CASE STUDY PROTOCOL
Prototyping Practices in SW Startups

Elizabeth Bjarnason

Goals and Research Questions

As part of our research project on *Effective Business Prototyping (ELLIIT)*, we want to investigate how new and small businesses currently use prototyping for RE purposes, i.e. to validate and generate innovative business ideas, and to communicate with external stakeholders such as investors and customers. We want to explore and understand the current prototyping practices within software startups, including possible variations in practices due to differences in business, organisation and product characteristics, e.g. regarding business domain, degree of maturity, customer characteristics etc.. The long-term goal and motivation for this research is to enhance software startups' ability to use prototyping to test business ideas early on to validate their viability in the market, and thereby focus on developing (only) successful software solutions and thus enable a more effective use of the scarce time and resources available to them.

This case study will be exploratory and aims at understanding the current situation and practices among software startups, by investigating the following research questions:

RQ1. How do software startups use prototyping for requirement engineering of new product ideas, i.e. for eliciting, validating and communicating requirements externally and internally?

RQ2. How do software start-ups reason about the cost-benefit balance for prototyping?

RQ3. What other factors influence software start-ups use of prototyping?

Research Method

We investigate start-ups use of prototyping for RE through a multi-case study of software startup companies. An interview guide was designed based on the research questions and on previous knowledge of prototyping and of product and organisational characteristics.

A systematic and theory-based approach will be applied in designing the study, and in analysing the empirical data. The long-term aim is to generate new theories and practical guidelines and recommendations for start-ups use of prototyping for requirements engineering.

The case study will be performed in an iterative fashion, starting with a broad set of interview questions and a smaller set of interviews (4-6). In a second iteration, the study will be expanded to more companies and the interview guide revised to enable more focused investigations of practices and factors found to be relevant. In subsequent iterations, we might choose to perform a questionnaire to capture a broader population of software startups, and/or observations/doc studies of specific start-ups to provide indepth insights.

Interviewees: Ideally 2-3 people per company are interviewed covering both business and technology/development aspects/roles. Since startups are small, this may not always be feasible.

Case sampling: Software startups will be recruited via local incubators including *Minc/Fast Track Malmo, Venturelab, SmiLe Incubator, Ideon Innovation, HETCH*

Interview Guide

The interviews will consist of the following main parts:
  1) introduction of study, researcher and interviewee
  2) characteristics and current status of startup
  3) RE practices – who and how are ideas and requirements identified, validated and communicated
  4) Prototyping practices – what, why and how is prototyping used to identify, validate and communicate ideas and requirements
  5) what should research look into?

1) Interview introduction – 10 min

  a) Present the study (purpose and time frame), main researcher, policy for NDA / confidentiality. GDPR paper, recording etc

  b) Interviewee presentation: current role, main area of expertise, #years at startup/in field, current and previous experience of startup ventures

2) Contextual characteristics [Business & Tech] – 10 min

- **Company/startup**: company origin/history, age (years), size (employees, teams)
- **Product**: domain, type of VP [SW-based product, content, service, experiences, user data [5]]
- **[B]**[1] **Business model**: customer type (market/bespoke, B2B), revenue model, channels
- [B] Show model of **start-up life-cycle maturity** [3]
    o   What stage and status are you currently in?
    o   Describe current main focus and goals for
        ▪   product development (ideation, building, variations)
        ▪   marketing/growth
        ▪   operations & customer support
    o   What stages & status have you been through?
- [B] Startup challenges & characteristics (based on [1] and [2], grouped by Time & Resources, Business vs Technology focus, Organisation)
    •   How does your startup relate to these, for each category?

3) RE practices – 10 min

For your current stage:

  ▪   **What are your main requirements sources**: internal/external, Tech/Business focus?
  ▪   **Do you currently have any software development?** Development model (agile, traditional, hybrid), Size (#engineers & teams)
  ▪   **How do you do handle the following?** Techniques based on [3] and [4] as checklist
      - **Elicitation**
      - **Validation**
      - **Communication of ideas & requirements** (primarily externally to customers and sponsors/investors)

---

[1] Questions primarily for interviewees with the business perspective

4) Prototyping – 25 min

What does prototyping mean to you? Simple sketches, mock-ups, mvps

Describe how you use prototyping, in what stages, for what purposes, with what scope and how.

Present our prototyping aspects model.

How do you relate to each aspect in your prototyping practices**:**

- Purpose
- Scope of prototype
- Use of prototype: review method, environment.
- Strategy for handling uncertainties

How do you reason concerning the cost-benefit balance for prototyping?

Do you use any tools for prototyping?

Does your prototyping approach vary, if so how and why?
   - for different purposes, such as eliciting, validating and communicating?
   - for different stakeholders?
   - due to different points-in time, e.g. as your start-up matures?

5) Future work – 5 min
- What would you like to improve around prototyping in your startup?
- What topics/areas/questions/problems within prototyping would you as a startup want research to address & investigate?

References

1. Berg, V. et al.: Software startup engineering: A systematic mapping study. J. Syst. Softw. 144, 255–274 (2018). https://doi.org/10.1016/j.jss.2018.06.043.
2. Giardino, C. et al.: Key Challenges in Early-Stage Software Startups. In: Lassenius, C. et al. (eds.) Agile Processes in Software Engineering and Extreme Programming. pp. 52–63 Springer International Publishing, Cham (2015). https://doi.org/10.1007/978-3-319-18612-2_5.
3. Klotins, E. et al.: A progression model of software engineering goals, challenges, and practices in start-ups. IEEE Trans. Softw. Eng. 1–1 (2019). https://doi.org/10.1109/TSE.2019.2900213.
4. Lauesen, S.: Software Requirements. Styles and Techniques. Addison Wesley (2002).
5. Teece, D.J.: Business Models, Business Strategy and Innovation. Long Range Plann. 43, 2, 172–194 (2010). https://doi.org/10.1016/j.lrp.2009.07.003.