The Venture Capital: A Classroom Game of Competition Simulating High Technological and High Risks Investment Funds

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ABSTRACT

This article introduces a game for classroom use based on a simplified model of venture capital. The market consists of nine different technologies in which new startups can be funded. It was designed for a three-hour session, in a classroom, with up to thirty participants, but preferably with around sixteen participants.
The model simulates the trade-offs and difficulties of developing startups in many fields but also the necessity for diversification of capital in an environment where the uncontrollable variables have more variance than the ones that are controllable. This leads to a game in which the players must manage their portfolio of startups to balance risk and return.
The model is simple to give the students a better view of the possibilities, and yet the possible combinations and adaptations are so many, that no two games will be the same.

INTRODUCTION

This article introduces a game for classroom use based on a simplified model of venture capital using concepts of investment strategy, diversification, portfolio management, diseconomies of scale, gravity model, risk analysis, risk aversion, and technological fields of research.

The game is a translation with minor improvements of the venture capital game published in Alves (2015), which is in turn another version of the same game published in Alves (2001), which used the motion picture industry instead of the high tech fields of this one.

The original game was published only in Portuguese language.

The basic model is that the players will have to fund new startups using a cost formula with diseconomy of scale built in. The quality of the company can vary in a one to five point scale (1 to 5 stars). The better quality (more stars) the more expensive, each new start doubles the costs of investment. The valuation of the company when it's sold will vary with a formula that uses the quality of company (stars) plus a random variable, that's is, a die (1 to 6 scale). In this way the uncontrollable variable has more variation than the controllable one, which points out to a diversification strategy. However one company per segment will have a snowball effect in terms of valuation, representing the gravity model of standardized technologies. This makes the best company in each segment very valuable and points towards a concentration strategy.

The players in this way have conflicting incentives towards concentrating and diversification of their investments.

The venture capital model was inspired from Zider (1998), but using the concept of gravity model (Desarbo, 2002) and evolutionary nature of technology (Mokyr, 1992) to explain the concentration of investments and buyers into a single technology per segment. The investment segments were based from in the forecast from R&D Magazine (2016).

The game rules section was written as an appendix so that it can be printed separately for the participants.

DESIGN GOALS

The main goal of the game is to be applicable in a classroom with minimal infrastructure, and therefore it retains the traditional pen and paper logic, however today we have a more easy access to spreadsheets and projectors, so that, not necessarily, the main game data has to be drawn in a blackboard.

The secondary goal is that it will be a competitive game to develop the concepts of investment strategy, diversification, portfolio management, diseconomies of scale, gravity model, risk analysis, risk aversion, and technological fields of research.

The tertiary goal is that it can be used in a three hour session with a thirty minutes explanation and a thirty minutes debriefing and two hours of gaming itself. This allows it to be applicable to executive education, MBA, EMBA, graduate, and under-

graduation courses.

The quaternary goal is that it has to be fun and engaging, while retaining a reasonable connection with the real world, so the formulas look like the real world despite not being perfect models, and the technological segments are real so they can identify with real world opportunities. The model is simple and explicit, but close to reality. Dice are used to represent life-like events like the success or failure of startups.

USAGE METHODOLOGY

This game was designed for use in a three-hour session, in a classroom, with up to thirty participants, but preferably with around sixteen participants.

The only materials needed are printed copies of the rules, a blackboard, and at least one six-sided die, but preferably more dice. This makes it a low cost application for any situation. However if a projector and a spreadsheet are available it will be much easier to use.

The participants should preferably have received the rules beforehand, but that is not entirely necessary, since the rules are simple and can be learned while playing.

The facilitator must divide the participants into four to six groups, ideally four groups. Each group can have from two to five participants, ideally four participants. So the number of participants can range from eight to thirty, but with an ideal number of sixteen.

Time usage should be:

a) Thirty-minutes for groups' setup and game explanation.
b) Thirty to forty-minutes for the first turn.
c) Twenty to thirty-minutes for subsequent turns.
d) Thirty to forty-minutes for debriefing.

The number of turns will depend on the speed of the groups for decision-making, but at least four turns should be taken, preferable five turns or more.

The facilitator should answer all questions pertaining to the rules of the game to the best of his or her ability, but never directly answer question about which strategy to pursue, or what decision to make. If a group is stuck with decision paralysis, that is unable to make a decision, it should do nothing that turn as a penalty for indecision.

Some questions and issues selected for discussion in the debriefing can be advanced with each group as they realize some of the points. However the game rules purposely miss the issue as which is the objective of the game, and who wins, so that this discussion may rise in the debriefing as how to evaluate a company, its assets, return on investment, sustainability of the profit, and future cash flow. So the facilitator must avoid a direct answer to these issues always pointing to the participants that this issue is missing on purpose, and asking them how they think the companies should be compared to each other. Usually only a few groups rise the question, and only in the later half of the session.

The market does not have a trend to monopoly and due to its nature past results don't warrant future results. In fact the risk in the game is enormous, and controlling it is very hard. The only "safe" strategy s diversification but that doesn't warrant the best returns on investment, so the game resemble a race in which you are on the verge of playing safe versus risking too much. It's a psychologically tense game, the winning group can lose very fast if they risk too much. After all it's a "venture capital" game and not a "safe capital" game.

DEBRIEFING

The game is a mean to an end, which is learning through experience, so to consolidate this learning a debriefing is necessary at the end of the session. The participants will probably keep talking about the game afterwards but it's important to give them a closure at the end of the session.

The facilitator may discuss whatever he or she finds necessary and important given the purpose of the course but some suggestions are made here.

a) The first question to address is which company won the game, since it's not explained anywhere on the rules on purpose. The facilitator should induce them to think how much each company is worth, or by how much money they would buy each company, or how much money each company will get in the future. The concepts behind those questions are valuation, future cash flow, and assets evaluation. They must understand that cash is not the only asset here, and the assets will have some value in the future, but this value is not fixed, and different evaluations may exist.

b) Other possible line of discussion is about the game dynamics that represents the game and its relation to the strategies. Since the model is built in such a way that uncontrollable factors have a bigger variation than the controllable one this can lead to several strategies ranging from the safest to the riskiest ones. In fact the game is about investment portfolio management, that's is the players will be managing their startups portfolio.
c) Another possibility is the group dynamics in terms of decision, or how they made their decisions during the game and how they felt time pressure, incomplete information, the risk aversion, group synergy or conflict, how they dealt with the competition, the deals and betrayals.
d) The segmentation of the fields of research itself can be a line of debate as well since the game presents a technological segmentation. In fact other segmentations can be used, like for motion pictures industry, or military equipment R&D, and stock market segmentation.
e) In almost the same vein one of the fields can be explored in detail with its technologies, opportunities and difficulties can be explored.
f) The assembling of the team can be explored. The discussion can be on how to recruit the best combination of science and management team, without overpaying and becoming too expensive. The logic of Human resources and teamwork and team acquisition can be the subject of the debriefing.
g) The model itself can be explored as to why the diseconomy of scale is used when computing the costs of assembling a startup, and why the uncontrollable variable is so important, and why the snowball effect exists, and what it represents (gravity effect in standardized technologies).
h) The gravity model and path dependence can be explored in detail following a session of this game using several examples like Betamax versus VHS, or Windows versus Linux, QWERT board still being used in computers coming from typewriters, and even stranger examples like the size of roads and tunnels coming from chariot sizes. There is an attraction factor in standardized technological solutions that make winning technologies so much more profitable than the ones that "lose the race".
i) The discussion can also be along the line of how new technologies develop from laboratory and experimental size, to startups and further levels of investment as the company grows up in size and valuation. The whole model of technology and venture capital can be explored.
j) On last possibility is to discuss the simplifications on the model, like the equations, the segments, and the lack of details. In fact the model could be more complicated in several ways, but that would increase difficulty and playtime without much gain in pedagogical terms. The game is a mean to an end.

COMMENTS

This model tries to simulate a venture capital market in high technology.

The players represent investors trying to develop a portfolio of startups. All segments are of the same size and risk for simplification.

The model was developed using the concept of risk and return as central to it. The players can control the quality of the startup in a one to five point range (1 to 5 starts). However the valuation of the company when it's sold depends on random factors varying from one to six (one six-sided die), and also each segment get a snowball effect that will multiply its value by a value ranging from one to six (another one six-sided die). Only the most valuable company per segment gets the snowball effect.

In this way there is an incentive towards diversification of the investment portfolio to dilute risk, however due to snowball effect there is an incentive towards concentrating the investment also. The players have to deal with these conflicting incentives in order to create a portfolio.

Too little risk will give a small but certain profit, while too much risk is a high stakes game in which one can get a win or lose a lot of money. A balanced portfolio is possible to achieve, but what constitutes such a portfolio will vary according the risk aversion of the players.

The game has too much risk, possibly more than in real life, but that's a pedagogical distortion to create a strong impression for the participants.

VARIANTS

The game can use the same engine to simulate other markets like Motion picture industry, Military equipment R&D, and stock market itself. All it takes is to change the names of the market segments, and the description of the game. The number of segments can also be changed but never allow for a perfect multiple of the number of groups playing so they cannot come up with a perfect cartelization strategy.

Examples of segments for those variants are:

Motion Picture industry – comedy, action, drama, horror, romance, and thriller.

Military Equipment R&D – infantry, cavalry, airmobile, artillery, logistics, and C4ISR.

Stock Market – aviation, banking, automobile, construction, mining, telecommunication, retail and agribusiness.

CONCLUSIONS

This article introduces a game for classroom use based on a simplified model of the venture capital industry. The game is designed to last three hours and train up to thirty participants.

The game is a translation with from the venture capital game published in Alves (2015).

The purpose is to create a relatively cheap training tool for investment strategy, diversification, portfolio management, diseconomies of scale, gravity model, risk analysis, risk aversion, and technological fields of research.

The game rules section is in an appendix so that it can be printed separately for the participants.

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APPENDIX A
GAME RULES

GAME SCENARIO

The increasingly competitive world economy is putting a high pressure in the development of new technologies. Some say we are on the verge of a new technological revolution. Among the new technologies there are Nanotechnology, biotechnology, advanced medicine, artificial intelligence, new materials and manufacturing techniques, new energy sources and storage technologies, sensors, robotics, information technologies.

All these fields have technologies that are moving from the laboratory and experimental level into practical applications and becoming market prototypes. It's the moment when venture capitalists set in to explore the possibilities and generate enormous wealth.

Your goal is to select opportunities in nine fields (or segments) and balance the investments to forma coherent portfolio of startups. And maximize return on investment in the next five years.

Assembling management and science teams and making them work together is not an easy task and sometimes it takes time for the firm to grow up and pay itself, but in other moments the grow is so fast that the best way to deal is by selling them as soon as possible either through an IPO, or to a M&A investor.

You must balance between optimal teams and optimal returns and time to market.

GAME SCALE

Each turn is the equivalent two fiscal years.

Each monetary unit ($ 1) is the equivalent to one million dollars (1 US$ Million).

Team quality is measured in a one to five point scale (1-5 stars - ¶'s). A one star team is a poor quality one, while a five star team is a top quality one.

Each group starts with two hundred Million dollars ($ 200).

GAME SETUP

The facilitator will distribute the rules among the participants, and separate them into four groups or more groups. Each group can have from two to five participants.

The facilitator must draw, or project, the main diagram table in a blackboard, or wall. Figure 1 shows the main diagram with all segments.

The facilitator will distribute a few copies of the Turn Expenditure spreadsheet. Figure 3 shows it.

FIGURE 1
MAIN DIAGRAM

Information Technology	**Robotics**	**Artificial Intelligence**
Materials and manufacturing	**Energy generation & storage**	**Sensors**
Biotechnology	**Advanced medicine**	**Nanotechnology**

FIGURE 2
TURN EXPENDITURE SPREADSHEET

Investment area	High Stakes	Future change	Keytech	Global Ventures
Information technology				
Robotics				
Artificial intelligence				
Materials and manufacturing				
Energy generation & storage				
Sensors				
Biotechnology				
Advanced medicine				
Nanotechnology				

Cash	200	200	200	200

Finally the rules must be briefly described and turn 1 will begin.

GAME SEQUENCE

The game is divided into turns representing one fiscal year. Each turn will be divided into several phases in the following sequence.

Phase 1 – Planning Phase
Phase 2 – Revelation Phase
Phase 3 – Calculation Phase
Phase 4 – End of turn Phase

Repeat these phases until the specified number of turns, or to the end of class time. A two-hour class will probably last three to five turns, while a four-hour class will last for five to six turns.

Each phase is now detailed.

Phase 1 – Planning Phase

During this phase the students will make their decisions. They will analyze the situation, discuss among themselves looking at the market segments and their cash and think about an investment strategy.

They have to choose how many companies they will fund and with which quality levels. They can fund no more than one startup company per field, and therefore no one than nine startups per turn. They can fund from zero to nine companies each turns.

The cost to invest in a company is a function of the quality given by the equation below where n is the team quality in a one to five point scale (or stars).

EQUATION 1
COST OF COMPANY INVESTMENT

$$C = 2^{n-1} \bullet 10\$$$

The table below shows the costs calculated by the equation above in order to simplify for the players.

TABLE 1
COST OF COMPANY INVESTMENT

Team quality	Cost of company investment
☆ (1star)	$ 10
☆☆ (2 stars)	$ 20
☆☆☆ (3 stars)	$ 40
☆☆☆☆ (4 Starts)	$ 80
☆☆☆☆☆ (5 Starts)	$ 160

The logic is very simple actually a one-star team costs $10, and each additional star doubles the cost.

Phase 2 – Revelation phase

In this phase all the decisions taken during the previous phase are revealed, so that the decisions taken privately are now public. The professor will mark the decision on the board, or spreadsheet.

Phase 3 – Calculation phase

In this phase the professor will make all calculations in front of the students in the following order:

a) Debit the costs of startup companies investment.
b) Roll the dice for valuation of each company in each segment.
c) Determine per segment which company gets the “snowball” effect.
d) Credit the value of selling the companies.

The step a above have already been explained.

Step b will require the roll of a die per company. The Initial market valuation (V) of a company is given by the equation below, where n is the team quality chosen in phase 1 and D6 is a one six–sided die, that will generate a random result from one to six.

EQUATION 2
INITIAL VALUATION OF COMPANIES

$$V = (n + D6 + 1) \bullet 5\$$$

The table below shows the values calculated by the equation above in order to simplify for the players.

TABLE 2
INITIAL VALUATION OF COMPANIES

n+D6+1	V ($)
3	15
4	20
5	25
6	30
7	35
8	40
9	45
10	50
11	55
12	60

The logic is very simple the result is a linear equation. Each point of quality and die increases the initial valuation in $5. The minimum valuation is therefore $15 and the maximum is $60. The problem is that the uncontrollable variable (D6) has a greater variation than he controllable one (1 to 5 stars).

During step c the facilitator will look at each segment looking for the company with greater initial valuation. This company will get a snowball effect that will multiply its valuation. If two or more companies have the same initial valuation none gets the snowball effect.

This represents several real world effects like gravity effect over standardized technologies and path dependence. The markets then values the best company several times above the competition concentrating capital flows on them.

The Snowball valuation (V_s) is given by the equation below where the initial Valuation (V) is multiplied by the result of a one six-sided die ($D6_s$)

EQUATION 3
SNOWBALL VALUATION OF COMPANIES

$$V_s = V \bullet D6_s$$

During step d it's assumed that venture capitalist immediately sell their stakes in all companies to the markets no matter how much they where valued. It's abstracted how this was done, whether through an IPO, M&A, or to a private equity fund, or private owner.

Example:

Let's suppose that in four-team competition a group made a 2-star company in robotics field, two others made a 3-star company, and the last one funded a 5-star company.

While calculating the initial valuation the 2 –star company got a result of four (4) in the die. In this way it's valued in $35. The 3-star companies got respectively a three ($35) and a six ($50) in the dice. The 5-star company got a miserable two (2) in the die and is valued at $40.

The best-valued company is a 3-star one with an initial valuation of $50. It gets the snowball effect and rolls a four (4). Its final valuation is $200.

Phase 6 – End of Turn phase

Once done the calculations the companies must have positive cash. If that is not the case the professor will give them enough money so that their cash becomes $100.

Remember that this money will have to be taken into account in the debriefing as if it was money sent by the corporate headquarters to save venture capital division.

The professor may at his discretion grant additional money for the group to keep itself in the game without going bankrupt. However this is unlikely to be necessary.