

A Research Focused Approach to Customer Discovery

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Abstract – Head injuries in football and bicycling highlight the severe disconnect between impact scenarios, injury biomechanics, standards and solutions for personal protective equipment. They also demonstrate the broader need for better methods in product development. This need is further illustrated in entrepreneurship, as the failure rate for product development is anywhere between 30 to 75%. To improve performance and reduce the failure rates of start-ups, new venture teams and nationally funded programs such as I-Corps adopted product development methods such as Lean Canvas and Customer Discovery. However, there are still challenges with these methodologies. Other than telling new venture teams to “get outside the building” and “listen,” there is limited training for developing questions and conducting interviews. As a result, shortcomings in both the personal protective equipment industry and product development in entrepreneurship demonstrate the need to understand the foundational elements of each, in a way that is grounded in research. The purpose of this case study is to address those shortcomings, identify areas for innovation and improve safety for athletes. The case study is grounded in qualitative research methods and is executed by implementing Customer Discovery. The application of the methodologies is expected to create a product development framework for entrepreneurs, implementing it with individuals that use bicycle helmets and bike industry personnel.

Index Terms – Bicycle helmets, case study, Customer Discovery, entrepreneurship, product development

INTRODUCTION

I. Product development challenges in personal protective equipment

Professional football exemplifies the highest profile case of industry inattention to the development of helmet standards. Until recently, helmets were designed to prevent skull fracture, with no emphasis on preventing rotational acceleration and concussion. Sadly, in 2011, the height of this controversy culminated with the suicides of two

football players who were suffering from degenerative brain disease as a result of repeated head impacts [1]. A development of national concern has been a more intensive evaluation of both the impacts that can cause concussion, as well as football helmet performance [2], [3].

Although the overall effects have not been as extensive, the professional bicycling world was demoralized by the suicide of Kelly Catlin, potentially linking back to a head injury she suffered the previous year [4]. Helmet use has been demonstrated to minimize the risk of severe head injury [5]; however, lower energy impacts, which are associated with concussion and are more common than high energy impacts, are not represented in current industry standards [6]. The personal protective equipment (PPE) industry has been slow to respond to update standards, so universities have become involved. In 2018, Virginia Tech developed a more rigorous testing method for bicycle helmets that focused on lower-level impacts and rotational acceleration, the forces widely believed to cause concussion [7]. The examples in football and bicycling highlight the severe disconnect between impact scenarios, injury biomechanics, standards and solutions for PPE.

II. Product development challenges in entrepreneurship

Head injuries in football and cycling also demonstrate the broader need for better methods in product development. Specifically to entrepreneurship, the need for better methods in product development is further illustrated as the failure rate is anywhere between 30 to 75%, depending on the context [8], [9]. The most popularized rate of startup failure is 75%, which appears in Steve Blank’s ubiquitously cited Harvard Business Review article, *Why the Lean Start-Up Changes Everything*. However, Brian Headd, an economist at the U.S. Small Business Administration found that after four years, 33% of new ventures closed and were unsuccessful, 17% of new ventures closed and were successful, and 50% of new ventures survived [10].

In response to the poor performance and failure rate of new ventures, the application of “the lean startup and customer discovery models... have become ubiquitous in startup culture, and have also become go-to methods for

state- and nationally-funded entrepreneurship programs” [11]. The most prominent nationally funded entrepreneurship program in academia is the National Science Foundation’s I-Corps. I-Corps boasts that from 2011 to 2017, 973 teams participated and produced over 320 companies, which would translate to a failure rate of 67% [12]. The point remains the same, “regardless of the exact percentage, current rhetoric implies that new product investments are extremely risky. New products can, and still do, fail,” [13] and developing new products that fail should be avoided when possible.

For teams participating in I-Corps, there is no clearly defined or consistent framework for developing questions or testing hypotheses [14], [15]. One study found that I-Corps bootcamps “provided remarkably little training about how to conduct effective interviews apart from ‘listen’ and ‘don’t talk about the product’” [16]. The challenge of no clearly defined framework is also true for new venture teams outside of I-Corps. Startup literature lacks an “explicit grounding in previous scholarly tradition” [17]. The application of the technique is not grounded in research, so it “has been determined that rigorous analysis of the academic antecedents of LS (Lean Startup) may provide important insights about its implementation challenges, as well as its merits and shortcomings” [17].

CUSTOMER DISCOVERY AND PROBLEM INTERVIEW OVERVIEW

For primary research for product development, qualitative data is collected through the Customer Discovery Process, which involves interviewing both end users and customers. Customer Discovery is a systematic process to establish rationale for product development [18]. There are many different activities and segments of people that use helmets, even within bicycling. Customer Discovery is the catalyst for down selection, identifying what customer pain point to solve, who to solve it for, and how to solve it. The process relies on three series of interviews: Problem Interviews, Confirmation Interviews and Solution Interviews [19], [20].

The Problem Interviews are the first step to developing questions and testing hypotheses, the primary tools for discovering the foundational elements of product development in entrepreneurship [20]. Through the Problem Interviews, the goal is to ask “why?” and “how?” until assumptions cannot be deduced any further [21]. From those foundational assumptions, additional principles may follow that reflect how expert designers view those principles in relation to other stakeholders [22]. Asking these questions is a continual process.

Finding a problem from the interviews is a task that requires interpretation and discernment from myself, the researcher. The reason for this is, the word, “problem” is ambiguous, contextual and application specific. During the

interview process, I (the lead author) knew I was looking for a problem, however, I did not fully understand what that really meant. I knew that I, the interviewer, should not intentionally or unintentionally lead a participant to describing a problem during the interview. Also, the problem should be one the participant can clearly identify, articulate, and has the potential to drive product development. So, for the Problem Interviews, when a theme around a problem began to emerge from participants’ answers, I operationally defined that specific problem in order to systematically and consistently identify a problem the end user is describing.

The definition of a problem was divided into three different categories: *Severe Problems*, *Major Problems* and *Minor Issues*. For the purposes of this project, the problem categories were defined as the following:

Severe Problems: an event or circumstance that is deemed negatively by the participant being interviewed, where the result is a significant behavior change compared to the established norm. In addition, there are considerable amounts of frustration expressed.

Major Problems: an event that is similar to a Severe Problem, as there is a significant behavior change with considerable amounts of frustration expressed, however there is some outlier which disqualifies them from having a Severe Problem. An outlier could be they found an adequate solution on the second or third try.

Minor Issues: an event or circumstance that is deemed negatively, however there is no resulting behavior change or frustration expressed.

An important consideration is that despite defining Severe Problems, Major Problems and Minor Issues, there is still subjectivity in how I interpret each participant’s response.

METHODS

The Problem Interviews, as the first step in the process, are the focus of this paper. The process involves deconstructing an initial product idea into the three riskiest aspects of a new venture, the Product risk (Problem), Market risk (Existing Alternatives) and Customer risk (Customer Segments) Hypotheses. The initial product idea was a safer bicycle helmet through 3D printed structures for Professional and Semiprofessional Male Mountain Bikers. The Problem Interview questions were developed, participants were solicited and the interviews were conducted.

For this initial set of interviews, I recorded, transcribed and coded the interviews, following an approved IRB

Protocol. The interviews were coded to categorize themes and analyze the information. This approach required some subjective judgement by me, the researcher, as answers from the open-ended questions allow for variation between participants.

I. Deconstructing an idea to Product risk (Problem), Market risk (Existing Alternatives) and Customer risk (Customer Segments) Hypotheses

To begin, I started with an initial product idea of a safer helmet through 3D printed structures for professional and semiprofessional athletes, which is shown in Figure 1. The reasons for selecting this initial idea are that issues with injury have been identified in mountain biking and that it is a sport that involves a higher risk of injury for concussion compared to most activities of daily living [23]. Furthermore, that risk of injury does not decline with experience and there is equal prevalence in injuries for elite and amateur athletes [24]. I initially anticipated that elite athletes would be in a better position or more willing to purchase a high-end solution with additional safety features. Also, there are limitations with helmet design, as studies have shown that the areas impacted most often are not represented in the CPSC-specified testable area [7]. In addition, helmets have been found to perform inconsistently between test standards and real world conditions [7]. Unfortunately, these deficiencies in helmet design affect helmet safety and can put the rider at risk. Finally, at the time of this initial idea, in the Fall of 2018, helmets that incorporated structure based thermoplastic liners, such as Koroyd and Wavacel were considered to be some of the safest helmets on the market [7], [25], [26].

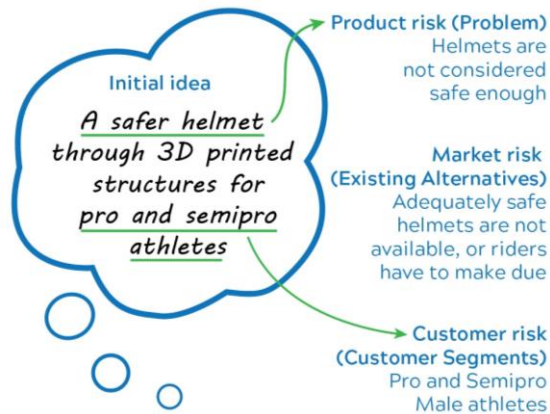


FIGURE 1. DECONSTRUCTION OF THE INITIAL IDEA INTO PRODUCT RISK, MARKET RISK AND CUSTOMER RISK HYPOTHESES.

II. Initial Hypotheses

For Customer Discovery, my co-chairs and I developed three hypotheses to identify and explore the pain points end users are experiencing in relation to risks associated with product development.

Product Risk (Problem) Hypothesis: Safety is a primary concern for the majority of users. Product risk (*Problem*) focuses on the Severe Problem trying to be solved. We chose safety as the Product risk (*Problem*), as it has been identified that most companies design PPE to the industry safety standard, as opposed to designing to real world scenarios that the end user experiences.

Market Risk (Existing Alternatives) Hypothesis: There are an inadequate number of helmets with adequate safety features for users who require a high level of safety for their individual sport. Market risk (*Existing Alternatives*) focuses on how customers currently solve product needs. We chose to focus on available safety features in currently available mountain biking helmets.

Customer Risk (Customer Segments) Hypothesis: Pro/Semipro Male Mountain Bikers are a viable user segment. Customer risk (*Customer Segments*) focuses on identifying a viable customer segment or market. We chose this user group as they have the highest level of experience and expertise regarding bicycling and safety. In addition, they also represent the user group that will be impacted by future development of safety equipment for mountain biking.

For this first set of Problem Interviews, our goal is to find out if safety is a Severe Problem, or if current safety features and product offerings fulfill the needs of Pro and Semipro Male Mountain Bikers. Understanding this question better will serve as an initial indicator for viability.

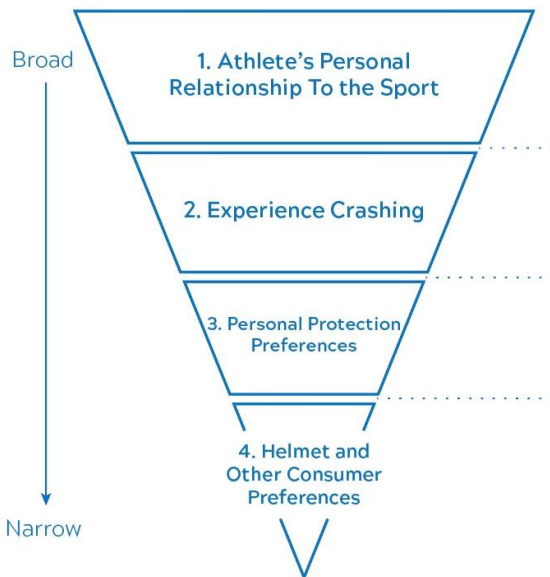
III. Interview Process

In the Fall of 2018, participants were identified through the US Cycling National Racing Results web page, with a total of 55 identified end users [27]. Next, individuals were contacted through social media, including Instagram and Facebook. After making initial contact, I followed up with additional study information and set up a time to conduct the interview if the individual was interested. A total of 31 athletes responded and 16 interviews were completed.

The interviews were conducted over the phone and recorded with a digital recorder. Recording the interviews over the phone allowed me to fully engage in the interview to appropriately ask follow up questions, without having to focus on writing down every response. Some real time observations were written down during the interview to capture immediate feedback. Each interview was transcribed. During the transcription process I identified Severe Problems, Major Problems and Minor Issues that were expressed by the participant, which reflected our

themes, as well as found new and unexpected themes expressed by end users.

The Problem Interview questions were developed to challenge and support my initial hypotheses, as well as determine Severe Problems the end user can identify and express. Interview questions focused on the athlete's personal relationship with the sport, experience crashing, personal protective equipment they use, preferences in regards to helmets and general consumer purchasing habits, as shown in Figure 2. Open-ended questions were asked to prevent leading the participants to answers that supported the hypotheses. The interview questions were developed to understand the broader goal of why they participated in the activity and then narrow the questions to challenge and support the hypotheses described in Section II of Methods. Organizing the questions in this way helps determine how top of mind Severe Problems, Major Problems and Minor Issues were in relation to the goal of the rider, compared to specific questions about their helmet. It should be noted that this system is not perfect as participants sometimes forget details or remember pain points at different times during the interview.



Interview Questions

1. Why do you ride, what does it mean to you?
 - Any likes or dislikes?
 - How would you describe your riding style?
 - Hit every feature? If you don't crash you weren't riding hard enough? et cetera...

2. Can you tell me about a time you've crashed?
 - What's the hardest you've crashed?
 - What were some of the injuries?
 - If you hit your head, any head injuries?

3. What's some of the protective equipment that you use?
 - Any likes or dislikes?
 - Any modifications that you or someone else has made?

4. Can you tell me about your helmet? What are some of your likes and dislikes right now? Why did you pick it?

- What were some of the helmets you tried? What were your likes and dislikes?
- Why MIPS?

-How did you get your helmet?

- Internet? Sponsorship? Pro Discount? Equipment manager? Recommendation?

-Is there anything about your helmet you'd like to change?

- Can you tell me about various seasonal use? Hot? Cold?
- High speeds vs. Low speeds?
- Same helmet for different applications?
- How was safety a factor when considering a helmet?

-How often do you get a new helmet?

-How many helmets do you own right now?

-How are you determining, is your helmet safe for you?

FIGURE 2. PROBLEM INTERVIEW QUESTIONS.

Sixteen interviews were completed with interview times ranging from 10 to 30 minutes. For this initial set of interviews, I coded the interviews with the qualitative research software Nvivo. During the coding process, I went through the transcribed interviews and found relevant phrases that fit themes, specific to our risk hypotheses, for scaling customer acquisition, as well as identified new themes that were unexpected. This approach requires some subjective judgment by me, the researcher, as answers from the open-ended questions allow for variation between participants and require some interpretation.

RESULTS

For Product risk (Problem), 9 of the 16 riders experienced some form of head injury and that 11 of the 16 riders care about new technologies, such as MIPS (a rotational acceleration mitigating liner), that will help keep them safe. This finding led me to believe that safety is a concern for riders. It is interesting that safety standards were referred to as the second leading response, considering safety standards have not been designed to real world scenarios [7]. The findings identified only one Severe Problem from an athlete. He received free helmets through a product sponsorship, yet he purchased his own trail helmet, because it had more coverage and he perceived it as safer.

For Market risk (Existing Alternatives), only 2 of the 16 riders had strong dislikes with their current helmet. Outside of that, sporadic issues were identified surrounding buckles, sweat drip, equipment being hot, preference for more safety features, straps and bulkiness. The initial findings show that the helmet industry has matured, with very streamlined product offerings, where most end users within this market segment are happy with what is currently available.

For Customer risk (Customer Segments), 13 of the 16 riders received their helmets for free through product sponsorship. Although Professional and Semiprofessional

Male Mountain Bikers may be the appropriate end user, they are not the appropriate customer because few actually purchase their equipment.

DISCUSSION

From the initial set of interviews, only one Severe Problem was found. The Severe Problem was the behavior change from the rider who received free helmets through a product sponsorship, yet purchased a different helmet which had more coverage. So, we determined that this group of hypotheses was not a strong enough indicator for viability to continue to the next step, the Confirmation Interviews. My co-chairs and I discussed the results and decided to pivot. We decided to change one of the initial three hypotheses based on the Product risk (Problem), Market risk (Existing Alternatives) and Customer risk (Customer Segments). By pivoting and delaying the transition to product development, we mitigated inventor’s bias and reduced opportunity costs: we did not spend resources, namely time and money, developing a safer 3D printed helmet for a user segment where there was no demand. It should be noted that pivoting is an exploratory process and does not guarantee success for finding a Severe Problem that can drive new product development [28].

Another important consideration for pivoting is beginning with a heuristic known in the business community called, First Who, Then What [29]. A successful pivot begins by having the right people in the room that will foster a positive environment for trying out new ideas and introducing new assumptions to explore. For my research the right people involved my co-chairs and myself during our bi-weekly meetings. For each pivot, we only changed one assumption, as shown in Figure 3:



FIGURE 3. PIVOTING BETWEEN RISK HYPOTHESES.

For this first pivot, we pivoted the Customer risk (Customer Segments) Hypothesis to Pro and Semipro Female Mountain Bikers. Data suggests females have lower injury tolerances and are more susceptible to injury than males [31], [32]. As we pivoted, we tried to focus on one pivot at a time, however there was some occasional overlap.

For product development in entrepreneurship, there are better ways to finding a problem that has the potential to drive product development than ‘listen’ and ‘don’t talk about the product.’ Applying qualitative research methods allows one to iteratively and methodically, establish where you are with your idea, then examine the riskiest parts for acting on that initial idea. By starting with broad questions and narrowing them down to the specifics of the problem you want to learn about, you are learning:

1. If the participant or potential customer is able to identify and articulate that problem.
2. How severe the problem is to them as a potential driver for product development.
3. Where the problem is in relation to the goal of the individual. For example, people do not bike to wear bike helmets, they bike for fun and enjoyment.

Professional communication and user experience design have well developed research methodologies. Customer Discovery will benefit by:

Iterating on the applied research methods.

Interviews are a method of collecting primary data in user experience design and professional communication. However, interview methods are generalized and do not address a specific area of inquiry, like product development in entrepreneurship. Applying the methods in this paper allows others to build upon, iterate and introduce other methods of discovery in a way that’s grounded in research.

Data analysis. Data analysis is a contextual and application specific process in user experience design and professional communication. Although approaches are well developed, applying specific methods for open coding and template coding have not been applied to Customer Discovery in a way that is grounded in research. Applying data analysis methods to Customer Discovery could benefit future entrepreneurs, as they navigate which information is most valuable for determining the initial viability of a new venture.

CONCLUSION

Head injuries in football and bicycling highlight the severe disconnect between impact scenarios, injury biomechanics, standards and solutions for PPE. In addition, failure rates for product development in entrepreneurship demonstrate the need for better methods in product development. However, despite these challenges for nationally funded programs like NSF I-Corps and new

venture teams outside of such programs, there is little training for how to develop questions, conduct interviews and analyze the data.

Starting with an idea for a 3D printed helmet for Pro and Semipro Male Mountain Bikers, I applied a research focused approach to Customer Discovery. From the interviews I determined that there were no initial indicators for viability. As a result, through a collaborative discussion between my co-chairs and I, we pivoted to Pro and Semipro Female Mountain bikers.

Applying qualitative research methods to Customer Discovery acts as a starting point for establishing best practices for Customer Discovery. In addition, it provides entrepreneurs with a foundation for breaking down an initial idea, developing questions, conducting interviews and analyzing the data.

NEXT STEPS

Once a Severe Problem is found, one that results in a significant behavior change from the end user, Customer Discovery will continue through Confirmation Interviews and Brainstorming Sessions, serving two roles. The first role is to confirm the Severe Problem is understood. The second role is to explore the solution space with end users who have experienced the Severe Problem. Confirming the Severe Problem and brainstorming solutions with end users will help to gauge problem/solution fit. The combination of Problems Interviews and the Confirmations Interviews/Group Brainstorming Sessions will help answer the question, is this an opportunity that should be pursued?

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