Research Article:

# Analysing the Malaysian Higher Education Training Offer for Furniture Design and Woodworking Industry 4.0 as an Input Towards Joint Curriculum Validation Protocol

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## ABSTRACT

An education programme at the master's level normally aims to facilitate graduates' acquisition, mastery and application of advanced knowledge in specialised areas of education. However, there is no learning pathway that aims to improve the level of specific and transversal competencies and skills, with particular regard to those relevant for the labour market in the furniture sector, such as management, entrepreneurship, language competences and leadership toward wood and furniture industry 4.0. The methodology for this research inquiry was based upon a survey questionnaire of 54 respondents during the MAKING4.0 Seminar at Universiti Teknologi MARA (UiTM)

in Shah Alam, Selangor, Malaysia. The results were analysed from the Work Package 1 (WP1) "Analysis and comparison of the current Higher Education training offer and furniture and woodworking industry", before the learning outcomes were defined for each of the identified topics. The definition of learning outcomes was made considering the Recommendations of the European Qualifications Framework (EQF), and subsequently harmonised with the Programme Learning Outcomes defined in the Malaysian Qualification Framework 2nd edition (MQF2.0) for a Master´s Degree Level 7. The identified learning outcomes have been grouped into four modules: (1) Processes and Production of Furniture, (2) Intelligent and Sustainable Design, (3) Wood and New Materials, and (4) Innovation Management. Results of the study indicated that MAKING4.0 is in line with the actions highlighted in the Malaysian Education Blueprint (2015–2025) and the objectives of the Ministry of International Trade and Industry in developing the National Industry 4.0 policy framework. MAKING4.0 aims to ensure an adequate supply of human capital and skills, as well as develop an innovative master's degree to modernise the current training offer in wood and furniture technology processes and design around Industry 4.0 in Malaysia.

**Keywords:** Industry 4.0, joint curriculum, Malaysian Higher Education, validation, wood and furniture

## INTRODUCTION

The wood and furniture industry has great socio-economic importance for Malaysia. (see Chumiran et al., 2015; Economic and Social Commission for Asia and the Pacific [ESCAP], 2018). This industry provides significant employment opportunities in the rural areas of the country and is in-line with The Sustainable Development Goals (United Nations, 2015). Malaysia is globally known as a big producer/exporter of wood products, e.g., saw logs and sawn timber. These products are the main materials utilised in the construction sector. Whereas, wood panels such as plywood, particleboard and fibreboard are used as essential components for furniture. At the same time, the recent trends in the uptake and adoption of Industry 4.0 are on the rise (see Ministry of International Trade & Industry, 2018; Ministry of Plantation Industries and Commodities & Malaysian Timber Industry Board, 2009; Schwab, 2016). The term 'Industry 4.0' refers to a fourth industrial revolution with four main characteristics: (1) The vertical networking of smart production systems, such as smart factories and smart products, and the networking of smart logistics, production and marketing and smart services, with a strong needs-oriented, individualised and customer-specific production operation, (2) Horizontal integration by means of a new generation of global value-creation networks, including integration of business partners and customers, and new business and cooperation models across countries and continents, (3) Through-engineering is in place throughout the entire value chain, taking in not only the production process but also the end product – that is, the entire product life cycle, and (4) Acceleration through exponential technologies that, while not really new in terms of their development history, have become capable of mass-market application as their cost and size have come down (e.g., sensor technology) and their computing power has risen massively (see Deloitte, 2015). These trends have arisen due to technological innovation and work demand (see Abdul Haseeb, 2018; Pahl & Beitz, 1996). Robots may work

with people and will massively increase industrial output. Manufacturing information will remain available throughout the production's value chain (see Chumiran et al., 2020; Ali et al., 2013). Therefore, Industry 4.0 is observed as a revolution for machines, job profiles and skills improvement for the wood and furniture industry.

## LITERATURE REVIEW

### Issues of Education and Training

New players with special business models will materialise, parallel with the development of new models of education and training. A company's successful furniture and product design creates a strong brand identity, allowing them to strategically position themselves in the market and thrive, particularly in Malaysia. (see Abdul Aziz et al., 2019; Abidin et al., 2016; Heskett, 1980). The way designers and stakeholders think about design during the evolution of Industry 4.0 is now totally different (Abidin et al., 2018; 2011; 2009). According to Ratnasingam et al. (2020), the lack of knowledgeable and skilled workers to handle Industry 4.0 technology is a concern among furniture manufacturers. Therefore, the proposed university-level Industry 4.0 programme may provide substantial benefits in training furniture workers in the future. Furthermore, for furniture workers to be upskilled, their education should incorporate coursewares that develop artistic skills practice and expand on their technological, pedagogical and content knowledge (see Anuar et al., 2019). Additionally, students should be encouraged to creatively develop their skills in intuitive formgiving (see Abidin et al., 2008; Zainuddin et al., 2016). University-level furniture design courses can explore the aesthetics and study the effect of formgiving on human sensations (see Zainal Abidin et al., 2008; Anwar et al., 2015; Ulrich & Eppinger, 2015). The framework of the co-creation approach for Malaysian interactive multimedia should be developed (see Jantan et al., 2020). Design should reflect the emotional and perceived quality expectations of consumers (see Jamaludin et al., 2013; Ab Hamid et al., 2013; Vermol et al., 2015; Kamil et al., 2019).

These fundamental changes are being developed by university, industry and wood-related institutions. Universities as major stakeholders play an important role in developing new knowledge and skills for Industry 4.0 implementation in the wood and furniture area. The Ministry of Higher Education Malaysia (MOHE) has proposed major reforms to Malaysia's higher education system in order to accelerate the changes, by introducing the Malaysia Education Blueprint 2015–2025 for Quality and Efficiency. In the meantime, the formulation of the National Timber Industry Plan (NATIP) back in 2009 further emphasised the government commitment to the development of wood-based industries' materials supply, workforce, markets, automation, design and branding, as well as entrepreneurship. The Malaysian Investment Development Authority (MIDA) has also recently viewed the potential development and extension of the Malaysian furniture hub, where all industry-related activities are housed at one location for all industry players so they are prepared and able to reap the many benefits of Industry 4.0.

**Formulation of Joint Curriculum Structure**

Following all these justifications, MAKING 4.0 has established a European-Malaysian collaborative consortium with the objective of developing an innovative master's degree for engineers of furniture smart factories that will modernise Higher Education (HE) degrees. A focus on ICT skills is vital for increased competitiveness in the Malaysian wood and furniture industry (see Romero-Gázquez et al., 2020; Abidin et al., 2020; Romero-Gázquez et al., 2021). It is obvious that the present project fits the regional and national priority of the Erasmus+ call CBHE for the Asian region. It focuses on curriculum development projects in manufacturing and processing, and also other priorities such as engineering and engineering trades and forestry at a master's level (see Malaysian Qualifications Agency, 2011; 2014b; 2018; European Training Foundation; 2012; European Union, 2018). The programme, namely "Master's of Advanced Technologies and Innovation for Wood-Based Industry", is currently being developed by the consortium. Table 1 shows the modular structure of the master's programme, which consists of five modules, carrying 40 credits:

**Table 1.** Modular structure of the master's programme

| Modules of the Master's Programme | ECTS |
|---|---|
| Module 1: Processes and Production of Furniture | 16 |
| Module 2: Intelligent and Sustainable Design | 4 |
| Module 3: Wood and New Materials | 6 |
| Module 4: Innovation Management | 4 |
| Module 5: Internship and Dissertation | 5 |
| Total Malaysian Credits | 40 |

There are compulsory and elective courses in the program. Table 2 displays the credit amounts of 28 (70%) and 12 (30%) for compulsory and elective courses, respectively.

**Table 2.** Credits for compulsory and elective courses

| Compulsory/Elective | Abbreviation | ECTS | Percentage (%) |
|---|---|---|---|
| Compulsory | C | 28 | 70 |
| Elective (Optional subjects) | E | 12 | 30 |
| | Total | 40 | 100 |

The appropriate structure for the master's degree program meets the European Credit Transfer and Accumulation System (ECTS) standard which has equivalency of a Cumulative Grade Point Average (CGPA), Appendix A shows the structure of the Master's of Advanced Technologies and Innovation for Wood-Based Industry and its subjects for two semesters. Ten courses must be taken in Semester 1, while seven courses in Semester 2. All courses carry a 2-credits value, except for the internship and project courses in Semester 2. which carry a 5-credit value for each course (both the internship

and project carry a 5-credit value). For the internship course, a 10-week placement would begin in Week 5.

| 1. | Name of Course : | Digital Transformation in Industry 4.0 |
|---|---|---|
| | Course Code : | |
| 2. | Synopsis : | This course is focused on understanding the concept of Industry 4.0 and the changes it will cause in traditional industry. This new concept will transform industrial and manufacturing companies. Knowledge is provided to understand the current state of the furniture sector with respect to the new Industry 4.0 paradigm. |
| 3. | Name(s) of academic staff : | |
| 4. | Semester and Year offered : | Semester 1 Year 1 |
| 5. | Credit Value : | 2 |
| 6. | Prerequisite/co-requisite: (if any) | No |

**7. Course Learning Outcomes (CLO) : At the end of the course the students will be able to:**

| | |
|---|---|
| CLO1 | Evaluate the possibilities of Industry 4.0 and digital transformation in the wood and furniture sector. (C5 = PLO1) |
| CLO2 | Integrate the benefits of digital transformation in the timber industry. (A4, TS = PLO3) |
| CLO3 | Integrate knowledge of digital transformation into personal, civic, social and employability skills.(A4, LL= PLO7) |

**8. Mapping of the Course Learning Outcomes to the Programme Learning Outcomes, Teaching Methods and Assessment :**
Please select the Learning Outcome Domain (LOD) for each PLO in the cells above it.

| Course Learning Outcomes (CLO) | Programme Learning Outcomes (PLO) | | | | | | | Learning and Teaching Method | Assessment Method |
|---|---|---|---|---|---|---|---|---|---|
| | Knowledge of Discipline Area | Practical Skills | Social Skills and Responsibilities | Values, Attitudes and Professionalism | Communication, Leadership and Team Skills | Problem Solving and Scientific Skills | Information Management and Lifelong Learning Skills | | |
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | | |
| CLO1 | √ | | | | | | | Lecture, self-Learning, Student-Center Learning. | Continuous assignment. Final exam. |
| CLO2 | | | √ | | | | | Lecture, self-Learning, Student-Center Learning. | Continuous assignment. |
| CLO3 | | | | | | | √ | Lecture, self-Learning, Student-Center Learning. | Continuous assignment |

Indicate the relevancy between the CLO and PLO by ticking "/" the appropriate relevant box.
(This description must be read together with Standards 2.1.2, 2.2.1 and 2.2.2 in Area 2 - pages 16 & 18)

**9. Transferable Skills (if applicable)**
(Skills learned in the course of study which can be useful and utilized in other settings)

| 1 | Be able to be part of a team that leads the digital transformation of a company. |
|---|---|
| 2 | Know how to identify the new key technologies of digital transformation. |
| 3 | Transmit the importance of digital transformation for a furniture company. |
| 4 | Gain knowledge about digital transformation. |

**10. Distribution of Student Learning Time (SLT)**

| Course Content Outline | CLO* | Teaching and Learning Activities | | | | | | SLT |
|---|---|---|---|---|---|---|---|---|
| | | Guided Learning (F2F) | | | | Guided Learning (NF2F) eg: e-Learning | Independent Learning (NF2F) | |
| | | L | T | P | O | | | |
| 1.- Introduction to I4.0. What is I4.0? | CLO1, CLO3 | 2 | | | | | 4 | 6 |
| 2.- History of Industrry 4.0. | CLO3 | 2 | | | | | 4 | 6 |
| 3.- Society 5.0. | CLO3 | 3 | | | | | 6 | 9 |
| 4.- Digital transformation in the wood-based industry. | CLO1, CLO2 | 4 | | | | | 9 | 13 |
| 5.- Application of some Key Enabling Technologies in the production process. | CLO1, CLO2 | 5 | | | | | 10 | 15 |
| 6.- Benefits of Digital transformation within the Industry | CLO1, CLO2, CLO3 | 3 | | | | | 6 | 9 |
| 7.- Machinery of the Industrry 4.0 in the woood-based industry. | CLO1, CLO2 | 4 | | | | | 8 | 12 |
| 8.- Case studies. | CLO2, CLO2, CLO3 | 3 | | | | | 6 | 9 |
| | | | | | | | Total | 79 |

| Continuous Assessment | | Percentage (%) | F2F | NF2F | SLT |
|---|---|---|---|---|---|
| 1 | Assignments. | 20 | | | 0 |
| 2 | Observation rubric. Group discussion. | 30 | | | 0 |
| 3 | Case study report. | 20 | | | 0 |
| | | | | Total | 0 |

| Final Assessment | | Percentage (%) | F2F | NF2F | SLT |
|---|---|---|---|---|---|
| 1 | Final Exam | 30 | 2 | | 2 |
| | | | | Total | 2 |

**Please tick (√) if this course is Latihan Industri/ Clinical Placement/ Practicum/ WBL using Effective Learning Time (ELT) of 50%

GRAND TOTAL SLT 81

L = Lecture, T= Tutorial, P= Practical, O= Others, F2F=Face to Face, NF2F=Non Face to Face
*Indicate the CLO based on the CLO's numbering in Item 8.

| 11 | Identify special requirement to | |
| 12 | References (include required and further readings, and should be the most current) | |
| 13 | Other additional information : | |

**Figure 1.** Draft of course information for Digital Transformation in the Industry 4.0 (Module 1/ Semester 1/ Compulsory).

Student Learning Time (SLT) for all 2-credit courses require their face to face (F2F) hours be kept to the very minimum, especially for Semester 2 courses, because students must undergo internships and complete projects. Figure 1 depicts a typical draft of the course information for "Digital Transformation in the Industry 4.0". The course has a total of 80 hours of SLT which includes 28 hours of F2F.

The Program Educational Objectives (PEO) for this master's course are to provide students with theoretical and applied knowledge of new technologies in Industry 4.0 and keep them up to date with the latest trends in materials and processes in the wood and furniture sector. Students will be able to apply their skills in utilising key enabling technologies for the wood industry while having a greater awareness and commitment to more productive and sustainable work practices.

The PEO of this programme are to produce graduates that are:

1.  PEO 1: Knowledgeable in the field of Key Enabling Technologies (KET) of the Industry 4.0 and current trends of wood materials and processes with appropriate skills and attitude to work in wood-based industry sector.
2.  PEO 2: Capable to apply the KET and the sustainable innovation within the production processes of the wood-based industry.
3.  PEO 3: Innovative and creative, as well as aware and committed to a more sustainable and technological productive society.

The Program's Learning Outcomes (PLO) reflect the seven Malaysian Qualifications Framework (MQF) domains and are consistent with and support the Higher Education Provider (HEP) vision and mission.

At the end of this program, students are able to:

1.  Demonstrate mastery of KETs knowledge in the wood and furniture industry.
2.  Apply practical skills about digital transformation in the wood and furniture industry.
3.  Relate ideas to societal issues in wood and furniture industry.
4.  Conduct research with minimal supervision and adhere to legal, ethical and professional codes of practice.
5.  Demonstrate leadership qualities through communicating and working effectively with peers and stakeholders.
6.  Generate solutions to problems in wood and furniture industry using scientific and critical thinking skills.
7.  Manage information for lifelong learning.

The program objective at the master's level (Malaysian Qualifications Agency, 2014a) is specifically to educate and train learners to become graduate scholar-teachers who are able to:

1.  Make judgements of relevant theories and practices and demonstrate capability of producing new and creative knowledge in order to be effective and inspiring professionals.

2.  Critically analyse, and synthesise the understanding of their own sources of mature professional knowledge and professional practices to solve significant problems.

3.  Plan and execute innovative projects, research initiatives and write dissertations, theses and reports for the purpose of building and applying knowledge for the benefit of the profession and society as a whole.

4.  Demonstrate capabilities in generating and communicating knowledge effectively through the practice of life-long learning and life-long contribution.

5.  Lead and participate in knowledge generation and in championing intellectual property rights and acknowledgments of original works by others, guarding against plagiarism and other academic improprieties.

6.  Acquire general knowledge and develop specialisations, individual talents and potentialities.


## METHODOLOGY

A total of 54 respondents were involved in the survey on the 3 December 2019 at the MAKING4.0 Seminar at Universiti Teknologi MARA (UiTM) in Shah Alam, Malaysia.

**Case Example of MAKING 4.0 and Questionnaire – Results and Overviews**

There were 13 questions regarding the analysis of the Work Package 1 (WP1) "Analysis and comparison of the current Higher Education training offer and furniture and woodworking industry". The respective respondents who were surveyed had participated in the seminar. Respondents were university lecturers, students, industrial players and business people. Figure 2 shows the percentage fraction of the respondents. Lecturers were the highest percentage, comprising of 40.7% (22 persons) of those surveyed. The second highest group of participants were students, 38.9% (21 persons), while the remainder of the respondents 20.4% (11 persons) were industrial players and business people.
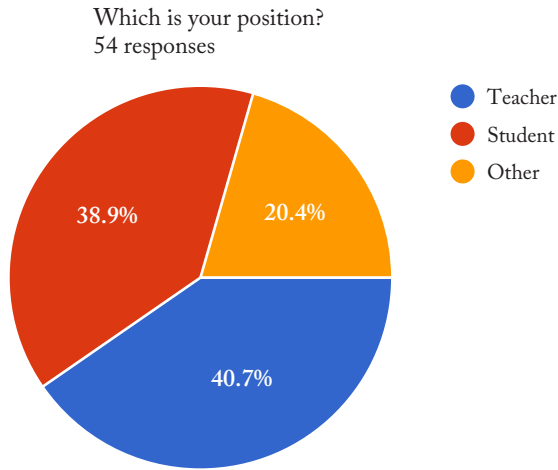
Which is your position?
54 responses



**Figure 2.** Percentage fraction of the respondents

The respondents were asked if they agreed to join a master's degree related to wood and furniture. Their feedback was of considerable interest. Figure 3 shows the students' responses about their interest in joining this master's programme. According to the figures, 50% (10 persons) of the students selected scale 4, while 30% (6 persons) selected scale 5. This totalled that 80% (16 persons) of the students were greatly interested in joining this master's programme.
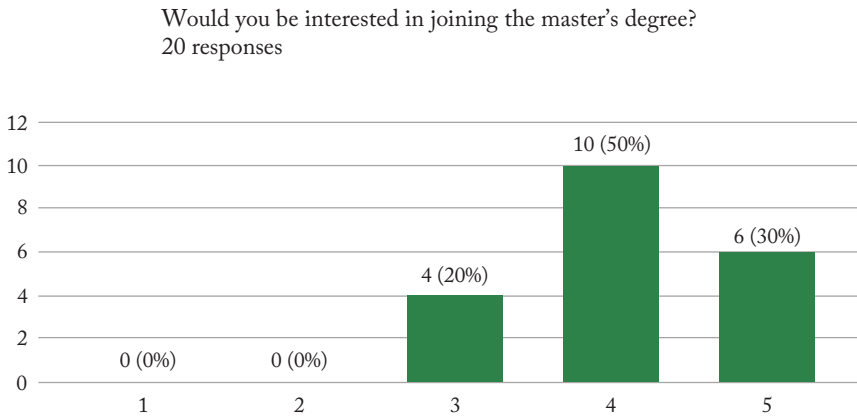
Would you be interested in joining the master's degree?
20 responses



**Figure 3.** Responses towards the interest in joining this master's programme

Respondents to the survey were asked about the importance of Industry 4.0 and if they were involved in the MAKING4.0 project. It was noticeable that that 60% of the respondents were lecturers and were involved in the development of the programme's development of Industry 4.0 (see Figure 4).

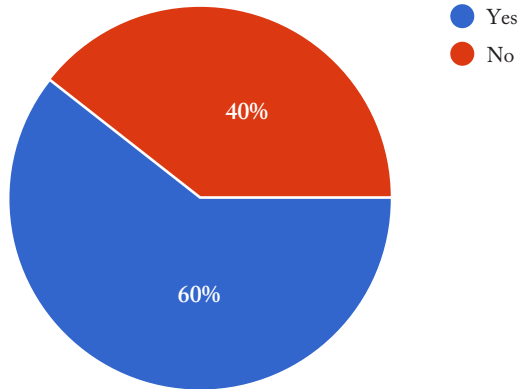Are you directly involved in MAKING4.0 project?
25 responses



**Figure 4.** Involvement in the master's programme development of MAKING4.0

Respondents were asked to rank the defined modules according to how they perceived their relevancy. Figure 5 indicates how those surveyed demonstrated their level of interest in the modules offered in the program. Module 4 (Wood and New Materials) and Module 5 (Internship and Dissertation) were the most highly rated modules with a five-point ranking. Figure 4 conveys how survey participants rank importance to the modules that are required over the period of the programme.

1. Please rate the relevance and interest of each of the defined modules for the the master. 1 to 5 (with 5 being the highest)
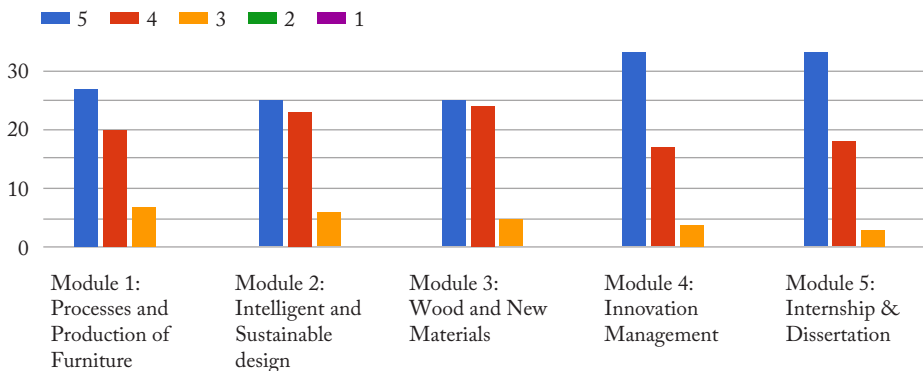


**Figure 5.** Rate of the relevancy and interest for modules 1 to 5

The distribution of credits has been adapted to the program and uses the European Credit Transfer and Accumulation System (ECTS). The ECTS should be considered in the development of the module, even though in Malaysia the Cumulative Grade Point Average (CGPA) is commonly used. Figure 6 presents that 94.4% of the respondents were confident that the distribution of credits for subjects would be adapted to the program. The majority were also confident that the distribution of the credits would be consistent with the number of credits in each module.

2.  Regarding the distribution of ECTS credits of the subjects, do you consider that it adapts to the programme and is consistent with the number of ECTS credits in each module?
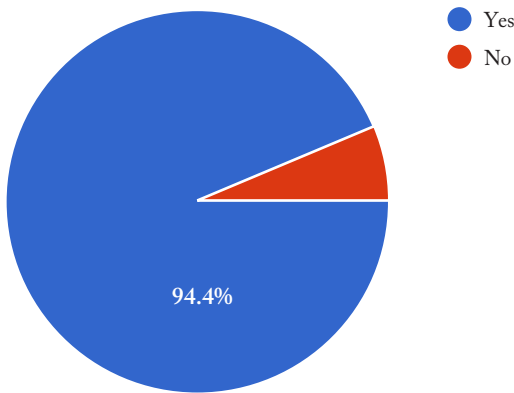50 responses



**Figure 6.** Distribution of the credits and adaption to the programme

Participants in the survey were questioned about how adequate was the joint curriculum in preparing students with Industry 4.0 for the wood and furniture sector? They indicated that it greatly addressed their training needs. Figure 7 declares that 90.8% of the respondents greatly trusted (63%) or somewhat trusted (27.8%) the joint curriculum's preparation of students for the Industry 4.0 in the wood and furniture sectors.

The majority of the survey participants were in favour of the distribution of modules, practical placements and thesis between the two semesters and agreed that the distribution of these course requirements greatly satisfied their academic needs. Figure 8 reveals that 92.6% of respondents either greatly or somewhat agreed with distribution of modules, practical and thesis between the two semesters. Only 7.4% of the respondents disagreed with the distribution of the course's components.

3.  In your opinion how much does the joint curriculum cover the needs to prepare students for the Industry 4.0 in the wood and furniture sector?
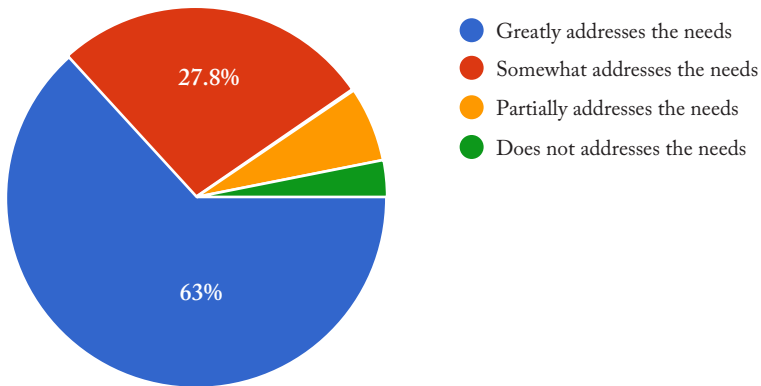    54 responses



**Legend:**
- Greatly addresses the needs
- Somewhat addresses the needs
- Partially addresses the needs
- Does not addresses the needs

27.8%

63%

**Figure 7.**  Coverage of the joint curriculum in terms of the students' preparation needs towards Industry 4.0 in the wood and furniture sectors

4.  What do you think about the distribution of modules/practices/master thesis between the two semesters?
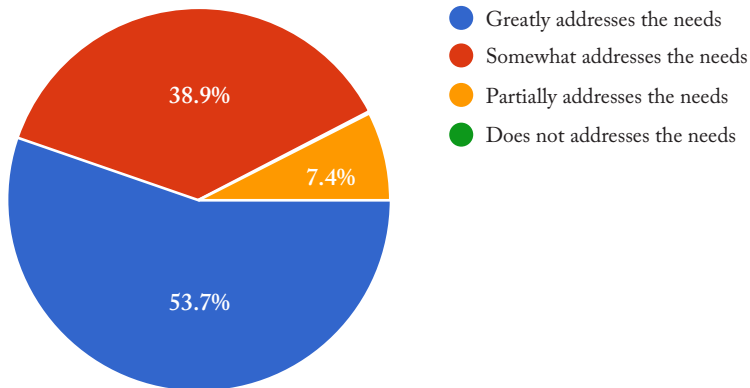    54 responses



**Legend:**
- Greatly addresses the needs
- Somewhat addresses the needs
- Partially addresses the needs
- Does not addresses the needs

38.9%

7.4%

53.7%

**Figure 8.**  Distribution of modules, practical and thesis between the two semesters

Figure 9 displays responses demonstrating the degree of respondents' agreement to the following statements about the master's course's effectiveness in meeting its objectives. The statements were; (i) with the knowledge obtained in this master's degree, participants will easily gain new skills, (ii) The specified modules and their associated subjects present a coherent structure which form a clear synergy, (iii) This course will support to close the gap of knowledge, skills and competencies of employees in the wood and furniture sector

in Malaysia, (iv) After successfully passing the course the participants are prepared for a relatively new/growing market which will have an impact on their competitive advantage, and (v) The participant will be satisfied with the knowledge obtained from the training. Most of the people surveyed chose a scale 5 and 4 to show their acceptance for each of the five statements about the course objectives.

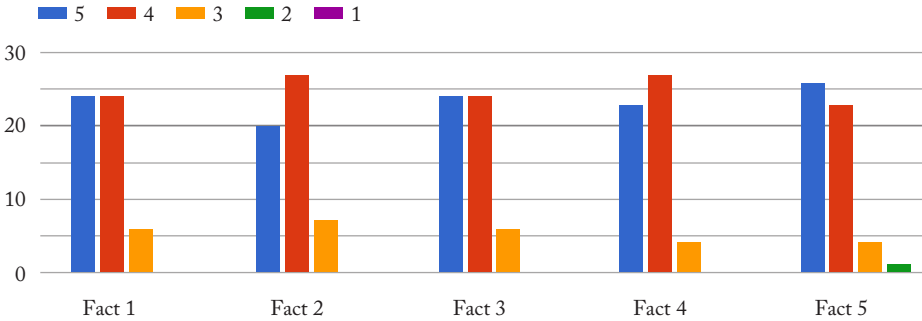5.   Please, rate in order 1 to 5 (with being the highest) the following statements:



**Figure 9.** Responses to statements about the master's effectiveness in meeting learning objectives

Participants positively responded to the question about the number of elective and compulsory subjects and the incorporation of Industry 4.0 in the wood and furniture master's programme. Figure 10 displays a total number of 74% of the respondents were confident (by selecting scale 5 and 4) that the number of elective and compulsory subjects were suitable for the programme.

6.   In your opinion, is this number of elective and compulsory subjects suitable?
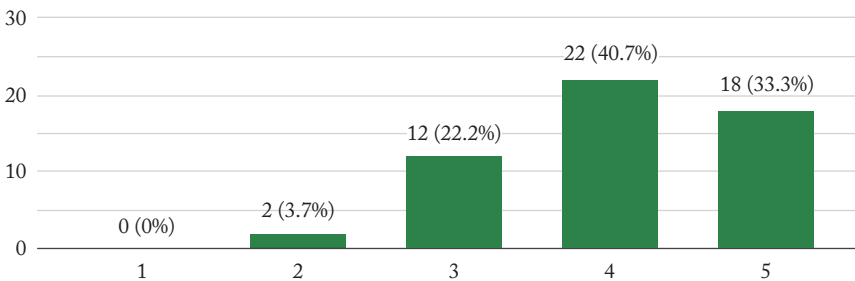      54 responses



**Figure 10.** Suitability of the number of elective and compulsory subjects

Respondents were questioned about whether any specific topic was not addressed in the defined "Joint Curriculum". Joint Curriculum is transforming the curriculum of a programme requires not only academic expertise. Most of the respondents did not think that any specific topic was left out of the curriculum. Figure 11 shows 25.9% of the respondents listed topics that should be covered in the master's programme (listed in Table 3), such as programming, commercialisation, design workshops, technologies, big data/internet of things/ethical and furniture testing. However, most of these topics have been incorporated in the programme structure and syllabus. Back to the respondents, about 74.1% of the respondents presumably agreed that the course variety had been well blended in the programme. This outcome supports the statements by Jajuri et al. (2019), where all STEM-related academic programmes require a complete package of blended learning aspects, that also include creative ingenuity and placing emphasis on design, entrepreneurship and ethics alongside the science and technology.

2. Do you miss any specific topic that it is not addressed in the defined "Joint Curriculum"?
54 responses



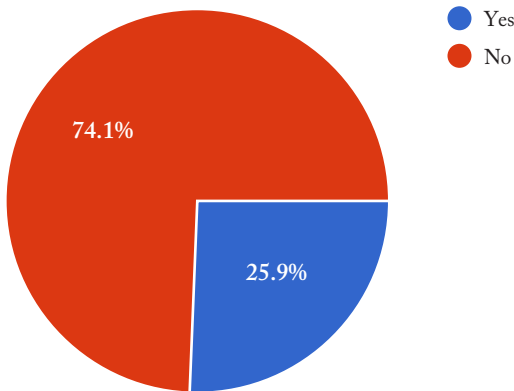**Figure 11.** Responses to whether any specific topic is lacking in the curriculum

**Table 3.** List of additional topics suggested by the respondents

| Topics the respondents suggested to be included in the curriculum |
| --- |
| • Programming |
| • Commercialisation, start-up |
| • Design workshops |
| • Design |
| • More technologies |
| • Big data/internet of things/ethical |
| • Furniture testing |

The participants in the survey were largely positive in their feedback that the master's degree covered appropriate modules. According to Figure 12, 85.2% of the total respondents were convinced (by selecting scale 5 and 4) that the master's programme had appropriate coverage of content and structure.

Positive remarks by the respondents have been recorded in Table 4. However, some respondents identified challenges to the master's program's development, such as; (i) a total 3 semesters are required for a bundle of 10 to 13 subjects, (ii) the difficulty to offer enough wood tech training due to a lot of ICT subjects, and (iii) there should be more industry players' input rather than students'. Notwithstanding, these opinions are being addressed by MAKING4.0 consortium members for the betterment of the program. According to Yaacob et al. (2019), the changing composition of academic needs signals the continuous effort to build-up knowledge and academics must adapt and innovate to deal with these constant changes. Therefore, the interdisciplinary and incorporative approaches to address these opinions should be strongly explored. This study calls for more attention from the university governance to provide functional execution of the proposed programme, especially in the distribution of subjects within program and multidisciplinary matters.

6.  Do you think that the modules described are appropriate to cover the master's programme in malaysia? (In terms of content and structure)
54 responses
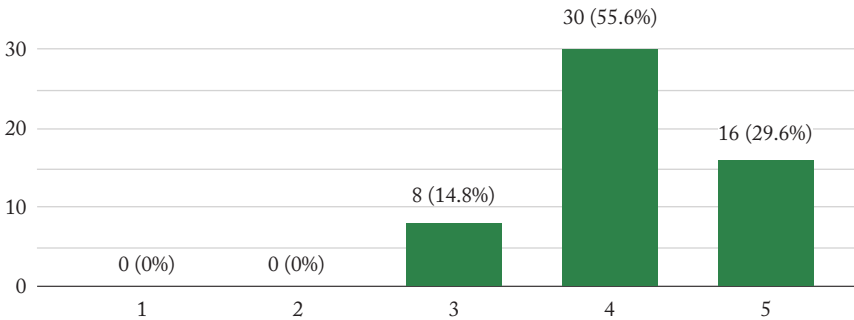


**Figure 12.** Responses to the appropriate coverage of the modules in the master's programme

## DISCUSSION

### Training Contents Validation Protocol

Based upon the analysis and the interpretation of the survey findings, herewith we suggested the execution of training contents validation protocol (see Figure 13). There are 2 validation phases and 4 steps to be accomplished with several interventions. Before the validation begins, the synopsis of the development of curriculum structure and content must be complete. The first step is the validation is Phase I. This task involves the stakeholders

**Table 4.** Some additional comments from the respondents

| Some additional comments from the respondents taken from the questionnaire |
| --- |
| <ul><li>I like it</li><li>The seminar gives me more information about furniture industry</li><li>Well done team Erasmus</li><li>The Malaysian wood-based industry is not ready for Industry 4.0</li><li>Too many courses</li><li>Need styling and design subjects in the curriculum</li><li>Too much time for these subjects</li><li>Curriculum should fit the purpose</li><li>Not enough wood tech modules and too much ICT subjects?</li><li>Lecturers in our faculty might not have relevant skills to teach some of the subjects</li><li>Very interesting course</li><li>MQA's student learning time in hours support flexible and blended teaching-learning environment, so a learner can be anywhere in the world but still be able to sign up for the MAKING4.0 master program, acquire the learning experience and achieve all the learning outcomes</li><li>Maybe 1 year and half is needed for this program</li><li>Requires more industry input</li><li>I think it is very interesting</li><li>Design and how to read drawings</li></ul> |
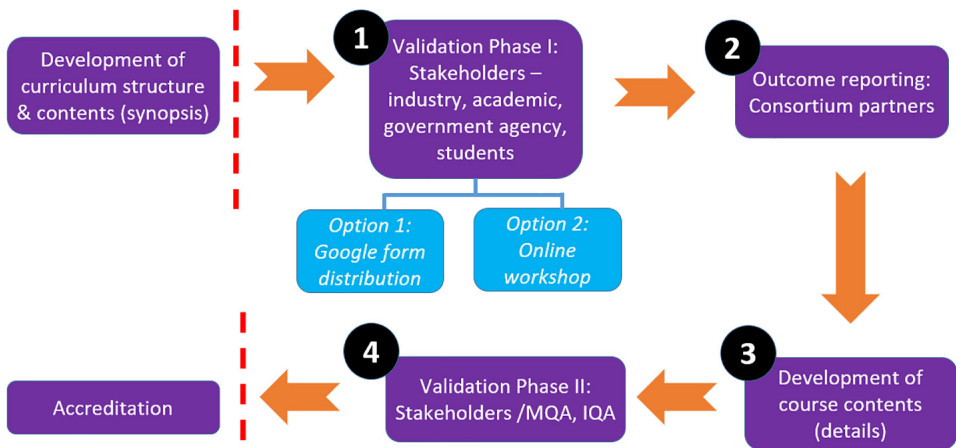


**Figure 13.** The execution of training contents validation

such as industry representatives, academics, government agencies and students. This can be done via two options. Option 1 is by using Google form distribution and Option 2 is by using the online workshop. The second step is outcome reporting: consortium partners need to be established. From there, it allows us to move to the third step which is the development of course content's details. This task is important in order to make sure it is in-line with the objective of the research and with the national agenda for both Malaysian and European partner countries. The fourth step is the Validation Phase II: stakeholders /MQA and the Internal Quality Insurance (IQA). The stakeholders should adhere to the structure of the curriculum proposed before submitting the proposed program to the IQA and the approval of the university's own accreditation. At the end stage the accreditation would be granted by the IQA and the MQA.

**Survey Instrument for Training Contents Validation**

The survey instrument for training contents validation will look upon new academic programme development (see Figure 14). It involves five sections such as: (A) General Information; (B) Contents of the Proposed Programme and its Relevance to the Needs; (C) Career Opportunities; (D) Others; and (E) General Remarks (if any). Section A: General Information, the respondents need to indicate their type of organisation (i.e., industry, academic/government agency, student). Section B: Contents of the Proposed Programme and its Relevance to the Needs. The respondents need to indicate their agreement on the proposed training contents. More precise for each of the list of statements, the respondents need to indicate their level of agreement on the contents of the proposed programme. Section C: Career Opportunities, the respondents need to indicate whether they think that graduates of this programme are suitable to work in their organisation? If yes, they need to indicate the area (the respondents may tick more than one scope). Section D: Others. The respondents need to indicate is their organisation willing to collaborate with the programme? Section E: General Remarks. The respondents need to address any issues or suggestions for the improvement of the programme. Attached to this process, the respondents will be provided with the courses offered and synopsis. Defining learning results should consider the recommendations of the European Qualifications Framework (EQF), and subsequently harmonise them with the Programme Learning Outcomes defined in the Malaysian Qualification Framework 2nd edition (MQF2.0) for a Master´s Degree Level 7. The identified learning outcomes have been grouped into 4 modules: (1) Processes and Production of Furniture, (2) Intelligent and Sustainable Design, (3) Wood and New Materials, and (4) Innovation Management.

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## MARKET SURVEY FOR NEW ACADEMIC PROGRAMME DEVELOPMENT:

Please tick ( / ) where applicable

| A. GENERAL INFORMATION | | |
|---|---|---|
| Type of organization: | Industry | |
| | Academic / Gov. agency | |
| | Student | |

| B. CONTENTS OF THE PROPOSED PROGRAMME AND ITS RELEVANCE TO THE NEEDS[1] | | | |
|---|---|---|---|
| For each of the following statements, please indicate your level of agreement on the contents of the proposed programme: | 1 – Disagree | 2 – Neutral | 3 – Agree |
| 1. The courses offered **fulfill** the need of related industries. | | | |
| 2. The courses offered are **relevant** to the current situation needs. | | | |
| 3. The courses offered **contribute to the strength** of the programme. | | | |
| 4. Does the proposed new programme **comprise all the relevant** courses? | Yes | No | |
| | | | |
| 5. **If no**, please indicate other additional areas that need to be covered by the program or name the specific courses. | | | |
| 6. Is there any course that is **not relevant** in the proposed programme? | Yes | No | |
| | | | |
| 7. **If yes**, what are the courses that need to be omitted / deleted? | | | |
| 8. Is this program sufficient in terms of length of study? | Yes | No | |
| | | | |
| 9. **If no**, please suggest the appropriate length of study (Please explain your suggestion if any). | | | |
| 10. Is the duration of internship sufficient? | Yes | No | |
| | | | |
| 11. **If no**, please suggest the appropriate duration of training: _____ weeks | | | |
| 12. Scope of internship (you may tick more than one scope): Note: Each student will be assigned to a specific job description during the training program | | | |

| Item | Scope | Tick | Item | Scope | Tick |
|---|---|---|---|---|---|
| a | Product design and development | | d | Sales and marketing | |
| b | Production and manufacturing | | e | Services (Certification, testing, standard, policy, commissioning, etc.) | |
| c | Quality assurance | | f | Others (please specify below): | |

1

**Figure 14** (continues)

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**C. CAREER OPPORTUNITIES**

1. Do you think that graduates of this program are suitable to work in your organization? If yes, please indicate the area (you may tick more than one scope):

| Item | Scope | Tick | Item | Scope | Tick |
|------|-------|------|------|-------|------|
| a | Technologist | | f | Administration Manager | |
| b | Sales Executive | | g | Audit Executive | |
| c | Production Manager | | h | Product Certifier | |
| d | Product Designer | | i | Research Officer | |
| e | Quality Assurance Manager | | j | Others (please specify below): | |

2. Expected graduates quality:

| Item | Skills and knowledge | Tick | Item | Skills and knowledge | Tick |
|------|---------------------|------|------|---------------------|------|
| a | English proficiency | | d | Costing and budgeting skills | |
| b | Report writing and presentation skills | | e | ICT skills (spreadsheet, word processor, presentation software, etc.) | |
| c | Relevant basic technical knowledge | | f | Others (please specify below): | |

3. What is the appropriate entry level income for graduates of this program:

| Entry level income | | | | | |
|-----|-----|-----|-----|-----|-----|
| Less than RM 2,000 | Tick | RM 2,000 – 3,000 | Tick | More than RM 3,000 | Tick |
| | | | | | |

**D. OTHERS**

| | Yes | No |
|---|-----|-----|
| 1. Is your organization willing to collaborate with the programme? | | |

2. **If yes**, please tick the column.

| Item | Collaboration | Tick | Item | Collaboration | Tick |
|------|--------------|------|------|--------------|------|
| a | Research and development | | d | Invited speaker | |
| b | Student internship | | e | Special project (consultancy, commissioning, mitigation, etc.) | |
| c | Access to workshop/laboratory facilities | | f | Others (please specify below): | |

**E. GENERAL REMARKS (IF ANY)**

[1]Refer to Attachments 1 & 2 for courses offered and synopsis

**End of questions. Thank you.**

2

**Figure 14.** The survey instrument for training contents validation

## CONCLUDING REMARKS

In the analysis of the Malaysian Higher Education Training Offer for Furniture Design and Woodworking Industry 4.0, some specific objectives were accomplished: the structure and contents of the master programme were reviewed, as well as the compilation of feedback from some respondents. It is concluded that most students are greatly interested in joining this programme. The community is also in favour of the structure and content of the modules offered in the programme. However, some crucial concerns by the respondents may be revisited, such as the duration of the programme, the number of the courses offered in the programme and the needs to engage more industrial players during the survey or programme development.

The content has been organised in such a way that the student acquires the content gradually and over two academic semesters. In the first semester they will achieve the objectives and outcomes more related to the new technologies and sustainable design. In the second students will learn about new business models, production processes and new materials. In addition, they will carry out internships to put into practice what they have studied and to gain experience working in different sectors. In order to pass the master's, the student must complete a master's thesis, to consolidate all the knowledge acquired in the course. Results of the study suggested that MAKING4.0 is in line with the activities outlined in the Malaysia Education Blueprint (2015–2025) and the Ministry of International Trade and Industry's objectives of establishing the National Industry 4.0 policy framework to ensure sufficient human capital and skills supply.

For further research, the mode of studies such as Open and Distance Learning (ODL), Blended Learning and Hybrid Learning should be explored for modules in the teaching and learning, especially how making it accredited. This need to be in-line with the trend and the dynamic change of the technology in furniture design education. The findings are expected can be used as a unified point of reference in the teaching and learning from futuristic master's degree programme perspective. Furthermore, the emphasis on futuristic modules and courses that allow data migration across relevant disciplines should be considered in order to make it agile, robust and harmonise.

## ACKNOWLEDGEMENTS

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## APPENDIX A

The structure of Master's of Advanced Technologies and Innovation for Wood-Based Industry and its subjects within two (2) semesters.

(a) list of subjects by modules

| Module | Subjects | Type | ECTS | Total ECTS |
|---|---|---|---|---|
| **Module 1** | Processes and Production of Furniture - choose two for elective subjects (E) | | | 16 |
| | Digital Transformation in the Industry 4.0 | C | 2 | |
| | Production Processes in the Furniture Sector | C | 2 | |
| | Automation and Mechanization | C | 2 | |
| | Additive Manufacturing | C | 2 | |
| | Internet of Things (IoT) Applied to Wood-Based Industry | C | 2 | |
| | Wireless Technologies for Logistic and Manufacturing | C | 2 | |
| | Network Communications in the Industry | E | 2 | |
| | Robotics Applied to the Wood-Based Industry | E | 2 | |
| | Augmented Reality | E | 2 | |
| | Simulation and 3D Scanning | E | 2 | |
| | Cloud Computing and Big Data Applied to Wood-Based Industry | E | 2 | |
| **Module 2** | Intelligent and Sustainable Design - choose two for elective subjects (E) | | | 4 |
| | Eco and Sustainable Design | E | 2 | |
| | Product Design and Digitalization | E | 2 | |
| | Circular Economy in the Wood and Furniture Sector | E | 2 | |
| **Module 3** | Wood and New Materials | | | 6 |
| | Wood Science | C | 2 | |
| | Materials for Furniture Manufacturing | C | 2 | |
| | Material Processing | C | 2 | |
| **Module 4** | Innovation Management - choose two for elective subjects (E) | | | 4 |
| | Innovation Management Systems | E | 2 | |
| | Technological Surveillance and Competitive Intelligence | E | 2 | |
| | Management Systems and Lean Manufacturing | E | 2 | |

| Module | Subjects | Type | ECTS | Total ECTS |
|--------|----------|------|------|------------|
| | Internship and Dissertation | | | 10 |
| **Module 5** | Internship Practicum | C | 5 | |
| | Master's Thesis | C | 5 | |
| **Total ECTS** | | | | 40 |

(b)  list of subjects by semesters.

| First Semester | | | | | Second Semester | | | | |
|----------------|---|---|---|---|-----------------|---|---|---|---|
| **Subjects** | **Type** | **ECTS** | **Total ECTS** | | **Subjects** | **Type** | **ECTS** | **Total ECTS** | |
| Processes and Production of Furniture – choose two for elective subjects (E) | | | 16 | | Wood and New Materials | | | 6 | |
| Digital Transformation in the Industry 4.0 | C | 2 | | | Wood Science | C | 2 | | |
| Production Processes in the Furniture Sector | C | 2 | | | Materials for Furniture Manufacturing | C | 2 | | |
| Automation and Mechanization | C | 2 | | | Material Processing | C | 2 | | |
| Additive Manufacturing | C | 2 | | | Innovation Management – choose two for elective subjects (E) | | | 4 | |
| Internet of Things (IoT) Applied to Wood-Based Industry | C | 2 | | | Innovation Management Systems | E | 2 | | |
| Wireless Technologies for Logistic and Manufacturing | C | 2 | | | Technological Surveillance and Competitive Intelligence | E | 2 | | |
| Network Communications in the Industry | E | 2 | | | Management Systems and Lean manufacturing | E | 2 | | |
| Robotics Applied to the Wood-Based Industry | E | 2 | | | Internship and Dissertation | | | 10 | |
| Augmented Reality | E | 2 | | | Internship Practicum | C | 5 | | |
| Simulation and 3D Scanning | E | 2 | | | Master Thesis | C | 5 | | |
| Cloud Computing and Big Data Applied to Wood-Based Industry | E | 2 | | | Total ECTS for Second Semester | | | 20 | |
| Intelligent and Sustainable Design – choose two for elective subjects (E) | | | 4 | | | | | | |
| Eco and Sustainable Design | E | 2 | | | | | | | |
| Product Design and Digitalization | E | 2 | | | | | | | |
| Circular Economy in the Wood and Furniture Sector | E | 2 | | | | | | | |
| Total ECTS for First Semester | | | 20 | | | | | | |