# INITIAL DIAGNOSTIC OF SUSTAINABLE DEVELOPMENT GOALS IN A MASTER DEGREE OF THE INDUSTRIAL ENGINEERING SCHOOL AT UNIVERSITAT POLITÈCNICA DE VALÈNCIA

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## Abstract

Sustainable development goals (SDG) are a United Nations initiative that seeks to achieve a sustainable future for all. The plan is structured around 17 goals, including the end of poverty, zero hunger, gender equality, economic growth, sustainable consumption and production, etc. All these goals are broken down into targets, which total 169. Many organizations around the world, such as universities, have embraced SDG in their strategy (mission, vision and values). At the Universitat Politècnica de València (UPV) in Spain, different initiatives are being deployed to promote the implementation of SDG into its degrees. One of these initiatives is carried out by the School of Industrial Engineering, which has launched a 2-year educational innovation project for academic years 2021-2022 and 2022-2023, which covers all its Bachelor's and Master's degrees. In the first year, the first step to be carried out is to know the initial situation; that is, to perform an initial analysis to know which SDG, and to what extent, are being worked on in each degree. This paper specifically presents the diagnostic and conclusions of the analysis performed in the UPV Master of Advanced Production Engineering, Logistics and Supply Chain. This study will help to redefine activities to promote training in SDG in the Master's degree.

Keywords: Sustainable development goals (SDG), Master's degree, Industrial Engineering.

## 1 INTRODUCTION

In September 2015 within the framework of the United Nations, the main world leaders unanimously adopted the document "Transforming our world: Agenda 2030 for Sustainable Development" [1], possibly one of the most important and ambitious global agreements reached to date. On 1 January 2016, Agenda 2030 came into force to set the world and its societies on a path towards a better future by 2030. This gave rise to 17 Sustainable Development Goals (SDG). The practical way of tackling these SDG is set out in the 169 targets associated with them [2].

The 17 SDG to transform our world [2] are:

- GOAL 1: No poverty
- GOAL 2: Zero hunger
- GOAL 3: Good health and well-being
- GOAL 4: Quality education
- GOAL 5: Gender equality
- GOAL 6: Clean water and sanitation
- GOAL 7: Affordable and clean energy
- GOAL 8: Decent work and economic growth
- GOAL 9: Industry, innovation and infrastructure
- GOAL 10: Reduced inequality
- GOAL 11: Sustainable cities and communities
- GOAL 12: Responsible consumption and production
- GOAL 13: Climate action
- GOAL 14: Life below water
- GOAL 15: Life on land
- GOAL 16: Peace and justice strong institutions

- GOAL 17: Partnerships to achieve the goal

Since they came into being, these SDG have become a source of inspiration for, and an influence on, most countries by encompassing both public and private institutions for being joined by business' growing interest. Obviously, universities also joined, play a key role in implementing Agenda 2030 and aim to achieve the 17 SDG with the sustainable development solutions network (SDSN). It is in the SDSN handbook where the foundations are laid to implement Agenda 2030 in Higher Education institutions by applying it to the four intervention areas: teaching, research, transfer, and institutional policy and social leadership.

This paper is based on the first phase of the results obtained from an Educational Innovation and Improvement Project (PIME) [3] at the Universidad Politècnica de València (UPV) [4]. Its objective is to develop actions to contribute to achieve SDG by focusing on the first intervention area: the teaching field at the UPV School of Industrial Engineering (ETSII) [5]. The ETSII is aware that one of our main priorities must be to train not only engineering professionals, but also enterprising people committed to sustainability. The PIME is going to be applied to official UPV degrees (5 Bachelor's and 7 Master's) that can impact about 4100 students, and more than 700 professors from 26 departments with at least 280 subjects.

The main specific objectives of the PIME are to:

- Know, for each degree, which SDG are being worked on, in which subjects and how they are being worked on
- Identify current good practices in SDG training for their dissemination in the school
- Analyze the potential for working on SDG in the subjects of each degree program.

This paper focuses on the Master's Degree in Advanced Production, Logistics and Supply Chain Engineering (MUIAPLCS) [6,7]. This Master's degree addresses graduates in Engineering, Experimental Sciences and Business Administration and Management, with an orientation toward industrial and service companies (logistics, distribution, logistics operators) and motivation for supply chain relations among suppliers, manufacturers, transporters, logistics operators and distributors.

The objectives of MUIAPLCS are to: (i) train professionals in advanced production, logistics and supply chain engineering by orienting their training toward companies' needs; (ii) provide the possibility of choosing a research path for those participants who wish to do their doctoral thesis; (iii) apply advanced planning, scheduling and sequencing techniques in both the industrial companies and supply chain contexts. It will introduce procurement and distribution logistics techniques, logistics and supply chain engineering and strategies, and will work on the application of business process management, performance measurement systems, and modeling and simulation techniques for production, logistics and supply chain systems [6, 7].

This paper aims to analyze the current context of incorporating SDG into the official MUIAPLCS Master's degree at the UPV to study its potential transfer to other subjects and degrees of the ETSII. It particularly focuses on the compulsory subjects of the analyzed Master's degree [6].

The structure of this paper is as follows. Section 2 presents the methodology followed to analyze the status of SDG in the Master's degree. Section 3 presents the obtained results. Finally, the last section provides the conclusions of this work.

## 2 METHODOLOGY

In the first year of the educational innovation project, the first step to be carried out is to know the initial situation; that is to say, to perform an initial analysis to learn which SDG, and to what extent, are being worked on each degree. This paper presents the diagnostic and main conclusions of the analysis carried out of the MUIAPLCS Master's degree. The followed methodology is shown below.

### 2.1 Step 1. Definition of a spreadsheet to perform the review

In order to collect information for the analysis, a spreadsheet was developed (see Figure 1). The spreadsheet is structured in rows (containing subjects) and columns that indicate the reviewer (who performs the syllabus review), the subject type (compulsory or optional), subject code, and SDG 1 to 17. The last column identified the part of the syllabus that is linked with the specific SDG.

| Reviewer | Subject type | Code | Subject name | SDG1 | SDG2 | SDG3 | SDG4 |
|---|---|---|---|---|---|---|---|
| MJ | Optional | 32607 | FOREING TRADE | | | | |
| MJ | Compulsory | 30369 | SUPPLY CHAIN STRATEGY | | | | 1 |
| BA | Compulsory | 32603 | ADVANCED MANAGEMENT IN PRODUCTION AND INVENTORY SYSTEMS | | 1 | | 1 |
| BA | Optional | 32609 | MANAGEMENT OF COLLABORATIVE PROCESSES IN THE SUPPLY CHAIN | | | | |
| BA | Compulsory | 30457 | BUSINESS PROCESS MANAGEMENT (BPM) | | | | 1 |

*Figure 1. Caption of the SDG analysis spreadsheet*

## 2.2 Step 2. Performing the initial analysis of the SDG in the syllabus of subjects

Once the spreadsheet is defined, the reviewers (lecturers of the Master with knowledge of the different courses) have to read the syllabus and fill in the spreadsheet. The spreadsheet contains two sheets: one for the analysis of the current status of the SDG in the syllabus of subjects; the other for the analysis of the potential development of SDG in subjects.

Regarding the syllabus' current status, the cell that intersects the subject and every SDG is filled in according to three options:

- In blank = the SDG is not involved in the subject
- 1 = the SDG is involved in the subject, but this fact is not explicitly made in the syllabus. This means that the subject has activities aligned with the SDG, but the syllabus does not make this linkage explicit
- 2 = the SDG is involved in the subject and is explicitly made in the syllabus

In addition, the reviewers have to read the syllabus (activities, units, etc.) and identify the potential development of SDG to further extend the current scope of subjects. For this purpose, a second sheet is filled in to assess the potential development of SDG in subjects. In this case, the cell that intersects the subject and every SDG is filled in according to three options:

- In blank = no link between the SDG and the subject
- 1 = the subject has content that is partially linked with SDG
- 2 = the content of the subject is completely linked with SDG

## 2.3 Step 3. Analyzing results and extracting conclusions

After both spreadsheets have been filled in, this stage aims to obtain an overview of the Master's degree in relation to SDG, e.g., the most and least developed SDG in the Master's degree and the potential to further develop other SDG in subjects.

# 3 RESULTS

The review of all the subjects is planned in two stages. The first stage comprises the review of compulsory subjects; note that eight out of the 16 subjects are compulsory. The second stage deals with the review of the optional subjects. This paper presents the main results obtained from the first stage.

After reviewing the eight compulsory subjects, Figure 2 shows the current status and potential development of SDG. The following results were obtained:

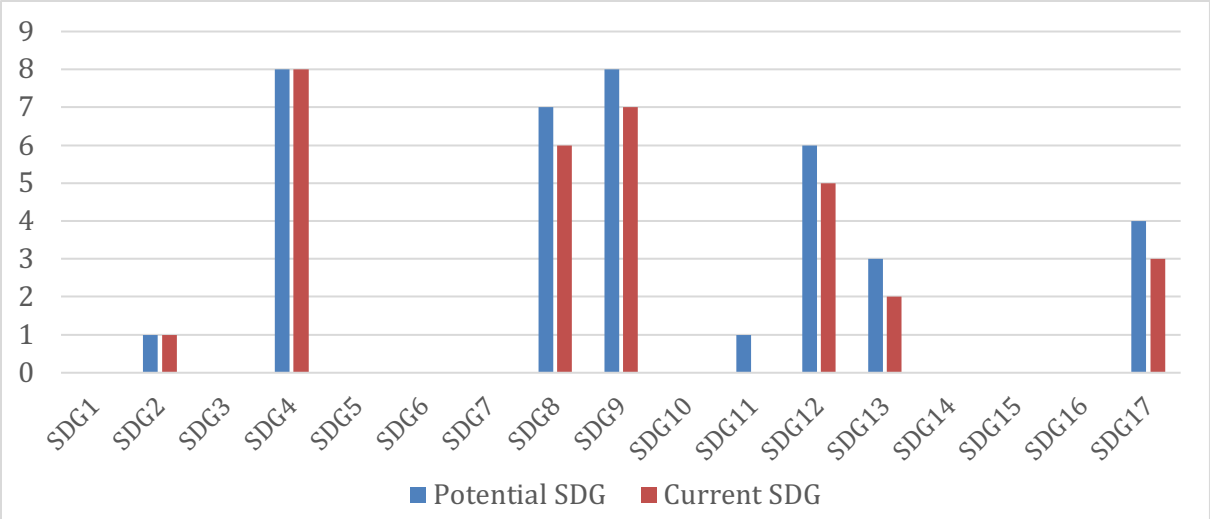


*Figure 2. Current status and potential development of SDG in the compulsory MUIAPLCS subjects*

Regarding the current status of SDG:

- To date, there is no subject that makes the SDG in its syllabus explicit. Thus the data shown below correspond to the cells filled in with "1" on the spreadsheet
- The subjects support the development of seven SGD (SDG2, SDG4, SDG8, SDG9, SDG12, SDG13, SDG17), as shown in Figure 2
- The top-4 most developed SDG in the Master degree (those that are worked on in more subjects) are SDG4, SDG8, SDG9 and SDG12. In fact SDG4 is worked on in all the compulsory subjects
- The SDG that are least worked on in subjects are SDG2, SDG13 and SDG17

Regarding the potential development of SDG:

- After assessing the potential development of SDG in subjects, we find a slight increase in the number of subjects that can work on SDG. This affects SDG8, SDG9, SDG12, SDG13 and SDG17, which can be worked on in one more subject, and SDG11 can be worked on in one subject in the Master's degree
- There are nine SDG that are not covered by the Master: SDG1, SDG3, SDG5, SDG6, SDG7, SDG10, SDG14, SDG15 and SDG16. A review has to be performed with the instructors of all the courses to verify if some of these SDG can be worked on by introducing changes in the syllabus after deciding if it is interesting or not

## 4 CONCLUSIONS

This paper proposes and develops a methodology to review, analyze and propose further work on the current and potential development of SDG in a Master's degree. The methodology considers three stages based on the review of the syllabus of each subject. These stages are: (i) defining a spreadsheet for the review, including the reviewer, subject information and SDG; (ii) conducting the initial analysis of the SDG in the syllabus curricula using the defined options to identify the current and potential use of SDG; analyzing the results and drawing conclusions about the most and least developed SDG and the potential for further development. Specifically, we carried out this analysis of SDGs in the MUIAPLCS of the UPV. In this case, compulsory subjects were carefully considered. The main findings show that: (i) there is no explicit consideration of SDG in the published MUIAPLCS curriculum, but they have been identified as being worked on throughout several learning activities; (ii) quality education; decent work and economic growth; industry, innovation and infrastructure; responsible consumption and production are the most addressed sustainable goals in MUIAPLCS, which is aligned with the main objectives of this Master's degree; (iii) zero hunger, climate action and partnerships to achieve the goal could be further developed.

Finally, by means of this analysis, additional work has been identified, such as: (i) identifying the best teaching practices, even when they are not explicitly stated in the syllabus or by transferring them from

other Master's degrees with some related subjects; (ii) conducting a survey of the lecturers who currently teach these reviewed subjects to verify the results with those provided by the reviewers; (iii) developing a SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis of the current situation to define, among other aspects, lecturers' training in SDG.

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