



BI4SME

boosting business
intelligence skills for SME
growth

Competence Framework

R1 - BI4SME Baseline knowledge pack

Project	BI4SME: Boosting Business Intelligence Skills for SME Growth
Project result	R1 - Baseline knowledge pack - Competence Framework
Entity in charge of the report	Amaris Spain
Authors	Antonio Navarro Adrianna Tryskuc
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1. Introduction

The BI4SME project arises from the ambition to contribute to the emerging challenges concerning Business Intelligence by developing an integrated training strategy for the uptake of business intelligence skills by SMEs. The ambition is to democratise the Business Intelligence technology to foster the SMEs' competitiveness and growth across Europe. To achieve this goal, the project seeks to develop the necessary outputs/results.

The project will enhance the skills and implement new tools that are adapted to non-IT professionals in order to provide an innovative learning experience on the business intelligence skills tailored specifically to SMEs staff.

The new training programme will target mainly managers and owners of European SMEs to boost the growth of their businesses and innovate. It will also aim at MBA students and early-stage entrepreneurs to equip them with a set of relevant skills for building successful businesses.

2. Aims and Activities of the Project

Result 1

The Project Result 1 "BI4SME Baseline knowledge pack" identifies a set of BI technologies that could be easily implemented for any organization based on 2 criteria:

- **Fast and intuitive use:** The goal is to get a selection of tools with a friendly user interface to minimize the learning curve for the students.
- **Affordable cost:** The selected tools are open-source, or with a reduced license cost. Its installation and configuration are easy for any non-IT professional users. In addition, they are windows app or web solutions based.

Subsequently, a proper training strategy is designed for students, who do not have previous knowledge in computer science. The required skills to use the selected tools and a minimum theoretical training program is set up. The criteria of selection for the different subjects are the "just enough" concept. To identify those clear concepts, with a very practical approach to help the student to create their own BI analytics, is the major target of this PR.

The training strategy addresses the following aspects:

1. **BI tools for SMEs:** Mapping available open-source technologies in the market or those with an affordable price for an organization.
 - Basic programming. Python, DAX, SQL, others.
 - Data processing. Advance Excel, Python, Pentaho, others.
 - Visualization. Power BI, Data Studio, Pentaho, Excel, others.
2. **Skills for not-BI Engineers:** The training road map will be split into four main areas.

- Maths for BI. Basic mathematical concepts to improve data analytics. Descriptive and inferential statistics, regression models, classification & clustering models.
- Computer programming. Basic and enough concepts of SQL querying, data processing with Python and its libraries, DAX functions to be used in Excel and Power BI.
- Data processing. How to extract data from different sources, model and enrich their features by crossing information from different sources to its final storage.
- Visualization. To present data and metrics in reports and dashboards to improve the decision-making process in the company.

This comprehensive catalogue of skills and tools has been selected aiming the needs of SMEs with a deeply practical approach for fast training of its staff.

The Competence Framework for BI4SME Training Strategy includes **5 areas of training**:

- 1. Math for BI**
- 2. SQL for BI**
- 3. ETL**
- 4. PowerBI**
- 5. Python for BI**

The Competence Framework and its Training Pathway will be in accordance with European Qualifications Framework (EQF) levels.

3. Methodology

This Competence Framework results from the following activities, which have already been implemented in the framework of the BI4SME project.

3.1. Definition of methodological framework and analysis tools

Based on the Project Results description, the methodological framework for the research on tools and skills was established. It contains:

- Template for **analysing BI tools** adequate for SMEs based on concrete criteria (user friendly for non-IT professional, skills needed for its use, costs, etc.)
- Templates of 2 types of **questionnaires** to survey to:
 - **VET entrepreneurship and business teachers, trainers, and coaches** on to what extent they have skills and knowledge in terms of Data Analysis and Business Intelligence.
 - **SMEs managers and owners as well as entrepreneurs** on their knowledge and skills related to BI as well as on their preferences regarding the training options.

Finally, the tentative **list of BI tools to be analysed** in the next task was elaborated.

3.2. Collection of feedback and data

Based on the outcomes of T1.1, all partners carried out:

- **Consultations at national levels** amongst at least 10 VET entrepreneurship and business teachers, trainers, and coaches and at least 10 SMEs managers and owners as well as entrepreneurs.

- **Analysis of BI tools** (24 in total).

3.3. Comparative analysis and conclusions

The data collected in the previous task was analysed and served as a basis for the establishment of the Competence Framework. There were 3 key partners in charge of providing comprehensive analysis of data:

- Synthesis analysed data collected through surveys and consultation phase and gathered the results into national and European report.
- Amaris reviewed technical aspects of the analysis of BI tools
- WSEI focused on the skills needed for the use of BI tools.

Taken together it allowed to obtain conclusions over the following points:

- Theoretical contents- Self-determination theory.
- Technologies and tools with more impact in the SME daily business.
- Previous knowledge expected of the students.
- Laboratory contents.
- Self-regulated learning.
- Learning on demand.
- Feedback on progress.

Furthermore, this enabled to draft the **list of relevant skills on BI and Analytics** relevant for non-technical SMEs managers (without background in computer science) to use BI tools. This list was based on the survey results and was complemented jointly by the partnership based on their experience and previous studies (particularly Amaris).

3.4. European Qualification Framework

The BI4SME competence framework hereby presented fulfils the educational requirements described by level 4 of the [European Qualification Framework](#)

(EQF). By the end of the training, participants should have gained the following set of knowledge, skills and responsibility and autonomy:

Knowledge	Skills	Responsibility and autonomy
Factual and theoretical knowledge in broad contexts within a field of work or study	A range of cognitive and practical skills required to generate solutions to specific problems in a field of work or study	Exercise self-management within the guidelines of work or study contexts that are usually predictable, but are subject to change; supervise the routine work of others, taking some responsibility for the evaluation and improvement of work or study activities

Level 4 of EQF was considered by the consortium in line with the objectives of the BI4SME project and the most appropriate for the identified target group. In line with the EQF, we defined the learners' competences according to knowledge, and responsibility and autonomy for each learning unit. Furthermore, specific learning outcomes are described for each unit and general learning outcomes are described for the full training course.

4. Expected Learning Outcomes

The learning outcomes expected to be achieved by a learner after completing the full BI4SME training course were defined. They can be summarised as follows:

- Understand and describe how BI technology works;
- Understand and describe differences among different types of Business Intelligence tools;
- Understand and describe the main application domains of Business Intelligence;
- Understand opportunities and challenges related to the use of Business Intelligence;
- Understand how BI technology can be used by SMEs staff and how they can benefit from it;
- Be able to solve a real business case, by using different BI tools and methodologies;
- Ask the right questions about Business Intelligence;
- Have the ability to work with BI tools effectively.

BI technology is key for SMEs workers and entrepreneurs to use and implement digital tools into the business. According to a survey by Gartner, “top performing enterprises are prioritizing digital innovation during the pandemic”. The Digital Competence Framework for Citizens (DigComp 2.0) released by the European Commission in 2016 identifies as a key component of digital competence “Information and data literacy”. This includes browsing, searching, and filtering data and comparing, critically analysing and managing information.

According to the EU Report on "Accelerating the digital transformation of European industry and enterprises", SMEs still lag behind in digital technologies and face problems such as lack of information and of knowledge in managing large volume of data. To this end, the BI4SME project aims at developing an integrated training strategy for the uptake of Business

Intelligence skills by SMEs across Europe. Our ambition is to democratise BI technology in order to foster SMEs' competitiveness and growth, providing the skills needed for data-driven management and developing a digital readiness to face the ever-changing business world.

5. Competence Framework

The competence framework was defined based on the learning units defined by Amaris. While developing the training course content some sections may be modified/removed/added or re-arranged, but that shall not change the key part of the competence framework that is about the definition of learning outcomes and their related competences in terms of knowledge, skills, responsibility and autonomy.

5.1. Course Structure & Competence profile

Competence framework on BI for SMEs owners and managers	
EQF LEVEL	Level 4
Total Duration	200 hours
Total ECTS credits	8,16 ECTS
Description of the profile	<p>Upon successful completion of this course, the "SMEs owners and managers with non-technical / IT background" will be able to:</p> <ul style="list-style-type: none"> • Understand and describe how BI technology works; • Understand and describe differences among different types of Business Intelligence tools; • Understand and describe the main application domains of Business Intelligence; • Understand opportunities and challenges related to the use of Business Intelligence; • Understand how BI technology can be used by SMEs staff and how they can benefit from it; • Be able to solve a real business case, by using different BI tools and methodologies; • Ask the right questions about Business Intelligence; • Have the ability to work with BI tools effectively.
Unit 1	MATH FOR BI

Duration of Unit 1	41 hours	
Description of LO1	<p>The mathematics of big data section is a summary training on mathematics with direct application in Business Analytics and Business Intelligence. The objective of this chapter is to teach students the basic techniques to use in their daily business.</p> <p>Its objective is to provide a clear explanation of the concepts rather than complex mathematical notation that may confuse students without a solid background in mathematics. Therefore, the training material will include graphs and visualizations to reinforce learning, as well as a good number of examples to aid understanding of the concepts.</p>	
ECTS credits of unit 1	1.64 ECTS	
<p>1.1. Descriptive Statistics to Understand Data</p> <p>1.2. Measures of Frequency and Central Tendency</p> <p>1.3. Measures of Dispersion</p> <ul style="list-style-type: none"> ○ Demos: Measures of Central Tendency and Measures of Dispersion <p>1.4. Probability and the Gaussian Normal Distribution</p> <ul style="list-style-type: none"> ○ Demo: Probability ○ Demo: Normal Distribution <p>1.5. Sampling and Randomized Controlled Experiments</p> <p>1.6. Sampling Distributions and the Central Limit Theorem</p> <p>1.7. Regression</p> <p>1.8. Common Tests of Significance</p> <p>1.9. Resampling</p> <p>1.10. Multiple Comparisons</p> <p>1.11. Skewness and Kurtosis</p> <ul style="list-style-type: none"> ○ Demo: Skewness and Kurtosis ○ Demo: Skewness and Kurtosis 		
Knowledge	Skills	Responsibility and autonomy
<ul style="list-style-type: none"> ● Applies statistical metrics in presentations and reports. ● Understands descriptive statistical techniques to draw conclusions about available data. 	<ul style="list-style-type: none"> ● Is aware of general concept of statistics. ● Is able to apply concepts of descriptive statistics, with demonstration of the most common data distribution. 	<ul style="list-style-type: none"> ● Can analyse social and economic problems with statistical methods. ● Can understand difference between descriptive and inferential statistics, can work with data using different statistical instruments.

<ul style="list-style-type: none"> • Knows to make mathematically based predictions in budgets and forecasts. • Understands estimation of sample data, to be able to assess if there is enough data to describe a population. • Knows test hypotheses that can be tested using statistical techniques. 	<ul style="list-style-type: none"> • Is able to do descriptive statistics analyses data to draw conclusions about the behaviour of variables. Describes the information in the data through relationships or graphs. • Has an ability to use concepts of Inferential Statistics. The objective is to learn techniques to make predictions from data. We can identify two main areas of study in Inferential Statistics. • Has a capacity to do parameter estimation. By taking the "statistic" from your sample data (which we use as a sample of data from a larger population), we can describe the input population. • Is able to do hypothesis testing. Answering research questions with the sample data. For example, you might be interested in whether a new cancer drug is effective. Or whether breakfast helps children perform better in school. 	<ul style="list-style-type: none"> • Can describe the information through graphical methods of visualization. • Can test the hypothesis and make explanations of receiving results.
<p>Unit 2</p>	<p>SQL FOR BI</p>	
<p>Duration of Unit 2</p>	<p>40 hours</p>	
<p>Description of LO2</p>	<p>SQL stands for Structured Query Language. SQL is used to communicate with a database. According to ANSI (American National Standards Institute), it is the standard language for relational database management systems.</p> <p>SQL statements are used to perform tasks such as update data on a database or retrieve data from a database. Some common relational database management systems that use SQL are: Oracle, Sybase, Microsoft SQL Server, Microsoft Access, Ingres, etc.</p> <p>There are two main groups in the SQL commands.</p> <ul style="list-style-type: none"> • DDL (Data Definition Language) which is used to define data structures. For example: create table, alter table are instructions in SQL. 	

	<ul style="list-style-type: none"> • DML (Data Manipulation Language) which is used to manipulate data itself. For example: select, insert, update, delete are instructions in SQL. <p>The scope of this Unit is focused exclusively on SQL commands to exploit data through queries over Data Bases. Therefore, only DML commands will be addressed.</p>	
ECTS credits of unit 2	1.6 ECTS	
<p>2.1. SQL, Format, Design and Data transformation</p> <ul style="list-style-type: none"> ○ Select ○ From ○ Where (Filters) ○ Group by (Grouping) ○ Having ○ Order by ○ Null ○ Function of SQL induction ○ Function of aggregation induction <p>2.2. Second module of SQL</p> <ul style="list-style-type: none"> ○ Grouping (dealing with Null) ○ Functions <p>2.3. Types of SQL Functions</p> <ul style="list-style-type: none"> ○ Others SQL ○ Subqueries 		
Knowledge	Skills	Responsibility and autonomy
<ul style="list-style-type: none"> • Knows how to extract information from database tables. • Knows how to create metrics and KPI from DB data. • Understand how to cross information among different tables and run data transformations. • Knows to do advance queries from different tables. • Understand how to remove or alter data from tables. 	<ul style="list-style-type: none"> • Possess a knowledge of SQL Introduction. • Has a capacity to install an Engine DB. • Has a capacity to Load Data into the DB. • Has an ability to do Basic queries. • Has an ability to Complex queries: <ul style="list-style-type: none"> - Joins - Subqueries 	<ul style="list-style-type: none"> • Can install MariaDB and use Heidi to execute queries. • Can create a basic database and its tables. • Understands the basics of relational databases. • Is able to perform advanced database queries, including subqueries and joins.

Unit 3	ETL - Extract, transform and load	
Duration of Unit 3	40 hours	
Description of LO3	<p>Extract, Transform and Load (often abbreviated ETL) is the process that enables organizations to move data from multiple sources, reformat and clean it, and load it into another database, data mart, or data warehouse for analysis, or into another operational system to support a business process.</p> <p>Within this Unit, students will learn the principles of the ETL process through hands-on practice. To carry out the developments they will learn how to use the Pentaho graphical ETL tool.</p>	
ECTS credits of unit 3	1.6 ECTS	
<p>3.1. What is the extraction, transformation, and loading (ETL) process?</p> <p>3.2. ETL Process in a Business Intelligence Project</p> <p>3.3. ETL tools Pentaho</p> <p>3.4. My first transformations</p> <p>3.5. Completing ETL transformation</p> <p>3.6. Executing the Transformation</p> <p>3.7. Other transformation overview Select</p>		
Knowledge	Skills	Responsibility and autonomy
<ul style="list-style-type: none"> Understands the data flow process. Knows how to load data from sources, modify data at different stages to finally load the data. Is used to the main features of Pentaho, and its different tools. Clearly understands the best practices and recommendations for developing computationally efficient transformations. 	<ul style="list-style-type: none"> Has knowledge on how to install and configure Pentaho. Has an understanding of data sources. Has a capacity to plan ETL. Has an understanding of data loading into different repositories. Has an ability to carry out jobs and transformations in Pentaho. Is able to use the most important Pentaho features. Is aware of data transformation best practices. 	<ul style="list-style-type: none"> Creates a consolidated view of your data in various formats and multiple locations. Streamlines the reviewing process leading to better business decisions. Extracts data from legacy systems. Cleanses the data to improve data quality and establishes consistency. Loads data into a target database.

Unit 4	PowerBI	
Duration of Unit 4	43 hours	
Description of LO4	<p>Power BI is a data analytics service from Microsoft aimed at providing interactive visualizations and business intelligence (BI) capabilities with an interface simple enough for end users to create their own reports and dashboards.</p> <p>This unit will focus on the use of PowerBI, one of the most popular BI tools on the market. It will include examples and hands-on practice. At the end of the unit the student will be able to create their own dashboards and reports from source data.</p>	
ECTS credits of unit 4	1.72 ECTS	
<p>4.1. PowerBI Introduction</p> <ul style="list-style-type: none"> ○ General concepts ○ Business Intelligence ○ Environment and Data Loading <p>4.2. PBI Desktop</p> <ul style="list-style-type: none"> ○ Power Query query window ○ Power BI Desktop editor window ○ Power Query Editor ○ Loading data to the model ○ Fields Panel ○ Tables and Columns ○ Data View Left Side Panel ○ Volume ○ Selecting Column ○ diagram of existing tables and relationships ○ Reports ○ Views ○ Modeling (Field Transformation) 		

- help
- Context Menus
- Adaptive menu options
- Others
- 4.3. The Data Source**
 - Open Power BI Desktop
 - Get Data
 - Introduction to data sources (General Concepts Data in BI)
 - Data Lake, Data Warehouse, Data Mart
 - Normalize or Denormalize Data: Structuring Data
 - Introduction Tables of Facts and Dimensions
- 4.4. Workflow in PowerBI**
 - Data connection
 - Power Query
 - Beginning
 - Column Type
 - Transform
 - Add Column
 - View
- 4.5. Building items in PowerBI**
 - Visualization
- 4.6. PowerQuery vs SQL (Source Connection)**
 - Source Connections
 - Transform
 - Add Column
 - Start, Merge Queries – Regarding Doing It in SQL
 - View
- 4.7. PowerBI Dashboard Practices**
 - Practices
 - Visualizations
 - Navigation and Presentations
- 4.8. Publish & Share**
- 4.9. Define strategy to share the Graphs-Dashboards (Dashboard)**
- 4.10. Formulas and Functions, DAX**
- 4.11. Bests Practices in the construction of reports**

4.12. Advanced handling of PowerBI visualization elements		
Knowledge	Skills	Responsibility and autonomy
<ul style="list-style-type: none"> • Having some source data knows how to create modern dashboards or reports. • Learns how to use the different powerBI environments • Knows general concepts of data sources. • Understands data engineering concepts (Data Lake, Data Warehouse, Data Mart). • Understands workflow in power BI from input to final visualization. • Discovers visualization tools, basic and advanced. • Understands basic DAX and other features to use in Power BI. 	<ul style="list-style-type: none"> • Has an Intermedium level of PowerBI. • Can create Reports and Dashboards. • Can create a data model (relation between tables) in Power BI. • Understands the data flow in a BI project and apply the concept in real cases. • Is able to do Metrics and KPI creation troughs basic DAX functions. 	<ul style="list-style-type: none"> • Enters data on PowerBI • Creates reports and dashboards from source. • Modifies and prepare data for analysis. • Publishes reports to multiple consumers. • Supports advanced data analysis.
Unit 5	PYTHON FOR BI	
Duration of Unit 5	40 hours	
Description of LO5	<p>Python is a general-purpose object-oriented programming language. It is one of the most widely used programming languages and one of the easiest to learn.</p> <p>Some basic programming concepts will be introduced to the student so that he/she can develop his/her own scripts and notebooks.</p> <p>However, this unit is not intended to be a complete Python programming manual and it rather teaches the student how to use high-level Python libraries related to data processing and visualization, such as Pandas, NumPy, and matplotlib.</p>	
ECTS credits of unit 5	1.6 ECTS	

5.1. General concepts

- **Data Analytics in Programming**
- **Big Data in Python**
- **Data in Python**
- **Data Analytics with Python**
- **Python Object Type**

5.2. NumPy and Pandas

- **Pandas**
- **Installing the Pandas and NumPy libraries in Python**
- **Data Series in Pandas**
- **DataFrame**

5.3. Development in Python Pandas General concepts

- **Python comments**
- **Statistics with Pandas**
- **Filling an empty DataFrame in Python**
- **Filling a DataFrame in Python**
- **Size of a DataFrame in Python**
- **Add a new column to a DataFrame**
- **Creating an empty table in Python**
- **Data type of a column in Python**
- **List in Python**
- **Index in Python**
- **To convert between data types, you can use**
- **Joining two DataFrame in Python**
- **Loops in Python**
- **Group by in Python**

Knowledge	Skills	Responsibility and autonomy
<ul style="list-style-type: none"> ● Understands basic concepts of programming with Python. ● Is aware of the Anaconda ecosystem. ● Knows how to install libraries in Python. 	<ul style="list-style-type: none"> ● Is able to process data with python. ● Is able to visualise data with python libraries. ● Is able to compile data using Jupyter Notebook. 	<ul style="list-style-type: none"> ● Is able to install Python and Anaconda independently. ● Can compile different aspects of data from a project through Jupyter Notebook consulting online resources for help when/if needed.

<ul style="list-style-type: none"> • Understands how to use Jupyter Notebook. • Knows how to create and transform datasets with Pandas. • Is aware of NumPy basics, and to use in combination with Pandas. • Knows the data visualization, matplotlib or seaborn libraries. • Understands Basic Exploration Data Analysis with Pandas. 	<ul style="list-style-type: none"> • Is able to use scripts and basic programs to automate reports and dashboards. • Is able to use Pandas as an "advanced excel". • Is able to install data visualization, matplotlib and seaborn libraries. 	<ul style="list-style-type: none"> • Is able to select from, install and use Python libraries to process and visualise data in an autonomous way. • Knows how and where to look for further information and instructions about Python, NumPy, Pandas, matplotlib and seaborn in case of doubts or struggles.
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5.2. Unit content

All training units will include at least the following contents:

1. Introduction and basic theoretical content
2. Examples and case studies
3. Self-assessment quiz and exercises
4. Additional materials and references

6. Conclusions

In this document, the competence framework developed by the BI4SME consortium for the professional profiles of SMEs owners and managers with non-technical / IT background is reported, as part of the first Project Result, the BI4SME Baseline knowledge pack.

The methodology that brought the consortium to develop this document is presented, and the key learning objectives are defined.

The competence framework is based on level 4 of the European Qualification Framework (EQF) and was defined in terms of learning outcomes and competence defined according to the EQF methodology (knowledge, skills, responsibility, and autonomy).

The competence framework was developed according to 5 learning units that will be part of the training course, allowing for flexibility in the structure or order of the sections of each unit.

These competences will be the basis for the definition of the methodological framework and structure for training materials and resources, part of the second Project Result.