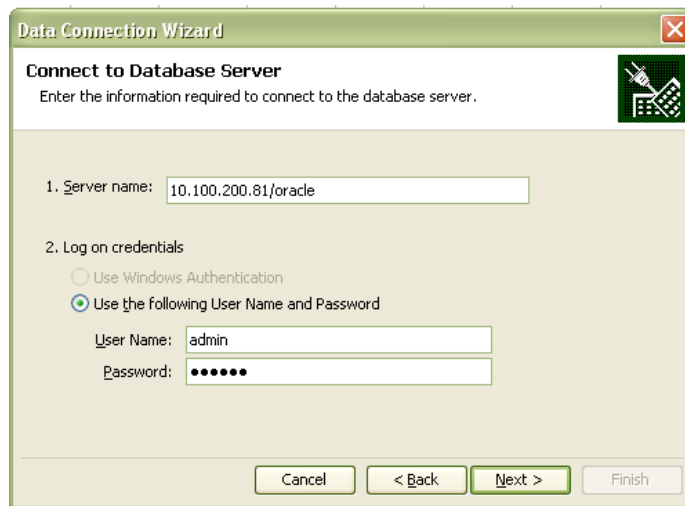
A large part of the indicators are calculated according to the HEROM model or can be taken from the Excel Sheets of the final users. Calculation methods are fully described in [2].

#### 4 EXTRACTING AND PROCESSING DATA

The last part of the application, still under construction, sees to processing data from the database and introducing them in Excel Sheets in order to obtain reliable predictions and visual graphical representations.

To connect to the Oracle server, you have to use the Excel’s Import Data option (*Data->Import External Data->Import Data->Conect to External DataSource*) with an Oracle database. Connecting to the server will necessitate authentication through the VPN connection, by supplying the IP it provides.





*Fig. 12. Connecting to Oracle server*

Importing data from the database. Oracle transfers the relational model's chart contents in the current work sheet where they can be later processed. This part remains to be implemented in the near future.

## REFERENCES

1. Institute for Noul model HEROM. Raport de progres, Proiect: Imbunatatirea Structural Research capacitatii institutionale de evaluare si formulare de politici macroeconomice in domeniul convergentei economice cu UE a CNP cod SMIS 27153, Seminar CNP, 2012.
2. Comisia Națională de Impactul fondurilor structurale în Romania - Evaluare cu ajutorul Modelului Herom, <http://www.cnp.ro/ro/modelare>
3. CISCO Group Encrypted Transport VPN (GETVPN) Design and Implementation Guide, 2012, <http://www.cisco.com/en/US/products/ps7180/index.html>
4. \*\*\* Neorouter, IdealRemote Access & VPN Solution-paginafirmei <http://www.neorouter.com/index.html>

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