The following publication H. C. B. Chan, "Teaching Entrepreneurship Using C3 Model-Map," 2021 IEEE 45th Annual Computers, Software, and Applications Conference (COMPSAC), 2021, pp. 1114-1118 is available at https://dx.doi.org/10.1109/COMPSAC51774.2021.00152.

Teaching Entrepreneurship Using C^3 Model-Map

Henry C. B. Chan
Department of Computing, The Hong Kong Polytechnic University

Abstract — This paper presents an innovative C^3 (C-cube) Model-Map for teaching entrepreneurship and shares the experience of using this C^3 Model-Map in a freshman seminar subject for computing students. Comprising three core elements: Customer, Concept and Company (C^3), it can be used to shape a business model (e.g., for technology startups). In other words, students can use a concise and systematic model to frame their business ideas. This seeks to foster both analytical thinking and creative thinking. The teaching methodology and some evaluation results are also presented in this paper.

Keywords — Entrepreneurship, Startup, Business Model

I. Introduction

In recent years, with the advent of technology startups, there has been growing interest in teaching entrepreneurship at various levels and for different purposes e.g., [1]-[4]. In particular, freshmen (e.g., first year computing students) can be introduced to the concept of entrepreneurship in a freshman seminar subject. As computing freshmen have little background in business, a concise and systematic model is needed for teaching entrepreneurship. This prepares them to develop business or startup ideas throughout their undergraduate studies.

Here are some related teaching methodologies for entrepreneurship. Conventional approaches for teaching entrepreneurship typically involve a long or comprehensive business proposal to address different business topics. Proposed by MIT, disciplined entrepreneurship is a systematic framework for teaching/learning entrepreneurship [5]. The Business Model Canvas provides a simpler framework to develop business plans and models [6]. Similar to the Agile software development methodology, The Lean Startup is an iterative approach for developing startups [7]. The Blue Ocean Strategy focuses on new market development (forming a "blue ocean" instead of a "red ocean") [8]. The 4P marketing mix is a traditional marketing framework to address Product, Price, Place and Promotion, the four most important elements for all businesses [9]. The Mind Map is a popular and general tree-based diagram to express ideas (e.g., business ideas) and organize information [10]. Inspired by the aforementioned models and methodologies, the aim of this paper is to develop an innovative and concise model for students to shape a business model or business ideas in a systematic and creative manner. Compared to the aforementioned models/methods, the proposed C^3 Model-Map seeks to provide the following contributions. First, it provides a concise model for shaping business ideas, focusing on the customer, concept and company components (i.e., three core components). Second, it seeks to integrate some of the elements of the aforementioned models/methods, such as combining the Business Model Canvas and Mind Map to establish the basic framework and extending the 4P marketing mix (i.e., the 6P) to shape a company. Third, it fosters both analytical (left brain) thinking and creative (right brain) thinking. After shaping their ideas, students can use other methodologies for further development. In relation to the model-map terminology, there are two similar ones on the Internet. First, ModelMap is a Java component in the Spring Framework [11], which is for programming purposes. Second, the business model map in [12] seeks to integrate several business model tools. However, the proposed C^3 Model-Map focuses on the 3C (Customer, Concept and Company) components for teaching/learning entrepreneurship.

The remaining sections of this paper are outlined as follows. Section II presents the C^3 Model-Map. Section III discusses the evaluation results. Section IV provides a conclusion.

II. C^3 Model-map

In this section, the C^3 Model-Map is presented. Before presenting the model-map, the meaning of entrepreneurship can be introduced to students through quotes (i.e., asking students to think or discuss about them). Here are some good examples.

"*Success comes down to hard work plus passion, over time. If you work really, really hard over a long period of time, it will pay off.*"

Stanley Tang

"*The true entrepreneur is a doer, not a dreamer.*"

Nolan Bushnell

"*I have not failed. I've just found 10,000 ways that won't work.*"

Thomas Edison

"*Business opportunities are like buses, there's always another one coming.*"

Richard Branson

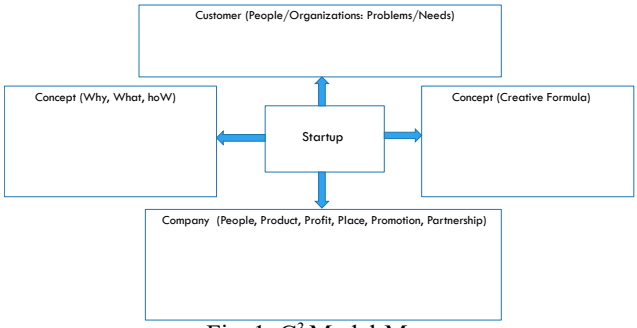

Fig. 1: C^3 Model-Map

Fig. 1 shows the C^3 Model-Map with three key components: Customer, Concept and Company. It seeks to answer three fundamental questions.

- Who are your customers and what are their needs?
- What is the business concept to satisfy the customer needs?
- How to form a company to realize the business concept?

Very often, students, especially computing students, tend to focus on technologies. However, for entrepreneurship, the most important first step is to identify customer needs and problems. To illustrate this important point, the following example can be used.

I went to a bookstore to buy a few books to learn about entrepreneurship. There were so many books in the bookstore. It was not easy to find the books. After finding the right bookshelf, I read a few possibly suitable books. However, I was not sure whether they were good or not ...

In this case, the customer need is to learn about entrepreneurship, and the customer problem is that it is difficult to find a good book (i.e., to evaluate whether a book is good or suitable).

Having defined the customer needs and problems, the next step is to develop the business concept to fulfill customer needs and to address customer problems. Both analytical thinking (left brain) and creative thinking (right brain) are used. For the former approach, there are three basic questions: why, what and how. Here is an example for the launch of smartphones to illustrate the basic approach.

Let's go back 10+ years ago ... Mobile phones and personal digital assistants (PDAs) are useful devices for voice and data communications, respectively. Currently, it is not convenient to carry a mobile phone and a PDA separately. A smartphone integrates a mobile phone with a PDA, and provides other functions. Basically, through a large screen, a user can choose the communications functions as well as useful applications. A smartphone looks like a mini personal computer – a computer inside your pocket.

As an exercise, students can be asked to think about the why, what and how. The following figure outlines a possible answer:

Why	• Separate phones and personal digital assistants, not convenient
What	• An integrated voice/data communications device called "smartphone"
hoW	• A large screen for users to select/use functions and apps

Fig. 2: Outlining why, what and how

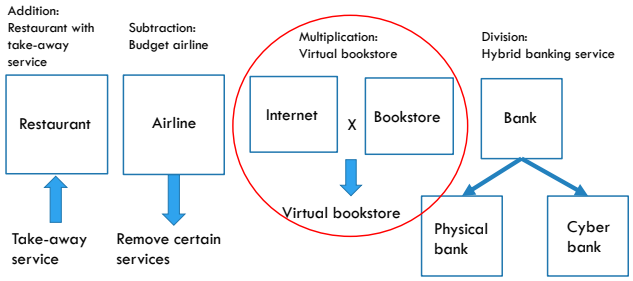

Fig. 3: Creative formulas

For creative thinking, the C^3 Model-Map also provides a creative formula approach. Basically, a business can provide a new product or service using four basic approaches: addition, subtraction, multiplication and division (i.e., +, -, x, /) as shown in Fig. 3. It can also be called "entrepreneurship mathematics". In terms of additions, a business can add additional service features, for example. Conversely, a business can delete certain service features (i.e., subtraction) to focus on a niche market. A good example is a budget airline. For multiplication, which is the focus of the model-map, two businesses or things in general can be multiplied (crossover or fused) to create a new business. For division, a business can be divided into sub-businesses, each focusing on a special market segment. In summary, the creative formula seeks to inspire students' creative thinking to create a new business concept to fulfill customer needs.

Last but not least, the company component seeks to shape the company or organization to implement the business concept. There are 6P elements inspired by the 4P marketing mix [9]. The key questions are given as follows:

- People: What is your management team?
- Product: What will you offer to your customers?
- Profit: How do you make money to sustain your business?
- Place: How/where do you sell your product?

- Promotion: How do you promote your product?
- Partnership: Who or what companies will you partner with to enhance competitiveness?

The first one is People, which is the most important element. For all startups, success usually depends on the team rather than on the idea. Inspired by the 4P marketing mix, the core 4P elements are: Product, Profit, Place and Promotion. The last P is Partnership, which is also important, especially for startups.

Fig. 4 presents a virtual bookstore example as outlined by the C^3 Model-Map. Imagine in this moment that it is now more than 20 years ago, without any Internet stores. In other words, we can only buy books at a physical bookstore. The customer need is a convenient way to buy books, and the customer problem is the difficulty in finding suitable books. In terms of a business concept, the book market is a large market, as illustrated by market statistics. The business concept is to facilitate book title searches and book buying through a powerful server, coupled with good logistics. From another perspective (i.e., a creative thinking perspective), it seeks to integrate the Internet with a physical bookstore. To realize the business concept, a company with a diverse team is needed. The core product is of course a virtual bookstore website, coupled with book recommendation services. The traditional transaction-based revenue model is employed. Note that as physical stores are not needed, certain costs can be saved, enhancing competitiveness. In terms of partnership, the virtual bookstore can partner with publishers for mutual benefits.

Based on the C^3 Model-Map, students were asked to form groups to propose technology startup ideas and conduct entrepreneurship projects (i.e., for the freshman seminar subject). Selected student groups were also invited to join a virtual co-working space called C^3 space (see https://c3.comp.polyu.edu.hk) to further develop the virtual startups. To complement the C^3 Model-Map, C^3 space fosters computational thinking, creative thinking and collaborative thinking to form C-cubes (student virtual startups). In general, this innovative initiative is also inspired by the CARES (Computing for Application, Research, Entrepreneurship and Service) model or education philosophy. In summary, the CARES model covers four main development areas: application (applying knowledge), research (advancing knowledge), entrepreneurship (innovating knowledge) and service (serving with knowledge).

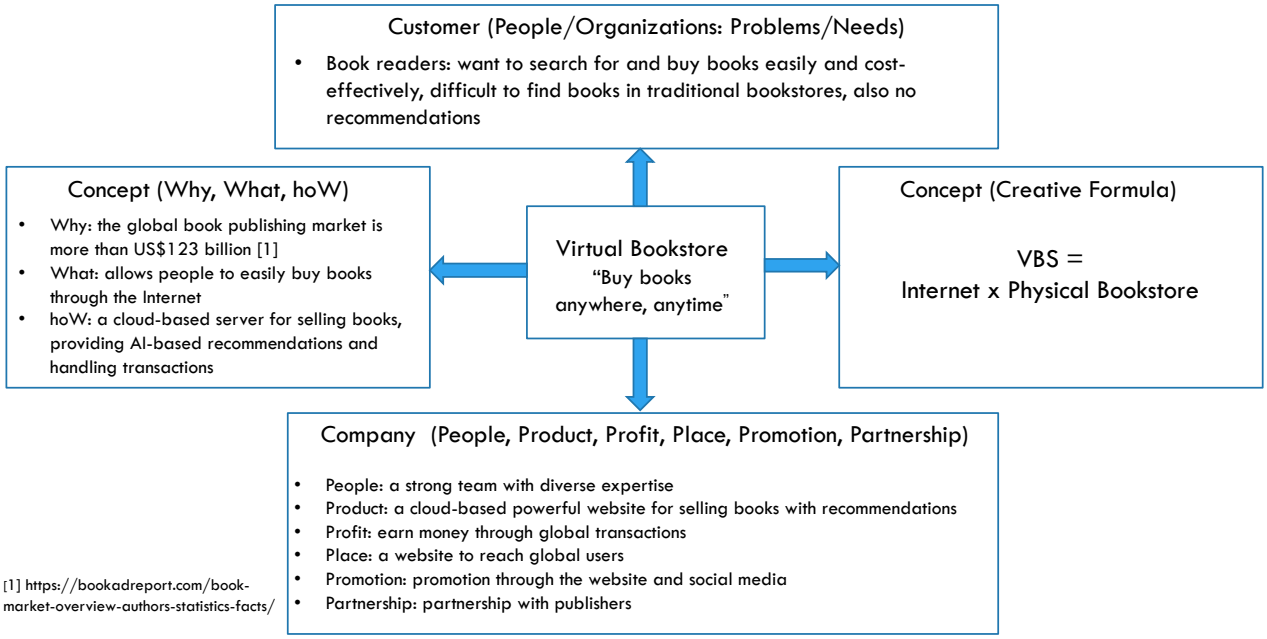

Fig. 4: Virtual bookstore example

III. Evaluation

A pilot evaluation for the C³ Model-Map was conducted. A total of 13 students who were active in entrepreneurship were selected to complete an anonymous survey. Note that it was a pilot survey with the aim of obtaining initial findings (e.g., possibly for further analysis and enhancement). It is expected that more comprehensive surveys will be conducted in the future as well. All participating students agreed that the C³ Model-Map is useful. They were asked to rate the usefulness of the components or elements. A 10-point rating scale (1 (not useful) – 10 (very useful)) was used. Fig. 5 shows the mean scores for the customer, concept and company components. It indicates that the students find the concept (analytical thinking) and customer components to be the most useful. Fig. 6 shows the score variance for the customer, concept and company components. It is interesting to note that the company and concept (creative thinking) components (i.e., the ones with lower mean scores) had the largest variance. In other words, the students had more varied opinions. For future instruction, the importance of these two components should be highlighted and discussed in more detail.

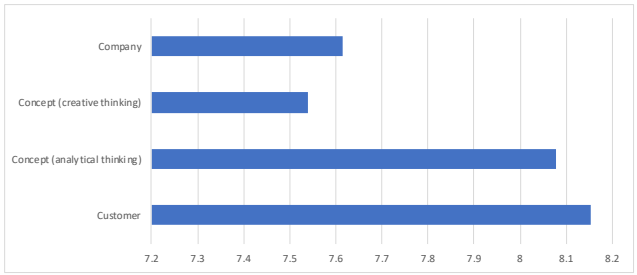

Fig. 5: Mean score for the company, concept and customer components

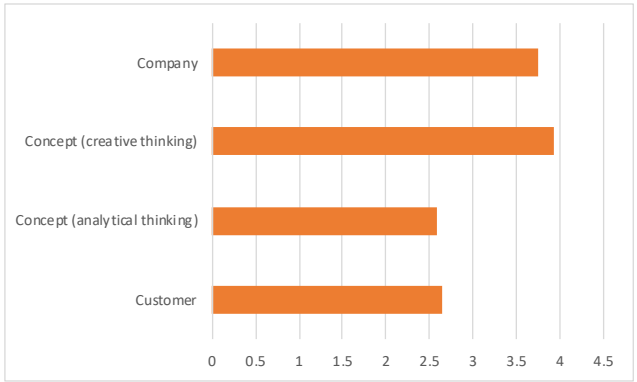

Fig. 6: Score variance for the company, concept and customer components

Fig. 7 shows the mean score for the 6P elements. It is found that the product, partnership and people elements have higher mean scores. In other words, students think that these elements are relatively more important. Fig. 8 shows the score variance for the 6P elements. It is interesting to find that the profit and place elements have the largest variance (i.e., varied opinions). Computing freshmen with little business background may focus more on technologies and products. In future courses, teachers should highlight the importance of revenue models (i.e., a business cannot survive and grow without a sound revenue model). The place element (i.e., one factor in the traditional marketing mix) may become blurred in the new digital economy. In fact, "place" can exist in new forms in the digital world and should also be highlighted in future teaching.

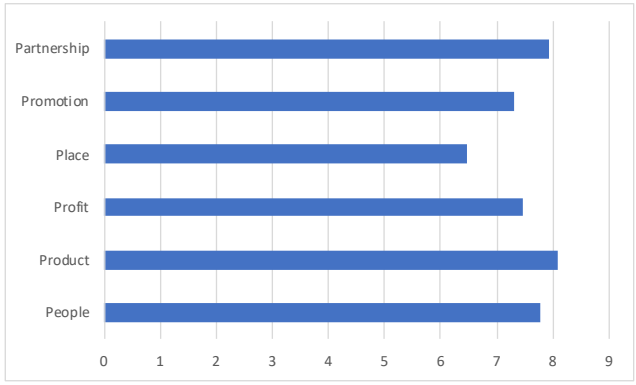

Fig. 7: Mean score for the 6P elements

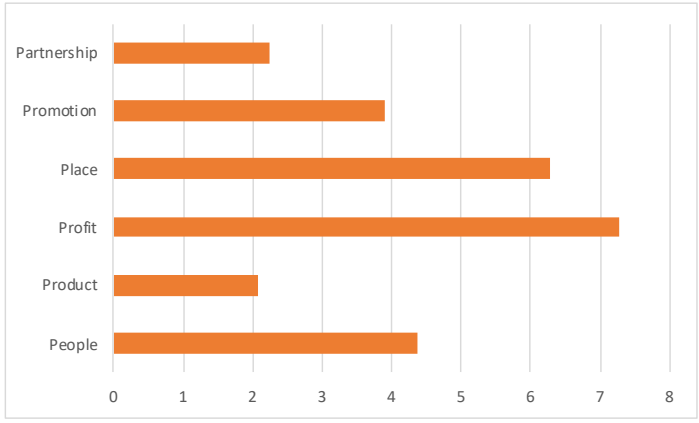

Fig. 8: Score variance for the 6P elements

IV. CONCLUSION

In conclusion, this paper has presented an innovative C^3 (C-cube) Model-Map for teaching entrepreneurship and shared teaching methodologies. The aim is to provide a concise and systematic model to help students shape their business ideas. Subsequently, other business tools can also be used for further development. Very often, students need a concise and systematic model to get started. The model-map has been used for teaching computing freshmen with good results. Furthermore, selected students are encouraged to further develop their entrepreneurship projects in a virtual co-working space. The pilot survey provides insights into the use of the C^3 Model-Map and the future teaching of entrepreneurship to computing freshmen.

ACKNOWLEDGMENTS

The work by Derek Ma, for developing and managing the C^3 website, and the support by the Department of Computing, The Hong Kong Polytechnic University, are much appreciated.

REFERENCES

[1] Z. Tekic, "Moving ideas to impact: entrepreneurship education for STEM geeks," *Proc. IEEE EUROCON 2019 -18th International Conference on Smart Technologies*, Novi Sad, Serbia, pp. 1-6, 2019.

[2] M. Martínez and X. Crusat, "The entrepreneurship journey: fostering engineering students' entrepreneurship by startup creation," *Proc. 2019 IEEE Global Engineering Education Conference (EDUCON)*, Dubai, United Arab Emirates, pp. 120-123, 2019.

[3] S. Tokunaga, M. Martínez and X. Crusat, "Engaging on entrepreneurship: the effectual logic behind the entrepreneurship journey," *Proc. 2018 IEEE Global Engineering Education Conference (EDUCON)*, Tenerife, pp. 637-642, 2018.

[4] P. Shekhar, C. Woodcock and A. Huang-Saad, "Assessing the development of student outcomes in project-based learning engineering design and entrepreneurship courses," *Proc. 2018 IEEE Frontiers in Education Conference (FIE)*, San Jose, CA, USA, pp. 1-4, 2018.

[5] B. Aulet, *Disciplined Entrepreneurship: 24 Steps to a Successful Startup*, Wiley, 2013.

[6] A. Osterwalder and Y. Pigneur, *Business Model Generation: A Handbook for Visionaries*, Game Changers, and Challengers, Wiley, 2010.

[7] E. Ries, *The Lean Startup*, Currency, 2011.

[8] W. C. Kim and R. Mauborgne, *Blue Ocean Strategy*, Harvard Business Review Press, 2005.

[9] P. Kotler and G. Armstrong, *Principles of Marketing*, 16th edition, Pearson Education, 2013

[10] T. Buzan, *The Mind Map Book*, Plume, 1996.

[11] https://docs.spring.io/springframework/docs/current/javadoc-api/org/springframework/ui/ModelMap.html

[12] http://businessmodelzen.com/business-model-map/