

**SEA-ABT: SOUTH EAST ASIA ACADEMY FOR BEVERAGE TECHNOLOGY**

Project number: 561515-EPP-1-2015-1-AT-EPPKA2-CBHE-JP

October 2015-September 2018

**Deliverable D1.2****Full inventory of available capacities and identified gaps****Prepared by:** Chaleeda Borompichaichartkul (CU)**Contributors:** Sarn Sethachaimongkol (CU)**Delivery date:** M16 (1<sup>st</sup> version M8, due date 4)

Dissemination Level		
<b>PU</b>	Public	
<b>PP</b>	Restricted to other programme participants (including Commission services and projects reviewers)	
<b>CO</b>	Confidential, only for members of the consortium (including EACEA and Commission services and projects reviewers)	<b>X</b>

**Summary:**

This deliverable presents full inventory of skills needs in beverage processing and quality of the job market and the currently available training tools and capacities.

They were collected by using various tools (electronic: online form, email; individual interviews, face-to-face meetings: printed form and group discussion) in D1.1 to survey knowledge gaps and skills needs for the development of a Beverage Technology curriculum. Existing Lifelong Learning (LLL) elements, approaches and structures at the partner universities were collected and reviewed, as well as at those of other universities and institutions in Thailand that hold Food Science and Technology courses.

From Task 1.2, survey, interviewing, and brainstorming for identifying already existing Lifelong Learning (LLL) courses, needs, subject area and available training tools for courses and modules (HE and Continual Professional Development, CPD) were collected. There are 3 groups of survey were carried out thereby the missing information was collected, as follows;

- (1) A survey to collect information on existing Lifelong Learning (LLL) teaching tools including curricula (bachelor, master degree), subjects, training courses in universities and institutes that with existing study programmes on Food Science and Technology course.
- (2) A survey to collect competences & skills needs of the operators and professionals of the beverage industry and, at large, beverage production chain. It was carried out in

two steps:

### 2.1 Preliminary survey

A short survey for needs of Beverage Technology curriculum limited to 26 beverage companies to collect their interest on a Beverage Technology course and how they would like the course to contribute in develop their employee's skills and knowledge.

### 2.2 Specific survey on needs of beverage industry (complete online survey)

After collecting (2.1) preliminary survey, information have been gathered and analyzed as well as SWOT analysis, then a draft structure of HE and CPD was proposed and send to 144 stakeholders including companies (SME and large enterprises), the academia from university and research institute to give their opinions on draft structure of HE and CPD that proposed.

(3) A survey for currently available expertise on beverage science and technology to partner universities of the SEA-ABT consortium.

The three surveys allowed to understand the current status on study programmes and on the current HE competences in the project consortium and in Thailand and identify the skills needs of the job market in the Beverage technology in Thailand and in South East Asia to develop the Beverage Technology course.

The results from the survey (1) showed that none of the Thai institutes has Beverage Technology as a full curriculum at the Higher Education (HE) level i.e. BSc, MSc or one year certificate. Most of the Thai universities have Beverage Technology as a course/module or as part of a course/module. None of them have Continuing Professional Development (CPD) in Beverage Technology. However, the EU partner institutes (BOKU, HGU UNITE) do provide teaching activities at various levels (full curriculum or courses/modules, CPD courses) on the same topic.

Therefore, 'Beverage Technology' as a full HE study programme/curriculum is a need for Thailand as well as CPD trainings that are of interest of the beverage manufacturing sector stakeholders and the project SEA-ABT is offering a great opportunity to develop both. Contributions can be obtained from Thai partner universities such as Chulalongkorn (CU), Kasetsart (KU) or King Mongkut Institute of Technology Lad Krabang (KMITL). These universities have experience on conducting short courses i.e. 20 weeks for skill development in Dairy Operator (CU) and hygienic design and processing (KMITL) that can be shared and used to implement some of the course structure in SEA-ABT. Thai partner universities have pilot plants and UHT processing (lab (KU), pilot (CU)) for supporting training tools for beverage technology and processing techniques.

The needs of beverage industry are reflected in the results of the preliminary survey (2.1) that shows beverage companies (future employers of the graduates) pay more attention on real practicing or hands-on learning and skills which is the big gap in the beverage industries. **Food law, management, marketing and communication** are of second importance. The industry supports the employer's development in both higher education and training. The **short-term training** is the most preferred educational timing by all beverage companies followed by a course that provide **classes after working-time** as a 1 year-certificate course. The beverage industries need competent employees who have practical skills, understand food law and regulation, be able to communicate and the full course for 1 year and short



training course is satisfied them. The long distance learning such as via **webinar** or **online course** is also preferred by the companies.

From the above outcomes of (2.1), the structure of Higher Education study programme (HE) and Continuing Professional Development (CPD) courses were designed as well as the SWOT analysis of the outcomes of survey (2.1) and the survey (2.2) of draft structure of HE and CPD was send to stakeholders. 144 were filled in surveys and collected and analysed by the WP1 partners.

The drafted subjects of HE subjects that are preferred by more than 50% of the stakeholders include **Food law, Beverage chemistry, Beverage Technology 1 (Principles of non-alcohol beverage processing), Beverage industry management, Beverage Technology 2 (Principles of alcoholic beverage processing, New Product Development, Waste management), QA&QC, Hygienic engineering and design, Practical laboratory in beverage industry, unit operation**. For CPD topics that have good to very good attention to the stakeholders are in the **QA** and **QC** area.

The specific expertise of the partner’s universities of the consortium is listed at the end of this deliverable in Table 5-6.

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

# 1 Survey for existing LifeLongLearning (LLL) structures and elements regarding Beverage Technology

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Currently available Higher Education (HE), Life Long Learning (LLL) tools, approaches and structures at the SEA-ABT partner universities were collected as well as at other universities and institutions in Thailand that have Food Science and Technology Course. The survey involved 26 institutes (22 government, 4 private institutes). The results are presented in Table 2 below.

The results of the survey showed that none of these institute has Beverage Technology as either a HE full curriculum i.e. BSc, MSc or a 1-year certificate programme. Most of them has Beverage Technology as a subject or in a part of a subject within other Food Science and Technology study programmes. None of them also have CPD courses on Beverage Technology.

Most of the university have couses/modules where beverage technology topics/subjects and practical laboratory such as fruit juice processing, pasteurization process, enzymatic treatment of juice clarification etc. are included. Therefore, currently available are some practical and learning tools such as lecture notes, power point presentation, equipment or models of beverage for students to study and having hands-on experience. Missing are interactive media such as video, e-learning, online courses or video clip on beverage technology aspects are still not available for HE teaching. Some universities organize visits for student to beverage industry and learn about the actual production in manufacturing of beer, wine, fruit juice or milk product.

Overall, the LLL and HE tools available on beverage science and technology are lecture notes, books, practical labs on the real equipment and industry visits, power point presentations..

## List of beverage related courses given by Thai Universities, National Institute and companies

There are training courses related to beverage from institutes and companies for example Universities, National Food Institute, Institute of Food Research and Product Development and Tetra Pak (only available for it clients and not available to be taken by everyone). The summary is listed in Table 1.

**Table 1** Summary list of LifeLongLearning (LLL) structure and elements in any existing course on beverage technology with in Thailand

Number	Institution/Company	Existing HE study programme/module and Continual Professional development (CPD) training courses on Beverage Technology :			
		As a full specific curriculum	As a specific course/subject in another curriculum	As a part of relevant course/subject in another curriculum	As short-term training course (equivalent to CPD)
1	Assumption University	NO	Beverage Technology for BSc in Biotechnology	Industrial fermentation for BSc in Biotechnology	NO
2	Bansomdejchaopraya Rajabhat University	NO	Beverage Technology for BSc in Science	NO	NO
3	Chulalongkorn University	NO	Beverage Technology for BSc, MSc, PhD in Food Technology	Dairy Technology, Elementary Food Technology, Fruit and Vegetable Technology, Industrial Microbiology, Food Fermentation, Applied Food Microbiology for BSc, MSc, PhD in Food Technology	NO
4	Drurakij Phandit University	NO	NO	NO	NO



**Existing HE study programme/module and Continual Professional development (CPD) training courses on Beverage Technology :**

Number	Institution/Company	Existing HE study programme/module and Continual Professional development (CPD) training courses on Beverage Technology :			
		As a full specific curriculum	As a specific course/subject in another curriculum	As a part of relevant course/subject in another curriculum	As short-term training course (equivalent to CPD)
5	Kalasin University	NO	Beverage Technology for BSc in Food Science	Food Processing, Fruit and Vegetable Technology, Fermentation Technology for BSc in Food Science	NO
6	Kasetsart University (Bangkok campus)	NO	Alcoholic Beverage Technology, Non-alcoholic Beverage Technology for BSc, MSc, PhD in Food Science and Technology	Dairy Technology, Fruit and Vegetable Technology, Food Microbiology for BSc, MSc, PhD in Food Science and Technology	NO
7	Kasetsart University (Sakhonnakhon campus)	NO	Alcoholic beverage Technology for BSc in Food Science and Technology	Food processing for BSc in Food Science and Technology	NO
8	King Mongkut's Institute of Technology Ladkrabang (KMUTL)	NO	Alcoholic beverage Industry for BSc in Fermentation Technology	NO	NO
9	King Mongkut's University of Technology North Bangkok (KMUTNB)	NO	NO	Biotechnological fermentation for BSc in Biotechnology	NO



**Existing HE study programme/module and Continual Professional development (CPD) training courses on Beverage Technology :**

Number	Institution/Company	Existing HE study programme/module and Continual Professional development (CPD) training courses on Beverage Technology :			
		As a full specific curriculum	As a specific course/subject in another curriculum	As a part of relevant course/subject in another curriculum	As short-term training course (equivalent to CPD)
10	King Mongkut's University of Technology Thonburi (KMUTT)	NO	NO	Food Preservation for BSc in Food Science and Technology	NO
11	Maharakham University	NO	Non-alcoholic Beverage Technology for BSc in Food Technology	Food processing, Food Microbiology for BSc in Food Technology	NO
12	Nakhon Ratchasima Rajabhat University	NO	NO	Fruit and Vegetable Technology, Food Microbiology for BSc in Food Science and Technology	NO
13	Prince of Songkla University	NO	NO	Food Chemistry, Food Processing, Food Microbiology, Food Additives for BSc, MSc, PhD in Food Technology	NO
14	Rajamangala University of Technology East	NO	Beverage Technology for BSc in Food Science and Technology	Food Processing, Fermentation Technology for BSc in Food Science and Technology	NO
15	Rajamangala University of Technology Isan	NO	Healthy drink product development for BSc in	Food Processing, Food Chemistry, Food	NO





**Existing HE study programme/module and Continual Professional development (CPD) training courses on Beverage Technology :**

Number	Institution/Company	Existing HE study programme/module and Continual Professional development (CPD) training courses on Beverage Technology :			
		As a full specific curriculum	As a specific course/subject in another curriculum	As a part of relevant course/subject in another curriculum	As short-term training course (equivalent to CPD)
	(Sakonnakhon)		Food Science and Technology	Microbiology for BSc in Food Science and Technology	
16	Rajamangala University of Technology Krungthep	NO	Beverage Technology for BSc in Food Science and Technology	Food Processing, Food Chemistry, Food Microbiology for BSc in Food Science and Technology	NO
17	Rangsit University	NO	Beverage Technology for BSc in Food Technology	Food Processing, Food Chemistry, Food Microbiology for BSc in Food Technology	NO
18	Sakon Nakhon Rajabhat University	NO	NO	NO	NO
19	Siam University	NO	Beverage Technology for BSc in Food Technology	Food Processing, Food Chemistry, Fermentation Technology for BSc in Food Technology	NO
20	Suan Dusit University	NO	Beverage Technology for BSc in Food Processing Technology	NO	NO



**Existing HE study programme/module and Continual Professional development (CPD) training courses on Beverage Technology :**

Number	Institution/Company	Existing HE study programme/module and Continual Professional development (CPD) training courses on Beverage Technology :			
		As a full specific curriculum	As a specific course/subject in another curriculum	As a part of relevant course/subject in another curriculum	As short-term training course (equivalent to CPD)
21	Suranaree University of Technology	NO	Enology for BSc, MSc, PhD in Food Technology	Dairy Technology, Food Fermentation, Fruit and Vegetable for BSc, MSc, PhD in Food Technology	NO
22	Surindra Rajabhat University	NO	NO	NO	NO
23	Ubon Ratchathani University	NO	Alcoholic Beverage Technology, Non-alcoholic Beverage Technology for BSc, MSc, PhD in Microbiology and Biotechnology	Microbiology for industry, Microbiology for fermented product for BSc, MSc, PhD in Microbiology and Biotechnology	NO
24	National Food Institute ( <a href="http://www.nfi.or.th/th/schedule.php?year=2559&amp;lang=th">http://www.nfi.or.th/th/schedule.php?year=2559&amp;lang=th</a> )	NO	NO	NO	-Packaging technology for beverage -Aseptic process for soft drink -Application of hydrocolloid in beverage
25	Institute of Food Research and Product Development	NO	NO	NO	-Most of the course is a short course and about



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Number	Institution/Company	Existing HE study programme/module and Continual Professional development (CPD) training courses on Beverage Technology :			
		As a full specific curriculum	As a specific course/subject in another curriculum	As a part of relevant course/subject in another curriculum	As short-term training course (equivalent to CPD)
	( <a href="http://ttc.ifrpd.ku.ac.th/index.php/training-service-menu/41-ttc-course/academic-course/157-academic-course-training.html">http://ttc.ifrpd.ku.ac.th/index.php/training-service-menu/41-ttc-course/academic-course/157-academic-course-training.html</a> , <a href="http://ttc.ifrpd.ku.ac.th/index.php/training-service-menu/42-ttc-course/vocation-course/159-vocation-course-training.html">http://ttc.ifrpd.ku.ac.th/index.php/training-service-menu/42-ttc-course/vocation-course/159-vocation-course-training.html</a> )				how to make a specific beverage for example soy milk, corn milk, vinegar, cider, herbal drinks, UHT and pasteurized drinks etc.
26	Tetra Pak	NO	NO	NO	-Aseptic training related to specific requirement of customers (not open for everyone)



The survey result has confirmed that Beverage Technology as a full curriculum does not exist in Thailand yet and the SEA-ABT project could represent a great opportunity to establish and develop it. Missing are also training activities for Continual Professional Development (CPD) that could be of interest to all stakeholders in beverage sector.

## 2 Collection of competences & skills needs of the operators and professionals of the beverage industry and production chain

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### 2.1 Strategic plan

The collection of the competences, knowledge and skills needs for the professional and operators of the beverage industry in Thailand has been carried out in three different steps

- Preliminary online survey, with a short list of questions (D.1.1, 2.1)
- On-site, face-to face workshop
- Complete online survey with specific questionnaire and large number of questions

### 2.2 Results

#### 2.2.1 Preliminary survey

In a preliminary survey (see D1.1, 2.1), 32 companies of the beverage sector were asked about the need and their interest on a Beverage Technology full curriculum (one year certificate/master degree) programme and how that they would like the course to be carried out. The companies were selected on the basis of their manufacturing sector and market share. Most of them were medium-large companies, however, small and medium enterprise (SME) were also invited to give their opinion for this beverage technology course.

The survey was conducted before (email, online survey, interview) and during the stakeholder meeting held on 11<sup>th</sup> February 2016, total is about 70 participants (23 SEA-ABT partners, 15 academia and government authorities, 32 companies). The survey during the stakeholder meeting was carried out by asking the participants to fill the printed survey during coffee break and lunch time. Not all participants return the questionnaire, however only 26 replied questionnaires were collected and analysed for the purposes of the project

The results of this survey showed that:

- Industry pays more attention on real practicing or hands-on learning and skills. Additional technical skills, like food law and regulation, management, marketing and communication are in a second position in the overall ranking for importance and preference.
- Industry is interested to support the employee's development in both higher education and training.
- The short-time, intensive training is the preferred modality to carry out the training; as alternative, training could be carried out after working time (e.g. 1-2 hour) for a 1 year-certificate study programme.

## 2.2.2 Output from Brainstorming during stakeholder meeting

During the development of the preliminary survey, a brainstorming workshop was organized on 11<sup>th</sup> February 2016 from 10 am – 4 pm at Faculty of Agro-Industry, Kasetsart University, Bangkok, Thailand. Fifty representatives of food and beverage industries, authorities, and academia were present (List of participants in Annex 1).

The brainstorming during the stakeholder meeting was organized in two sections.

In the first section, all the participants were asked to answer to the following questions, individually:

1. What are your challenges? List the top 5.
2. What is the skill that you should have to solve question 1 challenges?
3. What is the most difficult task that you have encountered and you can solve it?
4. From the answer of question 3 what is the skill that you use?
5. If you are promoted, what is the 5 skills that your successor should have?
6. What is the skill that difficult to find in your one level below employers
7. What are the skills that people who is in one level of position above you should have?

At the workshop attended 70 participants; 23 SEA-ABT partners, 15 academia and government authorities, 32 companies. At each question, participants were asked to answer by writing on post-it papers and stick the answer on a flip-board different for each question. At the end all skills and needs were collected and analysed.





**Figure 1** The brainstorming during the stakeholder meeting on 11<sup>th</sup> February 2016

From the 252 replies it resulted that the main challenges for the stakeholders of beverage industry are communication, knowledge, time management, innovation and regulation. The skills that are needed to solve the challenges are: leadership, teamwork, communication and technical skill. The most difficult task for people who is involved in the beverage industry is lack of innovation technologies. Therefore, the skill to overcome this problem, is knowledge, training and connection. Therefore summary of skills from these opinions show that **soft skills** such as **time management, problem solving, communication and leadership** are important. Furthermore **technical skills** such as understanding of **processing, equipment, raw materials and ingredients, food safety and regulation, process design and hygiene** are equally important for product and processing improvement.

In the second step of the workshop, the collection of the needs was carried out through an open floor, free discussion at which around 50 people from food and beverage industry, authorities and academia participated.

Representatives of the stakeholders beverage sector expressed their main concern about skills needs on product development, quality of product, regulation, opportunity of marketing and all the expertise on business activities related to exporting overseas and to EU (e.g. ingredients and products regulations, law, labelling, fair trading, economics aspects, advertisement and promotion of Thai products, Innovation, consistency of supply chain, ingredients regulation, and shelf-life of their products). For this business task, they imply that the beverage industry professionals and workers have knowledge of **shelf-life extension, ingredients regulation** for beverage product and **supply chain management** that, thus, should be added in the course curriculum.

As regards the setting and implementation of a **HE study programme/curriculum** for this sector the following results came out:

### **1. Contents/topics/disciplines/activities**

- practicing and operating skill (emphasis on)
- Training/internship with mentoring by the industry and industrial project
- Food law and regulations especially of food additives
- Research and development

- food technology and processing (basic knowledge)
- Food engineering and hygienic design
- Automation system/control
- Maintenance and energy saving
- New technology in Beverage processing

## **2. Collaboration with Industry**

Industry representatives confirmed their main interest to collaborate in terms of guest lecturers, project, talent mobility and feedback to improve the curriculum.

### **3. Certification of the training or completion (by EU/international organizations)**

This topic was under debate and two main opinions came out:

- NO: no necessary but the information that can be obtained is important
- YES: it can increase the standard of capability, responsibility and basic knowledge required.

### **4. Online class for distance learning**

- There is no objection and it actually convenience for working people from industry.

### **5. SME requirement**

- SME need simple technology or basic approach of processing that requires low skill and technology
- Need basic knowledge for food processing and preservation

## **2.2.3 Specific survey on need of the beverage industry (Complete online survey)**

After the brainstorming meeting, a meeting of Thai partners i.e. KU, CU and KMITL was set up to analyze outputs from stakeholder meeting (11 February 2016). It resulted the need to design and to collect additional information from the beverage sector representatives. Thus, another questionnaire (Specific online survey on needs from the industries (see D1.1, 2.2) had been developed.

The questionnaire was aimed to collect the opinion of the stakeholders about a list of subjects/disciplines/modules to be included in the HE curriculum/programme and in CPD trainings on Beverage products, science and technology. The list of modules/disciplines below reported was developed based on the results of section 2.2.2 and additional suggestions from the Thai partners.

### List of modules/disciplines

1. Food Law & Regulations
2. Beverage Technology 1 (Non-alcohol beverage processing)
3. Beverage Technology 2 (Alcoholic beverage processing, New Product Development, Waste management)
4. Hygienic Engineering



5. Unit Operation
6. Quality Assurance and Quality Control
7. Beverage Chemistry and microbiology
8. Beverage Industry Management
9. Practical Laboratory
10. Seminar
11. Special Problem
12. Others (open field)

The questionnaire was sent to all stakeholders (30 universities and research institutes and 120 persons in beverage industries) related to food and beverage sectors such as food and beverage industry, authorities and academia. Therefore, 150 people were invited by email and social media (Facebook) to answer the questionnaire during March to April 2016. However, only 144 replies the questionnaire (Annex 1).

### **Results:**

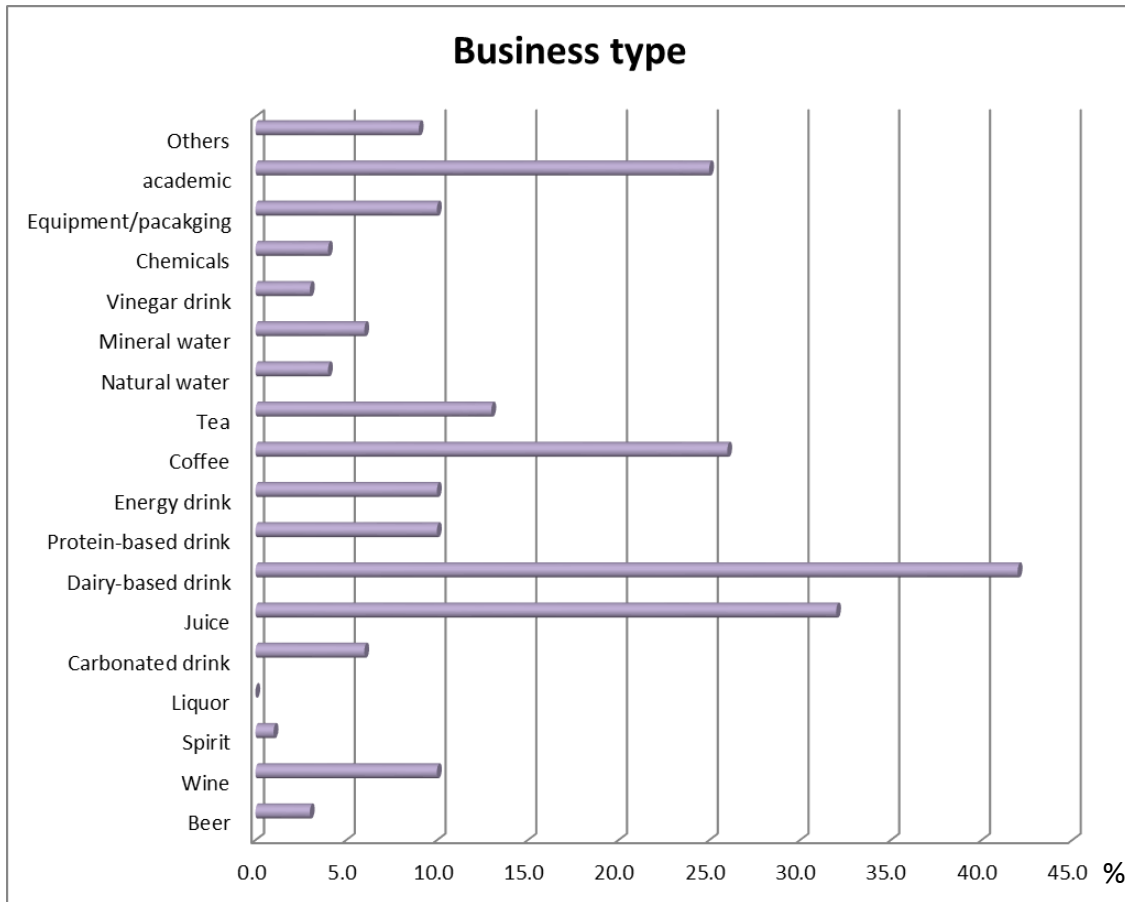
The results are summarized here below:

- ***Characteristics of the panel of the respondents***

Total number of respondents: 144.

Female 60% and Male 40%

The respondents are from various sections as shown on Figure 2.



**Figure 2** Classification of respondents based on sector and business type

However, in the section of company (108 companies), respondents were 43% from SMEs and 57% from industry or large companies where the respondents have the following position in the company;

- Owner 9%
- Executive 3%
- CEO 1%
- QA&QC 7%
- Production 9%
- R&D Researchers 30%
- Engineering 6%
- Marketing 5%
- Others 30% (e.g. consultant, operator, )

Responses were obtained mainly from representatives of **dairy and juice industries** even if almost all sectors of the beverage production were involved (e.g. coffee, tea, beer, wine, mineral water, natural water, spirit, liquor etc. see Figure 3)

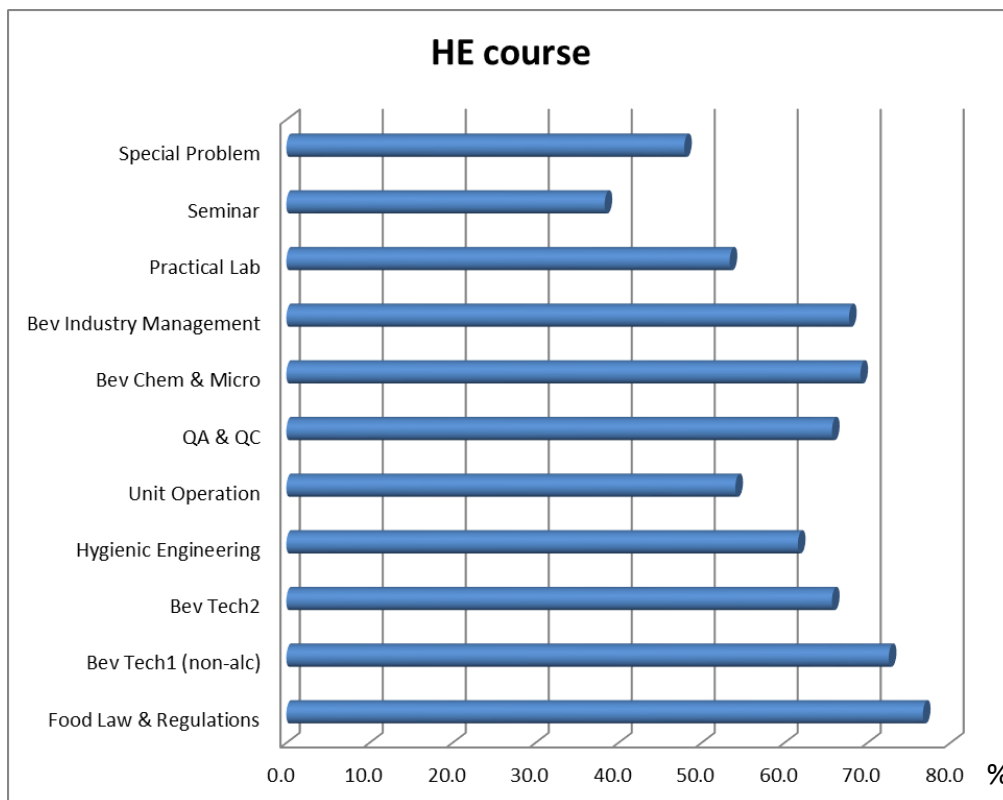
- **Timing of course**

Respondents indicated the preference for week-end classes (Saturday, 53.2%; Sunday, 35.8%).

- **Modules/disciplines preference for HE**

Respondents gave preferences higher than 50% to the following subjects/disciplines (Figure 1): Food law and regulation, Beverage chemistry, Beverage technology 1 (non-alcoholic), Beverage industry management, Beverage technology 2 (alcoholic), QA&QC, Hygienic engineering and design, Practical laboratory in beverage industry, unit operation.

Subjects/disciplines that received a preference lower than 50% are “Seminar” and “Special problems”.



**Figure 3** responses of preference for the subjects proposed in the curriculum on beverage technology (expressed as % of the total respondents)

From this result, it could be highlighted that Thai industry has main concern on the food law and regulation about beverage and non-alcoholic beverage based also on the local production and processing of tropical fruit and milk.

On the other side, surprisingly they seems to be less interested to improve the personal/soft skills via the development of activities on specific case studies (Special problems) activity that generally is used to improve team working and problem solving abilities.

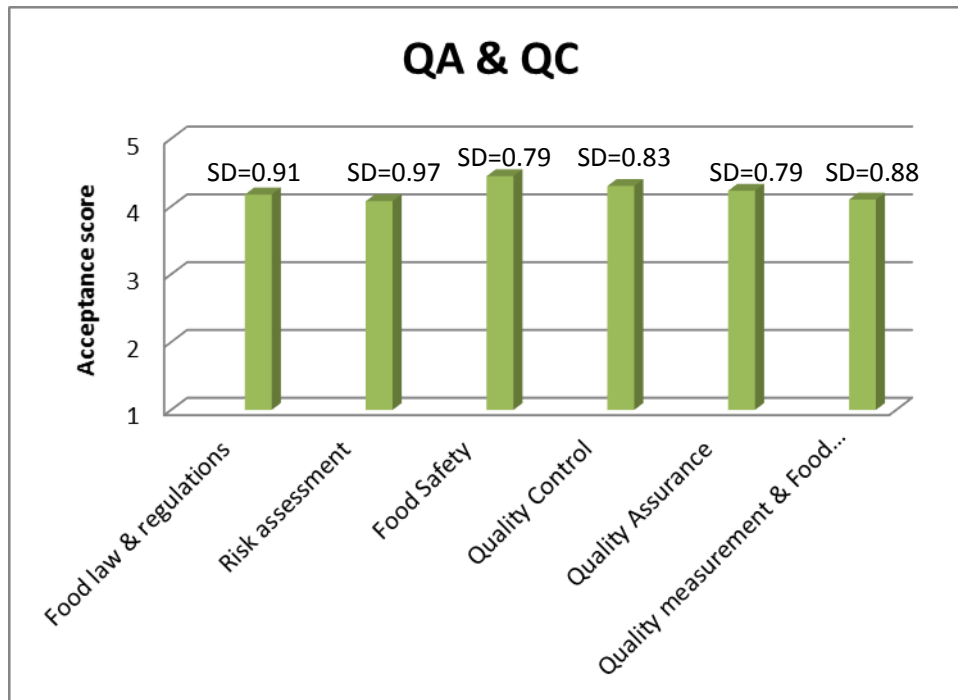
- **Modules/disciplines preference for CPD courses**

Representatives of stakeholders were interviewed and surveyed also about their needs for Continual Professional Development (CPD) training topics.

The preferred topics/disciplines/subjects are here below listed and ranked from the ones that received the highest score (4-5) to those that were rated of lower importance or acceptance.

- **Quality Assurance (QA) and Quality Control (QC)** (all content) Score 4-5 (high– very high)

QA and QC obtains highest score as a preferred topic for CPD. The popularity of topic is shown in Figure 4.

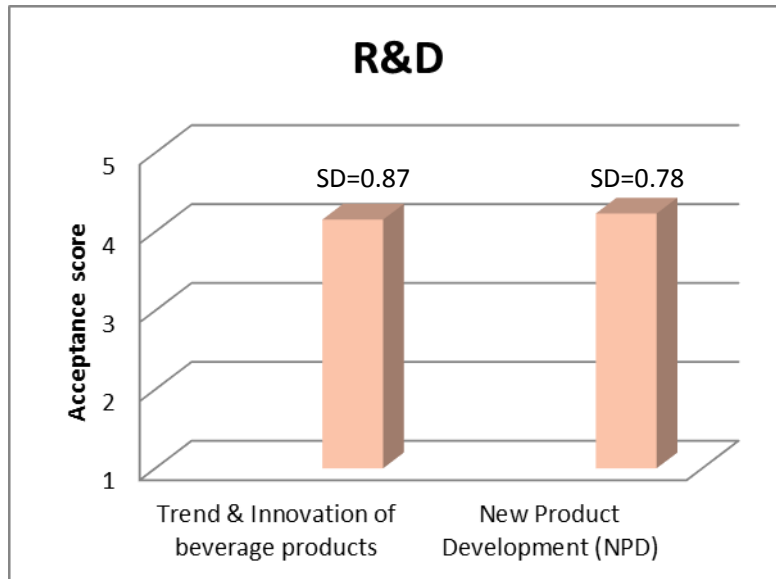


**Figure 4** Average acceptance score for CPD topics/subjects in QA and QC

For CPD, the only area that gain high score is QA & QC and main attention is given to topics like food safety, quality control, quality assurance, food law and regulations, followed by risk assessment and quality measurement and food. For Food safety, the specific interest is on how to make sure the product is safe for consumption.

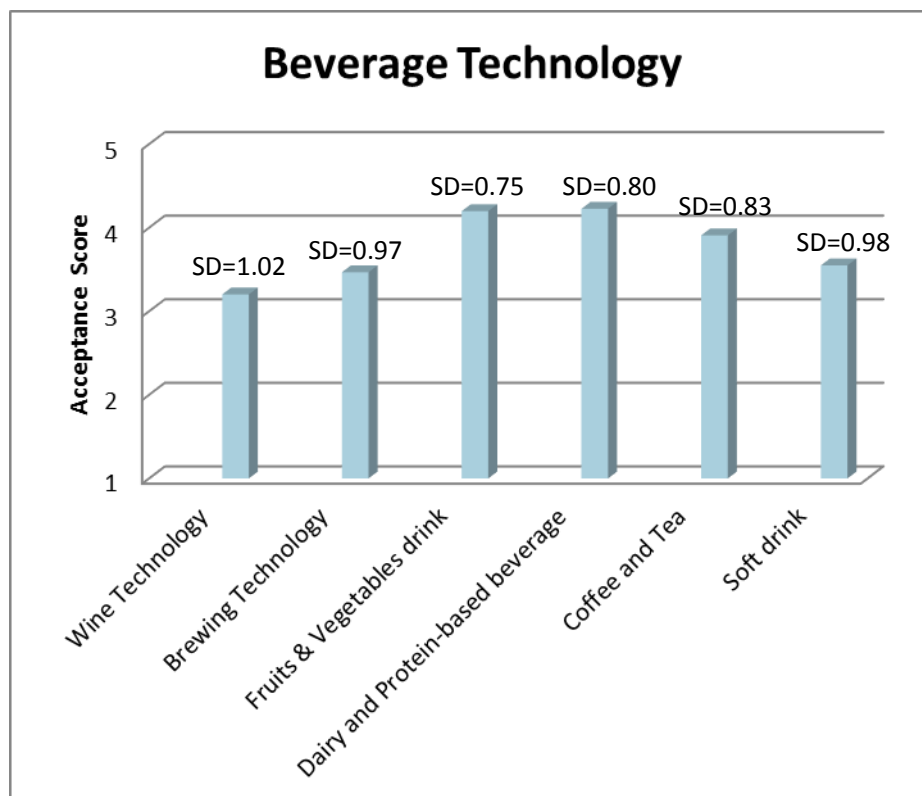
- **Research and Development** (score 3-4, fair – high) (Figure 5)

In this framework, Food product Innovation, process innovation are included (Figures 5)



**Figure 5** Average acceptance score for CPD topics/subjects in Product Development

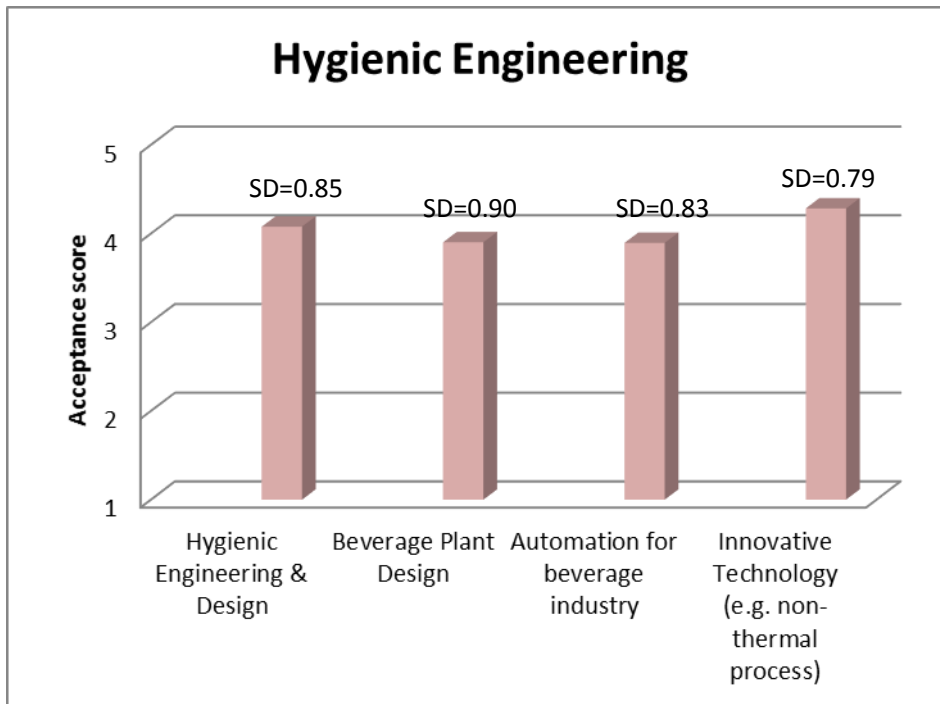
In Product Development area, both “Trend and innovation of beverage products” and “New product development” collected similar preferences and interest even if, overall, lower than the topics of QA&QC (fair to high acceptance).



**Figure 6** Average acceptance score for CPD topics/subjects in Beverage Technology

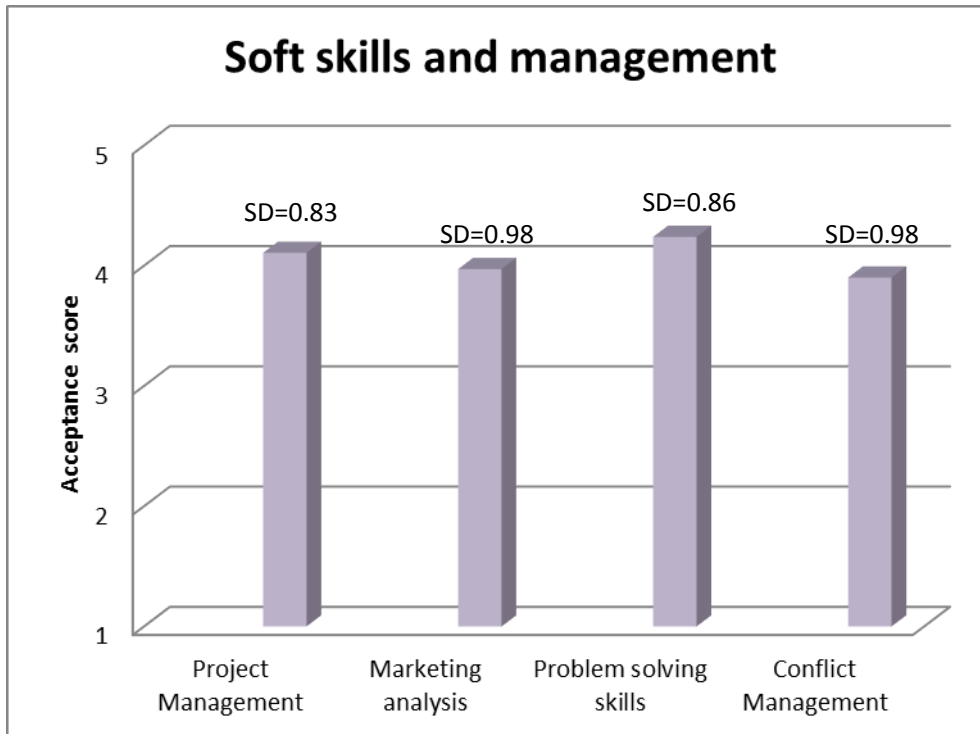
Taking into account specific beverage sectors, fruits and vegetables drink as well as dairy and protein based beverage were the ones that were more preferred for the development of CPD activities in beverage technology followed by coffee and brewing technology. This may due to

Thailand is agricultural country and rich in tropical fruit and vegetables. Therefore, there is a need on knowledge and training in those areas.



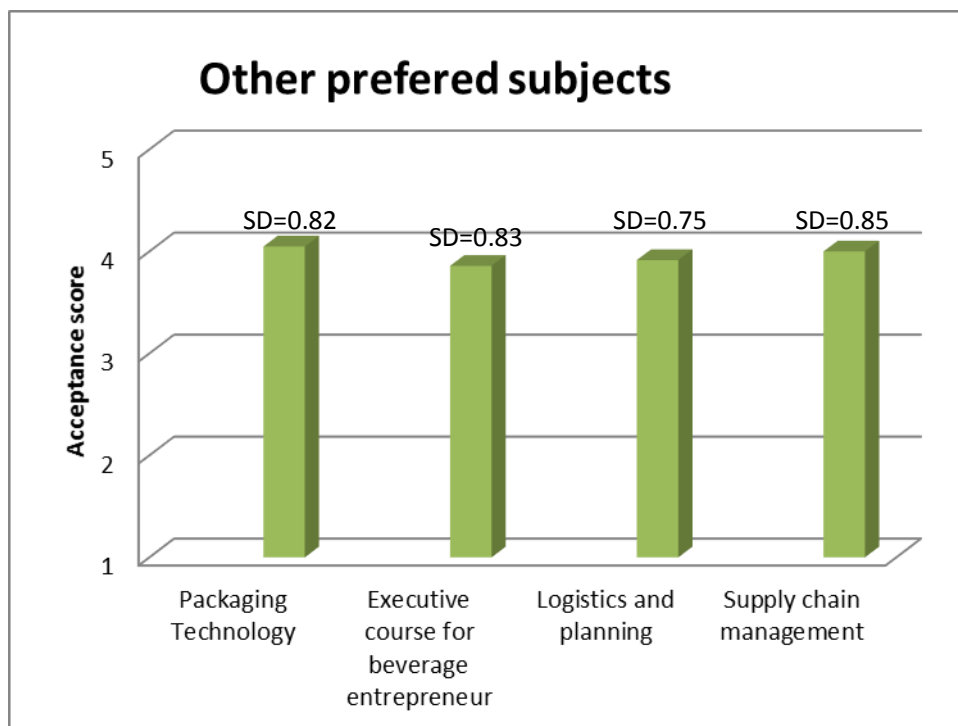
**Figure 7** Average acceptance score for CPD topics/subjects in Hygienic Engineering

In the Hygienic Engineering area of topics, “Innovative technology” (e.g. non-thermal processes) gained the highest score followed by “Hygienic engineering and design”. Beverage plant design and automation for beverage industry has similar acceptance score from 3-4 (fair to high).



**Figure 8** Average acceptance score for CPD topics/subjects in other soft skill and managements

Among the personal and transversal skills, it resulted that industry is more interested in the improvement of problem solving and project management of employers. However, marketing analysis and conflict management are also preferred by stakeholders.



**Figure 9** Average acceptance score for CPD topics/subjects in other preferred areas

In the “Other preferred subjects” respondents were free to include any missing topic/course/discipline. In this area packaging technology and supply chain management, were found of interest for industry as well as logistics and planning. For higher positioning worker small percentage preferred executive course for beverage entrepreneurship.

In summary, the content that we proposed is accepted and agreed by the stakeholders that the acceptance score is more 3.0.

- **Other comments**

Here below a list of some comments added by the respondents to the filled in questionnaires:

- **Brand design** and images as well as **packaging design** should be included for market aspects.
- More emphasize on **case study** and how to **apply knowledge**.
- More topics on “**Innovation**” esp. **product, technology, process** or **equipment**.
- Duration 3-5 days will be too short, Propose to design training for 2 weeks
- Consider **environmental, ethics**
- **Fresh juice processing**
- All subjects are equally important
- Trend in food technology
- The curriculum should have “core subjects” which is fundamental knowledge and “selective subjects” for people who have different background
- Optimization about **planning with material, time** and plan.
- **CIP** or **cleaning technology**
- Law and regulation i.e. EU standard, code

## 2.3 SWOT analysis

During the workshop meeting, a SWOT analysis was carried out and developed by all Thai partners (namely KU, CU and KMITL) taking into account in particular the results of preliminary survey and the workshop discussion and main points are reported in Table 2.



**Table 2** Results of SWOT analysis of HE curricula on Beverage products and technology under development within the SEA-ABT project

<b>Strength</b>	<b>Weakness</b>
<ul style="list-style-type: none"> <li>-Strong support from high experience and expert EU universities on conducting beverage technology course</li> <li>-Existing capabilities of each partner on courses, facilities (pilot and lab scale), long distance learning</li> </ul>	<ul style="list-style-type: none"> <li>- Never developed a HE course specific on beverage technology before</li> <li>-Industry is on favor of a short course and after working-time classes</li> <li>- People from industry has little time to attend classes i.e. cannot perform actual participation in the class, prefer online class</li> <li>- Background of students are wide</li> <li>- Language problems</li> <li>- The target students such as workers have low skill of practice and operation</li> </ul>
<b>Opportunity</b>	<b>Treats</b>
<ul style="list-style-type: none"> <li>-First time of launching a Beverage Technology study programme in Higher Education (HE) in Thailand</li> <li>-The collaboration of KU, CU and KMUTL as well as BOKU, UNITE, HGU and companies give an attraction on reliability and high quality of the study programme</li> <li>-Introduction of new training and teaching tools (by distance, web-based, online classes and seminar) as new learning approach</li> </ul>	<ul style="list-style-type: none"> <li>-Big companies may have/develop their own in-house courses after attending our courses (i.e. copy) for saving their budget</li> <li>-Certification of courses might not be recognized or important for the companies</li> <li>-Risky to address overall the needs of SMEs and of large companies as they might be quite different (definition of focusing of the project)</li> <li>-Competences of the partners may not be extensive enough to cover trainings for soft skill</li> </ul>

### 3 Survey for expertise to universities in the consortium

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#### Available competences at the project partners

For all partners, there is some inventory available related to beverage technology as listed in Table 3 - 6.

**Table 3** Inventory available from Thai partners on HE course subjects

Course	Course Description	Learning Outcome	CU	KU	KMITL	PATKOL	EHEDG
<b>Food Law &amp; Regulations</b>	<i>Domestic &amp; International Food Law and Regulations related to food additives, Beverage manufacturing and packaging</i>	<ul style="list-style-type: none"> <li>• Understanding both domestic and international laws and regulations related beverages.</li> <li>• Achieve the way to search related websites and documents to locate information correlated to laws, standards and regulations related to beverages.</li> <li>• -Apply knowledge of regulation while developing new beverage products or seeking the approval of new beverage</li> </ul>		Kriskamol			



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Course	Course Description	Learning Outcome	CU	KU	KMITL	PATKOL	EHEDG
		products					
<b>Beverage Technology 1</b>	<i>Principle of non-alcohol beverage processing</i>	-Understand principle of non-alcohol beverage processing, including juices, dairy-based beverages, energy drinks , coffee, tea, and etc.	Sarn (dairy)	Sasitorn (juice)			
<b>Beverage Technology2</b>	<i>Principle of alcoholic beverage processing, New Product Development, Waste management</i>	-Understand principle of alcohol beverage processing, including wine, beer, liquor and etc.  -Understand new product development concept for creation of new beverage product.  -Manage waste utilization for beverage factory.	Sarn (wine)	Sumalika (wine, liquor)  Ulaiwan (Beer)			
<b>Hygienic Engineering and Design.</b>	<i>Law &amp; Regulations for food machinery design, Material of construction for equipment in contact with food</i>	-Understand law & regulations for food machinery design, Material of construction for equipment in contact with food			Navaphattra , Taweepol	Worrapanya	Expertise of EHEDG



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Course	Course Description	Learning Outcome	CU	KU	KMITL	PATKOL	EHEDG
	<i>contact with food, Measurement and Instrumentation, Hygienic equipment design criteria, Hygienic design of piping, Air handling system, and Steam quality</i>	<p>-Design and specify the specifications of factory building, piping system, valves and accessories, pumps, wastewater treatment and other equipment related to beverage factory.</p> <p>-Design the processing lines and plant layout of beverage factory.</p> <p>-Understand principle measurement, instrumentation and automation used in beverage industry</p>					
<b>Unit Operation</b>	<i>Thermal process, Filtration process, Fundamental of heat transfer</i>	<p>-Explain the basic principles of the unit operations listed.</p> <p>-Perform basic calculations and analysis of these unit operations.</p> <p>-Identify basic beverage processing equipments and explain the principle of operation.</p> <p>-Select proper</p>	Chaleeda (Heat transfer, heat exchanger, Drying)	Ulaiwan Sasitorn (Principle of thermal processing)			



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Course	Course Description	Learning Outcome	CU	KU	KMITL	PATKOL	EHEDG
		equipment for specific applications.					
<b>QA &amp; QC</b>	<i>Statistics for Quality Control, Quality measurement and analysis, Food Safety Management system e.g. HACCP BRC ISO22000</i>	<ul style="list-style-type: none"> <li>- Understand how to evaluate quality of beverage products</li> <li>-Understand how to apply various statistic tools and techniques used in quality control and quality improvement system</li> <li>-Understand different food safety management system e.g. HACCP BRC ISO22000</li> </ul>		Warapa (HACCP)			
<b>Beverage chemistry &amp; microbiology</b>	<i>Principle of chemistry for beverage e.g. colloid ,additives, preservatives, Principle of microbiology for beverage, Shelf-life study)</i>	-Understand basic chemistry and microbiology related to different beverages.	Sarn (microbiology, spoilage, fermentation)	Kriskamol (chemistry) Warapa (microbiology) Sumalika (microbiology)			
<b>Beverage</b>	<i>Marketing,</i>	-Understand principle of					



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Course	Course Description	Learning Outcome	CU	KU	KMITL	PATKOL	EHEDG
<b>Industry Management</b>	<i>Logistics, Supply chain management, Project management</i>	business management necessary for beverage industry.					
<b>Practical Laboratory in Beverage Industry</b>	<i>e.g. UHT Evaporator Filter Heat exchanger</i>	Hands-on Laboratory related to beverage industry	Chaleeda (heat exchanger)		Taweepol, Navapahttra (Hygienic equipment)	Worapanya (Hygienic equipment)	
<b>Seminar</b>	<i>Presentation technique, Scientific communication skill, Connectivity, Creativity, Personality, Guest speaker</i>	-Be able to analyze and comprehend the scientific research papers. -Use scientific database to update or follow the research - Be able to give oral scientific presentation effectively -Write a seminar report as the scientific review paper	All	All	All	All	
<b>Special Problem</b>	<i>Information literacy, Study of any topic related to</i>	-Problem solving skills related to beverage industry.	All	All	All	All	



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Course	Course Description	Learning Outcome	CU	KU	KMITL	PATKOL	EHEDG
	<i>Beverage Technology</i>						
<b>Others</b>							

**Table 4** Inventory available from Thai partners on CPD course

Course	CU	KU	KMITL	PATKOL
Food Law & Regulations		Kriskamol		
Risk assessment		Warapa		
Food Safety		Warapa		
Quality Control	Chaleeda			
Quality Assurance				
Quality measurement & Food analysis for beverage	Sarn	Kriskamol		
Trend & Innovation of beverage products	Chaleeda			
New Product Development (NPD)				
Wine Technology	Sarn	Sumalika		
Brewing Technology		Ulaiwan		
Fruits & vegetables Drink		Sasitorn		
Hygienic Engineering & Design			Navaphattra, Taweepol	Worapanya

<b>Course</b>	<b>CU</b>	<b>KU</b>	<b>KMITL</b>	<b>PATKOL</b>
Dairy and Protein-based beverage	Sarn			
Coffee and Tea	Chaleeda			
Soft drink				
Beverage Plant Design				
Automation for beverage industry			Taweepol	
Innovative Technology (e.g. non-thermal process)	Chaleeda	Sasitorn		
Project Management				
Marketing analysis				
Problem solving skills				
Logistic and planning				
Conflict Management				
Supply chain management				
Packaging Technology				
Executive course for beverage entrepreneur		All		



**Table 5** Capacities of European partners on HE subjects

Course	Course Description	Learning Outcome	BOKU	HGU	UNITE	IFA	EHEDG	HABLA
<b>Food Law &amp; Regulations</b>	<i>Domestic &amp; International Food Law and Regulations related to food additives, Beverage manufacturing and packaging</i>	<ul style="list-style-type: none"> <li>- Understanding both domestic and international laws and regulations related beverages.</li> <li>- Achieve the way to search related websites and documents to locate information correlated to laws, standards and regulations related to beverages.</li> <li>-Apply knowledge of regulation while developing new beverage products or</li> </ul>	Contacts to lawyer for EU Food law		<p>Part of the topics are included in some disciplines of the Master course including:</p> <p style="padding-left: 40px;">Food additives, laws for new beverages development</p> <p>Reference: prof. Pittia</p>		Also EHEDG	

Course	Course Description	Learning Outcome	BOKU	HGU	UNITE	IFA	EHEDG	HABLA
		seeking the approval of new beverage products						
<b>Beverage Technology 1</b>	<i>Principle of non-alcohol beverage processing</i>	-Understand principle of non-alcohol beverage processing, including juices, dairy-based beverages, energy drinks , coffee, tea, and etc.	Dairy technology	Frank  (fruit & vegetable juices, nectars)	Yes, various disciplines of the Food Technology area  Food Technology I, II  (reference: prof. Pittia-Mastrocola)			
<b>Beverage Technology2</b>	<i>Principle of alcoholic beverage processing, New Product Development, Waste management</i>	-Understand principle of alcohol beverage processing, including wine, beer, liquor and etc.  -Understand new product development concept for creation of new	Beer  Wine  Spirits  Product development	Frank  (wine, fruit wine, processed products, beer, spirits, liqueur)	Yes, various disciplines of the Wine Technology area  (reference: prof. Pittia-Arfelli)			

Course	Course Description	Learning Outcome	BOKU	HGU	UNITE	IFA	EHEDG	HABLA
		beverage product. -Manage waste utilization for beverage factory.						
<b>Hygienic Engineering and Design.</b>	<i>Law &amp; Regulations for food machinery design, Material of construction for equipment in contact with food, Measurement and Instrumentation, Hygienic equipment design criteria, Hygienic design of piping, Air handling system, and Steam quality</i>	-Understand law & regulations for food machinery design, Material of construction for equipment in contact with food -Design and specify the specifications of factory building, piping system, valves and accessories, pumps, wastewater treatment and other equipment related to beverage	Master course on: law & regulations for food building and machinery design, Material of construction , ability to identify hygienic risks in food production areas and to make proposals for improvement, knowledge on cleaning and				training materials	Is expert for cleaning

Course	Course Description	Learning Outcome	BOKU	HGU	UNITE	IFA	EHEDG	HABLA
		<p>factory.</p> <p>-Design the processing lines and plant layout of beverage factory.</p> <p>-Understand principle measurement, instrumentation and automation used in beverage industry</p>	<p>sanitation (mechanisms and methods), ability to validate cleaning efficacy, teamwork</p>					
<b>Unit Operation</b>	<i>Thermal process, Filtration process, Fundamental of heat transfer</i>	<p>-Explain the basic principles of the unit operations listed.</p> <p>-Perform basic calculations and analysis of these unit operations.</p> <p>-Identify basic</p>	Pilot plant		<p>Discipline: Unit Operations (reference: prof. Pittia-Mastrocola)</p>			

Course	Course Description	Learning Outcome	BOKU	HGU	UNITE	IFA	EHEDG	HABLA
		beverage processing equipment and explain the principle of operation.  -Select proper equipment for specific applications.						
<b>QA &amp; QC</b>	<i>Statistics for Quality Control, Quality measurement and analysis, Food Safety Management system e.g. HACCP BRC ISO22000</i>	- Understand how to evaluate quality of beverage products  -Understand how to apply various statistic tools and techniques used in quality control and quality improvement system  -Understand different food safety	Lectures and exercises on Food Quality and Food Safety management systems, QM tools, Statistical process control, Computer Assisted Quality assurance (QA for Beer, wine, dairy products		Yes, various disciplines of the Bachelor and Master degree programme. In particular  Food Analysis  Food Microbiology  Food Hygiene  (reference: prof. Compagnon			

Course	Course Description	Learning Outcome	BOKU	HGU	UNITE	IFA	EHEDG	HABLA
		management system e.g. HACCP BRC ISO22000	Audits, method validation, risk assessment		e)			
<b>Beverage chemistry &amp; microbiology</b>	<i>Principle of chemistry for beverage e.g. colloid ,additives, preservatives, Principle of microbiology for beverage, Shelf-life study)</i>	-Understand basic chemistry and microbiology related to different beverages.		Frank (beverage chemistry, analytics)	Yes, various disciplines of the Bachelor and Master degree programme. In particular Food Technology I (Food ingredients and formulation) Food Technology II (Shelf-life prediction-module) Food processing Food Microbiolog			



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Course	Course Description	Learning Outcome	BOKU	HGU	UNITE	IFA	EHEDG	HABLA
					<p>y</p> <p>Food Hygiene</p> <p>This year: Food product design (2 ECTS) – 13-24<sup>th</sup> February (visiting professor S. Saguy) (reference: prof. Pittia and Paparella)</p>			
<b>Beverage Industry Management</b>	<i>Marketing, Logistics, Supply chain management, Project management</i>	-Understand principle of business management necessary for beverage industry.	Project management					
<b>Practical Laboratory in</b>	<i>e.g. UHT Evaporator</i>	Hands-on Laboratory	Pilot plant	Frank (practical	Project on beverage			

Course	Course Description	Learning Outcome	BOKU	HGU	UNITE	IFA	EHEDG	HABLA
<b>Beverage Industry</b>	<i>Filter Heat exchanger</i>	related to beverage industry		wine & beverage chemistry)	design and formulation (mostly fruit-, milk-vegetable-based beverages)  (Food Technology II)			
<b>Seminar</b>	<i>Presentation technique, Scientific communication skill, Connectivity, Creativity, Personality, Guest speaker</i>	-Be able to analyze and comprehend the scientific research papers.  -Use scientific database to update or follow the research  - Be able to give oral scientific presentation effectively  -Write a seminar report as the scientific		All	All			



Course	Course Description	Learning Outcome	BOKU	HGU	UNITE	IFA	EHEDG	HABLA
		review paper						
<b>Special Problem</b>	<i>Information literacy, Study of any topic related to Beverage Technology</i>	-Problem solving skills related to beverage industry.	“Garage” concept	All	All			
<b>Others</b>			Sensory analysis e-elarning					

**Table 6** Inventory available from EU partners on CPD course

Course	BOKU	HGU	UNITE	IFA	EHEDG	HABLA
Food Law & Regulations						
Risk assessment	Yes					
Food Safety	Yes		Yes, Colleagues of the Food Microbiology area  (reference: prof. Paparella)			



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Course	BOKU	HGU	UNITE	IFA	EHEDG	HABLA
Quality Control	YES		Yes, Colleagues of the Food Analysis area (reference: prof. Compagnone)			
Quality Assurance	YES		YES Colleagues of the Food Analysis area (reference: prof. Compagnone)			
Quality measurement & Food analysis for beverage	YES	Frank	YES Colleagues of the Food Analysis area (reference: prof. Compagnone)			
Trend & Innovation of beverage products			YES Colleagues of the Food Technology area (reference:			



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Course	BOKU	HGU	UNITE	IFA	EHEDG	HABLA
			prof. Pittia)			
New Product Development (NPD)	YES		YES Colleagues of the Food Technology area (reference: prof. Pittia)			
Wine Technology	YES	Frank	YES Colleagues of the Food Technology area (reference: prof. Pittia)			
Brewing Technology	YES	Frank				
Fruits & vegetables Drink	YES	Frank	YES Colleagues of the Food Technology area (reference: prof. Pittia)			
Hygienic Engineering & Design	YES					
Dairy and Protein-based	YES		YES			



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Course	BOKU	HGU	UNITE	IFA	EHEDG	HABLA
beverage			Colleagues of the Food Technology area  (reference: prof. Pittia)			
Coffee and Tea			YES  Colleagues of the Food Technology area  (reference: prof. Pittia)			
Soft drink			YES  Colleagues of the Food Technology area  (reference: prof. Pittia)			
Beverage Plant Design						
Automation for beverage industry						
Innovative Technology (e.g. non- thermal process)	YES		YES  Colleagues of the Food			



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Course	BOKU	HGU	UNITE	IFA	EHEDG	HABLA
			Technology area (reference: prof. Pittia)			
Project Management	YES					
Marketing analysis						
Problem solving skills	YES					
Logistic and planning						
Conflict Management						
Supply chain management	YES					
Packaging Technology	YES		YES Colleagues of the Food Technology and Food microbiology area (reference: prof. Pittia & prof. Paparella)			
Executive course for beverage entrepreneur			YES/NO To be checked with colleagues of other faculty			



## Annex 1: Stakeholders name list

name (organization)	contact/contact person	Category*	email address
304 Industrial Park 10. Co., Ltd.	Nanipa Laeyakul	Industry	Foodscience_bbs@hotmail.com
Alcidini Winery Co.,Ltd.	Tontrakul ทริชพิพรรธ	Industry	tony.k@alcidini.com
Ampol Food	Pimvisuth	Industry	pimvisuth.c@gmail.com
Asia Food Beverage Thailand Magazine	Sukrit เติมสายทอง	Magazine	editor_afb@ttim.co.th
B Media Focus	Arkkrapol อนันต์โชติ	Magazine	a.arkkrapol@gmail.com
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Chulalongkorn university	Sirirat Rengpipat	University	srengpipat@gmail.com
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CP Meiji	Arkhom	Industry	arkhomcdc@gmail.com
CP Meiji	Seree	Industry	seree.t@cpmeiji.com
CP Meiji	Sukontha กุศลวิภากร	Industry	sukontha.kun@cpmeiji.com

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Dutchmill	Sineenat Silpchai	Industry	sineenat.s@dutchmill.co.th, may1514@hotmail.com



name (organization)	contact/contact person	Category*	email address
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Ecolab	Sukritta หมั่นจิตร	Industry	sukritta.sm@gmail.com
Firmenich Thailand	Suhuttaya นำชัยสุวรรณ	Industry	Suhuttayan@yahoo.com
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FrieslandCampina Thailand	Tossapol วโนทยาโรจน์	Industry	
Global Language Resource Centre	Pratima อัครรังษี	Training	poonseespace@gmail.com
Hokkaido Morimoto	Worawit วงศ์แสนประเสริฐ	Industry	hokkaido.tui@gmail.com
Hokkaido Morimoto Milk	Waraporn เพชรเรืองจรรยา	Industry	hokkaido.rd@gmail.com
Honest Intention Co.,Ltd.	Tanon ทวีกิจกัจจกร	Industry	t.tanon@hotmail.com

name (organization)	contact/contact person	Category*	email address
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IFRPD	Khemmapat ศรีสุวรรณ	Research Institute	ifrwdo@ku.ac.th
IFRPD	Pissamai ศรีชาย	Research Institute	ifrpms@ku.ac.th
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