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Apply Lean Thinking With Industrial Experience To Professors' Careers Opinion And Survey

Part I - The Opinion

ABSTRACT

This paper describes how professors could apply lean thinking and industrial experience to their careers. There is also a survey of the usefulness of this method after professors read this paper. The entire paper is divided into two parts, with the first part covering the author's opinions and the second part covering the survey result. The novel idea presented in the first part combines lean thinking, the author's academic and industrial experience to optimize the professors' career development process. This paper should be of interest to university professors and postdocs. Students who are in graduate programs will also benefit from learning how their professors think.

Keywords: lean thinking, career, professor, management, funding, research

1. INTRODUCTION

Each year many new PhDs graduate. Some of them may become postdocs and then become professors, some of them become professors directly, and some of them work in

industries. There is no doubt that those PhDs are experts in their areas. If they decide to work in industries, then that person would be more likely to work for people (Nerad, M., 1999&Larson, 2013). The goal is clearer for them. However, it would be very different for those PhDs who stay as academics. Their new jobs as 'professors' require teaching, managing people in their labs, leading graduate students, doing research, writing grant proposals, getting funding, and publishing papers. However, those PhDs may not have training in managing people, selecting graduate student candidates, and enough networking for collaboration, etc. Those are the obstacles to their careers. Those problems may not just happen to new professors, but also to more experienced professors. With such challenging careers, a systematic approach and industrial experience would help to plan their careers. This paper presents how to apply lean thinking with industrial experience on professors' careers, it is the part one of the whole article. The part two of the article is the survey results of the effectiveness of this opinion.

'Professor' is not a well paid job when you compare it with other jobs that require professional doctoral degrees (e.g. medical doctors and attorneys). After spending years in research and teaching, at close to retirement age a professor could just make the same amount of money as a student with a bachelor's degree and a few years of work experience. For example, a step V associate professor in the UCLA engineering department in 2019 earned USD 120,700 ("Academic Personnel and Programs", 2019). That is maximum earning for an associate professor, they may need, at the age of fifty ("For how long should I be a postdoc?", n.d. &"The 1940 Statement of Principles on Academic Freedom and Tenure",1993. &"Beginning a Faculty Appointment", n.d.), to earn that amount of salary. On the other hand, an average for a Senior Mechanical Engineer's salary in Los Angeles, CA is USD 122,024 ("Senior Mechanical

Engineer Salaries in Los Angeles, CA ", n.d.). A person with an average of 5 to 10 years of industrial experience after college is considered a senior mechanical engineer. It would be roughly at the age of 32 - 33. The author has had many chances to talk to many professors because of his job. He found that many professors had lofty ideals. They believed that their jobs were like artists. There was no guarantee of a good income or of living well. However, the author does not agree with that. Their situations could be better if they could be promoted as early as possible.

2. METHOD

Lean manufacturing was originally from Toyota Japan back in 1930 ("Lean manufacturing", 2020). The idea of Toyota manufacturing was to reduce waste which did not contribute to the goal. The term “Lean” was first used in 1988 by John Krafcik ("John Krafcik", 2020). Since then people have used the phrase “Lean thinking” in different areas, such as in management, production, health care, etc. (Poksinska, 2010).

The five major lean principles are;

1. Define value
2. Map the value stream
3. Create flow
4. Establish Pull
5. Pursue Perfection.

The following section shows how to apply lean principles with industrial experience to reduce possible career obstacles and hopefully speed up a professor's (your) career.

2.1 Lean Principle #1: Define value

Your value is what you provide to your customer to make them happy so that they buy your service. In this case, your customer is your department head and the dean of your college. All the deans of the colleges have a common target, they want to improve or maintain the rank of their college. Let us use an engineering college as an example. The US News report ("Methodology: 2020 Best Engineering Schools Rankings", 2020) lists the factors to rank a college. Figure 1 shows the ranking factors and the corresponding weights. Since some of the

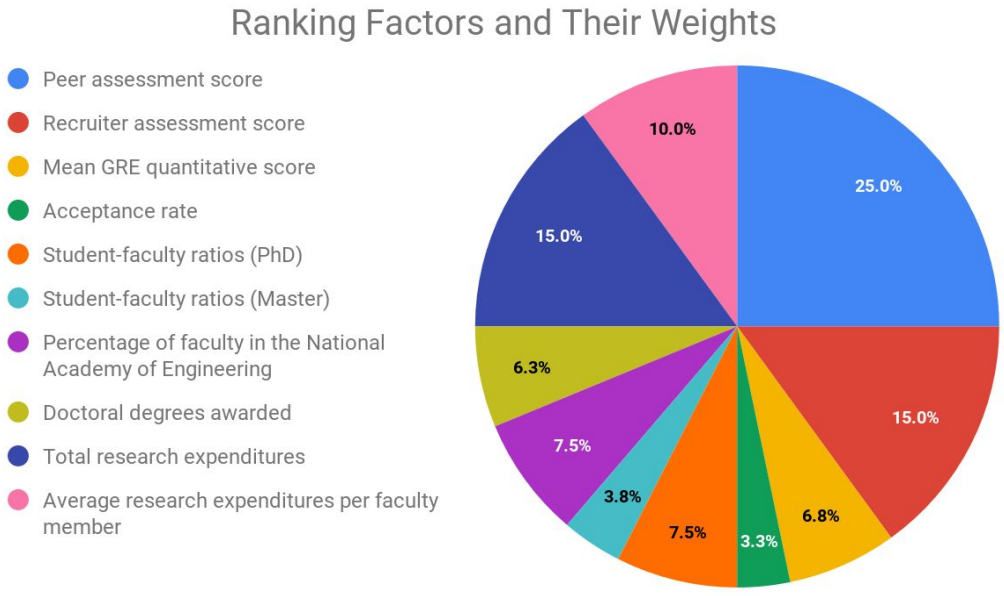

Figure 1: The Factors To Rank An Engineering College (usnews.com, 2020)

factors cannot be controlled mainly and solely by a professor, those factors will be ignored. Additionally, “Total research expenditures” and “Average research expenditures per faculty

member" will be considered as a single factor "funding". After adjustment and relabeling, the factors and ratios of a professor's value are shown in Figure 2. The chart may be over-simplified but it is good for discussion.

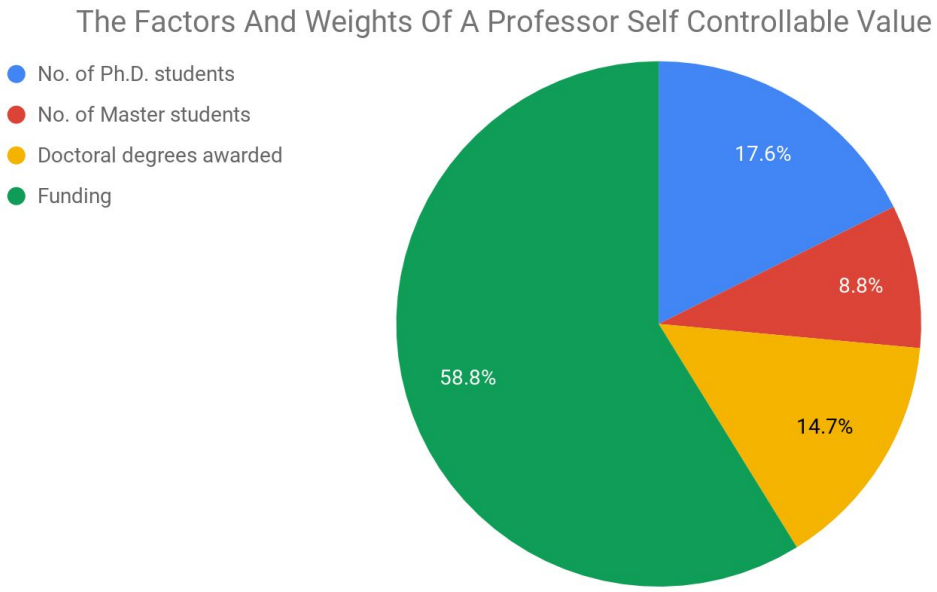

Figure 2: The Factors To Rank An Engineering College that are mainly solely controlled by a professor

2.2 Lean Principle #2: Map the value stream

After knowing what your value is, you need to reduce or eliminate the activities that do not add value to your career. There are three types of activities. One is directly adding value, one is no value-added but is necessary, and the final one is no value-added and unnecessary. The key is to reduce the no value-added but necessary activities and eliminate those no value-added and unnecessary activities. The following are some examples of no value-added but necessary activities and no value-added and unnecessary activities.

Most professors are required to teach undergraduate student classes. Therefore, the following are some example of “no value-added but necessary” tasks

- Creating supplemental instructional materials
- Building a course curriculum
- Accurately evaluating students’ progress

The following activities ("What Do Professors Do?", n.d.) are classified as “no value-added and unnecessary”,

- Reviewing too many papers for journals
- Spending too much time in administrative committees
- Travelling too much to give talks at conferences
- Supervising too many independent studies
- Helping too many students by writing letters of recommendation
- Supervising too many undergraduate research projects
- Running too many organizations for students

You will need to adjust your calendar to make sure that you put the time in the right place.

2.3 Lean Principle #3: Create flow

After the values are known, the next step is to ensure the value creation is smooth. The first thing to identify is the obstacle and waste, find out why the obstacle and waste occur, then find out ways to overcome them. From figure 2, we can see that the values are funding, number

of master students, number of Ph.D. students and the number of Ph.D. students that graduated. This section discusses how to apply industrial experience to improve and/or optimize the production of those values.

2.3.1. Funding

Normally, applying for funding needs 1) a novel idea and 2) initial data to back the idea up. Figure 3 shows what is necessary to get funding.

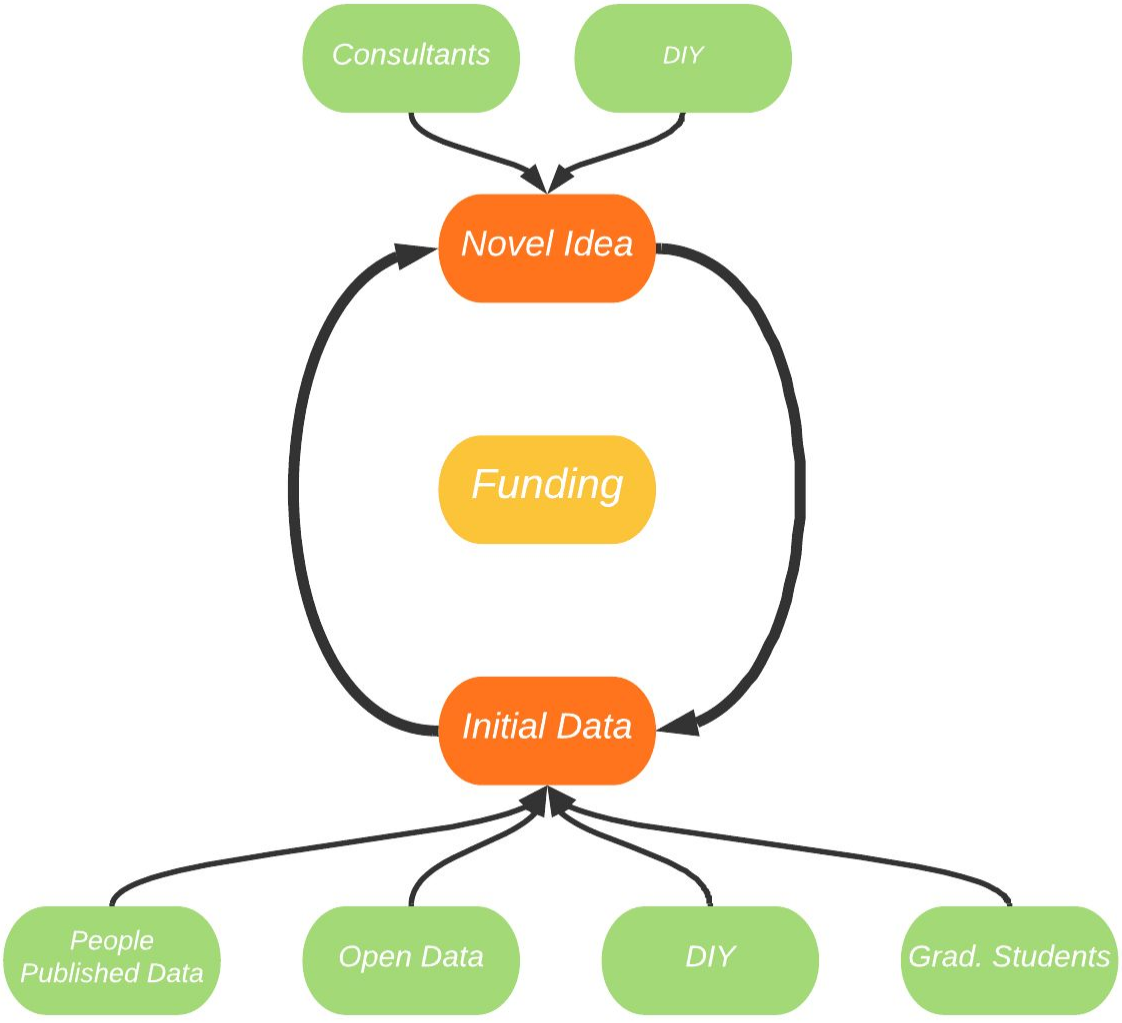

Figure 3: A Concept Map Of The Factors That Generate New Funding

2.3.1.1 Novel ideas

It is not easy finding someone to discuss your idea within an academic environment because it is isn't helpful if you find a professor who hasn't got the necessary background to understand your idea, and it would be very risky to share your idea with a professor who has a similar background to you because they might use your idea and apply for funding and publish a paper ahead of you. Even if you and the other professor create a partnership to apply for funding, it would be difficult to judge who should be the principal project investigator. In industry, people sign non-disclosure agreements (NDA) before discussing ideas (Klee, M., 2000). However, it would be too drastic in an academic environment. If you, as a professor, ask another professor's opinion but that professor has common interests, an NDA could block that professor from publishing any papers or applying for any funding in the areas of common interest. Therefore, it is highly unlikely that any professor would sign an NDA.

There is no doubt that discussion would help create ideas. To find experts that can discuss an idea does not necessarily have to be within the academic arena. Professors should create networks with people in industry. Many PhDs work in industry and their companies' interests are, usually, how to improve their profits, so they would not be interested in your idea, yet they could help. If you ask people in industry to sign an NDA, it is not seen as an odd request. Professors could easily start networking with people in industry by offering them some work. There are many consultant firms. Some consultant firms are specifically helping college research teams.

2.3.1.2 Initial data

To get initial data, there are a few methods

- Use open data from the internet (e.g. from Google Dataset Search) or data from other published papers as the initial data to support your idea for your funding proposal. If the data is available, it will save weeks/months of manpower and money for setting up experiments.
- Do It Yourself. The advantage is that you know what kind of data you want. However, it could take a long time and you may not have enough knowledge to get the initial data quickly.
- Ask graduate students to do it for you. If it could be a very long process, it would be nice for other people to do the work. The disadvantage is that it could still be a long process of teaching because the students may not have the background to pick up the information fast enough.
- Find outside consultants to help. You will need to spend some money, but you only need to set up an initial contract with the consultants and the project can move forward. Sometimes, you may be able to discuss with the consultant a deal where they will only get paid if you get funding. Some consultants are willing to do this kind of deal.

Overall in the funding application process, creating networks with industrial experts has the following advantages.

- Do not be afraid of discussing your idea since people in industry do not mind signing NDAs and their interest is in creating business deals, not publishing papers.
- It's possible to create collaboration between you and the people from industry, e.g. apply for Small Business Innovation Research (SBIR) funding with people from industry.
- (Added benefit) You could invite them to join your graduate student dissertation committee to fulfill the schools' requirements.

2.3.2 Graduate students

From figure 2, we know that having a Ph.D. student is better than a Master's student if the amount of handling time and their productivity is the same. Therefore, only Ph.D. students will be discussed in this section. Ph.D. students are a valuable resource during the research process. They can help with running experiments, doing data analysis, and you will have a good profile if they graduate with Ph.Ds. However, they could also interrupt the lean process of your career because a non-productive Ph.D. student could take up a lot of your time teaching and managing them. You could also have pressure from the department asking why the Ph.D. student has not graduated after a certain number of years. Therefore, the keys are;

- Find good graduate students
- Simplify the management and guidance of the students,
- Help them when they need

2.3.2.1. How to find good Ph.D. students?

In academia, a multi-stage selection process is very common in faculty interviews (Onwuegbuzie, A. J., & Hwang, E., 2014). However, it is uncommon for graduate student interviews. In the industrial hiring process, a multi-stage selection process is usually for all positions, because they need to make sure that the person hired has the ability to do the work. Moreover, they always use a group of people to interview the same candidate to prevent any bias decision.

In the graduate student interview process, professors can do the following;

- Use phone calls to pre-screen candidates
- Use video conference calls to ask candidates to show their technical skills and present their previous work. For example, software companies ask candidates to do code challenges that test their programming skills under pressure.
- Have other people (like other professors or other Ph.D. students) give multiple interviews to the same candidate. Each person on the interview team could have different rules, some may ask technical questions, some may ask them to present their previous work and some may focus on the candidate's behavior.

2.3.2.2. How to simplify the management and guidance of the students?

This very much depends on the field. For example, In the sciences, where there is a lot of collaboration going on, things will be different than in the social sciences or humanities. It also depends on the student and their project. Some students don't need too much of your time. Here are some suggestions.

2.3.2.2.1. General management

- Setup a plan for each student (each person needs a target to become their motivation)
- Every two weeks has an hourly long lab/group meeting, where students are asked to present their work. (each person knows about what is going on in the team)
- Have one on one meetings for students in specific subjects (focus on individual teaching so the students can ask questions)

2.3.2.2.2. Specific guiding

- Teach students how to solve problems. (For example, asking them to think about how they will change the experimental setup and data analysis method when they read other peoples' papers)
- Teach students how to find help with solving problems. (For example, a professor can tell the students to discuss their problems with outside consultants. Outside consultants would like to share their ideas if they have business relationships with the professor's lab.
- Teach students how to find a good problem for a dissertation. (For example, read funded project proposals from NIH, SBIR websites. It would help the students understand what types of work would get funding.)

2.3.2.2.3. Help them when they need - To reduce the waste of a Ph.D. student

Sometimes you may have an unproductive Ph.D. student. The professor may have developed a graduation plan (For example, he/she has to publish three papers before graduation) for the student and the professor doesn't want to give up on the student. The professor can help that student grow by publishing a review paper with the professor, that student and other graduate students as the authors. There are a few benefits.

- It will help that student move one step closer to graduation.
- That student will understand the field better by writing a review paper.
- The professor and other graduate students will have one more publication.
- The professor will not get a bad reputation by getting rid of a graduate student.

2.4. Lean Principle #4: Establish Pull

Establish pull is using the idea of "only make when you need". Your values are to guide Master & Ph.D. students, graduate Ph.D. students and get funding. You could not support Ph.D. students if you don't have funding. On the other hand, you would be unable to get your research going if you don't have any Ph.D. students to work on the projects. If you don't have any funded projects, your students would not have the resources to gather data and/or do experiments for publications. In an ideal situation, you should not have to wait too long to get new funding and new graduate students. To achieve this, you need to always have new ideas & initial data for the next funding proposal, and a big pool of graduate student applicants.

2.4.1 To have a big pool of graduate student applicants

If you always have a big pool of graduate student applicants, you will have a good chance of finding good graduate students when you start a newly funded project. Here are some factors that would attract more potential applicants to contact you.

- Have a modern lab webpage to show off your team research results because no one loves seeing an ancient style website.
- Put how many students you graduated in the past and the number of years that they needed for graduation on the webpage. Every student wants to graduate, potential applicants would love to know the number of years that they might expect to spend.
- Put how much stipend that each of your students would receive per month on the webpage.
- Keep the contact information for the good undergraduate students that you have taught in the past with their permission, they may want to come back to school again after working in the industry for a few years.

2.4.2. To always have new ideas & initial data for the next funding proposals

In the previous section, how to get new ideas and initial data was already mentioned, so it is not going to be discussed here.

2.5 Lean Principle #5: Pursue Perfection

This is an endless process. You should keep improving the process to reduce resource waste, time costs, and increase efficiency.

CONCLUSION

In this article, the author presented a novel process system for professors' career development. The author applied the five principles of lean thinking (define value, map the value stream, create flow, establish pull, and pursue perfection) and his academic and industrial experience to create systematic processes for professors to smoothly produce their values (product knowledgeable PhDs, guiding graduate students, and get funding). This smoother process reduces the chance of the professors getting obstacles in their careers and should reduce the time between promotions.

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