ANNALS OF THE UNIVERSITY OF ORADEA
FASCICLE OF TEXTILES, LEATHERWORK

# DIGITAL TRANSITION FOR ROMANIAN TEXTILE INDUSTRY

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***Abstract:*** *This paper presents aspects concerning the e-learning courses for the Romanian textile sector in the context of digital transition. In the framework of the ADDTEX Erasmus+ project, INCDTP developed three interactive lessons covering digital aspects of the textile industry. The proposed courses for digital transition cover aspects related to data acquisition, visualization, and analytics-based descriptive, diagnostic, predictive, prescriptive, augmented, and real-time analytics, including mathematical and business modelling by artificial intelligence. The proposed courses gradually introduce the learner to digital knowledge, starting from basic principles necessary for technicians, graduates, engineers, professionals, managers, and mentors. In order to achieve the objectives of the ADDTEX project, the developed courses and certification tools for different specialization levels cover digital aspects that could support innovation in the development of new products based on mathematical models and business modelling, promotion of entrepreneurship and improving the quality and relevance of employers' skills. In addition, data visualization of historical data record stored in data warehouse for analysis and data visualization using specific tools (scatter, combo, list or stacked plots) help in quick visualization of the aspects related to performance and improves the business outcomes. The courses related to digital transition are available on the Addtex project website and offer learners certificates for completing the courses after the courses after completing the course modules and the electronic tests assigned to each module.*

***Key words:*** *digital, courses, textile, data, analytics, visualization.*

## 1. INTRODUCTION

In the EU-27, the technical textiles industry represents approximately 30% of the total textile turnover, with an increase of 27% of the total textile production. Technical textiles are "fibers, threads, 2D and 3D materials" that meet technical rather than aesthetic criteria.

The technical textiles industry generates innovative products with high added value but is highly fragmented, comprising many European SMEs that specialize in certain types of products or technologies.

The main objectives of the ADDTEX project covering digital transition are to support innovation in the context of the digital, intelligent and ecological transition, the development of new products and business models, Promotion of entrepreneurship, supporting the new products development based digital tools and improving the quality and relevance of skills developed and certified through education and training systems. The specific objectives of the ADDTEX project are:

-Analysis and evaluation of the needs of the private sector after COVID-19 for the transition to a European economy based on digital, intelligent, ecological components and zero carbon emissions;

-Realization of personalized professional training programs;

-Encouraging the transfer of know-how between universities and the business environment;

-Development of hubs to support communication between companies and universities through clusters.

## 2. COURSES DEVELOPMENT

The Digital transition courses for technicians and graduates (figure 1) contain 6 lessons, from which INCDTP was involved in developing 1 lesson related to data acquisition, visualisation and analytics.

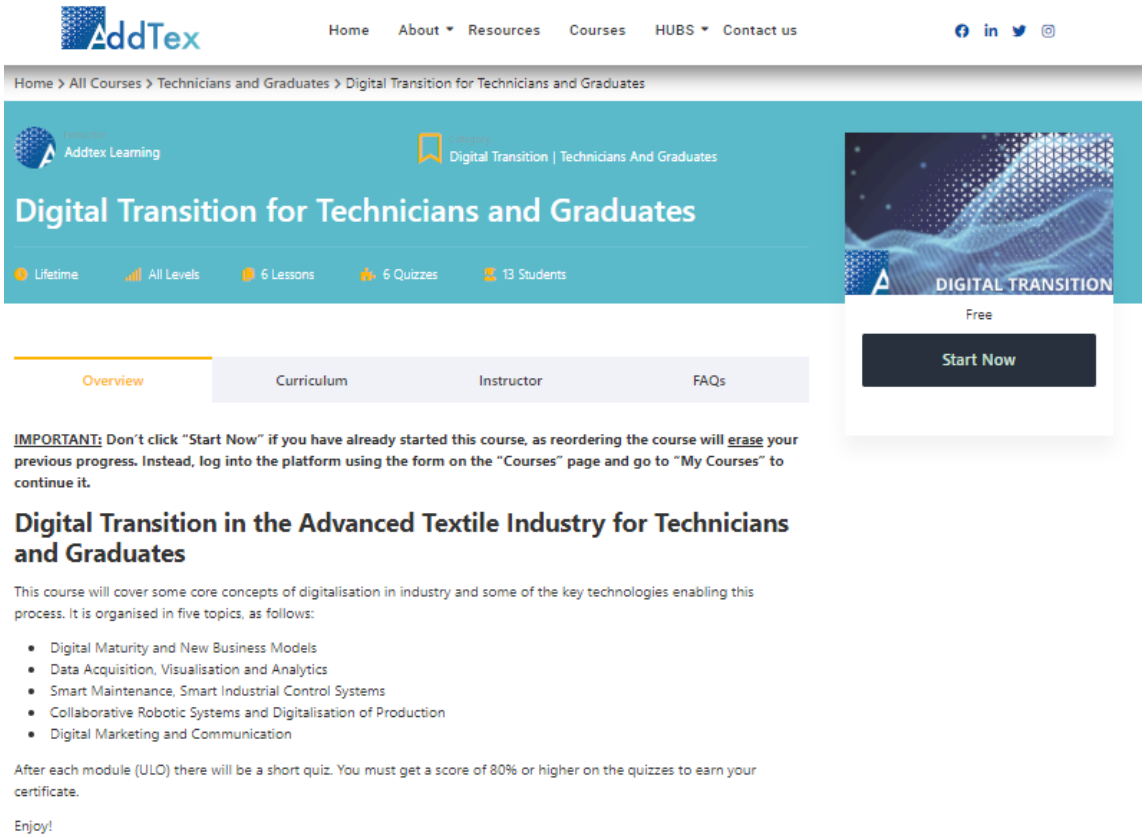



***Fig. 1:*** *Digital Transition for technicians and graduates*

The first lesson developed by INCDTP for technicians and graduates aims to introduce learners to basic data acquisition and visualization knowledge. Data analytics analyzes raw data sets using performant software tools based on sophisticated algorithms to understand the relationship between variables and obtain trends and adequate conclusions.

Data analytics can be used for business optimization and maximizing profit. The objective of using data analytics is to understand the relationship between various variables and to obtain

trends and adequate conclusions. Overall, data analytics can be used for business optimization and maximizing profit.

Data analystics can be performed using descriptive, diagnostic, predictive, prescriptive, augmented and real-time analytics software applications. Data sources for analytics are OLTP, OLAP databases, current transactions and data collected in real-time and historical data (data warehouse). In data warehousing (figure 2), the initial data are collected for multiple data sources in different formats (numerical, char, text, files). After that, data are extracted, transformed, and loaded and in the end, these data can be visualized and used for reports or business intelligence applications.

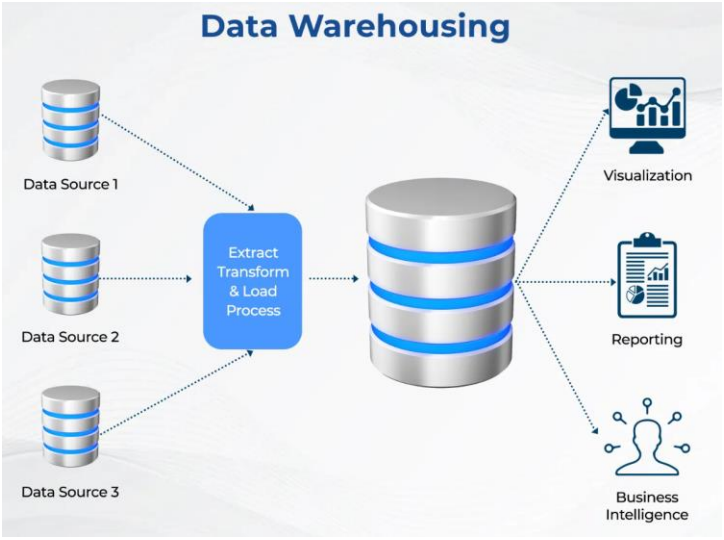



***Fig.2:*** *Data sources used for the data warehouse [1]*

Data can be acquired in real time through textile sensors, e-commerce store software, sales management software, virtual shopping platforms, ERP software, and OLTP databases. Data processing and extracting valuable information uses methods such as regression analysis, factor analysis, cohort analysis, Monte Carlo simulations and time series analysis. At the same time, data visualization involves using histograms, regression plots, scatter plots, and bar and line charts to visualize the results [2].

The second lesson developed by INCDTP is included in the digital transition for engineers and professionals, which is related to the mathematical methods used to process experimental data. Experimental data is measured data from physical experiments. This physical process is characterized by the set of measured data (Table 1). Mathematical and statistical methods may further analyse the set of data. The scatter plot is the first mathematical statistical processing of this experimental data (Figure 1).

**Table 1.** *Tensile strength for the different solution concentration*

| **Sample test** | **20 g/l** | **30 g/l** | **40 g/l** | **50 g/l** |
|---|---|---|---|---|
| 1 | 501 N | 503 N | 509 N | 515 N |
| 2 | 498 N | 510 N | 513 N | 512 N |
| 3 | 503 N | 512 N | 516 N | 517 N |
| 4 | 515 N | 506 N | 512 N | 520 N |

| | | | | |
|---|---|---|---|---|
| 5 | 504 N | 508 N | 514 N | 516 N |
| Average | 504.2 N | 507.8 N | 512.8 N | 516.0 N |
| ***Std. Dev.*** | ***6.45 N*** | ***3.49 N*** | ***2.58 N*** | ***2.91 N*** |

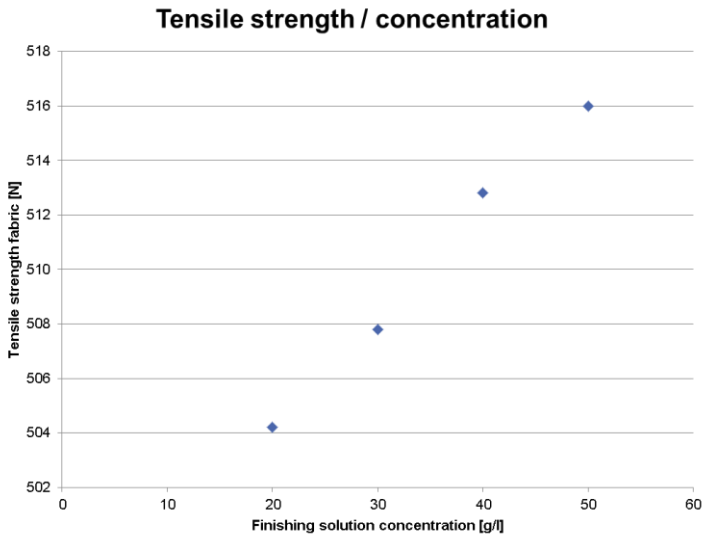
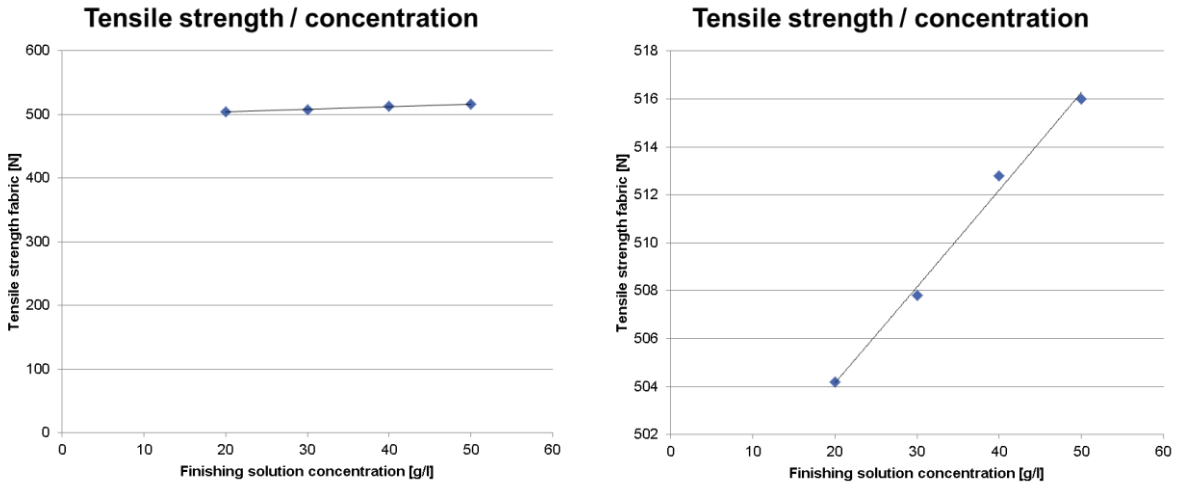



***Fig. 3:*** *Scatter plot of the warp tensile strength in relation to the solution concentration*

From the scatter plot (figure 3), we can observe that the higher the solution concentration, the higher the tensile strength.

This lesson describes the linear interpolation (1) and exponential interpolation (2). As a consequence of computing the parameters, we get the analytic relation of the linear trendline (1) and the analytic relation of the exponential trendline (2) (figure 4 a, b).




*a. Linear trendline of the warp tensile strength in relation to the solution concentration*

*b. Exponential trendline of the warp tensile strength in relation to the solution concentration*

***Fig. 4:*** *Tensile strength/concentration interpolation*

$$y=0.404x+496.06 \quad \textbf{(1)}$$

$$y = 496.23e^{0.000792x} \quad \textbf{(2)}$$

Where:
y = tensile strength [N]
x = solution concentration [g/l]

The third lesson developed by INCDTP was included in the digital transition courses for managers and mentors. This lesson presents aspects related to data analytics aspects that can be added to business processes to predict sales, take into account production and advertising costs, study the behaviour of the customers and, predict future actions and make decisions about future product developments and the necessary team to achieve the objectives [3-6]. The Business Analytics Value Chain (figure 5) consists of [7] identification of new business challenges, data audit, preparation and execution, analytics knowledge discovery, test and learn knowledge management and execution and continuous optimization. In order to perform data analytics, it is necessary to have specialized human resources (e.g. database specialists, report developers, Python developers, AI developers and data analysts using tools such as SQL, BI tools, or cloud-based services to extract, load and transform data.

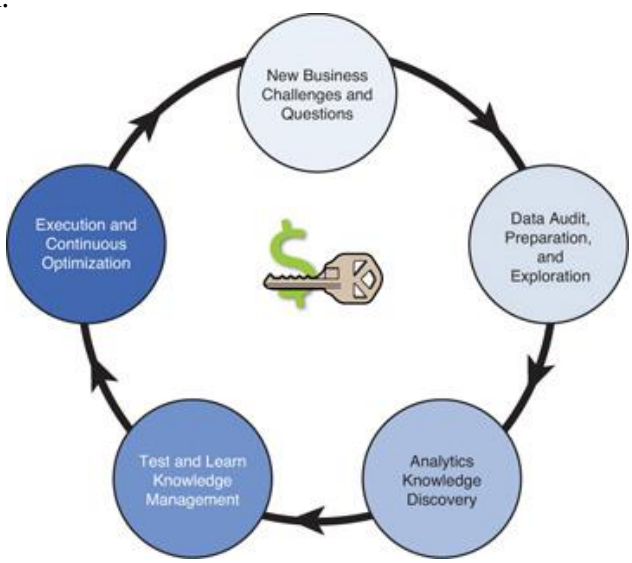



***Fig. 5:*** *Analytics business value chain [3]*

## 5. CONCLUSIONS

The proposed lessons in the framework of the ADDTEX Erasmus+ project can help technicians, graduates, engineers, professionals, managers and mentors from the textile industry improve their knowledge about data analysis, acquisition and visualization to generate business growth through customer behaviour and sales prediction. In addition, business analytics require adequate software products and human resources.

Accurate data fitting and development of the model help in sales, production and behaviours (competitors or customers) prediction and outlines elimination. Predictive analytics involves several

steps, such as data sampling, selecting the appropriate algorithm, predicting the target/type and using a machine learning model to anticipate the results.

In the case of using historical data records (massive volume of data) for analysis, the data visualization (e.g., scatter, combo, list, or stacked plots) helps in the quick visualization of the aspects related to performance and improvement of the business outcomes [8].

## ACKNOWLEDGEMENTS

The Erasmus+ ADDTEX project has been funded with support from the European Commission. This publication reflects the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.


Co-funded by the Erasmus+ Programme of the European Union

The publication of the scientific paper is funded by the Ministry of Research, Innovation and Digitization within Program 1 - Development of the national R&D system, Subprogram 1.2 - Institutional Performance - RDI excellence funding projects, Contract no. 4 PFE/2021.

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