# A Dynamic Software Startup Competency Model

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**Abstract.** Current literature suggests that engineering activities of software engineering and software startup engineering differ. Thus, there is the need to elicit competencies specific for software startup engineering. This paper proposes a model that provides the various types of competencies and their respective relevance at the various stages of software startup evolution.

**Keywords:** Startups, Innovation, startup engineering, startup evolution

## 1 Introduction

The competency of startuppers and developers are ingredients for software startup success. Especially, how their competency needs addresses specific challenges of software startups [1]. Software startups are new companies with no operating history that produces cutting-edge technologies at extremely fast pace. Hence, there is the need for such startups to possess unique competencies that will propagate them to survive a competitive business environment. These competencies are the knowledge, skills and attitudes that a developer require to accomplish a software project. Due to lack of methods and frameworks for guiding the establishment and operations of startups, developers adopt ad hoc methods for starting ups and these mostly leads to failures [2].

Some attempts have been made to provide frameworks and methods to guide startups, but they have mainly focused on challenges, characteristics and growth [7]. Yet, competency needs have been identified a key issue in all successful startups. Consequently, it has become imperative to identify the key competencies required for successful startups. This study therefore reports initial findings of a research activity that seeks to expand existing work by [6].

## 2 Problems of software startup competency model

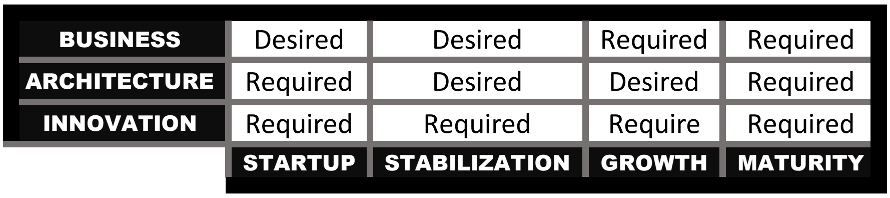
Although software startups appear promising by creating jobs, innovation and digital disruptions, its failure rate is discouraging. Over 60 % of startups fail within the first 5 years [7]. This may be attributed to issues including, technology uncertainty, lack of problem or solution fit, neglected learning process, lack of resources, etc. Currently, existing startup competency models are static and address issues such as personnel experience, limited resources, and dependency on external parties. They fail to adequately address the dynamic nature of startups [8].

There are six (6) human capital areas that must be considered in startups[6]. These areas are application domain, software development, hardware development, mechanic development, systematic development, and difficult technology domain. The six areas can be acquired using nine (9) means (i.e. founder' experience, other products, prototyping and testing, customer cooperation, research, experience team growth, and unconventional team growth). This argument was derived from fundamental principles in human capital theory [9] and resource-based-view [10] in existing literature. Seppänen et al [6] explained that human capital (competency needs) evolves as startups grow and thus calls for the need for competency needs models to be dynamic. Yet, studies that seek to understand the variables of human capital, particularly regarding software competencies fail to address questions on issues such as (i) what types of competencies (human capital) are required for successful startups, and (ii) what required levels of competencies are needed to ensure a successful startup as it goes through the different evolutionary stages.

## 3 A software competence framework

In this study, it is argued that existing software competencies can be classified into three (3) main types. These are architecture competency, innovation competency and business competency. Innovation competency is perhaps the most important of all. It is a set of skills, attitude and knowledge possessed by startup professionals that enable them to translate ideas into product or service for money. It includes creative thinking, problem solving ability, visionary thinking and empathy. It can be observed that without any form of innovation, a startup does not exist. Architecture competency is the set of fundamental software and hardware related skills and knowledge that a startup professional need during a startup creation. They include competencies in programing language, database developing skills, networking skills, application framework skills, electronic and machine skills. These set of competencies are relevant because they provide the foundation upon which a startup can be initiated. There is a need for strong understanding of knowledge in the tools needed for converting the innovative idea into a reality. Although competencies in innovation (i.e. having a groundbreaking idea or concept), and architecture (having the prerequisite knowledge and skillset of hardware and software tools for converting an idea into a product or a service) is necessary, it is not sufficient for establishing a startup to maturity. Competency in business is required to ensure a successful transition from one stage to the other within a startup lifecycle. Business competency is the set of interpersonal knowledge and skills required by a startup professional to ensure that groundbreaking ideas are converted into matured businesses. These skills may include organizational skills, teamwork, leadership skills, communication skills, social skills, etc.

The relevance of these competencies (i.e. architecture, innovation, and business) differ as startup’s evolve. Hence a particular competency may be classified as desired or required at a stage. Desire competencies are not urgent as compared to required competencies. They add value, however without their presence, a startup can survive. They are therefore not mandatory. A required competency is mandatory and without their presence a particular task cannot be performed. As compared to desired competency, it is the backbone need and the lifeline at a particular stage within the lifecycle.



|  | STARTUP | STABILIZATION | GROWTH | MATURITY |
|---|---|---|---|---|
| BUSINESS | Desired | Desired | Required | Required |
| ARCHITECTURE | Required | Desired | Desired | Required |
| INNOVATION | Required | Required | Require | Required |

**Fig. 1.** Startup evolutionary competency Model

The Crowne [11] startup lifecycle model consist of four (4) main stages namely; startup, stabilization, growth and maturity. At the startup stage the product or service is still at the conceptualization state thus, innovation and architecture competencies are required whereas business competency is desired. Without a groundbreaking idea (innovation) a startup does not exist and for this idea to be realize as a product or service there is the need to have knowledge and skills in software and hardware tools.

Architecture competency is also a requirement. However, business competency is desirable at the first stage since the concepts and ideas can be improved at this stage without expert knowledge in business. As the startup progresses to stabilization, the relevance of architecture reduces whereas innovation remains “required”. At the growth stage the ability to make the product or service a leading-edge is crucial. Thus, innovation and business competencies become required whilst architecture is a desire. Figure 1 represent the various stages in the lifecycle and their respective levels of need.

## 4 Discussions and Conclusion

The lifecycle of successful startups such as Facebook, Google, SpaceX, etc. can all be identified with these stages. They started as groundbreaking ideas and have been developed into full businesses.  At the various levels, they focused and also exhibited different competencies. For instance, the founder of Facebook had programming competence (architecture) and a groundbreaking idea (innovation). The development of Facemash demonstrates that business competency was not a requirement at the startup stage. At stabilization, Facemash was used by student hence innovation was required to make it user friendly. At growth stage, additional users who were non-students joined. Thus, the need for business competency. Facebook started an initial public offering (IPO) and also found itself mingled in some legal issues. In addition, experienced market giants such as PayPal, Peter Thiel, joined Facebook. This confirms the assertion that there is a need for competencies in business and innovation at the growth stage. The maturity stage saw Facebook scaling into a large business industry and at this stage they demonstrated strong competencies in business, innovation and architecture. They hired more developers to enhance their architecture competence, they continued to innovate and added more features. They also put in place proper business structures.

From the above scenario, it can be observed that the classification of the various levels and relevance of competencies provide a thinking framework for both researchers and practitioners on how software startups can be managed through the lifecycle to achieve success. As argued earlier, successful software startups need competency models that are dynamic and capable of withstanding the extreme nature of startup lifecycle. This model therefore serves as a guide for practitioners and researchers to structure their thinking on the immature and volatile evolving environments of startups. Further studies need to be conducted to validate the efficacy of the proposed framework.

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