ON THE HIGH-TECH STARTUP LIFECYCLE MODEL AND THE PROGRESS METRICS

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Abstract: The paper argues that the analogy between project management methodology and lean start-up methodology could be used for knowledge transfer to accelerate learning, could be also used to better conceptualize high tech entrepreneurship, define and organize start-up process groups.

A framework for mapping the concepts is proposed and, based on the assumption that only causal constraints must be used when deciding the process order, start-up process groups are identified as Innovative Idea, Innovative Product and Innovative Business Model. For each of the Process Groups, actionable, quantitative measurements are identified and proposed to assess the maturity of the innovative idea, the value of the innovative product and the business model creativity.

The paper is descriptive but also exploratory and considers both qualitative and quantitative aspects.

Keywords: digital innovation, start-up model, maturity metrics

Introduction

Digital innovation and high tech entrepreneurship represent the key to the development of an entrepreneurial economy (complementary to industrial economy) and long lasting prosperity in every community [1]. Over the last years it has become clear, that a university educational model which stimulates digital innovation and a university-based entrepreneurship ecosystem can provide the most effective and supportive context in which entrepreneurship and innovation can thrive [2] and supports high-tech entrepreneurs to transform their ideas into products or services.

In this vision, there are two groups of questions in search of correct answers and as digital innovation like high tech entrepreneurships is not "science" but "practice" the general concepts within which we operate are: "body of knowledge", "good practices", "methodology" and "models".

The first group of questions is related to the body of knowledge and the good practices in promoting digital innovation and high tech entrepreneurship in higher education:

1. What are the best practices to develop a university-based entrepreneurship ecosystem [10], to optimize the journey from idea to established and profitable business, to provide mentorship and provide the guidance for innovative ideas, to incubate digital innovation and accelerate the transformation of ideas into products and services, to provide a permanent and effective link with industry?
2. How to practice and stimulate digital innovation via systematic and replicable methods [11]

The second group of questions is related to understanding and modeling the processes of a high tech start-up during its lifecycle. The difficulty arises from the fact that high tech

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startups are technological and economical complex systems, far from a simplified version of a mature company. So far, the processes inside a start-up system during its lifecycle has not been formally modeled despite several attempts [6,7,8,9] which led to a widely used methodology [18] (The Lean Start-up Methodology) based on the concepts introduced by the ontology of Alexander Osterwalder [19, 20].

Let's start by making the observation that difference between a manager and an entrepreneur is that the first is involved in *on-going activity* (executing business model processes) while the second is involved in a project whose deliverables are: an innovative idea, an innovative product/service and an innovative business model.

The research questions are:

3. Is IT project management methodology suitable to describe the processes of a high-tech start-up?
4. What are the appropriate measurements we should use to assess the progress during the "start-up" project?

The paper argues that the analogy between project management methodology and lean start-up methodology could be made and used for knowledge transfer to accelerate learning, to better conceptualize, define and organize high tech entrepreneurship activities.

The paper is descriptive but also exploratory and considers both qualitative and quantitative aspects.

Conceptual framework

The methodology used includes literature review, structured interviews (quantitative) with experts, semi-structured interviews (qualitative) with entrepreneurs and direct observations during mentoring activities. For qualitative data, triangulation approach towards data collection was used.

The model was informally tested during entrepreneurial events (Startup Weekend).

A model embodies a theory and the analogy (theory) we propose is based on the following assumptions.

Hypothesis 1 Project management methodology is suitable to formally describe the processes of turning an innovative idea into a product or service, i.e. the processes which lead to the creation of a scalable start-up.

This hypothesis is based on the observation that while a business manager executes on-going work, a high tech entrepreneur goal is to develop an innovative idea, an innovative product and an innovative business model (*project deliverables*), in a given period of time (estimated time to market) and on a given budget, which are the three constraints which define the *project* concept.

Based on this hypothesis one can derive Product/Service Breakdown Structure (PBS) for the *start-up project*. Based on hypothesis 1 we can state:

Proposition 1.1 IT Project Management Methodology can be mapped with Lean Start-up Methodology

This proposition insures the flexibility needed in mapping the concepts.

At high level, we assume that the start-up process is a causal connection between three subprojects, named here process groups (Fig.1)

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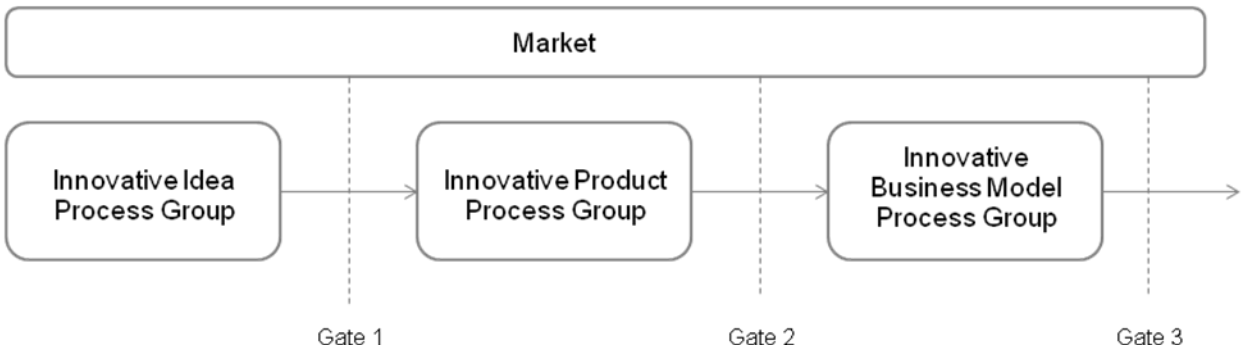


Figure 1The first three process groups of a start-up seen as a project

Proposition 1.2 For a start-up, the process groups manifest simultaneously causal, discretionary and resource constraints.

The causal constraint is the most important one meaning that is a waste of resources to start building the product before we proved that the idea is worth investing time, resources and effort.

The discretionary constraint is usually used by young entrepreneurs to start working on the business model before making sure the start-up has something of value to offer.

The resource constraint is also an issue, because the funding teams of start-ups are very small. The proposed model assumes all necessary resources are available.

Proposition 1.3 Only the causal constraint must be used when deciding the process order.

This proposition ensures that the logical order is preserved when prioritizing work packages.

Hypothesis 2 The criteria to pass a Gate are additive, meaning that in order for the start-up project to pass Gate 2, both Gate 1 and Gate 2 criteria must be met and in order to pass Gate 3, all gates criteria must be simultaneously met (Fig 3).

This hypothesis is based on the observation that to be scalable (at the end of the third process group, Fig 2), start-up must have simultaneously all conditions met.

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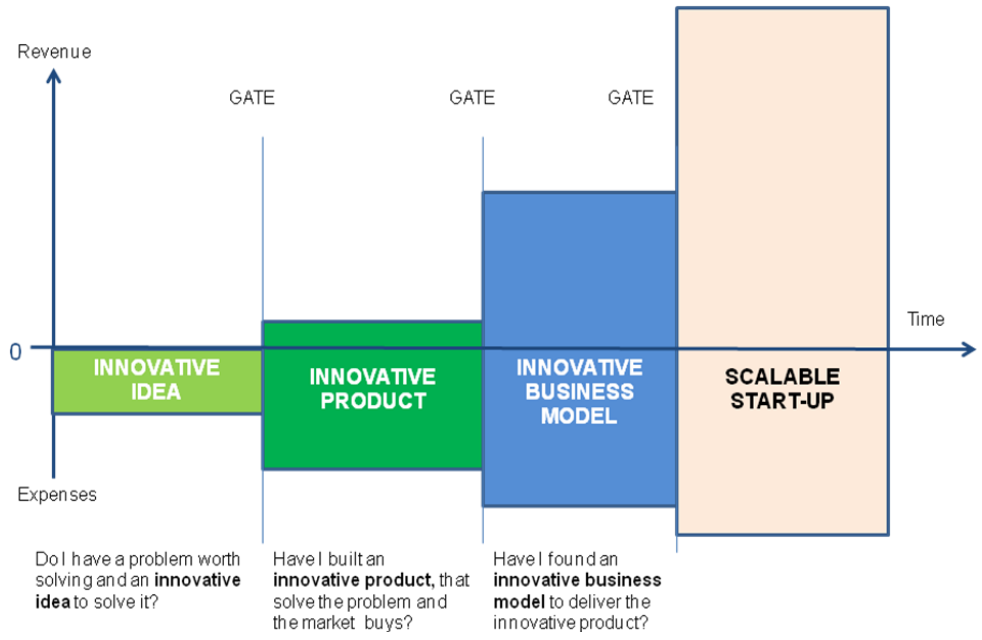


Figure 2Start-up Lifecycle

Hypothesis 3 The criteria to pass from one process group to another must be both quantitative, answering the question ***what happened*** *and qualitative, answering the question* ***why it happened****.*

This hypothesis is necessary to make sure that not only we can answer through quantitative measurements to the question what happened but we can also understand correctly why it happened and take corrective actions.

Hypothesis 4 Quantitative and qualitative measurements must be based on actionable, independent variables.

Firstly, this hypothesis ensures that no vanity metrics are used to assess the progress; secondly, that variables used to assess the progress of a process does not depend on a *causal dependent process*.

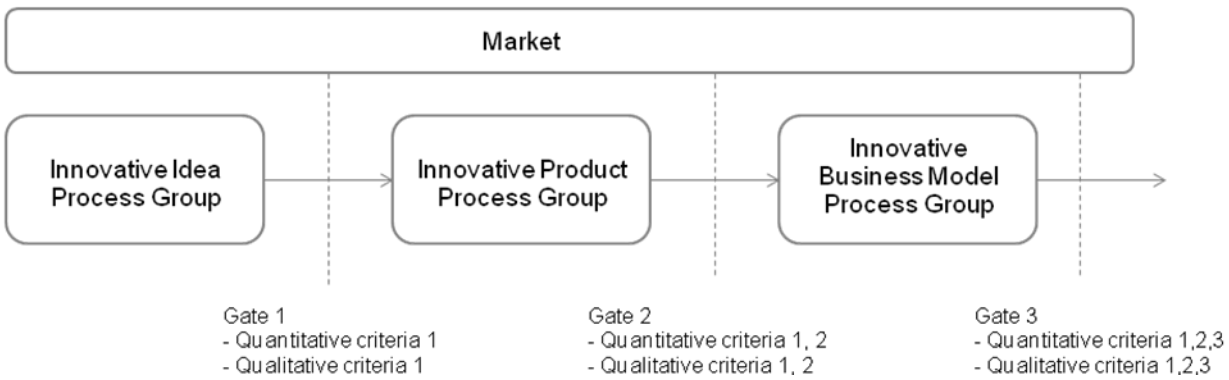


Figure 3 Additive deliverable acceptance criteria

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Actionable, Independent, Quantitative Measurements

A way to evaluate the maturity of an innovative idea is proposed by Josh Kaufman [26] who suggests a comparative scaling technique to answer the following questions with numbers representing degrees of attractiveness from 10 (extremely attractive) to 0 (extremely un-attractive)

Innovative Idea Gate Criteria	**Independent Variables**
Urgency to solve the real, relevant problem/need	Urgency (0-10)
How many people are presently buying similar things	Market Size (0-10)
How much it typically costs	Pricing Potential (0-10)
How much would cost you to make a sale	Cost of Customer Acquisition (0-10)
How much effort and money would it cost to create and deliver	Cost of Value Delivery (0-10)
How unique is your offer	Uniqueness of Offer (0-10)
How quickly you can create it	Speed to Market (0-10)
How much you need to invest before you sell	Up-front Investment (0-10)
Can you make secondary offers after they buy	Up-sell Potential (0-10)
How much work to continue selling after the initial sell	Evergreen Potential (0-10)

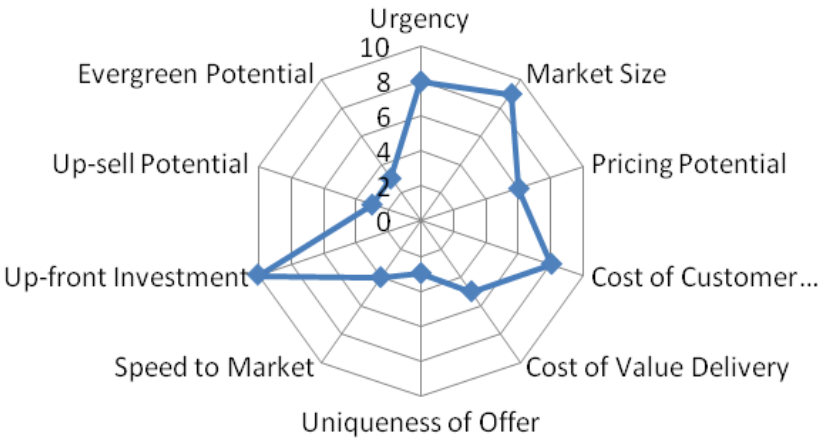
The metrics could be used to compare the maturity of two ideas but also, based on an empiric calibration, to assess the maturity of an innovative idea suitable for a product/service of a high-tech start-up. E.g [26]

Bellow 50 -> Move to another innovative idea or another problem or need to solve/alleviate

Above 75 -> Very promising

Between 50 and 75 -> has potential but requires huge investment, time, energy and resources

Hypothesis 2 propagates the criteria to the next gate and in time the values assigned to these variables might change. It is useful therefore to visualize all variables when making a decision, e.g. using spider visualization.



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The product/service Gate is the most important one as the whole start-up strategy is based on its perceived value. Most economists have accepted that the only meaningful concept of value arises from the interaction of demand and supply in markets [4]
The deliverable of the Innovative Product Process group is Minimum Viable Product, (MVP), an implementation of the Innovative Idea which presents "the smallest number of benefits necessary to produce a sale"[26]

The value formula:
Product Value = (perceived economic values)/cost
According to Kauffman [26], there are nine common economic values that people consider when buying a product/service:

Product Gate Criteria	**Independent Variables**
How well does it work	Efficacy/Quality
How quickly does it work	Speed
can I rely on its functionality	Reliability
How much effort to learn to use it	Ease of use
How many other functions next to the fundamental function	Flexibility
How other affects how others perceive me	Status
How aesthetically pleasing it is	Aesthetic Appeal
How does it make me feel	Emotional impact
How much to give to get it	Cost

Efficacy is the most important characteristic as people buy a product/service to fulfill the basic function (at minimum cost) and appreciate the secondary functions as product/service differentiator.
Kevin Maney [3] reduces these characteristics to two variables: *convenience* and *fidelity.*
Products/services that manifest high *Speed, Reliability, Ease of use* and *Flexibility* are *Convenient.*
Products/services that manifest *Efficacy, Aesthetic Appeal, Emotional Impact* and *Status* are *High Fidelity.*
Thus we can assess an Innovative Product using only three variables: *Convenience, Fidelity and Price.*

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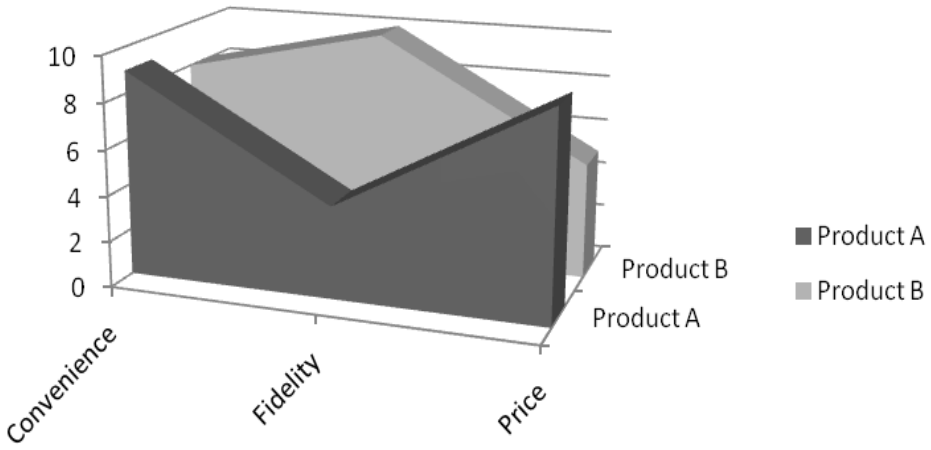


Figure 4 Comparing two Innovative Products

The study of business model innovation and related metrics is the basis of empirical research. Using the method of exploratory factor analysis [14] in an attempt to construct a questionnaire including only independent variables, it has been fund [25] that despite its apparent complexity (e.g. customer acquisition, activation, retention and referral) business model measurement relies on only two underlying independent variables: business model creativity (BMC) and business model application (BMA)

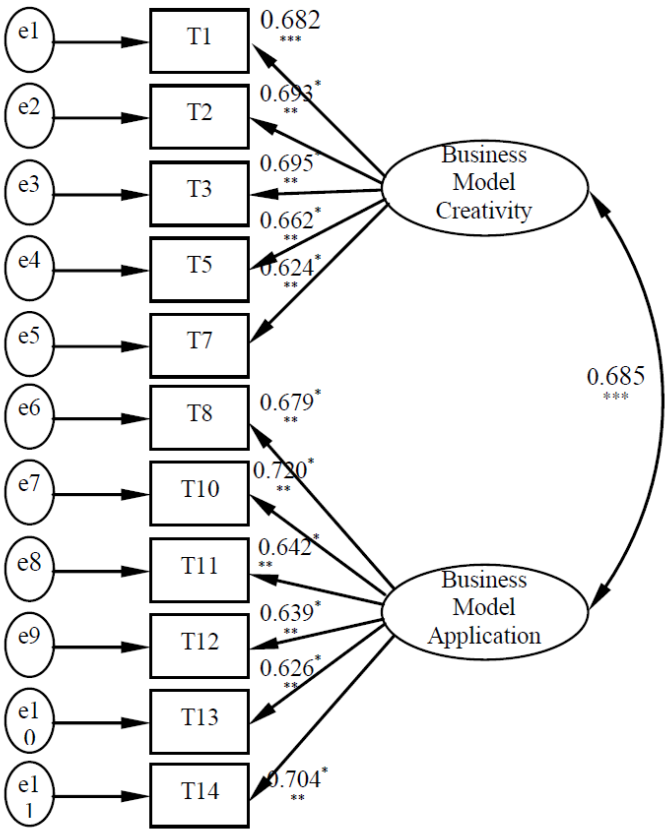
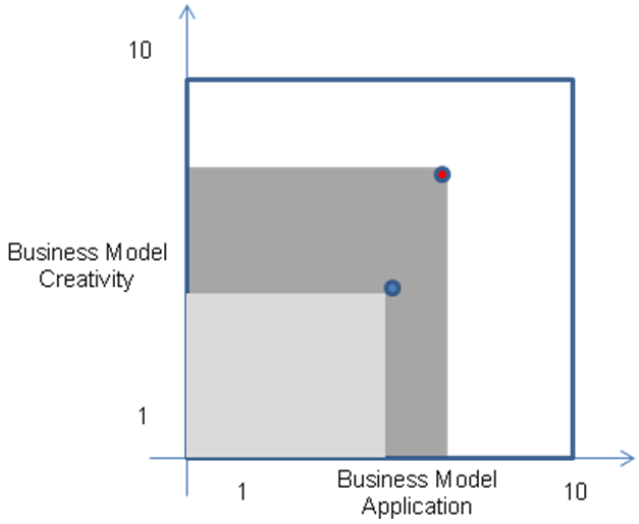


Figure 5 Business Model Factor Analysis (apadpted from [25])

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If we agree to evaluate the tow variables on scale from 1 to 10, comparing two different business models or two versions of the same business model is a relatively easy job.



At the end of the measurement process we will have a consistent framework to rank high tech start-ups maturity by comparing their innovative ideas, innovative products/services and innovative business models.

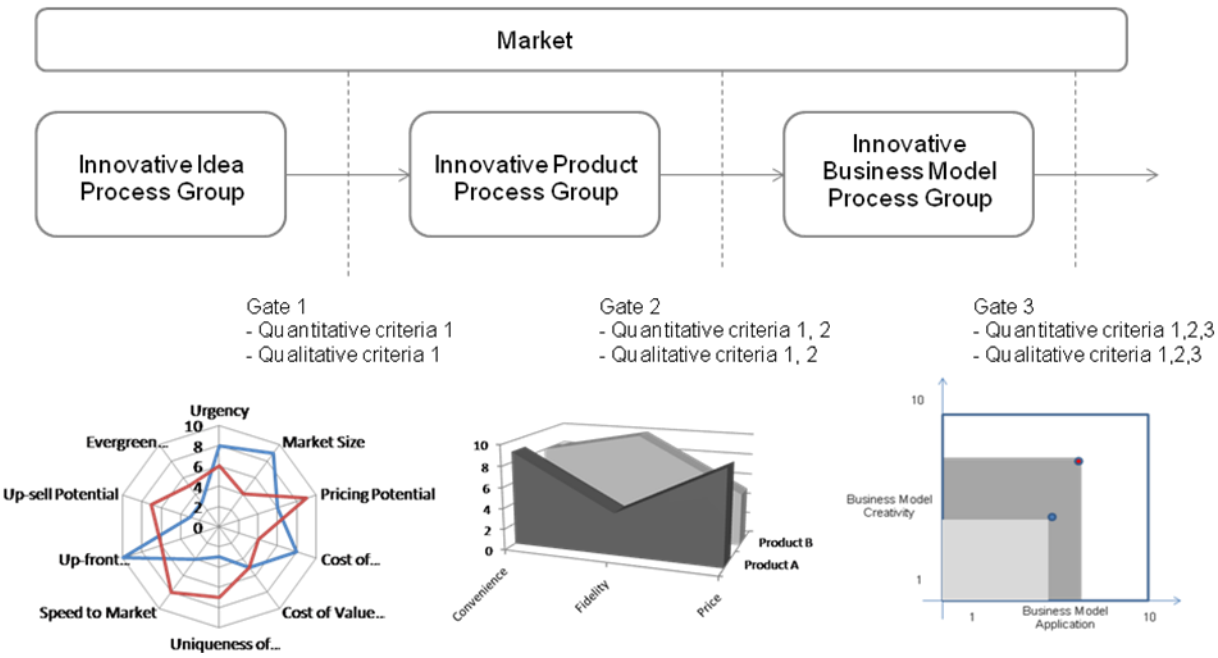


Figure 6 A framework to rank high-tech start-ups maturity

Discussion

Digital innovation is a holistic endeavor and high tech entrepreneurship is a very complex process.

The analogy between the two methodologies supports the knowledge transfer for entrepreneurs familiar with project management methodology and provides a framework to support decisions which need to reflect the maturity of ideas, product and business models.

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Without measurements you cannot manage anything. Taking the analogy further can help organize the sub-processes of a start-up which in Lean Start-up methodology appear almost Brownian

The model could be also used in future empirical studies.

There are three major ways to test the model and the hypothesis [5] which could be the basis of further research:

- The rate of success of start-ups using this model and metrics compared to a witness sample
- Checking the model against a number of selected case studies that replicate and fill conceptual categories
- Checking the model against random set of case studies

We should note that the model assumes that all necessary human resources are available and the environment is stable (e.g. market, culture, society, IT forces do not change during the process).

This applied research is intended to support the decision to extend the Project Management Unit of Study content for IT students in order to accelerate knowledge transfer and promote high tech entrepreneurship in the university entrepreneurial ecosystem, in an attempt to move more knowledge about the high tech entrepreneurship to where the technology is.

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