

# A Comparative Analysis of Career Growth Models in R&D Organizations

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## 1. Introduction

The organizations that emphasize on research and development (R&D) require outstanding professionals in the subject matter. Managing those resources is critical to conduct state-of-the-art research and development, and manufacturing. It is important to understand what these R&D professionals want to achieve. If managers cannot comprehend their career growth needs they may end up losing those personnel. Organizations need to come up with career paths to retain and motivate workers. They need to make a balance between organizational needs and individuals' needs, and develop career paths accordingly [1]. This allows for achieving employee commitment and retention within the organization.

The professionals in R&D have a desire to focus on particular specialty on top of career orientations geared towards promotions [2]. Research scientists care more about how their colleagues around the world think about their work than their immediate supervisor [3]. Organization must make effort to have R&D personnel achieve excellence in scientific discovery. A healthy competitive environment needs to be maintained so that organizations can get most out of their R&D personnel's talent and capabilities.

An organization's R&D activities are different from the other functions in the organization. R&D encounters many challenges and uncertainties in terms for project duration, budget and by nature of results [3]. The R&D results aspect is very important. This demands that R&D personnel need a healthy research work environment, motivation and job satisfaction to be efficiently taken care of. R&D personnel need to have enough freedom of work as opposed to being micromanaged.

In high-tech companies R&D is the main driver of competitive advantage and growth [4]. Organizations invest huge amount of money in R&D. Large companies such as Intel, IBM, HP, Microsoft, and Siemens, spend billions of dollars in their R&D. Managerial challenge is to make sure R&D investment is effectively translated into innovation to foster growth and competitiveness of the company [4]. Managers in R&D must ensure that scientists and researchers get logistics and managerial support to be successful [5], [6]. Manager needs to promote communication channel between R&D personnel and the rest of the relevant organization to keep employees engaged.

Given R&D is an organization's vital department the career growth path needs to be designed effectively[7]. In this paper we make an attempt to review the R&D career path of some selected high-tech global companies in the US and suggest a career growth model that could be used by R&D organizations in different sized companies in different sectors. We make an attempt to provide details of career path hierarchy, training, logistic support and incentives to be successful in different stages of R&D career path. Chen et al.[8]argue that appropriate career development programs need developed to satisfy the needs of R&D personnel at various career stages of career ladder. The emergence of the Internet and communication technologies has made business organizations global. Innovation, research and development and business have become so much competitive. The R&D personnel in organizations need to stay competitive and organizations need to invest in R&D growth of employees. Organizations need to come up with a management framework for the sustainability of R&D department. The framework for R&D management needs to provide employees stay engaged within themselves and the rest of the organization to perform efficiently and provide best results.

The R&D career path might differ from one another depending on the size of the organization. Large organizations might have career ladder more hierarchical compared to small and medium sized organizations. To manage employees in large organizations many processes need to be in place. That might make employee promotion growth bureaucratic. This needs to be streamlined to maintain employee morale and career growth. On the other hand, small companies might not be able to provide logistical support such as state of the art research lab to conduct research or they might not be able to provide career growth opportunities. This needs to be addressed as well. In this paper, we will make an attempt to come up with career growth models for organization with different sizes. We make attempt to provide detailed career growth model.

In this study we will make attempt to get available info from some selected companies to understand what their R&D personnel look for in career growth to be successful. On the other hand, we will also review as to what the management of those R&D organizations expects from the R&D personnel. How those organizations laid out the career path for their R&D personnel. What kind of training and growth opportunities they offer their R&D personnel.

This paper is organized as follows: Section 2 briefly provides an overview of existing literature on this topic. Section 3 provides details of the research methodology. Section 4 discusses data collection and analysis. Section 5 summarizes and concludes the paper.

### 2. Literature Review

There are four major career paths described in the literature: linear, dual, hybrid, project. The first one, linear, implies that a scientist is promoted to managerial positions. In this case an individual is gradually leaving his or her technical responsibilities [9]. One of the major downside of this approach is that R&D organizations are often losing good scientists over to administration [10]. Usually in the organizations with linear career development there is no way to grow if a person chooses to stay in a technical area of expertise and he or she eventually reaches a plateau, which leads to decreased efficiency and satisfaction [11].

Another career development model is called "dual career path" or "dual ladder system". It was introduced in late 50s [12]. The dual approach states that an

employee can choose to grow either along technical path or to pursue an administrative route. This gives more career opportunities within one organization that can lead to high success. John P. Doherty, DuPont's director for U.S. compensation said "We want to provide them with parallel routes so they can go into either track, whichever one is suitable for them as well as suitable from a business perspective in what [we] see as the strengths of particular employees" [10]. It is notable that this approach did not find successful applications up until 90s [13]. Nowadays it is widely utilized in scientific and engineering companies, especially high-tech ones [14]. Although the details may vary the career paths are similar. Salary grades are equivalent across both ladders. An example of a dual career ladder is presented on the picture below. Some authors state that this approach stimulates innovation among employees [15].

In 1991 Bailyn proposed the "hybrid career" system which allowed employees to move among various career routes both sequentially and concurrently [16].Study conducted by Allen and Katz [12] indicated that many R&D professionals would prefer neither management nor scientific path, but would rather move from one project to another. Petroni called this approach "from project to project" [16].

In 2000 Petroni[16] did a very interesting research on what career route was the most preferable by R&D specialists. The questionnaire was completed by 151 engineers and scientists. The findings showed that only 45 respondents had unequivocal preferences, whereas others expressed equal preferences for several career paths. Among those who had clear preferences, the managerial path had the highest score. On average though technical route was the most preferable one, followed by "from project to project" route, and managerial path was ranked the lowest. The author concluded that dual career path was not an effective approach for managing R&D professionals. Another finding corresponded with Chen et al. [17] conclusion that career opportunities and rewards should be flexible to suit employees with different needs and aspirations.

It is notable that even though dual ladder system is one of the most widely used ones it is still criticized, because it does not provide equal opportunities for growth for management path and technological routes, technical employees lack decision power in comparison with managers, and managerial career is more attractive and prestigious than a technical one [12], [16], [17]. Petroni et al. [15] in their recent studyunderline that this system does not support employees' development as integration experts, T-men, who is required for open innovation. The authors propose to an "open dual ladder" approach, which he describes as following: "graduates with a technical background start their career in the R&D division of a firm and can later move to other positions, including those that involve significant managerial responsibility". They also suggest that managerial trainings are important part of this system to better prepare specialists for administrative positions. Besides the four most employed career development programs there are some alternatives that are less widely used but can be more suitable for some companies. Strategic spin-off as an alternative to traditional R&D management was proposed by Ferrary[4]. The main idea of this approach was that a parent company helped its researcher-entrepreneurs to create a spin-off and supported at the beginning. Further a former employer could partner or acquire the spin-off if it turned out to be successful. The author stated that in case of strategic spinoffs researcher-entrepreneurs were more innovative, creative and motivated as they were not limited by bureaucracy and formalities of big company, had more decision autonomy, and got social recognition. In order to encourage such career development the parent company should provide entrepreneurial trainings and allow former employee to return back if a spin-off failed.

Another alternative to dual ladder called "knowledge ladder" was described by Debackereet al. [18]. The main determinants of career growth in this system were individual knowledge and competence. Salary and rewards were not directly connected to the hierarchy but to the employee's performance. The authors stated that it allowed linking organizational development and personal evolution and growth.

Chen et al.[8] conducted a study to analyze how career development programs at R&D organizations fitted employees' career needs and whether the gap between career needs and available programs affected satisfaction and turnover. More than 360 R&D personnel in the high-tech industry in the Hsinchu Science-based Industrial Park (HSIP) participated in the study. The results indicated the gap between available programs and employees' needs negatively affected job satisfaction and led to higher level of turnover. The authors argued that there were a number of diverse groups within R&D organization that had different career needs and expectations and thus there should be different career development programs to meet those needs. They proposed that managers should identify career needs at different career stages, exploration, establishment, maintenance, and disengagement, and offer appropriate career development programs at each of the stages.

One of the major works on employees' aspirations and drivers was published by Edgar Schein [19] in 1970-80. He identified eight following patterns that affected person's career development: 1) Autonomy/independence; 2) Security/stability; 3) Technical-functional competence; 4) General Managerial Competence; 5) Entrepreneurial Creativity; 6) Service or Dedication to a Cause; 7) Pure Challenge; and 8) Life Style. He found out that most people would classify themselves into several groups, but in most cases a person's decision about his or her career would be mostly dominated by one of the anchors. Bigliardi and Dormino[7] studied how career anchors corresponded with three career routes, managerial, technical and project. More than 150 R&D specialists participated in the study. The results indicated that the managerial route was strongly positively correlated with Managerial competence, Entrepreneurial creativity, and pure challenge anchors, but it had negative correlation with Technical-functional

competence and Security/stability anchors. The technical route was positively correlated with Technical-functional and Life style anchors, and negatively with the Managerial competence anchor. The project route was correlated positively with the Technical functional anchor, but negatively with the Managerial competence one. They also found out that age was strongly related to Security/stability, Autonomy/independence and Technical-functional anchors. Life style anchor was found to be the most important one, followed by Technicalfunctional one, and third most important was Service/Dedication, Managerial competence was the least preferable one. Based on the results the authors suggested that a greater number of career opportunities should offered in order to overcome the too formalized ladder system. The same conclusion was made by Igbaria et al.[1]. They surveyed 78 R&D employees in New Mexico to study career orientations, job involvement and satisfaction. The researchers found that the managerial and technical competence orientations got the lowest scores, whereas service, job security, and lifestyle had the highest priorities. Thus they concluded that the dual career ladder did not provide a complete model to satisfy career needs and aspirations of R&D professionals. The authors proposed that additional career paths and appropriate reward systems should be developed.

Multiple researches state that a company not only needs to develop a career path, but also provide trainings to its employees [4], [20], [21], [22]. They would increase knowledge and skills, positively affect employees' attitude and job satisfaction, and increase efficiency and performance [20]. As Schein [19] pointed out that besides technical competences employees needed managerial and leadership skills, which could be developed through trainings and seminars. Also trainings might have a positive effect on knowledge sharing among R&D professionals [22].

## 3. Methodology

Our approach was to review the career growth models and practices in companies with major R&D investments and draw observations from the data collected from the study. We came up with three main focus areas to investigate. First, what kinds of questions are relevant to career growth in an organization? Second, what kind of organizations are good candidates for this study? Third, if there are other kinds of data on the organization itself that would influence the career model in practice.

#### 3.1 Research Questions

We broke down the questions to look into in studying the career growth model into 5 main categories:

• The first objective of understanding the career growth model in practice in the organization is to understand if they are following any of the commonly known career growth model.

What kind of progression levels exist? What is the model in use in the company?

Driving higher results requires not only innovation and expertise in a technical field, but also non-technical competencies, e.g. communication. Documented and readily available expectations remove ambiguity in interpretation. Hearing career success stories in the organization not only has the ability to inspire, but also to educate. So, our next set of questions focused on the information and resources available to employees so that they can understand, own and drive their own career growth.

Are the requirements for each level documented? Is it divided into categories of competencies (Technical & Non-technical)? Are the R&D career path success stories available and shared? Is this information available to the employees?

• Continuous learning is key to the growth of any individual. Organizations that recognize and encourage on-going training will reap not only from the enhanced knowledge, but also the motivation that the employee will gain.

What kind of training or career development programs do they provide (e.g. tuition re-imbursement, ad-hoc – internal and external – training classes, professional memberships, attending conferences)

People are more successful when they are passionate about the job they do. Continuous education needs to be augmented with practice. Having an open environment where the employee can work on assignments in different roles will help them experiment and determine what types of jobs are the most desirable and in line with their personal growth. It also gives them an opportunity to practice and hone different skills.

> What kinds of additional opportunities are provided for skills needed for career advancement (e.g. short-term assignments, rotation programs)?

• A recognition pinnacle for any researcher is the ability to patent their innovation. However the cost involved in patenting can be a challenge. An organization that wants to retain and grow innovators can benefit from supporting the financial impact of patenting for the individual.

Does the company encourage and support patent submissions?

#### **3.2** Choosing theOrganizations

Second, we had to decide what type of organizations we were interested in. Some of the industry giants in innovation had to be included in the study. As patents are a widely known measure of R&D innovation, we first picked a company with the highest number of patents in the last year, referred to from here on as Company A. Given that R&D investment is yet another widely publicized metric of a company, we next chose one of the top investors, referred to from here on as Company B. We decided that it would be useful to look at an industry beyond semiconductor and ICT, so we included a leading R&D investor in energy sector, referred to as Company C in this study. We decided to add startups and academic research institutes in the study as these are other common leading R&D avenues. These are referred to as Company D and Company E respectively.

### 3.3 Additional data points

Third, it would be interesting to study other R&D data on the organization. We decided that R&D expenses, number of employees and number of patents filed in 2012 would be useful information to correlate the career growth model against.

We collected R&D data from annual reports. We met with and discussed with one or more individual from the organization to cover the list of questions regarding the career development models and programs in practice.

# 4. Findings and Analysis

We studied five companies. These companies belong to different industries. Here we provide the facts and findings about these companies about their R&D career path and career development opportunities.

#### 4.1 Career Ladders

First we will define the various career ladder that have been identified in the literature which we will then identify each company against in the future sections.



Figure 1. Linear Career Model[9]



Figure 2. Dual Career Model[12]



Figure 3. Hybrid Career Model[16]



Figure 4. Project Career Model[16]

#### 4.2 Company A

Company A is the number one company in the world, for the last twenty years (20), to obtain patent grants. As such it prides itself in encouraging and helping employees to submit patents, and provides resources to cover the legal, technical, and financial expenses associated with filing of a patent.

Company Aclose matches the hybrid career ladder.It allows its employees to remain technical/professional or move to management/executive ladder. Company A distinctly documents the Technical and non-technical competencies and expectations for each level.



What is the dual-career ladder?

Figure 5. Company A Career Model

Company A offers a variety of training programs to its employees in order to keep its workforce competitive and up to date. The main programs include the following: *Individual Development Plans*; it is an annual activity used to identify future business commitments and opportunities to improve the individual's skills. The manager and employee discuss career opportunities to identify areas of growth or gaps in the individual's repertoire. *Mentoring;* each employee is encouraged to find multiple mentors for different areas such as career growth, technical knowledge, business and client knowledge. *On Demand Learning;* this is a customized training offered by professionals and managers on different areas of the company. The program allows individual employees to be trained in areas of development, new initiatives, or is provided as an aid to re-skill the workforce. *Foundation competences*; is an in depth training designed to grow the skill of the workforce for future market shifts.

Besides those unique training opportunities, Company A also offers career advice, tuition reimbursement, and "internal job markets" which is an internal jobs-database allowing current employees to apply directly to existing positions available at Company A.

#### 4.3 Company B

One of the R&D companies we studied was a semiconductor company. In 2012, this company spent more than 10 billion dollars in R&D. Each year it releases a good number of cutting-edge products to the market. All these speak for the company's managing a large number of and strong R&D personnel.

This company provides hybrid career path for R&D employees. One path provides R&D managerial ladder and the other path provides pure R&D technical leadership ladder. In this dual path approach both managerial and technical ladders hold stages of career paths. Expectations in each of the stages in the ladder demands varying expectations of expertise in the hierarchy. These technical ladders are used as tool for strategic development, systematically developing technical experts in accordance with strategic business needs. These technical ladders are also used as motivator, as promotion, development, and strategic planning tool. Technical ladders provide an exclusive career path for outstanding experts. Technical ladder distribution is driven by strategic business needs as well. The technical ladder nomination on different levels expresses rather the potential for a technical ladder career of an employee and is a sign of recognition of the employee's technical expertise.

On the managerial path in R&D managers are expected to assume both managerial and leadership role in driving the R&D personnel to achieve business expectations and contribute to the company's business and revenue growth. Management is destined to manage the employees in different ladders of technical career path. They are in charge of ensuring selection of technical employees for different ladders by carefully cross-checking nominations and reviewing technical ladder employees.

This company assists its R&D personnel and engineers in career advancements to allow them to acquire varies skill-sets. These include short term assignments as rotation engineer, normally six months to one year.

Each year, this company allocates huge money for employee career development in terms of internal and external training classes, attending professional conferences, and acquiring professional memberships.

This company provides tuition-reimbursement opportunities to its employees. This allows employees to go to college to learn latest tools and technologies and earn advanced degrees. This tremendously helps employees to be productive and successful at work. The company hires intern engineering students for summer jobs. Later many of them join the company as full time employees.

The company also provides mentor and mentee partnership as part of mentoring program. By matching mentee's identified development areas and mentor's areas of expertise this program allows employees broaden their skill-sets.

This company strongly encourages its R&D personnel and engineers to submit patent applications. For 2012, this company has been granted as many as 1,290 patents.

#### 4.4 Company C

Company C is a leading solar panel manufacturer with a history of innovation and headquartered in Germany. In their 2012 annual report, the company noted 2355 employees.

The company uses a linear career ladder currently. Career growth is given careful and ongoing attention for every employee. Regular discussions happen between managers and employees in terms of career growth opportunities and potential. The company takes pride in supporting on-going education for every employee and has a tuition re-imbursement program. They also recognize the need for both theoretical learning and practical applications of the knowledge. They encourage researchers to practice their skills and apply it into deploying their developments into the manufacturing line. Managing R&D with a global development viewpoint is considered a critical competency. Ongoing technical growth is encouraged by incentive programs such as bonuses; they also have an award called the Edison award. Patenting is encouraged and supported by the company, it is included in the annual report.

#### 4.5 Company D

We conducted an interview with a representative of a small biopharmaceutical start-up company, which was founded in 2006. The company focuses on developing oncology treatments. In 2013 seven employees are engaged in R&D. Though the company does not have a formalized career development model the employees are encouraged to expand their area of expertise and acquire new knowledge and skills. Salary and rewards are mostly linked to individual's level of experience, competence and performance. Based on this description we have concluded that Company D employs a "knowledge ladder". The salary level is determined using a benchmarking service called Radford, which allows comparing aggregated information about different companies in biotech industry.

The company supports employees' aspirations to study and provides tuition reimbursement. In 2013 two employees are studying to get MBA diplomas and their expenses are covered by the employer. The representative underlines that they are promoting and encouraging any desire to learn and grow professionally. He emphasizes that his role as an employer is to provide his employees with a valuable set of knowledge and skills that are highly demanded on the market. The company has a patent that provides exclusivity for the medication they developed. It also is actively prosecuting two patent families, including 14 pending applications. The patents are results of teamwork, but if a researcher decides to file the patent on his/her own the company will support the submission and processing costs. Representative's observation about dual ladder:

There are people who are neither talented scientists nor great managers so they cannot successfully progress through either of the paths. These employees tend to stay at their positions for many years without any visible performance improvement. The managers then have to make a decision whether such employees are worth keeping. If a company does not have a clear and understandable system for personnel evaluation such decisions might be subjective and unfair. Criteria for employees' evaluation should be identified and a process for promotion or termination of employment should be developed.

### 4.6 Company E

We also studied career paths in a public university that employs over 2,200 faculty members. The university provides a faculty track for those who teach, do research and service and a track for those employees who only conduct research. The levels are similar and linked to rewards and salary. It can be concluded that this career development model is similar to a dual career ladder found in R&D organizations.

The university offers classes to its employees at reduced price and also allocates some money to each department for external trainings. The patent submission is supported and all the decisions are made at the high level of management.

#### 4.7 Summary

The summary of the findings from the various companies is listed in the Table 1.

Comp any	Categor y	Industry	Туре	R&D Expe nse	# of Emplo yees	# of Pate nts	Type of career ladder	Docume nted Expectat ions for each level	Traini ng Progra ms	Career Develop ment Program s	IP Submis sion Support
Comp any A	Establis hed	ICT	Comme rcial	\$6.3B	43424 6	6478	Hybrid	Yes	Yes	Yes	Yes
Comp any B	Establis hed	Semicond uctor	Comme rcial	\$10.1B	10500 0	1290	Hybrid	Yes	Yes	Yes	Yes
Comp any C	Establis hed	Energy	Comme rcial	€29.1M	2355	71	Single	Yes	Yes	Yes	Yes
Comp any D	Startup	Biotech	Comme rcial	\$14.6K	12	1	Knowle dge	N/A	Yes	Yes	Yes
Comp any E	Establis hed	University	Educati on	N/A	2289	33	Dual	Yes	Yes	Yes	Yes

**Table 1. Summary of Findings** 

Table 1 shows that there is a potentially a relationship between the type of career ladder based upon both the industry and the number of employees. We also find that organization development is critical is all sectors, so a management career path is imperative in all. Some organizations however do have the ability to also sustain a technical career path.

In our discussions, we also came across that fact that private and public organizations have different performance management methods and policies.

# **5. Conclusion and Future Work**

This study is based on data collection through interviewing and reading documents related R&D career path in four organizations. We also conducted an extensive literature review.We identified several key areas that an organization should consider in developing its R&D career path. We observed that large organizations maintain hybrid or dual career path to allow R&D personnel pursue a managerial or pure technical path. R&D personnel find job satisfaction in their career when they are encouraged and provided support to show excellence in terms of state of the art research work and scientific discovery. Adopting a continuous improvement processes in R&D career path are found to be the strongest predictors of career aspiration in R&D organizations [23].

The R&D organizations need to provide employees with other professional development opportunities such as tuition reimburse, training opportunities in latest tools and technologies. They need to promote and encourage any desire to learn and grow professionally. The R&D organizations must encourage and support patent application submissions. In order to make sure R&D personnel are motivated at work and in their career growth there must be a well-defined system for employee performance evaluation. That helps employees to know upfront as to what is expected from them by the company management.

In this paper, we have come up with an R&D career growth model that R&D organizations might find beneficial. To make R&D career growth model effective senior executives need to patronize it. Our career growth model should enable R&D organizations to deliver operational excellence in terms of quality, efficiency, velocity and capacity to deliver scientific discoveries and cutting-edge technologies. Given high-tech industry is fast moving, business conditions also change fast and employee aspirations also change, the career growth model needs to be revisited periodically and improved as needed. As part of future work, we will work on sustainability metrics for an R&D organization's career path.

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