

Entrepreneurial process meets capstone project in a collaborative environment

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ABSTRACT

This paper explores the nexus between entrepreneurship and capstone projects. It draws on a case study which depicts the introduction of the entrepreneurship principle of 'adding value' through an entrepreneurial 'process' and its application through a capstone project. The paper documents the innovative stage of a University of Canterbury commerce student's business concept and its realisation through a capstone project completed by a Christchurch Polytechnic Institute of Technology student. The case study explores the collaborative environment which enabled this entrepreneurial opportunity to progress through to a fully workable prototype as part of the capstone project; and this paper supports the existing literature which suggests there are positive synergies to be achieved by linking entrepreneurial activities with capstone projects.

Keywords

Entrepreneurial process, capstone project, collaborative environment, innovation, trigger, implementation, ITP, university, discovery prototyping, web interface

1. INTRODUCTION AND BACKGROUND

An innovative and entrepreneurial commerce student at the University of Canterbury entered a competition with an innovative business idea. A final year information technology student from the Christchurch Polytechnic Institute of Technology was seeking a website development capstone project. The two students were supervised and mentored by three academic staff from across the two institutions as the two students set about achieving their goals.

The origins of the term entrepreneur can be traced back to the economics literature of the 1700s. Since that time definitions have evolved which depict the entrepreneur as a risk taker, innovator, profit maker, opportunist, and an organiser. However the contemporary popular literature has focused on the successful personalities or those that have fallen from grace [2, 24]. This has not always positioned society's perception of the entrepreneur in a good light. Academic research have traditionally focused on the specific characteristics of the individual termed the entrepreneur [23] but more recently emphasis has been on the entrepreneurial

process and the environmental context of the entrepreneurial behaviour [1, 31].

The entrepreneurial process can be considered a far more encompassing means of understanding what entrepreneurship actually entails as a mechanism for 'adding value', as opposed to simply referring to a person with specific characteristics which make them entrepreneurial. Adding value suggests being entrepreneurial is the engagement in any financially feasible activity that can enhance society in a social, political or economic sense. Such a creative process can be depicted by an events formation model [8] with encapsulates innovation, trigger, implementation and growths phases within entrepreneurial activity that may have much broader social, political and economic implications than purely profit or personal wealth generation.

This paper draws on a case study which depicts the application of the entrepreneurship principle of 'adding value' through an entrepreneurial 'process' in contributing to the development of a business concept which has both commercial and social benefits. The paper documents the innovative stage of a University of Canterbury commerce student's concept for gun control in New Zealand - which has implications for both commercial application and social benefits - and outlines the link with a capstone project completed by a student from the Bachelor of Information and Communication Technologies (BICT) from Christchurch Polytechnic Institute of Technology (CPIT). The BICT student's capstone project was at the trigger stage of the entrepreneurial process. The case study explores the collaborative environment which enabled this entrepreneurial opportunity to progress through to a fully workable prototype as part of the capstone project.

2. LITERATURE REVIEW

2.1 Introduction to Literature Review

There are three different areas of the literature that have relevance to this study. Firstly there is the literature relating to the entrepreneurship and the entrepreneurial process; secondly there is the literature relating to capstone projects in general; and thirdly there is the literature relating to the development methodology used in the project which in this case was the use of prototyping to discover user needs.

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2.2 Entrepreneurship

In considering the term entrepreneur the current popular literature has focused on the successful personalities [4] or those that have fallen from grace [3]. This has not always positioned entrepreneurial activity in high standing [22]. As an academic discipline, however, entrepreneurship research has attempted to define and understand the person and processes that constitute entrepreneurship in its various forms, and considers the entrepreneur's activities within the context of economic and social development within nations. From Cantillon's introduction of the term 'entrepreneur' into economic theory in the 1700s [11], entrepreneurship theory has become well established in the literature. The 20th century saw prolific development in this field. von Thunen's work developed a theoretical model that introduced the factors of 'risk' and 'uncertainty' into the definition of the entrepreneur at the turn of the 20th century under the German-Austrian Tradition [14]. Several decades on the concept of 'innovation' [38] was introduced as fundamental to his theories of entrepreneurship and a nation's economic development. It was contended that only certain extraordinary people have the ability to be entrepreneurs and that they bring about extraordinary events [37]. Later, under the Chicago Tradition, Knight presented the original von Thunen concept of uncertainty as being quite distinct from the accompanying capitalist and managerial functions. He saw the entrepreneur as an individual who was prepared to undertake risk and bear uncertainty in order to achieve reward or profit [14]. This view portrayed the entrepreneur as an 'energiser' in economic activity. McClelland's studies during the 1950s and 1960s focused more on motivational factors of the entrepreneur [28], while in the 1970s Leibenstein envisaged the entrepreneur as, on the one hand, performing a managerial function and, on the other hand, possessing a certain psychological capacity to stimulate (energise) entrepreneurial organisations [11].

All these theoretical developments considered the entrepreneur as 'a person', whilst current literature suggests that entrepreneurial thinking has moved away from the figure, characteristics, and intentions of entrepreneurs to consider in more depth the process of their actions and outcomes as a method of defining entrepreneurial behaviour [1, 6, 31]. The process approach focuses on entrepreneurs' behaviours over the time of their entrepreneurial activity, as opposed to simply identifying specific personal traits as constituting an entrepreneur [23]. For example, theories have surfaced around entrepreneurial emergence [12, 19] and entrepreneurial competences [21, 25, 29] as vital factors in the entrepreneurial process. A prominent theme in the literature has associated entrepreneurial behaviour with the new venture/small business domain [22, 25] by isolating factors such as innovation, implementation and growth. This development of a process approach to understanding entrepreneurship offers a more encompassing explanation of the concept of 'adding value', which refers to a idea that entrepreneurial activity can enhance society in a social, political or economic sense [13]. This creative process is described by [8] events formation process as encapsulating innovation, trigger, implementation and growths phases which are deeply embedded in the personal characteristics, the environment, and sociological and organisational context in which the entrepreneurial activity is undertaken. This also supports the expansion of the definition to include such people as social entrepreneurs (e.g. aid specialist Judy Moore of World Vision), inventor entrepreneurs (e.g. inventor Dean Kamen of DEKA), and entrepreneurs within educational institutions [35]. It therefore provides a model of entrepreneurship with much broader social,

political and economic implications than purely profit or personal wealth generation.

2.3 Capstone Projects

Capstone projects or cooperative education projects have become common place in information technology related qualifications in the Institute of Technology and Polytechnic (ITP) sector in New Zealand and have been the focus of many studies [7, 9, 18, 26, 32, 33, 39].

The form of capstone project can vary from ITP to ITP. However one of the unique characteristics is the balance that the projects strike between product and process [7, 9]. The projects normally involve the completion of a finished product in the form of a paper, formal presentation, and developed software, while at the same time having an emphasis on the methodology and process involved [9]. This aspect has also been described as being a combination of work experience and on-campus academic learning [10].

A very significant aspect of capstone projects is to "make learning real" and to integrate theory and practice [15, 17, 18, 30, 32, 39, 40].

A further factor for successful capstone projects is the importance of having good clients; providing a real service to them and having clients with realistic expectations [17, 18, 32].

A four factor model of earned value has been suggested [36] and is reproduced in Table 1. The Use of Product factor relates to whether the project results in a product that is used by the person or organisation that the project was completed for. The Value of Processes factor relates to whether the overall process of the project was valuable to the student in terms of their learning and to the client in terms of their own organisation. The Quality of Project factor relates to whether the work completed in the project was of sufficient quality. The Pedagogical Benefits relate to the learning that has taken place by the student as a result of having completed the project.

Table 1 – Four Factor Model for Capstone Projects [36]

Use of Product
Value of Process (to client and student)
Quality of Project
Pedagogical Benefits

A six principle model for capstone project has also been proposed [30] and is reproduced in Figure 2. These principles outline a model for what makes capstone projects achieve their potential outcomes and provides a framework that capstone projects can be evaluated against.

1. Transition

An effective capstone experience supports transition by:

- Drawing on students' self-management and other legal skills to deal successfully with uncertainty, complexity and change;
- Assisting students in beginning to develop a sense of professional identity; and
- Supporting students to manage their career planning and development.

2. Closure

An effective capstone experience provides closure by:

- Supporting students to integrate, synthesise and extend their learning in the program; and
- Enabling students to attain a sense of completion and an understanding of what it means to be a law graduate and a global citizen.

3. Diversity

An effective capstone experience responds to diversity by:

- Enhancing students' capacity to engage with diversity in professional contexts; and
- Being inclusive of all students.

4. Engagement

An effective capstone experience promotes student engagement by:

- Requiring students to assume active roles, to apply their learning in realistic and unfamiliar contexts and to take responsibility for their own work; and
- Providing opportunities for reflection to enable students to make connections between their learning and professional contexts and to assist the development of their professional identity.

5. Assessment

An effective capstone assessment recognises the culminating nature of the experience by:

- Aligning assessment practice to the capstone principles; and
- Requiring students to make appropriate use of feedback and to reflect on their own capabilities and performance.

6. Evaluation

An effective capstone experience:

- Should be regularly evaluated to ensure its relevance, coherence and alignment with the program;
- Contributes to the whole of program evaluation; and
- Contributes to the demonstration of student attainment of the discipline learning outcomes.

Figure 2 - Six Principle Model for Capstone Projects [30]

2.4 Prototyping to Discover User Needs

The methodology to be used is an important aspect of software development projects. When it comes to capstone projects, instructors and supervisors should pay attention to the selection of methodology as there are a number of factors to consider which will impact on the smooth running of capstone projects [39].

The development of a prototype can serve the purpose of capturing requirements [27], and saving time and cost for a quick development process. This will also result in users understanding

and reviewing the proposed system [34]. Other studies also identify that prototypes can help in capturing the elicitation of requirements, which leads to proper specifications and the taking of less time to capture the requirements [36], with part of the success being the regular user feedback [20].

The use of prototyping to discover user requirements has also been used in capstone projects where user requirements were not fully understood initially [32].

2.5 Summary of Literature Review

The literature considered the entrepreneurship principle of 'adding value' through the entrepreneurial 'process' [13]. This approach considers the personal, sociological, organisational and environmental factors that contribute to the development of a business concept which can have both commercial and social benefits. This events formation approach [8] can be applied to this study as it documents the innovative stage which encapsulates a commerce student's creative process in developing a business idea - which has potential for both commercial success and social benefits. It also allows for the linking with a CPIT BICT student's 'capstone project' [7, 9] at the trigger stage of the events formation process (i.e. taking the innovative concept and prototyping and testing it for commercial application).

There are a number of important aspects of capstone projects with these including the balance between product and process; the importance of having a completed product; a combination of work experience and academic learning; and the desire to make learning real. Two different models are identified that can be used to evaluate capstone projects: The Four Factor Model [26] and the Six Principle Model [30].

The use of capstone projects has become commonplace [9] and choosing the appropriate methodology is important [39]. The innovative nature of the project that was the focus of this study resulted in the 'user needs' being quite difficult to document as similar systems with similar needs and requirements did not appear to exist. As a consequence a decision to use a prototyping methodology [27] was made. Making such a decision was consistent with the literature relating to the use of prototyping to discover user needs.

3. THE PROCESS

3.1 The Entre' Competition at UC

Each year, students from across the University of Canterbury (UC) can enter into the Entre' Competition which requires them to take an innovative or entrepreneurial idea, develop a business plan and take the idea through to a 'proof of concept' stage. Students are assigned mentors from the academic staff early on in the competition to provide some guidance on how to work through the processes involved. In 2011 a commerce student at UC developed a new concept for gun licensing in New Zealand. The student was developing the concept for the Entre' competition under the mentoring of one of the lecturers in a management related subject at UC.

It became apparent that the best way to move forward with the concept would be to have some technology developed that could be used to demonstrate the concept in the presentations that were part of the Entre' competition requirements. For this stage the commerce student made contact with one of the lecturers in information systems related subjects at UC. After some discussion it was apparent that due to the idea being new and innovative that

the actual requirements were not clear. At this point it was decided that a website would be needed to demonstrate the concept, but that the requirements for the website were quite unclear: something which is reasonably common for new and innovative ideas.

The information systems lecturer suggested that a process worth following would be to find a student who needed to complete a project of significant size, then allow them to develop a series of prototypes with the aim of better understanding the requirements and having a 'proof of concept' to demonstrate during presentations for the Entre' completion. Due to the time of the year, there were no UC information systems or computer science students able to work on such a project. As a consequence of this an approach was made to CPIT to see if there was a final semester BICT student available to complete this work as their capstone or cooperative education project.

3.2 The Capstone Project at CPIT

The project team consisted of a student at CPIT identified as having an interest in completing a web site development project, an academic supervisor from the academic staff at the CPIT School of Computing, the information systems lecturer from UC acting as the industry supervisor, and the commerce student from UC being the real world client for the project.

The title of the project was "Proof of Concept and Prototype Development" with the stated aim of the project being to:

"... develop a proof of concept prototype to enable the marketing of a concept to interested parties. This initial prototype will then be refined and expanded to provide the functionality that the client desires across multiple platforms. Client satisfaction with the development will be an expected outcome as the client will have to market their concept based the prototype."

The methodology that was chosen for the project was that of Rapid Application Development (RAD) and Discovery Prototyping.

3.3 Results

The regular meetings between the UC student (the client) and the CPIT student (the developer) resulted in both the client and the developer gaining a much better picture of what the requirements of the website would be. This was particularly evident as each iteration of the website was developed, and justified the use of RAD and Discovery Prototyping as the methodologies.

As part of the Entre' Competition the client was required to present a three minute sales pitch. One of the earlier iterations of the website was developed specifically for the three minute sales pitch, and the success of the overall process was demonstrated in the client winning the award for the best sales pitch in the competition.

The developer's skills in technical areas relating to web development were enhanced during the project, particularly when it came to adopting new development frameworks, and the experience in dealing with unstructured situations, in particular when requirements for a system are unclear or not completely understood, were also enhanced significantly. The developer also needed to further develop the ability to communicate with a variety of stakeholders (client, industry supervisor and academic supervisor) throughout the project.

The client found the process of discovery prototyping was very valuable for gaining a fuller and deeper understanding of what the requirements for the system needed to be, as well as creating a working prototype that met the requirements of a 'proof of concept' model.

For the developer, the process and the outcome served the purpose of integrating theory and practice, which was evident in the final report and presentation that were part of the requirements for the capstone project. In addition the developer gained sufficient real-world experience so as to gain employment as a developer soon after completing the BICT degree.

4. ANALYSIS AND DISCUSSION

The client (UC student) had developed an entrepreneurial business idea in a manner that was consistent with the literature of 'adding value' through the entrepreneurial 'process' [13]. The business idea (for new gun control measures), certainly has social benefits and the concepts also has clear business potential. The process that was followed by the client was successful in that it took the idea to a 'proof of concept' stage that was of a quality that it reached the finals of the Entre' Competition and won the award for best sales pitch.

The 'proof of concept' stage being demonstrated through the completion of a CPIT BICT capstone project was successful from the viewpoint of the client and a means of actioning their entrepreneurial concept.

From the developer's perspective, it was also successful in that it was consistent with the Four Factor Model for Capstone Projects [26] as the product was able to be used for its intended purpose; the prototyping process was useful to both the developer and the client in terms of understanding the requirements; the product was of good quality as evidenced by the winning of the best sales pitch award and the developer gained employment; and the pedagogical benefits were evident in that the developer's learning through the entire process was evidenced in the final presentation and report completed.

The capstone project can also be evaluated against the Six Principle Model for Capstone Projects [30]. The first principle of Transition was particularly evident in that the student had to "deal successfully with uncertainty, complexity and change". The second principle of Closure was evident through the student's need to "integrate, synthesis and extend their learning", particularly when it came to learning new development frameworks. The third principle of Diversity was present in the need to interact with people from a variety of backgrounds including the client (from a commerce background) and the industry and academic supervisors. The fourth principle of Engagement was present in that the student needed to be actively engaged to have any chance of determining the client's requirements. The fifth principle of Assessment was present in the assessment criteria used for the BICT capstone project at CPIT which requires students to reflect on their performance. The sixth and final principle of Evaluation was present in that the student was required to interact on an ongoing basis with the academic supervisor, industry supervisor and other academic staff within the School of Computing at CPIT.

The decision that was made early on in the overall process to use a discovery prototyping methodology [27] proved to have been the correct decision as the final product could not have been envisaged and documented by the client at the outset of the overall process.

Given that the process proved to be valuable to both the client and the developer; and that the final product was of use to the client, the idea that projects should strike a balance between product and process [9, 7] was achieved.

5. CONCLUSIONS

The overall process, from the generation of the entrepreneurial idea, through to the development of a website following a prototyping methodology was a success from a number of perspectives, particularly from the point of view of the two students involved. One, the UC student (client) was able to further their entrepreneurial business idea and gain significant experience from taking it through to a 'proof of concept' stage and performing well in the Entre' Competition. The other, the CPIT student (developer) was able to complete the capstone project for their degree; learning significantly along the way, and gaining employment as a consequence. Therefore this was a very successful example of the entrepreneurship and capstone project nexus.

The three academic staff from across CPIT and UC all benefitted from the collaboration involved, and believe that such collaborative approaches across institutions should be encouraged in the future as they benefit the students involved primarily, but also the staff involved as well as the "added value" to society.

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