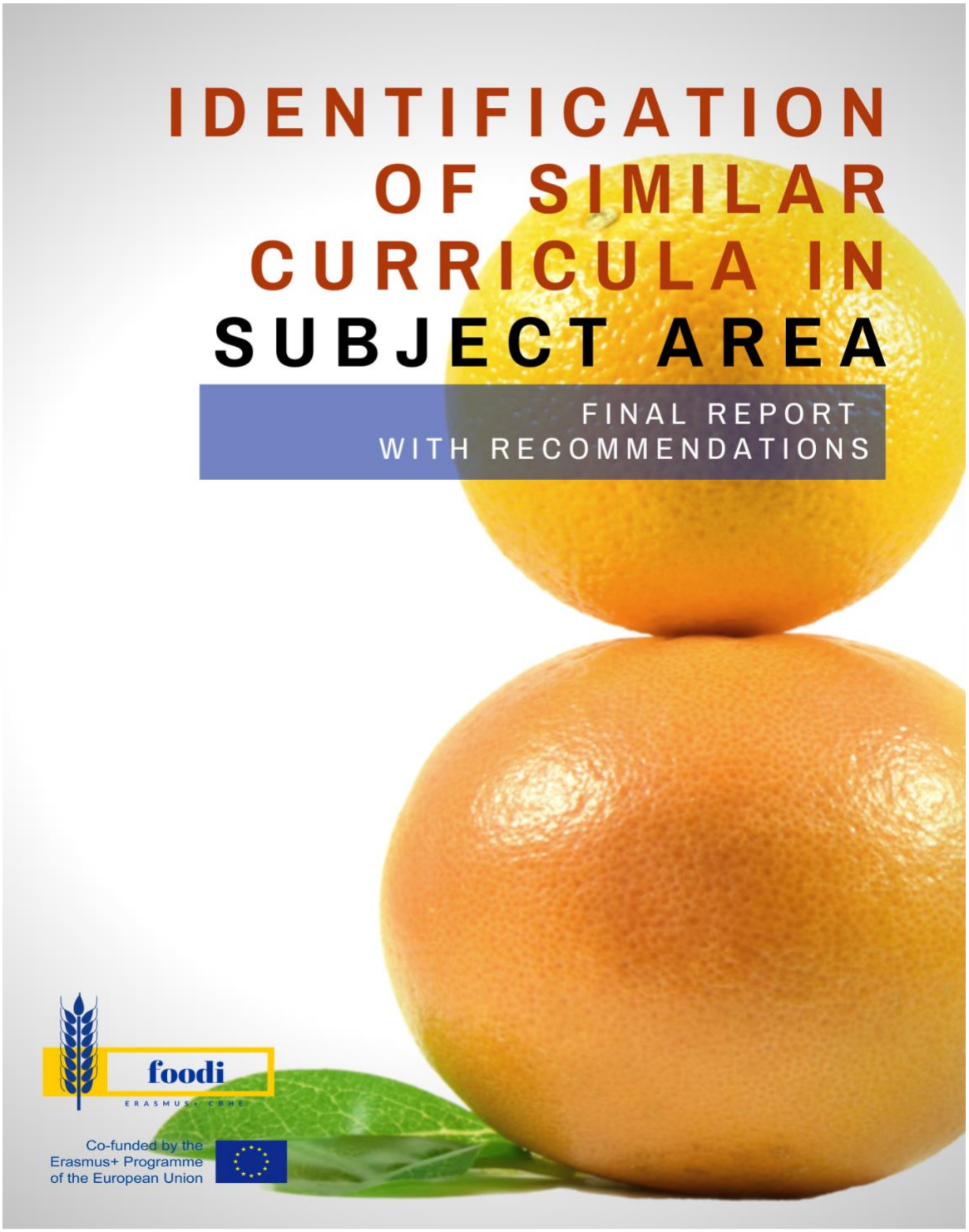

D1.4 FINAL REPORT WITH RECOMMENDATIONS

WP1. Identification of similar curricula in the subject area

Project Information

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Executive Summary

WP1 contained three deliverables.

The *first deliverable* was the investigation of Similar Postgraduate Study Programs in Asia. In this area there are altogether 36 Master programmes in food through coursework being offered across Asia.

The *second deliverable* was the investigation of Similar Postgraduate Study Programs in Europe. The research has evolved into two phases:

a) Research for similar postgraduate courses at universities in Europe.

b) Qualitative research through questionnaires to academic experts in food science.

The *third deliverable* of the first work package WP1 was the investigation of similar VET programs in ASIA and specifically in the partner countries of Malaysia, Cambodia and Thailand.

The highlighted conclusions are:

In the **36 Master programmes in Asia**, more than 65% of the offered courses focus on *Science and Technology dimension* and more specifically in sub-dimensions such as Food Science and Technology,Food Chemistry, Functional Food, Food Development, Food Nutrition, Food Processing and Food Safety and Quality. On the other hand, the dimension of Entrepreneurship& Innovation is in less than 10% of the offered courses.

In the **134 MSc Courses at European universities**, the overwhelming majority of programs are targeting the regions of *Food Technology, Science and Engineering* and only 15%-25% of them have a more entrepreneurial perspective concerning the food industry.

According to the research in**75 Academic Experts** the importance of the main subject of *Food Science and Food Technology* is highlighted.

Cambodia is an agricultural country that focus more on agro-business. Therefore, Universities should revise and develop the existing curricula to produce human resources to response the country's needs.

In **Malaysia** there is a lack of short courses at professional certificate levels. Current food courses *do not tailor to specific needs of local food industries* particularly relating to appropriate *packaging and rice processing* course

In **Thailand, t**here is demand for training courses in the areas related to food innovation. The Need for sustainability of food production and manufacturing process as well as research and production development was highlighted during the research activities of the project.

1 Similar Postgraduate Study Programs in Asia

WP1 contained three deliverables.

The *first deliverable* was the investigation of Similar Postgraduate Study Programs in Asia.

In this area there are altogether 36 Master programmes in food through coursework being offered across Asia.

Generally, the MSc. Coursework programme requires completion of 34 credits of core courses and 6 credits of elective courses with presentation and submission of dissertation in all countries from Malaysia, while the only programme in Cambodia from Institute of Technology of Cambodia requires 52 total credits. MSc Coursework programme in Thailand are similar to Malaysia with the exception of Chulalongkorn University, Thailand offering two programmes with 39 credits, two with 42 total credits andSuranaree University of Technology with 48 total credits. Method of teaching includes lectures, laboratory practical, assignment, case study and mini project.

The **courses were categorized into 4 clusters** based on their related topics on **Entrepreneurship, Science and Technology, Innovation,** while unrelated courses are categorized into Others. There are altogether 790 courses with 67 percent of the courses under Science and Technology while the rest are under clusters: Entrepreneurship, Innovation and others with around 10 percent. Two programmes are entirely on entrepreneurship: MSci (Technopreneurship and Innovation Management) and MSci (Food Service Management) which do not offer courses on Science and Technology Cluster.

The courses are further categorized into sub-clusters within the clusters based on description of topics of similarities but slight variation in names of the courses. The Agribusiness and Management sub-cluster has the most courses in the Entrepreneurship Cluster. In the Science and Technology cluster, sub-clusters on Food Science and Technology,Food Chemistry, Functional Food, Food Development, Food Nutrition, Food Processing and Food Safety and Quality are most prominent with over 30 courses. The Food Safety and Quality sub-cluster has the most with 55 courses. The Engineering clusters focuses on Food Processing and Food Engineering sub-clusters. In the others, all programmes have the Research Methodology sub-cluster courses.

2 Similar Postgraduate Study Programs in Europe

The *second deliverable* was the investigation of Similar Postgraduate Study Programs in Europe.

The research has evolved into two phases:

a) Research for similar postgraduate courses at universities in Europe.

b) Qualitative research through questionnaires to academic experts in food science.

In the first part, researchers had to locate the corresponding postgraduate programs through an online survey. The results of this first phase of the survey are described as follows. A total of 134 MSc Courses at European universities were identified.

60 postgraduate programs (45%) were found in Europe Area 1, with most of them in England (42%) and Ireland (18%).

39 postgraduate programs (28%) were found in Europe Area 2, most of them in Italy (34%).

35 postgraduate programs (27%) were identified in Europe Area 3, most of them in Greece (34%).

All the selected courses are related to food and have at least a food technology/science/engineering dimension or a food innovation dimension.

However, only 5 from 60 programmes in Europe Area 1, 5 from 39 in Europe Area 2 and 9 from 35 in Europe Area 3 referred specifically to Innovation and Entrepreneurship (14%).

From the above data, it is clear that the overwhelming majority of programs are targeting the regions of Food Technology, Science and Engineering and only 15%-25% of them have a more entrepreneurial perspective concerning the food industry.

This picture is also reflected in the detailed study of the curricula and the corresponding courses.

The lack of courses on entrepreneurship and innovation is made even clearer by studying curricula. Even in programs that include the concept of management, such as MBAs, the only business dimension that develops is that of quality control, law, marketing, and quantitative methods. There is therefore a large gap in the analysis of the business environment, the study of entrepreneurship and the emergence of innovation as the main pillar of the development of businesses in the food sector.

Some other major characteristics of the curricula were identified among the examined courses are international dimension; regional/industrial valorisation; curriculum flexibility; transdisciplinary. Often, it is found also some element of valorisation of local food culture or the relationship with industries in the region. Flexibility of the master course, allowing an extensive tailoring of the subjects taught, is also very frequently found.

It appears that very often the engineering dimension is less significant. Also, the innovation dimension is frequently lacking in the curricula examined. Less frequently but still significant is the number of curricula with little or no credits dedicated to entrepreneurship. Therefore, the weakness of the curricula with respect to the expected design of FOODI where categorized in the following cases: less entrepreneurship; less innovation; less engineering; less training.

All the above mentioned MSc courses includes a Master Thesis for the completion of the course.

Finally, the duration of the programs ranges from 3 to 4 semesters of study with a corresponding educational result of 90 – 120 ECTS.

For the second part of the research, European universities created lists of qualified academics who could participate in the research and with their opinion contribute to the creation of FOODI Master Course.

From this sample, researchers received answers from 75 Academic Experts from whole the Europe.

A weakness of the research is the fact that although the largest number of postgraduate programs is found in northern Europe, experts from northern Europe participating in the second part of the research are less than those of the other two regions.

However, we therefore conclude that the final panel of participants gives a representative picture of the European territory, the responses represent the whole of Europe's reality, and this way the academic experience developed in Europe on postgraduate food education programs can be safely captured.

Concerning this part's conclusions, we can mention the following.

The modules of management, such as food supply chain management, agri-food marketing and consumer behavior, are more significant, and we can say that the dimensions of entrepreneurship and innovation follow.

Concerning the food science, there is a greater attention on the modules of food quality and safety, as well as to R&D activity for the food development. On the contrary, the modules of engineering, such as internal processes or those of packaging and labeling are not so prevalent.

So, we can say that the importance of the main subject of food science and food technology is highlighted by the academic experts. Then the management dimension emerges as quite important especially in specific subjects such as quality control and marketing and then follows the engineering subjects such as production management. The dimension of innovation and entrepreneurship seems to be lacking in this qualitative assessment.

At any case, experts agree that the main body of such a postgraduate program should be technical courses in the field of food science. However, experts recognize the high need for subjects such as the business perspective in such a program.

Academic experts consider as strengths of their postgraduate programs mainly the fields of food processing, food quality and food & health. Additionally, the close relationship with the real (business / industrial) rorld through the internships and projects for companies as well as the institutional networks have been identified as important educational elements of their programs.

Regarding the academic reality, experts highlight as important elements of their programs, mainly the Links with Research programs and the Cooperation with other universities / institutes. As for the operational issues, the majority of the existing MSc courses offer part- and full-time curricula and there is a lack in offering distance learning programs.

Finally, the experts mentioned as prospective student, agriculture science employees, engineers and food business employees as first target and then entrepreneurs, food technologists and graduates of other science-based disciplines seeking employment in the food industry.

3 similar VET programs in ASIA

The ***third deliverable*** of the first work package WP1 was the investigation of similar VET programs in ASIA and specifically in the partner countries of Malaysia, Cambodia and Thailand.

The main findings per country are summarized below.

Cambodia

In the ***Country report* of *Cambodia*** it was discovered that for sustainable growth, Cambodia as an agricultural country **focuses more on agro-business** in terms of food softy and security and technology. **Universities should revise and develop the existing curricula to produce human resources to response the country's needs**. Food industries and factories should be established to process the overwhelming agricultural productions produced by the Cambodian famers. Furthermore, the Cambodian Higher Education Institutions are challenged with risks such as:

- **Lack of qualified lecturers** and experts to run the programs
- **Lack of laboratories** to support the programs
- **Limited number of students** who will enroll in the programs
- **Lack of financial support** to run the courses due to the low tuition fees

Some proposals in order to address these matters, are:

- **The design of an integrated curriculum** on Food Technology, Entrepreneurship, and Agro-Business.
- **The structure of a new Cambodian government'sRectangular Strategy 2018-2023**, Policy on Higher Education Version 2030, and Cambodian Industrial Development Policy 2015-2025 which will focus more on sustainable growth.
- **The institutional capacity building of the Universities and training centers in the country** to increase their ability and performance in managing food innovation programs.

Further to the above points, another set of key issues to be taken into are:

- P**roduct quality** needs improvement from process engineering.
- Fable **Process control monitoring**.
- Problematic **quality management system** and implementation (food safety standards or other standards).
- Challenging **General Management System (GMS) and Quality Management System (QMS).**
- Lack of **practical and communication skills**, and **foreign languages skills** as well as **soft and hard skills** of the personnel.
- It is difficult for the **Cambodian food sector to overcome the problem of competition** with other food companies and imported products. Consumer demand will need also to be studied and offer what the consumers need and be able to buy at an affordable price.

Furthermore, the food analysis and testing methods in Cambodia are moderately different and for that reason there is a need for some study program/equipment in order for these 2 fields to be distinguished.

Other challenges involve:

- Gaps in processing skills
- Gaps in Food quality, especially in food safety and quality management (FSQM)
- Gaps in Packaging and labelling which Cambodian Government needs to strengthen to make the food products more attractive.
- Gaps in Food innovation
- Need for more training in Soft skills in the field of production between engineers, personnel and workers.
- Gaps in Food value chain in the research and innovation for food production and marketing.
- Need for Product development to be added as an input in the food processing.

In the Part 3: Internship Demand & Curricula design input Findings it was also discovered that:

- **The Internship program needs to be scheduled** with practical skills and offer the additional guidance and mentoring to support and improve the associate (employee) skill as much as possible by internal and external experts.
- **There are problems during the operation** which have employees or interns coming from various institutions. Skills such as communication and feedback are desirable for team works.

Despite the existing legal framework in Cambodia, there are a number of critical issues challenging food safety implementation, especially the lack of effective cooperation among the line ministries.

Malaysia

In the **Country Report of Malaysia,** a lack of short courses at professional certificate levels to be provided for in-service training for the food industry was identified. Food process improvements are needed to achieve better efficiency and cost that will also formulate product specifications.

The emergence and growth of Halal food market with the broad acceptance among non-Muslim consumers who consider Halal food as safe, hygienic, quality and wholesome product has created huge gap in halal food training facilities and human resources.

In the *Focus Groups in Malaysia* needs and challenges faced by food processing industries are identified as such:

- **Difficulty to get the right graduates** to fill in talent gaps for the food industries.
- **Difficulty for most graduates to pursuit** an ideal career.
- **Lack of present graduates in right attitude** and soft skills such as communication, critical thinking and hands on skills.
- **Current food courses do not tailored to specific needs** of local food industries particularly relating to appropriate packaging and rice processing course.
- **Collaboration between Universities-Industries** lacks while it would be an advantage if this area being addressed as universities would have access to the food processing equipment and facilities of the industry,
- **Food industry is facing rising cost** of materials and ingredients, while the increase of cost could not be simply transferred to consumers to ensure acceptable menu pricing.
- **Limited storage areas to maintain good quality** of raw items, translating to more frequent delivery of goods and this impacted the cost.

- In the Part 2: Sector Skills Gaps Findings it was also discovered that:
- **The majority of graduates** have a background in food programs but are not specialized in food innovation.
- **The majority of current talents** particularly from public universities are excellent in certain skills but lack in soft skills, particularly in communication, teamwork and punctuality
- **There is a lack of confidence** amongst public university graduates.
- **The majority of courses** may require the technical knowledge of a specific area such as supply chain or product management.
- **The majority of students** fail in understanding the importance of life- long learning
- **•The Gaps in human resource management**, engaging with peers and stakeholders and leadership skills.

The main strengths of the discussions are the participants of the focus groups who are really commited to answer all the facilitators questions and sharing their perspectives of the industry. All of them have strong experience of an average of more than 22 years and they have built their career in food related industries since they graduated.

In terms of needs and challenges, participants are in view that the main needs are for right graduates to fill in talent gaps for the food industry. Other challenges include sustainable source of raw materials from local suppliers, stringent requirement for Halal and Safety of food and rapid change of technology to cope with. This is not surprising as Malaysia is a developing country which requires skillfull talent in its journey to be an advanced nation. As the country intends to be the major Halal Hub for the region, more talents with halal knowledge and expertise are needed. The rapid innovations and technology advancement is another challenge that must be addressed for the industry to remain competitive and spell the needs for proactive talent with agility to cope with changes.

In terms of skills gap, the major gaps identified amongst the talents in food industries are the **lack of soft skills such as communication, teamwork and entrepreneurial drives which includes motivation, attitude and innovativeness**. Talents must keep abreast with latest technology in food development and be able to overcome gaps in skills for human resource management, leadership quality and engagement skills with peers and stakeholders. Soft skills such as maintaining integrity, punctuality, team player and going beyond are very valuable to the industry.

All participants are open to ideas and will be ready to support the intended MSc in Food Processing program whenever possible. Curricula design must include; Halal Certification, Regulatory Requirements, and specific module for major food sectors in the country such as rice processing, paultry management and so on. Food safety and food related business management are also required.

As far as the "FOODI Analysis Survey- Descriptive Analysis", conducted by Malaysia in order to identify which Technical Modules should form the major part of postgraduate programs for the Food Industry, the vast majority of participants addressed the need that technical model should form the major part of postgraduate programs for the food industry.

Thailand

In the *Country report in Thailand*, it was discovered that:

- There is demand for **training courses** in the areas related to food innovation.

- Training courses have to focus on the **development of academic, technical and soft skills.**
- The gap between **industrial equipment and university education** needs to be considered.
- The enhancement of specific skills such as **laboratory analysis**, **management, communication and software skills.**

As far as the *Focus Groups in Thailand*, are concerned, it was shown that:

- Many participants lack in **laboratory skills** and quality analysis management.
- Industries have to focus on the **sustainability of food production** and manufacturing process.
- Industries have to do **research and production development**.
- Skills such as **entrepreneurship and engineering** are not considered of high importance as core modules.

According to the three country reports, we can see that it is difficult to distinguish how NQF Programs are related to EQF Modules. This is an issue that should be addressed, as students could:

- Gain a broader insight into how food innovation processes throughout the world.
- Adapt in a globalized educational context.
- Find new possible issues that could be fixed.

In terms of personnel skills gaps, the most characteristic that the three countries lack are summarized as such:

- Innovation
- Digital
- Research
- Entrepreneurship

Moreover, soft skills that are considered of high demand and the three countries doesn't excel are:

- Communication
- Flexibility
- Leadership
- Management

To this end, all participants in the focus groups declared that they are more than willing to host the FOODI Internships once the program is further developed.

Without support and up skilling, the food industries struggle to produce products that meet specific (and rising) standards, and may rely on inputs that are harmful to human health.

On the other hand, new technology such as block chain technology, which can monitor and track food in the supply chain, can help in driving food supply transparency as well as increasing responsiveness to food safety issues. It would allow specific products to be traced at any time, allowing contaminated products to be traced easily and quickly.

The three countries need to invest in capacity-building and strengthening regulatory frameworks to deliver evidence-based policymaking. Governments need to develop their own capacities to ensure that evidence-based policymaking occurs in all areas of scientific research. New technologies such as CRISPR, and even

policies regarding import regulations and standards, require significant investment by governments to develop both understanding and regulation.

4 Conclusions & Recommendations

From the above-mentioned descriptions, we can highlight the following conclusions:

In the **36 Master programmes in Asia**, more than 65% of the offered courses focus on *Science and Technology dimension* and more specifically in sub-dimensions such as Food Science and Technology,Food Chemistry, Functional Food, Food Development, Food Nutrition, Food Processing and Food Safety and Quality. On the other hand, the dimension of Entrepreneurship& Innovation is in less than 10% of the offered courses.

In the **134 MSc Courses at European universities**, the overwhelming majority of programs are targeting the regions of *Food Technology, Science and Engineering* and only 15%-25% of them have a more entrepreneurial perspective concerning the food industry.

The business dimension contains courses such as quality control, law, marketing, and quantitative methods.

The engineering dimension is less significant, and the innovation dimension is frequently lacking in the curricula examined.

All the European MSc courses includes a Master Thesis for the completion of the course.

The duration of the European programs ranges from 3 to 4 semesters of study with a corresponding educational result of 90 – 120 ECTS.

According to the research in75 Academic Experts the importance of the main subject of *Food Science and Food Technology* is highlighted.

The main body of such a postgraduate program should be technical courses in the field of food science. Food Science courses such as food quality and safety, R&D activity for the food development, food processing, food quality and food & health are very important.

Management courses, such as food supply chain management, agri-food marketing and consumer behavior, are more significant.

Engineering modules, such as internal processes or those of packaging and labeling are not so prevalent.

The ideal target group for such an MSc program could be agriculture science employees, engineers and food business employees as first target and then entrepreneurs, food technologists and graduates of other science-based disciplines seeking employment in the food industry.

There is a large gap in the analysis of the business environment, the study of entrepreneurship and the emergence of innovation as the main pillar of the development of businesses in the food sector.

According to the research in 23VET programs in Asia.

Cambodia is an agricultural country that focus more on agro-business. Therefore, Universities should revise and develop the existing curricula to produce human resources to response the country's needs.

- Product quality and quality management system as well as Product development needs improvement. There are also gaps in Packaging and labelling, gaps in Food innovation, gaps in Food value chain.

- Therefore, there is a need for the design of an integrated curriculum on Food Technology, Entrepreneurship, and Agro-Business.

In **Malaysia** there isa lack of short courses at professional certificate levels.

- Current food courses do not tailor to specific needs of local food industries particularly relating to appropriate packaging and rice processing course.
- Most courses may require the technical knowledge of a specific area such as supply chain or product management.
- More talents with Halal knowledge and expertise are needed. Halal Certification, Regulatory Requirements, and specific module for major food sectors in the country such as rice processing, paultry management.
- There is a lack of soft skills such as communication, teamwork and entrepreneurial drives which includes motivation, attitude and innovativeness.
- There is a gap in skills for human resource management, leadership quality and engagement skills with peers and stakeholders.

In **Thailand, t**here is demand for training courses in the areas related to food innovation

- Need for sustainability of food production and manufacturing process as well as research and production development.
- Lack in laboratory skills and quality analysis management.
- Entrepreneurship and engineering are not considered of high importance as core modules.
- The most characteristic that the three countries lack are summarized as such:Innovation, Digital, Research, Entrepreneurship.
- Soft skills that are considered of high demand and the three countries doesn’t excel are: Communication, Flexibility, Leadership, Management.