TECHNICAL TALENT DEVELOPMENT STRATEGIES TO SUPPORT TECHNOLOGY ADVANCEMENT IN THE HYDROCARBON INDUSTRY IN THE KINGDOM OF SAUDI ARABIA

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DECLARATION STATEMENT

I hereby certify that this material, which is being submitted for assessment on the program of study leading to the award of PhD is entirely my own work, that I have exercised reasonable care to ensure that the work is original, does not to the best of my knowledge breach any law of copyright, and has not been taken from the work of others and to the extent that such work has been cited and acknowledged within the text of my work.

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I dedicate this thesis to my wife and children.

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Title of thesis: Technical Talent Development Strategies to Support Technology Advancement in the Hydrocarbon Industry in the Kingdom of Saudi Arabia

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ABSTRACT

This thesis focuses on technical talent development in terms of; i) defining top competencies for engineers and scientists involved in technology development in hydrocarbon industry of Saudi Arabia, ii) finding practical strategies to enhance technical talent development, iii) discovering challenges facing the implementation of these strategies with suggested mitigation measures and iv) recommending an implementation plan to use the research results.

This research work has confirmed that there are common competencies that every technology developer in the hydrocarbon industry in Saudi Arabia shall strive to attain and maintain. The top technical knowledge and competencies came out to be adequate filled experience, knowledge of research methods, up-to-date in specialty, and simulation modeling. The critical soft skills are effective communication, analytical capability, teamwork, and drive for results. From business domain, top competencies are economic evaluation and understanding of global and local perspectives. This work has explored fourteen different technical talent development strategies. The research revealed the following top five strategies; 1) Gain several years of field experience in the core hydrocarbon sector. 2) Participate in joint industry projects. 3) Implement a structured technical development program where career paths are defined by competencies and tasks. (4) Implement a mentorship program to formally select and qualify mentors. (5) Provide various venues of knowledge exchange between professionals. The research drilled down further into potential challenges that might hinder the technical talent development and confirmed several different challenges. The major one is retaining high potential individuals in the technical path. It was evident that management path is more attractive than technical path in terms of career progression and rewarding opportunities. Several mitigation means were suggested to reduce the impact of these challenges. The thesis has laid down an implementation plan to benefit from the research outcomes.

TABLE OF CONTENTS

CHAPTER 4 - Results and Discussion

CHAPTER 5 – Conclusion and Future Work

LIST OF TABLES

PAGE

LIST OF FIGURES

PAGE

ABBREVIATIONS

HC	:	Human Capital
Hi-Pot	:	High Potential Individual
HR	:	Human Resources
IC	:	Intellectual Capital
IDP	:	Individual Development Plan
KACST	:	King Abdulaziz City for Science and Technology
KFUPM	:	King Fahad University of Petroleum and Minerals
KPI	:	Key Performance Indicator
R&D	:	Research and Development
RP3	:	Resources, People, Programs & Practices
SHRM	:	Society of Human Resources Management
SCE	:	Saudi Council of Engineers
SPE	:	Society of Petroleum Engineers
SWOT	:	Strengths, Weakness, Opportunities and Threats
TM	:	Talent Management

CHAPTER 1

INTRODUCTION

1.0 General

Although the Kingdom of Saudi Arabia continues to diversify the source of income, its hydrocarbon resources remain at the top of the pyramid, fuelling the diversification plans and sustaining the requirements of current and future economic growth. To attain such plans, however, hydrocarbon resources need to be exploited in a very efficient and cost effective manner. Such exploitation is standing on several pillars, one of which is technology development and deployment. Successful technology application is driven by many factors such as adequate technology funding, time, risk aversion, patents and patents commercialisation, patience and above all the availability of the right talent.

You could have all the funds to research any topic; you could build best in class research and development facilities and acquire sophisticated laboratories, but without the right human capital, efforts are wasted. The main drivers behind this research are as follows.

Firstly, human resource or talent is the real competitive advantage of any successful organization and talented professionals bring innovation and advancement to technological applications.

Secondly, there is always joy and satisfaction at work when participating with others in developing engineers, scientists and future leaders. This joy grows when people motivation and organization benefits grow as well.

Thirdly, the author's organization, Saudi Aramco (The National Oil Company of Saudi Arabia) has given him a lot in terms of a rich work environment, challenging assignments, and rewarding career advancement. It is hoped that the outcome of this research will further the prosperity of this great enterprise, and serves as a guideline for professional development in the hydrocarbon business of Saudi Arabia.

Fourthly, the literature review revealed that what is written on the topic of developing professional engineers and scientists in the hydrocarbon industry is very

minimal. This has provided an opportunity to add to the technical talent development knowledge area.

1.1 Research Objectives

The research objectives are i) to define top competencies for engineers and scientists involved in technology development in the hydrocarbon industry of Saudi Arabia, ii) to find practical strategies and tactics to enhance and accelerate technical talent development iii) to discover potential challenges facing the implementation of these talent development strategies with suggested mitigation measures and iv) to recommend an implementation plan to use the research results.

This research will answer a series of questions including, but not limited to:

1. What are the common competencies (technical, business and soft skills) of competent researchers/technologists that allow them to excel in technology development and deployment?
2. What are the strategies to develop technical talent to attain and sustain such competencies?
3. What are the challenges facing the implementation of these talent development strategies?
4. How to mitigate these challenges?
5. What would be an effective implementation plan to apply this research results?

This research is divided into four phases: Literature review, Data Acquisition, Results and Discussion and Conclusions.

1.2 Research Limits and Boundaries

The title of the research gives a fair boundary of the topic. Despite that, drawing the boundaries focuses research efforts and produces more conclusive outcomes.

Talent resources which serve technology development include, but are not limited to; scientists, engineers, technicians, operators, administrative staff and leaders. This research work focuses on the talent of scientists and engineers or technical talent involved in research, technology development and deployment. The terms technical talent and technical professionals are used interchangeably. It is preferable to use the word “talent”

rather than “human resource” when aspiring to develop talent. The focus of this research is on talent development, the recruitment and retention of talent are excluded from this research. Technology is either proven, emerging or to be developed. The aim is not a transfer of proven technology to the Kingdom of Saudi Arabia. The aim is establishing in-house technology development and deployment. The strategy of importing or partnering with others will be considered as means to develop talent. The hydrocarbon industry includes oil and gas activities across the upstream and downstream chain starting from exploration, drilling, production, refining, transportation and ending by distribution. This industry includes both core hydrocarbon business and support services. This research, final analysis, findings and application of research outcomes target only the hydrocarbon industry in the Kingdom of Saudi Arabia. The following is a brief description about hydrocarbon industry and Saudi Aramco which is the major player in the hydrocarbon sector of Saudi Arabia.

Hydrocarbon Industry

Hydrocarbons are one of the Earth's most important energy resources. The predominant use of hydrocarbons is as a combustible fuel source. In organic chemistry, a hydrocarbon is an organic compound consisting entirely of hydrogen and carbon. The majority of hydrocarbons found naturally in “Crude Oil” or “Petroleum”, where decomposed organic matter provides an abundance of carbon and hydrogen. “Hydrocarbon Industry” or “Petroleum industry” includes the processes of exploration, extraction, production, refining, transporting and marketing petroleum products. The largest volume products of the industry are diesel, gasoline and fuel oil. Petroleum is also the raw material for many chemical products, including pharmaceuticals, solvents, fertilizers, pesticides, and plastics. The industry is usually divided into three major streams: upstream, midstream and downstream

Upstream

The upstream sector is a term commonly used to refer to exploration and drilling of crude oil and natural gas existing beneath the earth’s surface.

Exploration - Oil and gas exploration is the search by petroleum geologists and geophysicists for hydrocarbon deposits beneath the Earth's surface.

Drilling - Drilling is the process in which usable petroleum is extracted and removed from the earth' surface by drilling wells into the underground reservoir. The oil well is created by drilling a hole into the earth with an oil rig. A steel pipe (casing) is placed in the hole, to provide structural integrity to the newly drilled wellbore. Holes are then made in the base of the well to enable oil to pass into the bore. Finally a collection of valves called a "Christmas Tree" is fitted on the top of the well head to regulate pressure and control flow.

Midstream

The midstream is referred to processing or production of crude oil or gas and mid transportation of crude oil or gas to refineries. Gas Oil Separation Plant (GOSP) is one of the main industrial facilities in Midstream sector. The main two products of GOSP are oil which is fed to refineries and gas which is further processed in gas conditioning plants.

Downstream

The downstream sector is referred to the refining of crude oil and the selling and distribution of natural gas and products derived from crude oil. Such products include diesel, gasoline and fuel oil.

The downstream facilities are oil refineries, bulk plants, distribution network and retail outlets.

Saudi Aramco

Saudi Aramco is Saudi Arabia's national oil company –A fully integrated, global petroleum enterprise and a world leader in exploration, production, refining, distribution, shipping and marketing of petroleum products.

The roots of Saudi Aramco go back nearly seven decades. In 1933, shortly after Saudi Arabia was unified, the Government granted a concession to Standard Oil of California who recognized the potential of oil as a valuable export commodity and a source of revenue to begin building our nation. Standard Oil of California, the parent company of Chevron, was joined later by several other major oil companies and the venture became known as Aramco - the Arabian American Oil Company.

On November 8, 1988, the Council of Ministers approved a charter for a new national oil enterprise — the Saudi Arabian Oil Company.

Saudi Aramco manages the world's largest proven crude oil reserves of 260.1 billion barrels and the world's fourth-largest gas reserves, with 279 trillion cubic feet.

Figure 1.1 depicts a simplified Saudi Aramco Organizational structure, where colored departments participated in the different data acquisition tools.

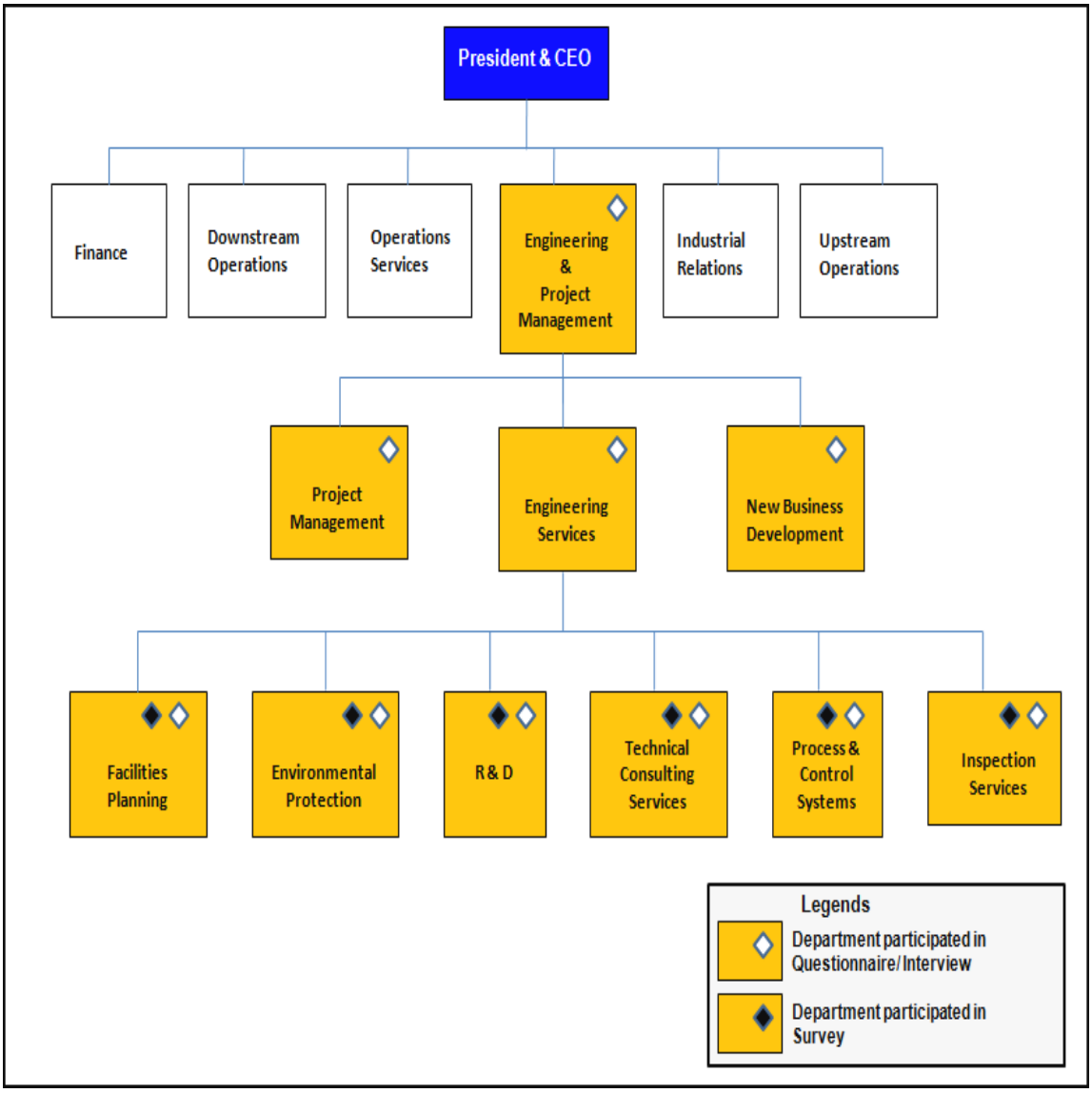

Fig 1.1 Depicts a Simplified Saudi Aramco Organizational Structure, Where Colored Departments Participated in the Different Data Acquisition Tools

1.3 Observations and Assumptions

From the author's personal thirty years of experience in the hydrocarbon industry, a series of observations and assumptions have been noted in the areas of professional competencies, talent development strategies, enablers and impedances facing technical talent development. Some of these observations include:

- Most professionals are not strong on the business competencies, correlation between global and local perspectives, and economical evaluation skill sets.
- The professional career path is not attractive as the managerial path which has a faster advancement pace, better recognized and well compensated.
- There is no incentive for senior professionals to mentor and pass knowledge to younger generations to enhancing the talent development process.
- The top attraction elements to an organization are challenging and interesting work assignments, competing compensation package, rewarding career path and recognition by others. Well established development/training programs could be viewed as an attraction element, as well.

For the talent development strategies, it is strongly believed that a well-structured development program is a key strategy to achieve long lasting talent development if impedances facing implementation are identified and eliminated. Examples of such challenges are a limited progression ladder, slower advancement path when compared to managerial path and low compensation for inventions and patents. Another key strategy is encouragement of self-development in any area that the individual desires and aligned with organization's objectives, with full financial and motivational support of the organization.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

All nations and organizations testify that the real capital asset they have is the human capital. Literature contains different phrases to describe human capital management such as personnel, human resources, intellectual capital and talent. Talent management is one of the latest terms in the literature and industry. In this chapter, talent management is defined, talent management building blocks are described and talent development methods are explained accordingly.

Literature review

Our review has included books, referred journals and other references. We have also tapped into public domain information through websites and networks such as:

- Educational institutions.
- Research and Development institutions.
- Hydrocarbon Companies and Hydrocarbon Support Services Companies.
- Countries studies and plans of R&D as a whole and human resources as part of these plans.

2.1 Talent Management

Lewis and Heckman [1] stated that; many authors wrote about talent management and everyone has his/her own assumption and definition. The term “talent management”, “talent strategy”, “succession management”, and “human resource planning” were often used interchangeably. Talent Management is defined by Jackson, and Schender [2] as: to ensure the right person is in the right job at the right time.

Rothwell [3] stated that talent management is a deliberate and systematic effort by an organization to ensure leadership continuity in key positions and encourage individual

advancement. Whereas Pascual [4] defined it as managing the supply, demand, and flow of talent through the human capital engine.

Berges [5] wrote that although many organizations have began to recognize the important role talent plays in their success, few are managing talent strategically. Leaders need to identify and invest in the critical talent that provides a platform for success, growth and new opportunities, but they must do so in a world of constraints – on time, money and especially talent.

The last decade there has been a tough competition on attracting and retaining talent. The literature review of Michaels, Handfield and Axelrod [6] in their book, "The War for Talent", indicated three fundamental forces fuelling the war for talent:

- The irreversible shift from industrial age to information age. When the war for talent began in 1980s (with the birth of the information age), the importance of hard assets-machines, factories, fund, etc. – declined relative to the importance of intangible assets, such as brands, intellectual capital and talent. As the economy becomes more knowledge-based, the differential value of highly talented people continues to mount [7].

- Intensifying demand for high-caliber managerial talent. Companies need managers who can respond effectively to globalization, deregulation and technological advances. Startups and small companies add an additional layer of demand on the talent pool. While short-term fluctuations in the economy will make talent market periodically looser, the demand for top managerial talent is still strong and will continue to be [8].

- The growing desire for people to switch from one company to another. When companies downsized in the late 1980s, the traditional bond that traded job security for loyalty was broken. When, in the 1990s, job opportunities surged and information about those opportunities was suddenly abundant and available (via the Internet), taboos against job – hopping evaporated. It is hard to see what could make employees surrender back to employers the control and responsibility they have assumed over their professional lives and well being. Since these structural forces show no sign of fading, it is believed that the war

for managerial talent will be a defining feature of the business landscape for many years to come [9].

2.1.1 Talent Management Strategy

Components of talent management strategy that need to be addressed include leadership, critical skills, organization and culture. These elements are interdependent but also distinct in the thinking they require [10]. Business leaders themselves repeatedly cite leadership as a critical competency and crucial for fulfilling business strategy [11]. The importance of critical skills is clear. The focus at this level is not about every kind of talent, but rather the key positions critical workforces and distinctive competencies to plan the talent supply chain and options for sourcing [12]. Organization is about assembling and structuring talent in the best combinations to generate high performance. There is a trend today about networked and connected organizations that facilitate the flow of knowledge and connection of talent. Governance and operating models are also much under study as organizations strive to find the balance between thinking globally and acting locally [13]. As to culture, this is defined as the shared set of assumptions, belief and values that guide a group's perception, judgments and behaviors. It affects the way people work together and how decisions are made, and are reflected in policies and procedures [14].

In creating a talent management strategy, the first task therefore is to understand the business strategy and define the talent needed to deliver that strategy, starting with a clear understanding of the talent on hand today [15]. The second task is for the business strategy and leader's vision to identify clearly the distinctive capabilities and how they need to be developed. This entails at least some basic segmentation: distinguishing between talent (present and potential) that is truly critical to strategic objectives and development of the business's distinctive capabilities, and talent that is not [16].

Once critical talent needs are identified to support the business strategy, the next challenge is to consider where the talent might come from [17]. Strategic sourcing of talent might include:

- A comprehensive understanding of current and future workforce demographic and their implications for talent supplies [18].

- A strategic approach to sourcing talent that reflects an organization's competitive strategy, present and future global workforce needs, and available talent pools to meet staffing needs [19].

- Talent supply chains which rapidly adapt sourcing channels and targeted talent pools to accommodate new strategic objectives and changing business conditions [20].

- Talent supply chains agile enough to allow the organization to manage changes in talent needs or supplies, adapt over time to changes in markets or business environment, and align the investments of all participating parties [21].

- Constant monitoring and adjustment of talent supply chains to ensure the continuous supply of talent needed to achieve business objectives [22].

- The right technology and analytics so that predictive models can be constructed to produce forecasts of talent needs and improve talent-sourcing decision [23].

2.1.2 Talent Management Imperatives

Michaels, Handfield and Axelrod [6] have surveyed 1300 executives at 120 companies, as well as case studies of 27 leading companies and presented a five part approach to managing an organization's talent resources.

- Embrace a talent mindset: A talent mindset is the deep seeded belief that having better talent at all levels is how you outperform your competitors. It is the belief that better talent is a critical source of competitive advantage, and the recognition that it is better talent that pulls all other performance levers. Leaders with this mindset don't delegate talent management to subordinates they commit a major part of their time and energy to strengthening their talent pool, taking bold actions when necessary to see that talent is maintained and grown throughout their organizations [24].

- Craft a winning employee value proposition: The days of having a career simply as a means to provide yourself and loved ones with food and shelter are over. Today, a talented person certainly needs those things, but they want to feel passionate about the work, to be enriched and inspired by their companies and leadership. If they are not fulfilled, they will not likely stick around. There are many attractive options out there, particularly for talented employee value proposition that provides employee with the core elements they seek in a career opportunity including: exciting work, a great company, attractive compensation and opportunities to develop [25].

- Rebuild your recruiting strategy: For generations, recruitments at most companies worked in a fairly uniform manner. The hiring department would put out the word, and people hungry for work would apply. The company had the power to make the selections; the employees were either selected, or they went looking for work elsewhere. Today, of course, it is an entirely different game; the balance of power has shifted to talented people. When the dot.com and startup boom happened, companies were finding no one lining up at their gates. This happened at precisely the time when companies needed not just more people, but more talented people than ever before. Organizations recognized that they must engage in solid recruiting strategies if they want to stay in the hunt for the best and brightest talent [26].

Those strategies include the following:

- Pump talent in at all levels.
- Hunt for talent all the time.
- Tap many diverse pools of talent.
- Develop new channels for reaching talent.

- Weave talent development into the organization: Companies must place an emphasis on the development of their people. Not everyone in your organization will develop into a superstar, even with the right amount of training and attention. However, everyone can push the limits of what they can accomplish when provided with the right challenges, encouragement, and support they need to succeed. Those organizations that weave talent development into the fabric of their organization will attract more talent, retain it longer, and perform better in the long run [27].

- Differentiate and affirm employees: To maximize the efficiency of your talent pool, you need to make certain you are differentiating your best employees from your mid and low level performers [28].

2.1.3 Talent Management Process Framework:

Choudhary and Mundra [29] suggested a talent management framework as depicted in Figure 2.1. This process starts with recruiting, where entry points, target profiles and required talent sources are identified. The second step determines methods to profile individuals, frequency of moving people, needed career paths and how and who makes work assignment decisions. The third step answers how to assess employees performance, what training is appropriate, and what other development supports.

Performance and reward is the fourth step and the final one determines organization structure, deployment model and how to shape jobs to individual needs.

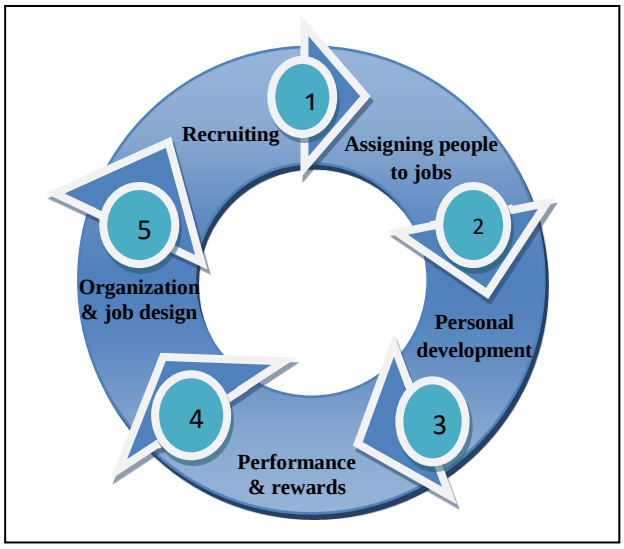

Figure 2.1 Talent Management Frameworks [29]

2.1.4 Challenges to Talent Management

London Business School [30] in its 2008 talent survey report asked respondents a number of questions relating to current challenges which have talent management implications. Respondents continue to identify the war for talent as the most significant factor influencing their talent management strategies.

Seventy five percent believed that the war for talent will significantly influence their talent management strategies in the future. The report concluded the top three challenges which impede an organization's success are:

- Developing a talent pool that fits our culture and values.
- Using cross silo assignments as part of talent management strategy.
- Building an employer brand.

2.2 Talent Development

The main building blocks of talent management are recruitment, development, and retention. A Deloitte research study [31] has presented an interesting talent

management model where it revolves around the talent development and claims that attraction and retention will be attained. Figure 2.2 exhibits Deloitte's proprietary Develop- Connect - Deploy talent management framework.

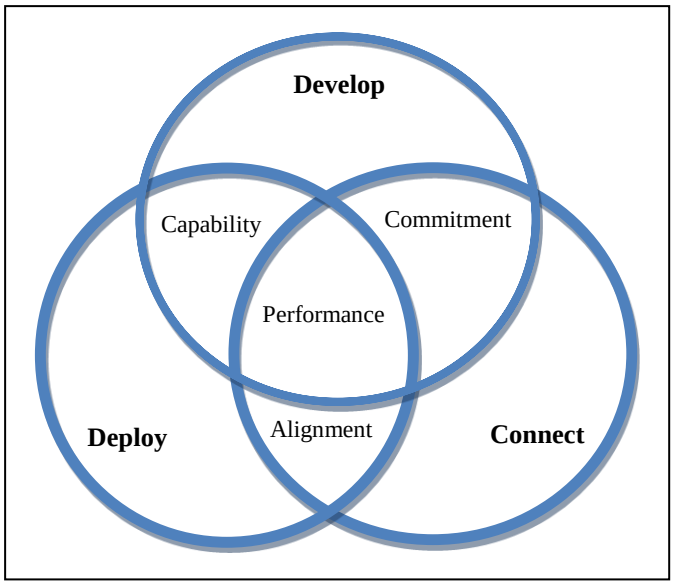

Figure 2.2 Develop-Connect-Deploy Model [31]

This study argues that this model should be at the core of an organization's talent management strategy. By focusing on its three elements; develop-connect-deploy, organizations can generate capability, commitment, and alignment in key workforce segments, which in turn improves business performance. When this happens, the attraction (recruitment) and retention of skilled talent largely take care of themselves.

By "Develop," they mean providing the real-life learning employees need to master a job. They don't mean just traditional classroom or online education. The focus is on on-the-job experiences that stretch employee's capabilities and the lessons they learn from peers, mentors, supervisors and others.

By "Connect", they mean providing critical employees with the tools and guidance they need to (i) build networks that enhance individual and organizational performance, and (ii) improve the quality of their interactions with others.

By "Deploy", they mean working with key individuals to (i) identify their deep-rooted skills, interests, and knowledge, (ii) find their best fit in the organization, and (iii) craft the job design and conditions that help them perform.

A learning organization is one that values, enables and measures learning as a critical part of the way it does business and what defines it [32]. From the top down, people have to see learning as important, part of their job, and part of the culture and fabric of the organization. Such organizations systematically share best practices, learning and knowledge, and they focus responsibility for learning and development across the organization at a senior level [33]. In a more expansive way, Peter Senge [34], who developed the idea of learning organizations, described them as organizations where people continually expand their capacity to create the results they truly desire, where new and expansive patterns of thinking are nurtured, when collective aspiration is set free, and where people are continually learning to see the whole together. It has been argued that to be a great learning organization, you also have to be a teaching organization. An organization that talks about stewardship or development of people must emphasize everyone's role in teaching and developing others as a core value [35].

Research and experience have shown that different models of learning produce different learning outcomes. Figure 2.3 summarizes research carried out by the National Training Laboratories [36] and replicated in numerous other studies.

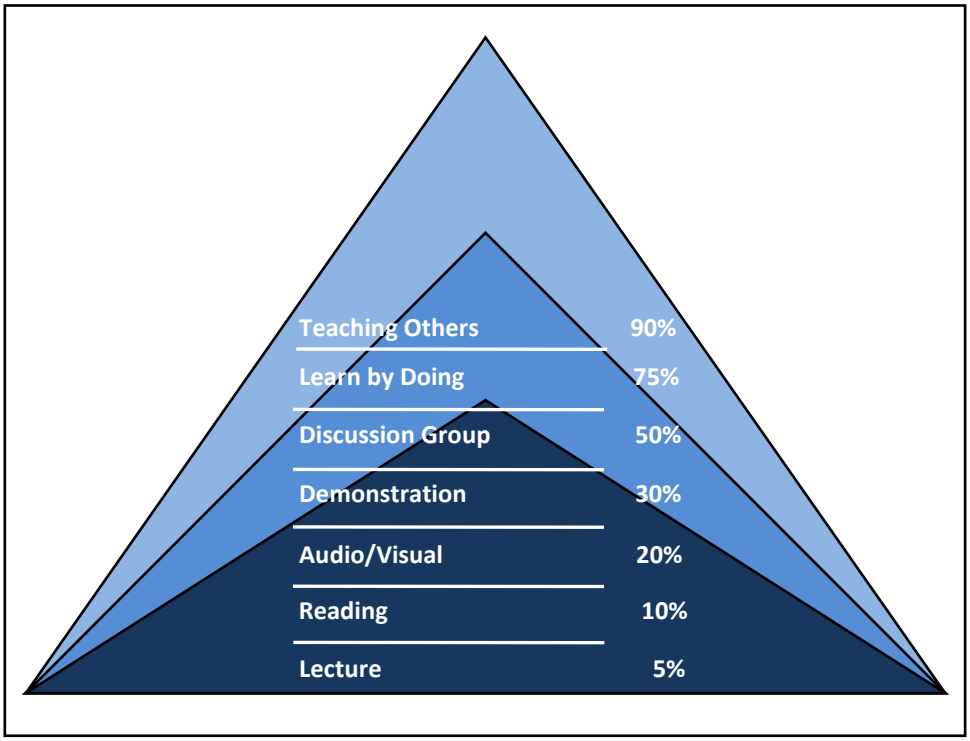

Figure 2.3 Average Knowledge Retention Levels for Different Instructional Method [36]

Teaching organizations soon discovered that teaching others is the most effective means of retaining knowledge. Because teaching others and on-the-job learning are so effective, many organizations appoint formal coaches, but most coaching takes place informally [37].

2.2.1 Talent Development Methods

The literature contains many methods of talent development and training that organizations use. Callahan, Kiker, and Cross [38] indicated that there are different ways for training available. Because of each has its own advantage and limitations, there is no one best way to train, and all of them can be effective in the right situation.

Spector [39] discussed eight different training methods that are frequently used in organizational training. These methods can be used in combination, because a good training program may need to take advantage of the strengths of different methods for different aspects of training. Table 2.1 lists these methods with the major advantages of each.

Method	Advantages
Audiovisual Instruction	• Presents material that could not otherwise be heard or seen. • Can train many people at once.
Auto Instruction	• Gives immediate feedback to trainees. • Individualized pacing.
Conference	• Allows for feedback to trainees. • High level of trainee involvement.
Lecture	• Economical. • Good information giving method.
Modeling	• High level of feedback. • Provides practice of new skills.
On-the-Job-Training	• Exposure to actual job. • High level of transfer.
Role Playing	• High level of feedback. • Provides practice of new skills
Simulation	• High level of feedback. • Provides practice of new skills

Table 2.1 Training Methods and Major Advantages of Each [39]

- Audio visual instruction: It involves the electronic presentation of material using an audio tape, video tape, DVD, or computer. It's common for lecturers to use computer based tools such as PowerPoint to add audio visual elements to presentations [40].

- Auto instructions: It refers to any training method that is self-paced and does not use an instructor [41].

- Conference: It is a meeting of trainees and a trainer to discuss the material in question. The distinguishing feature of the conference is that participants can discuss the material and ask questions. It also allows for a free flow of ideas so that discussion can go beyond the prepackaged material [42].

- Lecture: It is a presentation by a trainer to a group of trainees. Its major advantage is its efficiency. The trainer can present material to a large number of trainees. The mass presentation to many people limits the amount of feedback that can be given [43].

- Modeling: Modeling involves having trainees watch someone performs a task and then having them model what they have seen. This approach is often used for the training of supervisory skills [44].

- On-the-Job Training: It is any method used to show employees how to do the job while they are doing it. On-the-job training can be an informal system whereby a new employee watches an experienced employee to see how the job should be done. It can also involve a formal training program such as an apprenticeship program [45].

- Role Playing: A role play is a simulation in which the trainee pretends to be doing a task. The role play could be part of the modeling approach. The role play itself does not involve first observing another person performs the behavior [46].

- Simulations: A simulation is a technique in which specialized equipment or material are used to portray a task situation. Trainees are to pretend that the situation is real and carry out their tasks as they would in the actual situation.

Simulations can be used for training people in the use of equipment, such as automobiles or airplanes [47].

Electronic Training

Electronic Training or e-learning is the latest trend in organizational training and educational institutes. It involves the use of electronic tools and computers to provide training. Nowadays, e-learning programs are interactive and give feedback on the comprehension of the individual and at his/her pace.

De Ronin, Fritzsche, and Sala [48] noted several potential advantages of e-learning that makes it attractive to organizations. First, it can provide the learner a great deal of control over the training experience by being able to determine where and when the training is delivered and, with some methods, the order of material. Second, technology allows for rapid development and modification of training material as needed. A training module written in PowerPoint can be put together and e-mailed to employees or posted on a website in a very short time. Third, e-learning can be combined with others, more traditional methods, producing blended learning. For example, a classroom lecture can be coupled with some e-learning exercises. Finally, e-learning can be easily customized to meet individual employee needs. For example, a training program might include assessments that determine when a learner has mastered the material and is ready to move to the next topic [49].

Mentoring

Many organizations have found that new and inexperienced employees can benefit from being mentored by more senior and usually higher level employees. Day and Allen [50] have defined mentoring as a special kind of work relationship between two employees in which the more experienced one offers career guidance, counseling, and emotional support, and serves as a role model, to the less experienced one. Mentoring can be thought of as a kind of training that not only orients new employees to the job but helps them develop their careers with the company over a considerable period of time. Allen, Eby, Proteet, Lentz and Lima [51] have concluded in their research that employees who are mentored derive a number of benefits from mentoring, including better job performance, quicker promotion, better job attitudes, less turnover, and less conflict between demands of home and work.

Mentoring might occur naturally as relationships develop between people at work, but many organizations have formal mentoring programs in which mentors and mentees are assigned to one another [52].

Aryee, Lo, and Kang [53] have noted that formal programs can be useful because not all employees are likely to find mentors on their own. Individuals who are achievement oriented and sociable are most likely to find mentors naturally.

Executive Coaching

High level executives, especially in companies, are sometimes paired with a consultant who serves as an executive coach to help them improve job performance. One way the coach can operate is to solicit feedback from the employees who interact with the executive, perhaps using 360-degree feedback. The coach will meet with the executive to help interpret the feedback and devise an action plan to improve in areas that are deficient [54].

2.3 Technical Talent Development

Ian Cunningham [55] has stated: “In the early nineteenth century there was a young uneducated bookbinder in London who started to take an interest in science. He had no formal training in the field, but managed to get work assisting a famous scientist. Through this route he started his own experiments in chemistry and physics. He became quite established as a high effective experimenter, though he never understood mathematics and was not, in the early days, much respected by the scientific establishment. His name was Michael Faraday and he rates with Newton and Einstein as one of the most influential scientists who ever lived. His three volumes of Experimental Researches in Electricity, covering 1,114 pages, contained no mathematics yet has been the most influential document in its field. He was clearly a genius”.

The reason for this brief story has to do with how organizations often want to classify talent as a total package. The person is expected to show competencies across a wide range in order to justify being seen as talented. Faraday would not match up to modern criteria for even an average scientist.

Literature indicates that in the past, technical and scientific careers followed vertical career paths. Such a path is structured to keep employees within a single, specialized functional area. As organizations grow in size and strategic direction, the importance of recognizing different factors in career development initiate a change from vertical career ladder to flatter path and the encouragement of cross functional career development [56].

Corporate Leadership Council [57] in its 2004 study, suggested a scientific career management framework that is critical to developing and retaining technical talent of an organization, as depicted in Table 2.2.

Identifying Competencies for Technical Careers	Defining Technical Career Paths	Evaluating and Promoting Technical Employees
• Create a hybrid competency model • Communicate competencies	• Create career ladders • Lateral movement between technical and management career • Create cross functional career path	• Define evaluation criteria • Design attractive promotional rewards

Table 2.2 Technical Career Management Framework [57]

2.3.1 Competencies Model

Research and Technology Executive Council [58] suggests that most organizations define and evaluate all positions on one basic competency model. Given the specialized nature of skills required of technical talent, literature indicates that most effective technical employees development practice combine several competency models into one hybrid model. Table 2.3 outlines three basic competency models.

Competency Model	Definition
The Core Competency Model	• Based on the value systems, vision, and mission of the organization. • Defines the set of soft skills and behaviors that should be possessed by every employee of the organization.

Table 2.3 Competency Model Definitions [58].…….Continuation

Competency Model	Definition
The Functional Competency Model	• Built around key business function, like R&D, production, and marketing. • HR or upper management defines the specific functional skills that employees working in these functions need to have.
The Role-Specific Competency Model	• Identifies the skills an individual will need to possess to perform a particular role within a functional department.

Table 2.3 Competency Model Definitions [58]

A combination of these competency models allows the organization to map the behavioral and functional attributes that are required for each position. By identifying both broad and specialized competencies for different positions in a company, the organization facilitates vertical, horizontal, and cross-functional movement of employees [59].

Once companies develop competency models for technical employees, Human Resource Department and/or management must communicate them to employees. Without communication, it may prove difficult to engage employees in career development [60].

2.3.2 Technical Career Paths

Corporate Leadership Council [61] reported that traditional Research and Development (R&D) Laboratories hired scientists and engineers for their specialized technical competencies. In contrast, R&D laboratories currently hire scientists and engineers for more varied skills. Organizations require R&D employees to possess the following skills, in addition to the core competencies of the organizations:

- Communication Skills
- Cross-functional work experience or abilities
- Leadership and management abilities

A 2003 Council study on technical career ladders [61] profiled one pharmaceutical company's career development options. While the organization embraces a solely vertical career path for scientific employees, it identifies four specific competency areas (technical proficiency, field knowledge, job knowledge, and management and teamwork) that are required of every position in the technical career ladder.

Table 2.4 profiles an example of technical career positions and associated competency areas.

Position Title	Description of Competency Areas
Associate Scientist	• Technical Proficiency: Basic understanding and knowledge of techniques or instrumentation and lab functions. • Field knowledge: Practical knowledge in scientific discipline, familiarity with standard equipment and procedures. • Job Knowledge: Knowledge of company safety and environment policies and procedure. • Management and Teamwork: Participates constructively in team and takes direction well from supervisor.
Scientist	• Technical Proficiency: Performs experiments with minimum to no supervision, interprets and evaluate data, contributes to written reports. • Field Knowledge: Master's Degree and additional Lab experience, excellent, knowledge of Lab procedure, ability to perform library research and incorporate into experimental findings. • Job Knowledge: Assists in the preparation and/or prepares Lab procedures for company department. • Management and Teamwork: Trains junior members of team when needed, offers assistance to co-workers, provide back-up for supervisor.

Table 2.4 Example of Technical Career Profiles [61]

When Human Resource Department and upper management identify competency sets for technical career path, it is easier for an R&D employee to move laterally between laboratory and management.

A Society of Human Resources Management white paper [62] confirms that today's companies are moving towards flatter organizational structure as staffing budgets get tighter and product turnaround time for R&D departments get shorter. As factors combine to create flatter organizations, R&D employees are hired with

management competencies and a goal to further develop them throughout the employee's service with the company.

Scientists and engineers may have more than two career desires, making it difficult to move R&D employees only between technical positions and managerial ones. Cross-functional career paths allow scientific workers to gain valuable experiences across R&D departments and business units, yet few companies implement this practice [63].

Many organizations have begun to employ cross functional career tracks. A cross-functional career path allows an employee to move between several laboratories in the R&D department and/or from R&D to other departments with the company. This path offers the benefits to employers of having well trained and versatile staff, while also allowing employees to increase competency levels in areas that they would not develop in a vertical career path [64].

Organizations mainly use evaluation techniques to promote technical talent vertically within the company. Consequently, evaluation criteria remain undefined for lateral and cross-functional promotions. Research and Technology Executive Council [65] has reported that traditional evaluation criteria and metrics for technical employees include the following factors:

- Individual publications
- Number of publications cites by scientific peers.
- Patents generated individually and in work teams.
- Revenue brought into the company by patents.

Less quantitative evaluation measures might include laboratory processes learned, skills acquired, and knowledge gained. All of these criteria are positive indicators for a vertical career path and vertical promotion, but they do not necessarily evaluate candidate's performance in terms of a managerial promotion or across company [66].

Promotion rewards also remain an undefined area for technical employees that do not move up a vertical career path. While rewards for promotion in a vertical career

ladder are well-documented, lateral and cross-functional promotion rewards are difficult areas for many organizations. Often when employees move laterally or across company, they are not necessarily moving to a more senior position. Petroni [67] concluded from his literature review that building work life rewards, stock-options, and flexible work arrangement into promotions that are lateral and cross-functional is valuable.

Key technical talent is broadly defined as technological experts who possess strong intellectual aptitude, business knowledge, and leadership skills, which are of vital importance to their employers. Schwartz [68] has summarized the top competencies for successful technical employees as:

- Ability to adopt to change.
- Broad technical knowledge.
- Business acumen-basic understanding of business goals.
- Interpersonal communication skills.
- Love of knowledge-self-driven learning style.
- Specialized expertise within the designated area.

Enhancing existing skills and developing new ones is important to technical talent and their job satisfaction. Albritton [69] reported that ongoing employee learning and development should also be a priority to employers because of the fast paced changes that take place in the high tech industry.

Most companies prefer to develop existing talent, rather than hire external talent. Corporate Leadership Council [70] has studied a number of high technology companies that employ up to 50,000 employees and generate revenue up to $10 billion. There are no common strategies on how to develop technical talent. The best of all these strategies is condensed below.

2.4 Technical Talent Development Strategies

2.4.1 University Curriculum

Corporate University staff collaborates with stakeholders to source or develop training that will lead to the development of the newly required skills. Skill requirements are determined by the Advisory Board, which operates as shown in Table 2.5 [70].

Membership : Consists of the following: • HR professionals. • Management representatives. • Technical Contributors at the principle engineer. Meeting Frequency : Six times annually Responsibilities: Tasked with determining skill set requirements for technical and management staff.

Table 2.5 Advisory Board Function [70]

Technical leaders participate in training, developing or sourced by the Corporate University, to acquire the skills outlined by the Advisory Board.

2.4.2 Proactive Self Development

A more “hand off” approach is to encourage and facilitate self development. The role of the employer is to provide the training material, typically in an e-learning format that will serve the company’s objectives, whereas employees on their own pace acquire such learning. Some companies might demand that employees shall complete and pass certain e-learning courses as part on their performance reward system. In addition to the mandatory course, all key technical contributors are required to have a development plan that includes new skills they need to acquire [71].

2.4.3 On-the-Job Rotations

Most companies provide their leading technical talent with job rotation opportunities. Such rotations are characterized by (i) Driven by internal talent need, (ii) Require management support and approval, and (iii) Differ from opportunity to opportunity, depending on individual circumstances. This strategy provides development opportunities, addresses internal talent gaps, and allows individuals to learn various parts of the business [72].

2.4.4 Peer-to-Peer Knowledge Sharing

Internal networking groups facilitate employee knowledge sharing and development. These are typically composed of co-workers who have similar roles and responsibilities. This face-to-face and low-cost employee development strategy may take different forms, such as community of practice, knowledge sharing sessions, mentoring groups, networking groups, and workshops or conferences [73].

2.4.5 Structured Technical Talent Development Program

This strategy calls for designing a technical talent development program that encompasses pre-determined competency model, all available training facets and development strategies, and is aligned with corporate objectives to develop and retain technical talent [74]. Aerospace industry maintains such program although it varies from one company to another. Boeing Technical Fellowship Program [75] was reviewed. The main aim of this fellowship program is to ensure technical integrity across the enterprise in people, technologies, processes, tools and products. The objectives are: (i) Utilize the technical experts from diverse technical areas, with experience thought the lifecycles of all Boeing products, to solve key technical challenges across the enterprise, (ii) Expand Boeing's technical skill and performance by improving the acquisition, retention, knowledge and use of the technical workforce. The program is supported and managed by senior executives. It is considered as the mechanism to administer the technical talent pool where the selection process identifies top 5% of the technical workforce. Boeing maintains 77% of total fellowship as Associate Technical Fellows, 20% as Technical Fellows and 3% as Senior Technical Fellows. The cornerstone of development is the use of mentoring and coaching. There are trained coaches for all candidates at all levels and there is a common training for all involved parties; candidates, coaches, nominating managers and evaluators.

Through literature review, interaction with subject matter experts and author's own experience; little has been researched and written in the area of professional engineering development. The focus of what has been published about human resources or talent development is geared towards preparing and developing leaders and management personnel.

When zooming into professional development in the hydrocarbon industry of Saudi Arabia, no single study in the subject or close to it was found. Professional talent development in the hydrocarbon industry in the Kingdom of Saudi Arabia becomes, therefore, a virgin area to explore and understand. To further strengthen the originality of this work, the research did not stop at defining the effective professional talent development strategies, but it uncovered the challenges facing the implementation of these strategies.

The aim is to establish guidelines that the hydrocarbon industry of Kingdom of Saudi Arabia finds useful. Such guidelines would be a new addition to knowledge area of technical talent development.

It has been found that literature review is not an easy task, as a matter of fact; it was the most difficult phase in the research. This review has confirmed the selected topic deserves such a research.

CHAPTER 3

DATA ACQUISITION

3.0 Introduction

This research has been divided into four phases; literature review, data acquisition, results and discussion, and conclusion. There was no distinct phase end date and start of the other, but rather an overlap and interconnected phases and activities. Figure 3.1 illustrates a timeline of the main research activities showing overlap and sequence.

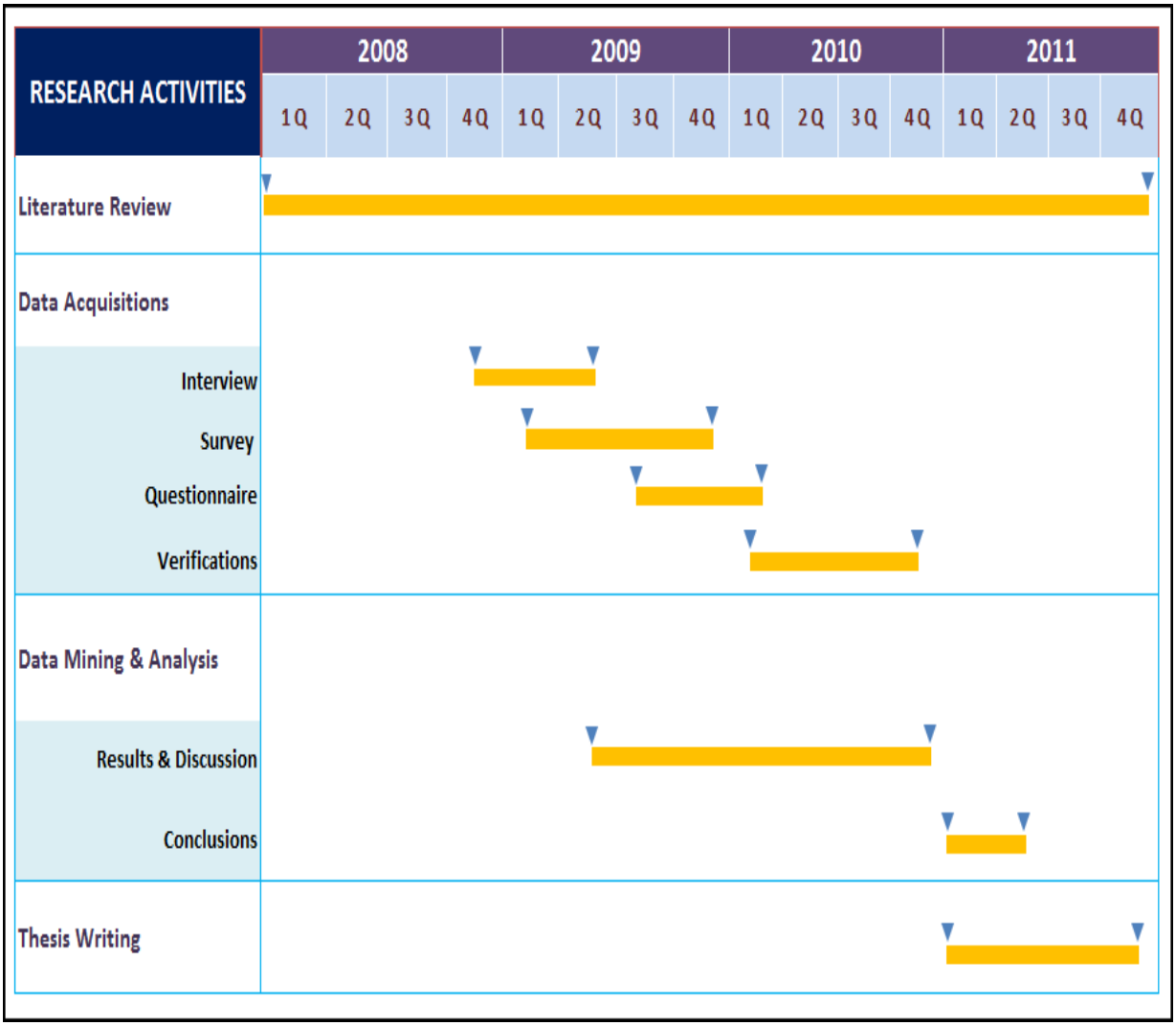

Fig 3.1 Timeline of Main Research Activities

It is important to note that data acquisition phase has been sequenced where interviews were conducted first, followed by main survey and concluded by level of leadership engagement questionnaire. Starting with interview was very helpful to define right topics serving research objectives and generate good questions for the main survey and subsequent questionnaire.

Data Acquisition

Research data and information have been collected from several sources using various methods. Figure 3.2 below depicts the main methods of data collection.

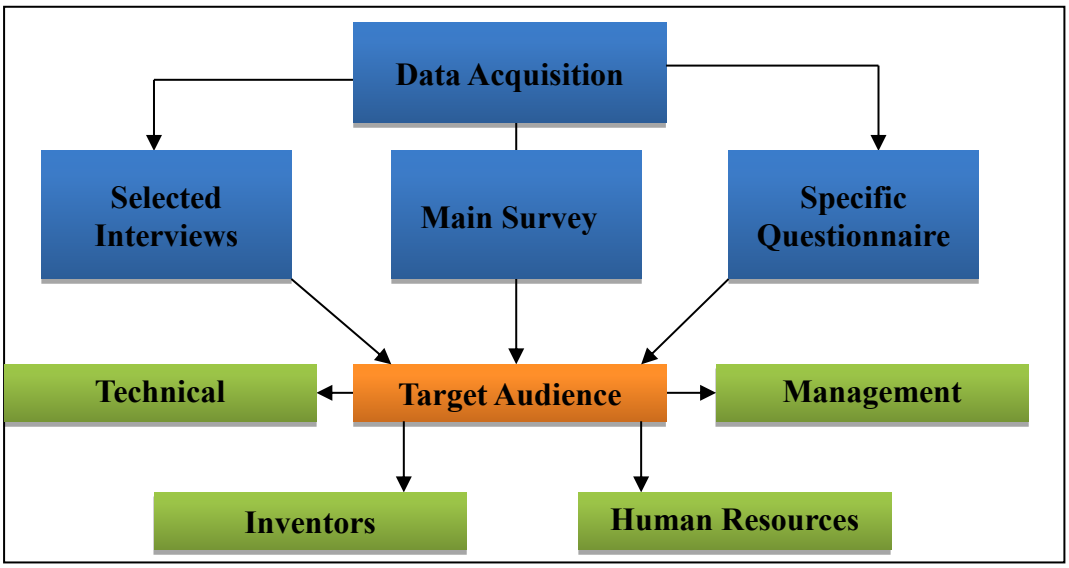

Figure 3.2 Research Data Acquisition Methods

Topics and Questions Preparation

At this stage, research objectives and limits were well defined, but this is not sufficient to determine specific topics and questions to ask participants during the survey, questionnaire and interviews. The scheme was as follows:

Literature review and author's experience were used to generate initial topics and questions for the data acquisition tools. These initial thoughts were shared with subject matter experts during a brainstorming session that was facilitated by the author. Modifications to the initial sets of topics and statements were made. Then an

initial survey coupled with few interviews was conducted on small scale participants to validate and calibrate reasonableness of the chosen technical talent development topics and relevant questions. As a result, adjustments and alterations were incorporated to finalize the main interview questions, survey topics and statements, and level of leadership engagement questionnaire.

Interviews

This is a very crucial tool for data acquisition and aid in the critical analysis. Examples of key people to interview were:

- Researchers and subject matter experts in the engineering and R&D organisations within Saudi Aramco of KSA.
- Saudi inventors with registered patents.
- Select management members at different levels in hydrocarbon organisations and support services companies.
- Human Resources consultants.

Main Survey

An electronic survey has been designed to collect data on research questions. The target organizations were:

- Research and Development Centres of Saudi Aramco.
- Technical Services departments in Saudi Aramco.
- Research Institute of King Fahd University of Petroleum and Minerals in Dhahran.
- King Abdulaziz City for Sciences and Technology.
- King Abdullah Research Institute of King Saud University in Riyadh.
- Hydrocarbon Support services companies in Saudi Arabia.

Specific Questionnaire

This questionnaire is designed to address level of engagement of parties involved in the technical talent development, including professionals being developed, their mentors and leaders at various levels. We have selected the main business line in Saudi Aramco that has the highest number of scientists and engineers, which is Engineering and Project Management. There were two similar

questionnaires. One was conducted in 2009 as the initial data source and base line. Another one was done in 2010 to verify previous findings and measure improvement over time.

Results and Discussion

Data Mining and Analysis

The data collected from different acquisition tools have been arranged and classified to detect patterns, screen out top issues, determine priorities and gaps in the areas of research; technical talent competencies, talent development strategies and challenges facing the implementation of such strategies. Comparative and affinity analysis are used to aid in reaching conclusions.

Verification of Findings and Observations

To enhance the credibility of the findings that would lead to solid conclusions, two complementary verifications tools were used. Firstly, the level of engagement questionnaire was repeated. Secondly, additional interviews were conducted with some technology inventors within the hydrocarbon industry of KSA, using insights that were gained after the data acquisition phase. This is followed by observations discussion.

Conclusions

At this stage there is a clear picture of the current reality and desired results of technical talent development and the research questions were answered, covering:

- Common competencies (technical, business and soft skills) of scientists and engineers engaged in developing technologies to support technology advancement in the hydrocarbon industry in KSA.
- Talent development strategies to attain and sustain these competencies.
- Challenges and hurdles facing the implementation of these talent development strategies and how to mitigate them.
- A suggested implementation plan to apply research results.

3.1 2009 Interviews

An important source of data is interview of people. The interviews were started prior the survey. These interviews with different people have opened eyes on many issues that facilitated better questions selection for the main survey and the subsequent questionnaires.

The interview has been conducted into two steps. First step was face-to-face discussion to ensure understanding of the interview objective, clarity of the questions, and to collect direct information. Second step was immediately after the interview, where the discussion questions were e-mailed to participants and they e-mailed back their thoughts.

The interview questions included but were not limited to:

1) What are the common (fundamental) competencies/skills that a qualified technology developer (engineer, scientist, or researcher) must have?

2) How do you (what are the strategies/programs/plans) develop technical talent to attain and sustain these competencies/skills?

3) What are the enablers (success factors) that would help to implement the talent development strategies that you suggested above and how to capitalize on these enablers?

4) What are the hurdles (challenges) facing the implementation of the above talent development strategies and how to mitigate such hurdles?

Figure 3.3 shows the interview target audience and Table 3.1 summarizes the outcome of the 25 interviews. Details of this interview results are in Appendix - IIIA.

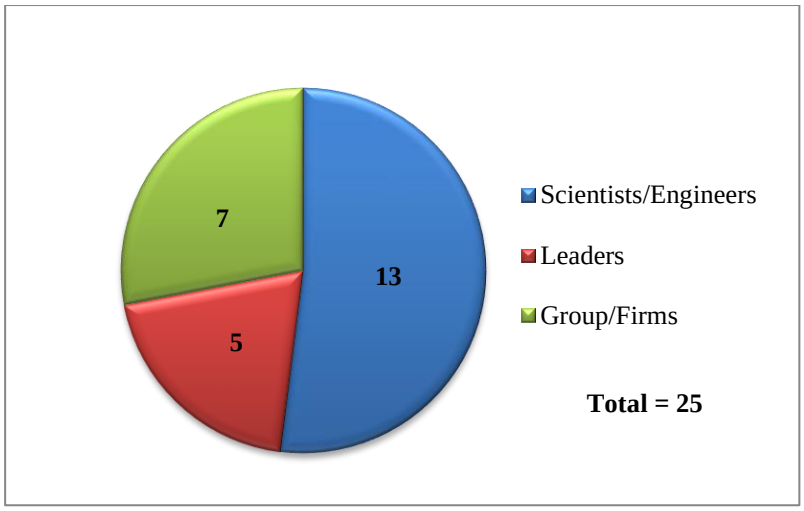

Figure 3.3 - 2009 Interview with Hydrocarbon Sector

Top Technical Competencies:	a) Adequate field experience b) Computing Knowledge c) Up-to-date in specialty d) Research methods
Top business/financial competencies:	a) Economic evaluation b) Cost estimation c) Project Management
Top Soft-Skills:	a) Communicate openly and effectively b) Teamwork c) Analytical capability d) Build relationship

Technical Talent Development Strategies:

1. Several years' assignment at field of industry.
2. Internship assignment with best in class organization.
3. Sponsor advance degree studies for high potential technical talent.
4. Establish a mentorship program.

Top success factors to develop technical talent:

1. Continuous support and commitment by management at all levels.
2. Creating the right environment for R & D.

Top challenges facing development of technical talent:

1. Available budget for training and conference.
2. Retaining of technical talent.

Table 3.1 - 2009 Interview – Summary of Findings

3.2 Technical Talent Development Survey

One source of data is the literature review which was critical to learn and find what others have contributed to the subject of the research. This review has revealed that a lot has been done in the talent management, especially in leadership/management aspect but technical talent development needs to be explored further. Another source is the author's thirty years of experience in the hydrocarbon industry and managing technical professionals. These two sources were not enough, of course, and examining the current reality of technical talent development in the hydrocarbon industry in Saudi Arabia is an imperative to his research. The key was a carefully designed and implement survey, questionnaire, and interviews.

The author had to do a little research on how to design an attractive and effective survey, which audience to target, how to ensure credibility of responses and how to ease data reconciliation and analysis afterward.

The survey targeted oil and gas operators in Saudi Arabia, specifically Saudi Aramco, hydrocarbon service companies Schlumberger and Halliburton and research institutes dealing with hydrocarbon research topics including Research Institute of King Fahd University of Petroleum and Minerals (KFUPM) and King Abdulaziz City for Science and Technology (KACST).

The survey consists of 32 statements in the area of talent management strategy, talent development, rewarding performance, leadership involvement, high potential technical talent, competency inventory, technical talent development strategies and tactics, team and organization characteristics and challenges facing technical talent development. These statements were developed through literature review, interview with involved subject matter experts and a brainstorming with selected participants. Appendix [IA] exhibits the survey statements.

Looking at Figure 3.4, ten organizations were invited (from Saudi Aramco, support service companies, research institutes at KFUPM and KACST), 176 (technical and managerial personnel) to participate in this survey and 90 have responded or 51%. This is considered very representative. Demographics of the survey showed that 34% of the 90 respondents are from management and the remaining 66% are technical professionals. Zooming into professionals, 48% hold a PhD, 29% a master and 22% a bachelor degree in

their area of technical speciality. Furthermore, 64% of respondents have more than 20 years of experience and 34% have an experience between 10-20 years. The confidence level and credibility of this survey outcome are considered very high.

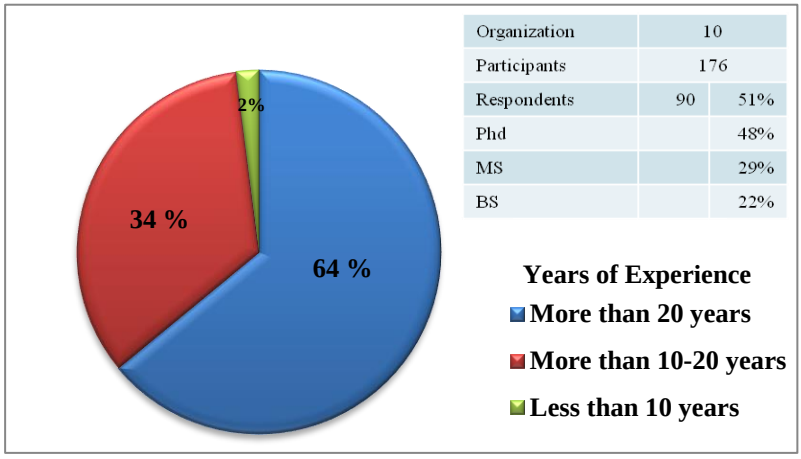

Figure 3.4 Technical Talent Development Survey – Participants Summary.

A summary of the survey statements and selected data of the answers are shown on Table 3.2 in the following pages. The answers of minor and strong agreement in this table are presented in grouped answers just to ease presentation. The detailed choices of answers are presented and discussed in detail in Chapter 4. Detailed survey results and comparative perspectives are included in the Appendices [I-B] and [I-C] respectively.

1. Talent Strategy		
	Minor Agreement	Strong Agreement
1.1 Talent development is aligned and integrated with business strategy.	34	56
	38%	62%
1.2 Critical roles and capabilities are identified in your organization.	37	53
	41%	59%
1.3 Individual performance is tied to talent development.	43	49
	48%	52%
1.4 Team leaders (first line management) are accountable for developing technical talent.	42	48
	47%	53%
1.5 Department managers are accountable for developing technical talent.	36	54
	40%	60%
1.6. The forecast range of supply and demand for technical talent is:		
No forecast	21	23%
Less than 1 year	6	7%
1-2 years	16	18%
3-5 years	30	33%
More than 5 years	17	19%
Total	90	100%

Table 3.2 Summary of Survey Results……Continuation

2. Talent Development		
2.1 Every technical professional has an individual development plan.	Disagree	Agree
	43	47
	48%	52%
2.2 Technical professionals can easily access accurate information on available development opportunities.	34	56
	32%	68%
2.3 Managers and technical professionals share accountability for talent development.	33	57
	36%	64%
2.4 Technical professionals have a clear picture of competencies they should develop to support business growth in your organization.		
Not at all	7	8%
To some degree	25	28%
To a considerable degree	41	45%
Fully understanding what is needed	17	19%
Total	90	100%
3. Rewarding Performance		
	Minor Agreement	Strong Agreement
3.1 Current compensation package is comparable with individual performance.	48	42
	53%	47%
3.2 There is a pay differentiation for high performers through both base and variable pay.	50	40
	56%	44%
4. Leadership Involvement		
	Disagree	Agree
4.1 Management involved with technical talent development	21	69
	23%	77%
4.2 Senior technical professionals teach and develop young talent	7	83
	8%	92%
4.3 Senior leaders teach and develop new leaders	29	61
	32%	68%
	Minor Agreement	Strong Agreement
4.4 Leadership conduct technical talent reviews on at least a semi-annual basis	41	39
	51%	49%
4.5 Technical talent review and development activities are based on well-defined competencies	42	48
	47%	53%
4.6 The succession planning process is used to fill critical technical positions	52	37
	58%	42%
4.7 Developmental assignments are used to address specific developmental needs	38	51
	43%	57%
4.8 Global assignments are used to develop specific developmental needs	38	52
	42%	58%
5. High Potential Technical Talent		
	Minor Agreement	Strong Agreement
5.1 High potential (technical) talents are aware of their status	44	46
	49%	51%

Table 3.2 Summary of Survey Results……Continuation

	Minor Agreement	Strong Agreement
5.2 Technical talent is attracted to a leadership (management) path	26	64
	29%	71%
5.3 Technical talent is attracted to a technical path	45	44
	51%	49%
5.4 Management identifies high potential (technical) candidates early and takes action to proactively develop them	40	49
	45%	55%
5.5 High potential technical talent pool is reviewed and calibrated	59	30
	66%	34%
5.6 High potential technical talents are given challenging/special projects	45	45
	50%	50%
6. Competency Inventory		
6.1 Generic Knowledge		
6.1.1 Computer programming	Not Critical	Critical
	49	27
	64%	36%
6.1.2.Numerical modeling	42	33
	56%	44%
6.1.3 Simulation modeling	35	40
	47%	53%
6.1.4 Research techniques	9	65
	12%	88%
6.1.5 Analytical methods	8	66
	11%	89%
6.1.6 Computational fluid dynamics	42	33
	56%	44%
6.1.7 Up-to-date in field	9	65
	12%	88%
6.2 Soft Skills		
6.2.1 Adaptive and learning	Not Critical	Critical
	10	80
	11%	89%
6.2.2. Analytical capability	4	85
	4%	96%
6.2.3 Innovativeness	8	83
	9%	91%
6.2.4 Foster teamwork	11	79
	12%	88%
6.2.5 Communicate openly and effectively	5	85
	6%	94%
6.2.6 Drive for results	4	86
	4%	96%
6.2.7 Influence others	13	76
	15%	85%
6.2.8 Plan and organize work	7	72
	9%	91%

Table 3.2 Summary of Survey Results……Continuation

	Not Critical	Critical
6.2.9 Build relationships	9	80
	10%	90%
6.2.10 Commitment and reliability	4	85
	4%	96%
6.2.11 Practice self-development	8	79
	9%	91%
6.2.12 Knowledge sharing	7	82
	8%	92%
6.2.13 Mentoring others	11	77
	12%	88%
6.2.14 Customer service oriented	16	74
	18%	82%
6.2.15 Inspire trust	5	83
	6%	94%
6.2.16 Passionate about job	9	79
	10%	90%
6.2.17 Risk taking	28	65
	30%	70%
6.3 Business Competencies		
6.3.1 Global and local perspective	Not Critical	Critical
	25	57
	30%	70%
6.3.2 Economic evaluation methods	28	53
	35%	65%
6.3.3 Cost estimation	31	49
	39%	61%
6.3.4 Project planning and execution methods	31	48
	39%	61%
7. Team/Organization/Leadership		
	Minor Agreement	Strong Agreement
7.1 Your team fosters collaborative teamwork	22	68
	24%	76%
7.2 Your organization creates an innovative environment	38	51
	43%	57%
7.3 Your management adapts a leadership style that promotes risk taking	50	40
	56%	44%
7.4 Your management makes adequate effort to develop technical talent	33	57
	36%	64%

8. Technical Talent Development Strategies/Programs/plans/tactics:			
8.1 Structured technical development programs where career paths are well defined by competencies and tasks and are aligned with business objectives. This program will groom the participant from start to an engineering specialist status	Not Effective	Average	More Effective
	6	23	50
	8%	29%	63%

Table 3.2 Summary of Survey Results……Continuation

	Not Effective	Average	More Effective
8.2 Short and focused orientation program followed by on the job assignments that participants will learn and produce at the same time	10	23	55
	11%	26%	63%
8.3 Direct job assignments/projects to meet business needs coupled with a senior individual's supervision to ensure that tasks are completed satisfactorily	10	21	58
	11%	24%	65%
8.4 Typical job orientation, followed by job assignments/projects but with the guidance of an assigned mentor to oversee the individual's development and contribution to the business objectives	8	29	53
	9%	32%	59%
8.5 Assign the individual to a team that has specific project and he/she will gain experience with time	20	25	42
	23%	29%	48%
8.6 Send the individual to obtain an advanced degree (masters/doctorate) in the subject that serves the organization's interest	14	25	48
	16%	29%	55%
8.7 Conduct adequate training to strengthen the mentorship role of senior engineers/scientists so the mentorship of young talent becomes more effective (Mentorship Program)	14	20	53
	16%	23%	61%
8.8 Conduct joint industry projects and exchange individuals between organizations/countries to exchange knowledge and strengthen talent development.	11	21	56
	12%	24%	64%
8.9 Assemble technical talent council to manage 9technical talent succession planning/technical talent pool and development programs/plans effectiveness.	24	25	39
	27%	29%	44%
8.10 Define career path for each engineering specialty and map each specialty based on competencies and let individuals demonstrate their capabilities based on self-development efforts.	10	28	51
	11%	31%	58%
8.11 Let in-house subject matter experts develop and deliver technical courses to young talent using problems/examples that our organization faces nowadays.	18	20	49
	21%	23%	56%
8.12 Mandate that professionals obtain industry recognized certification and maintain that status.	18	28	43
	20%	31%	49%
8.13 Make self-development the key element in technical talent development and embed such mandates in the annual performance review cycle.	15	31	43
	17%	35%	48%
8.14 Provide venues for knowledge exchange between professionals such as technical exchange meetings, community of practices and others.	8	26	55
	9%	29%	62%

Table 3.2 Summary of Survey Results……Continuation

9. Challenges:			
	Low Impact	Average Impact	High Impact
9.1 Management path is more attractive than technical path in terms of speed of advancement and rewarding opportunities.	10	13	63
	12%	15%	73%
9.2 Senior professionals are not well compensated for their efforts in developing young talent.	20	20	47
	23%	23%	54%
9.3 Job security acts like a hurdle where senior professionals are not sharing knowledge and experiences with others.	37	20	30
	43%	23%	34%
9.4 There is no well defined career path with an individual development plan.	35	18	32
	41%	21%	38%
9.5 There are not enough senior professionals to mentor young talent.	20	14	53
	23%	16%	61%
9.6 Senior professionals are not well trained as mentors. They lack mentorship skills.	25	27	35
	29%	31%	40%
9.7 The assigned leaders (management) are not competent and lack coaching and talent development skills.	26	27	33
	30%	32%	38%
9.8 The current HR policies do not differentiate/attract professionals to the technical path.	23	14	48
	27%	16%	57%
9.9 This organization does not provide opportunity to learn and grow.	48	17	19
	57%	20%	23%
9.10 This organization doesn't provide opportunity to perform challenging and interesting work.	56	11	19
	65%	13%	22%

Table 3.2 Summary of Survey Results

3.3 2009 Level of Leadership Engagement Questionnaire

An organization might have a good competency model and a well thought of technical talent development programs, but unless the involved participants are continuously engaged, the success and sustainability of technical talent development are questionable. Those involved participants are the leaders at all levels in the organization, candidates being developed and mentors of those candidates.

From change management perspective, if an organization wants to introduce a major change and sustain the outcomes, it needs to achieve the buy in status. Figure 3.5 illustrates the three phases of the buy in process: awareness, belief, then passion that an organization should work on and test prior saying that the involved participants have bought into the change. The engagement of leaders is very imperative in the buy in process of developing technical talent. For this critical reason, a questionnaire was initiated to find out where the organization stands.

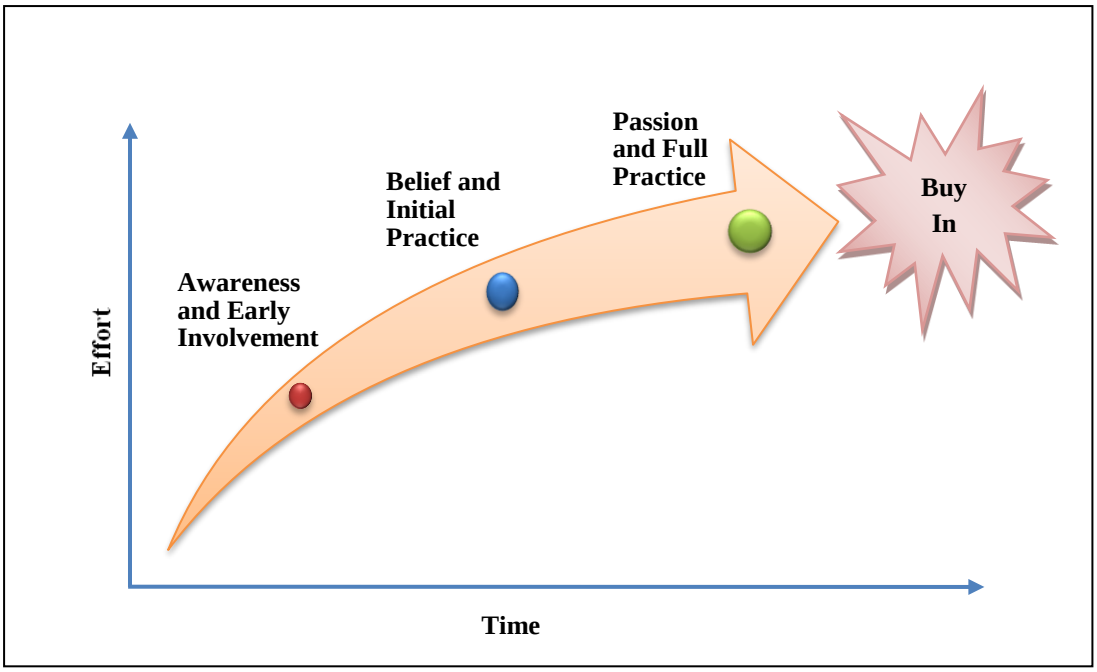

Figure 3.5 Journey of Buy In Process

The heart of people development is conducting a periodic discussion or dialogue between employee and supervisor focusing on employee's performance and developmental needs. Then mutually generate and implement an individual development plan. In late 2009, the author launched a specific and short questionnaire was launched that has four questions revolving around individual development plan and engagement of leaders at all levels. These questions are:

1. Is there a periodical discussion/dialogue between you and your supervisor regarding your work developmental needs?
2. If you have an Individual Development Plan (IDP), is it being implemented?
3. As a mentor/supervisor, what is the number of hours per week you spend on people development?
4. What are your concerns/suggestions about talent development in your organization?

The target audience of this questionnaire was Engineering and Project Management within Saudi Aramco because it contains a large number of scientists and engineers. Figure 3.6 shows the participation and response statistics indicating the representation and credibility of data and Table 3.3 presents a high level summary of the results. Details of this questionnaire are in Appendix - IIA.

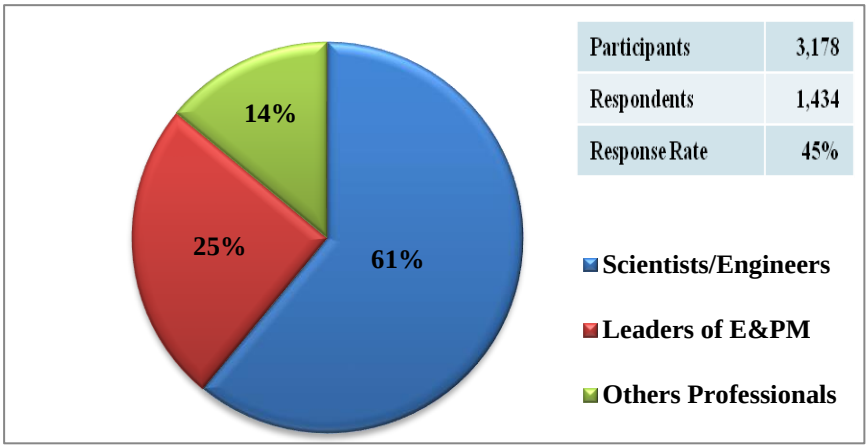

Figure 3.6 - 2009 Level of Leadership Engagement Questionnaire – Participation Statistics

Periodic Discussion	Respondents	Response YES	Percentage
Leaders	357	151	42
Scientists/Engineers	874	374	43
Others	203	102	50
Total	1434	627	44

IDP Implementation	IDP Implemented	IDP Not Implemented	NO-IDP	Total
Leaders No. - %	80 – 22%	53 – 15%	224 – 63%	357
Scientists/Engineers - %	201 – 23%	154 – 18%	519 – 59%	874
Others - %	44 – 22%	19 – 9%	140 – 69%	203
Total - %	325 – 23%	226 – 16%	883 – 61%	1434

Time Spent on Development	Hours/Week
Leaders	3.2
Scientists/Engineers	2.7
Others	1.8

Table 3.3 - 2009 Level of Leadership Engagement Questionnaire – Summary Results

The answer to the fourth question is a collection of common concerns and challenges facing talent development. The following highlights were captured based on the number of repeated comments by respondents.

- Inadequate IDP implementation and maintenance. Repeated 75 times.
- Weak Leadership engagement and accountability. Repeated 74 times.
- Inadequate mentorship. Repeated 66 times.
- Work overload and shifting priority. Repeated 50 times.
- Fairness and integrity. Repeated 37 times.
- Average reward and recognition. Repeated 27 times.
- Training budget constraint. Repeated 16 times.
- Understand talent development. Repeated 12 times.
- Technical and Managerial path competition. Repeated 9 times.
- Supervisor’s incompetence. Repeated 5 times.

CHAPTER 4

RESULTS AND DISCUSSION

4.0 Introduction

This chapter deals with mining and analyzing the data gathered so far. It discusses findings, draws common themes and patterns, and consolidates major results as the deliverables of the research. The results from each data acquisition method; survey, questionnaire and interviews will be discussed then integrated in one frame. The last part of this chapter verifies the main findings and discusses observations and assumptions made prior the research work. Two verification approaches were employed; 2010 level of engagement questionnaire and 2010 interviews.

4.1 Data Mining and Analysis

4.1.1 2009 Interview Common Themes

The author has interviewed twenty five individuals and groups in different business units of the hydrocarbon sector. Some belong to the core business such as exploration, drilling and production and others are in the support services side. Figure 4.1 shows a breakdown of the interview mix.

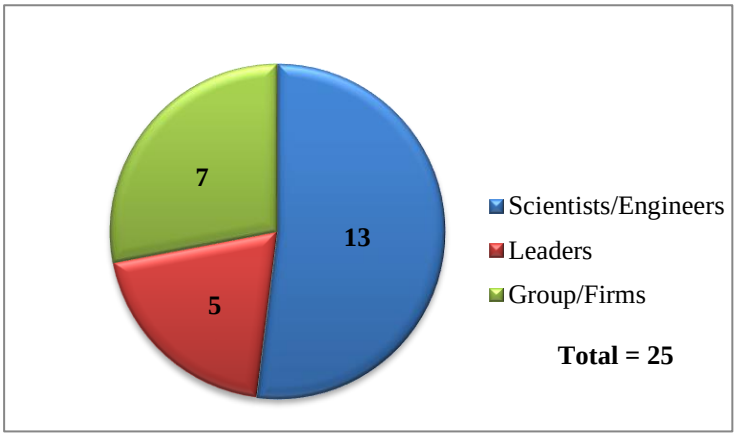

Figure 4.1 - 2009 Interview with Hydrocarbon Sector in Saudi Arabia

An interview is unlike a survey. In the face-to-face interview you receive in-depth feedback, clarification on questions and answers, reading of facial expression, tone of

voice and body language that are totally missed via a survey. Our interview was a major undertaking because of participant selection, critical preparation of questions since it was done prior than survey and other questionnaire. Some of the success factors were sharing the interview questions with participants ahead of time and doing the interview in two steps. First face to face interview then followed by a written response through the e-mails. This was the preferred way of most of the participants. The most difficult part, although rewarding, was gathering all answers and capturing common themes. These common themes are summarized in Table 4.1.

1) What are the common (fundamental) competencies/skills that a qualified technology developer (engineer, scientist, or researcher) must have?

Top Technical Competencies:	a) Adequate field experience (80% of participants) b) Computing Knowledge (50% of participants) c) Up-to-date in specialty (80% of participants) d) Research methods (34% of participants)
Top business/financial competencies:	a) Economic evaluation b) Cost estimation c) Project Management
Top Soft-Skills:	a) Communicate openly and effectively b) Teamwork c) Analytical capability d) Build relationship

2) How do we (what are the strategies/programs/plans) develop our technical talent to attain and sustain these competencies/skills? The focus here is the development, but you could suggest strategies/plans under recruitments and retention.

Technical Talent Development Strategies:
1. Several years assignment at field of industry. (40% of participants)
2. Internship assignment with best in class organization. (20% of participants)
3. Sponsor advance degree studies for high potential technical talent. (24% of participants)
4. Establish a mentorship program. (16% of participants)

3) What are the enablers (success factors) that would help us to implement the talent development strategies that you suggested above and how to capitalize on these enablers?

Top success factors to develop technical talent:
1. Continuous support and commitment by management at all levels.
2. Creating the right environment for R & D.

4) What are the hurdles (challenges) facing the implementation of the above talent development strategies?
Top challenges facing development of technical talent:
1. Available budget for training and conference.
2. Retaining of technical talent

Table 4.1 2009 Interview Results – Common Themes

This table is self-explanatory and, there is no right or wrong answers here. This outcome will be cross-checked and integrated with the findings of the main survey and level of engagement questionnaire.

There is an apparent emphasis on gaining sufficient field experience for scientists/engineers prior being R&D researchers and technology developers. The interviews revealed that top technical competency is adequate technical field experience in the hydrocarbon business. Having deep knowledge of design, installation, commissioning and operations of the facilities and systems of the hydrocarbon sector you serve, will definitely differentiate that professional during his/her research and technology enhancement work. From the financial perspective, economic evaluation of projects is a critical competency for R&D professionals. Most participants indicated that scientists and engineers were strong technically, but not all of them have a good handle on economic appraisal. In the soft skills side, effective communications repeatedly voiced out as the most critical skill especially in the area of presentations and persuasions.

The first technical talent development strategies came out to be several years of work at the field of hydrocarbon core business. This exposure is not at the field of speciality alone. Most interview participants mentioned that seven to ten years is the minimum duration so that the professional can understand and appreciate the field he/she is serving. This pays off during the technical solution development at central offices or R&D Centres.

The second strategy was internship assignment. It was highlighted by several interview participants as a very beneficial tool to gain experience in the speciality. For example, a pump specialist serving oil production facilities would be exposed to many pump operations and maintenance experience in home organization, but to expand knowledge the specialist can work with a pump manufacturer though an internship assignment, to capture the fundamentals of design, modelling, manufacturing and testing. Combing design, manufacturing and operation experiences will yield a better technology developer.

The third strategy in developing professionals was to acquire an advance degree study, typically a master or a PhD in the area of speciality with a pre-determined top institutes and renowned professors. The research topic is mutually agreed upon between

the sponsoring organization and the institute and it usually solves a field problem or brings new business opportunity.

The fourth strategy was establishing a formal mentorship program. Most interview participants were not happy about current mentorship practices and recommended a full program starting with mentor selection, then mentor preparation and qualification. A standard and professionally facilitated workshop is imperative where the three participants of the technical talent development are present. Those participants are the mentor, the mentee and the supervisor. The purpose of the workshop is to enhance awareness of the mentorship program and know the role and responsibilities of each participant.

4.1.2 Survey Results and Discussion:

The survey contained nine areas and 32 statements related to technical talent development. In the following pages, each area will be addressed separately with an emphasis on the research objectives.

Table 4.2 exhibits the survey results on six statements under talent strategy. To ease understanding and analysis, where applicable the there is a holistic approach to the answers rather than statement by statement. However, exceptions will be addressed. “To a considerable degree” and “Consistently across the organization” answers are combined since there would be no impact on the conclusion.

4.1.2.1 Talent Strategy

1. Talent Strategy				
	Not at all	To some degree	To a considerable degree	Consistently across the organization
1.1 Talent development is aligned and integrated with business strategy.	5	29	34	22
	6%	32%	38%	24%
1.2 Critical roles and capabilities are identified in your organization.	4	31	35	16
	5%	36%	41%	18%
1.3 Individual performance is tied to talent development.	10	34	39	9
	11%	37%	42%	10%
1.4 Team leaders (first line management) are accountable for developing technical talent.	14	28	31	17
	16%	31%	34%	19%
1.5 Department managers are accountable for developing technical talent.	10	26	38	16
	11%	29%	42%	18%
Total Response	10%	**30%**	**40%**	**20%**

1.6. The forecast range of supply and demand for technical talent is:		
No forecast	21	23%
Less than 1 year	6	7%
1-2 years	16	18%
3-5 years	30	33%
More than 5 years	17	19%
Total	90	100%

Table 4.2 Survey Results - Talent Strategy

Viewing the answers of statement 1.1 to 1.5 in Table 4.2, about talent development integration with business objectives, definition of roles and responsibilities, individual performance tied with talent development and accountability of developing technical talent development; there is a common trend where 60% (40% + 20%) of respondents have strongly agreed with these statements. Whereas 30% agreed to some degree and only about 10% of respondents disagreed. The overall outcome is considered normal and acceptable.

When participants were asked; "Team leaders (first line management) are accountable for developing technical talent", 16% of respondents are not in favour. This indicates there is a need to clarify the understanding of who is accountable for technical talent development. Everyone is accountable, the professional him/herself, the immediate leader and the department head. Every party has a role to play and a commitment to meet. Such clarity is critical to set expectation and drive for results.

The last statement in talent strategy is about the forecast of supply and demand for technical talent. 48% of respondents forecast less than three years, 33% forecast 3-5 years and only 19% forecast more than 5 years. When you consider hiring full experts from the industry is the way to succeed in technology development, then, less than three years forecast is very acceptable. When you, however, depend on fresh graduates to feed you technical talent pipeline, then, a forecast of more than five years is an imperative. As a matter of fact, the forecast shall be at least 10 years because it expectedly takes a minimum of 10-12 years to develop an engineer or a scientist to be on the first step of being a specialist.

Part of the data mining, is a comparative analysis of the survey answers where answers of management members were segregated from professionals' to test for

potential gaps between the two groups and find out critical misalignment in the organization, if any. Table 4.3 examines the six answers of the talent strategy with such comparative perspectives.

	Management		Professionals		Delta
1. Talent Strategy (Answers in %)	Not in Favor	In Favor	Not in Favor	In Favor	
1.1 Talent development is aligned and integrated with business strategy.	22	78	43	57	21
1.2 Critical roles and capabilities are indentified in your organization.	22	78	49	51	27
1.3 Individual performance is tied to talent development.	29	71	57	43	28
1.4 Team leaders (first line management) are accountable for developing technical talent.	26	74	56	44	30
1.5 Department managers are accountable for developing technical talent.	39	61	42	58	3

Table 4.3 Survey Results – Talent Strategy Comparative Perspectives

It was expected that first line management and department heads assume a higher accountability of technical talent development. 74% of management responded that immediate leaders are accountable. The answer of 90% and above was anticipated. Furthermore, the 44% professionals responded that immediate leaders are accountable for technical talent development. The gap between management and professionals responses about the accountability is 30%, which forms a wide gap. This comparative analysis enforces the need to clarify who is accountable for technical talent development and how.

4.1.2.2 Talent Development

This section of the survey asked about the use of Individual Development Plan (IDP) which is a useful tool for people development. It involves a feedback discussion between an employee and his/her supervisor that leads to defining performance gaps, writing an IDP that stipulates areas of improvement, how to improve, and how to measure results. Table 4.4 summarizes the respondents reply on IDP, accessibility to information on development opportunities, accountability for technical talent development, and clear understanding on required competencies.

2. Talent Development		
2.1 Every technical professional has an individual development plan.	Disagree	Agree
	43	47
	48%	**52%**
2.2 Technical professionals can easily access accurate information on available development opportunities.	34	56
	32%	**68%**
2.3 Managers and technical professionals share accountability for talent development.	33	57
	36%	**64%**
2.4 Technical professionals have a clear picture of competencies they should develop to support business growth in the organization	Disagree	Agree
Not at all	7	8%
To some degree	25	28%
To a considerable degree	41	**45%**
Fully understanding what is needed	17	**19%**

Table 4.4 Survey Results – Talent Development

Having an IDP for only 52% is considered low. Performance feedback, agreement on gaps and on how to bridge these gaps, then document and follow up are essential steps of any employee's development efforts. This is a major flaw that requires corrective action. On the second statement, 68% of respondents acknowledged that the organization has accessible information on available development opportunities. This is an area that can be further enhanced through awareness campaigns. The third statement (2.3) addressed the accountability for talent development, where 64% of respondents replied positively. One would have imagined that the score would have surpassed 90%. This statement is across check for the same under talent strategy section, (1.4). This confirms that expectation and accountability of talent development are not totally clear.

"Technical professionals have a clear picture of competencies they should develop to support business growth in the organization" Table 4.4, statement 2.4. The answer to this statement appeared with varying degrees, 45% and 19% of respondents stated "To a considerable degree" and "Full understanding" respectively. On the other hand, 28% of respondents indicated "To some degree" and 8% replied there is no understanding of the required competencies.

Tables 4.5, compares the answers of talent development statement from management versus professionals' perspectives.

2. Talent Development (Answers in %)	Management		Professionals		Delta
	Dis-agree	Agree	Dis-agree	Agree	
2.1 Every technical professional has an individual development plan.	52	48	44	56	8
2.2 Technical professionals can easily access accurate information on available development opportunities.	26	74	47	53	21
2.3 Managers and technical professionals share accountability for talent development.	29	71	40	60	11
	Not in Favor	In Favor	Not in Favor	In Favor	
2.4 Technical professionals have a clear picture of competencies they should develop to support business growth in your organization.	26	74	39	61	13

Table 4.5 Survey Results – Talent Development Comparative Perspective

It is noticed that the highest difference (delta) between the two perspectives is on the accessibility to information on development opportunities. 74% of management respondents stated “Agree” whereas 53% of professionals stated “Agree”, this gap attributes to communication breakdown and an inadequate awareness of available resources. The second highest delta is on the technical talent understanding of required competencies. 74% of management respondents believe that technical professionals have a clear picture of competencies that should be developed to attain business objectives, whereas 61% of professionals have this understanding. This misalignment is a by-product of not having sufficient IDP discussion and generation between management and technical talent.

4.1.2.3 Rewarding Performance

This area is added purposely to the survey because it is part of talent management and it has an impact on talent development whether as mentors or mentees.

Table 4.6, depicts reply of respondents on compensation package being comparable to individual performance and pay differentiation for high performers.

3. Rewarding Performance				
	Not at all	To some degree	To a considerable degree	Consistently across the organization
3.1 Current compensation package is comparable with individual performance.	17	31	29	13
	19%	34%	32%	15%
3.2 There is a pay differentiation for high performers through both base and variable pay.	17	33	30	10
	19%	37%	33%	11%

Table 4.6 Survey Results – Rewarding Performance

The answers of the two statements here are close to each other; therefore, the answers are combined. 19% of respondents are in disagreement, 34% to "Some degree" and around 47% in agreement. Let's look at Table 4.7, comparing response of management and professionals. The result of "NOT at all" and "To some degree" are combined as one category called "Disagree" and merged "To considerable degree" with "Consistently across the organization" as one category called "Agree". Although this somewhat conservative, but in the safe side and would ease the gap measurement between the two perspectives.

	Management		**Professionals**		**Delta**
3. Rewarding Performance (Answers in %)	Dis-agree	Agree	Dis-agree	Agree	
3.1 Current compensation package is comparable with individual performance	32	68	66	44	24
3.2 There is a pay differentiation for high performers through both base and variable pay.	39	61	63	37	24

Table 4.7 Survey Results – Rewarding Performance Comparative Perspectives

This comparison revealed that 68% of management agreed that compensation package is comparable with individual performance and only 44% of professionals have agreed. Similarly, 61% of management members agreed that there is a pay differentiation for high performers and only 37% of professionals have stated their agreement. One might argue that such results are not alarming and there is a need to drill down further and see impact on recruitment efforts and retention of technical talent with the organization. The author argues that this matter dictates a full transparency with employees in terms how compensation package is designed and in what basis merits and promotions are granted. Human nature desires more, however, when your share with professionals how systems and decisions are made and prove to them that their current organization is very

comparable with similar organizations, they tend to understand and appreciate their situation.

4.1.2.4 Leadership Involvement

The leadership involvement in technical talent development is essentially one of the main drivers of the process. All aspects and systems of people development are enablers and success factors and autopilot mode does not cut it. Engagement of leaders at all levels is a career time mission. In this section eight statements have been designed as shown on Table 4.8, in an attempt to understand to what degree leaders are involved in technical talent development. Table 4.9 depicts the comparative answers of management and professionals for same set of statements.

4. Leadership Involvement				
	Disagree	Agree		
4.1 Management involved with technical talent development	21	69		
	23%	77%		
4.2 Senior technical professionals teach and develop young talent	7	83		
	8%	92%		
4.3 Senior leaders teach and develop new leaders	29	61		
	32%	68%		
	Not at all	To some degree	To a considerable degree	To a high degree
4.4 Leadership conduct technical talent reviews on at least a semi-annual basis	15	36	25	14
	17%	40%	28%	15%
4.5 Technical talent review and development activities are based on well-defined competencies	14	28	34	14
	15%	31%	38%	16%
4.6 The succession planning process is used to fill critical technical positions	20	32	23	14
	22%	36%	26%	16%
4.7 Developmental assignments are used to address specific developmental needs	7	31	32	19
	8%	35%	36%	21%
4.8 Global assignments are used to develop specific developmental needs	12	26	35	17
	13%	29%	39%	19%

Table 4.8 Survey Results – Leadership Involvement

4. Leadership Involvement	Management		Professionals		Delta
	Dis-agree	Agree	Dis-agree	Agree	
4.1 Management involved with technical talent development	13	87	29	71	16
4.2 Senior technical professionals teach and develop young talent	0	100	13	87	13
4.3 Senior leaders teach and develop new leaders	23	77	37	63	14
4.4 Leadership conduct technical talent reviews on at least a semi-annual basis	42	58	64	36	22
4.5 Technical talent review and development activities are based on well-defined competencies	35	65	53	47	18
4.6 The succession planning process is used to fill critical technical positions	45	55	66	34	21
4.7 Developmental assignments are used to address specific developmental needs	13	87	57	43	44
4.8 Global assignments are used to develop specific developmental needs	19	81	53	47	34

Table 4.9 Survey Results – Leadership Involvement – Comparative Perspectives

The overall results, looking at Table 4.8, show 23% of respondents disagreed that "management or leaders are involved with technical talent development". 13% of leaders and 29% of professionals, looking at Table 4.9, disagree with this statement. This highlights an area of improvement. One would have expected that disagreement of leaders is to be less than 10% to draw a conclusion of acceptable level of leaders engagement in talent development. There is a general consensus that senior technical professionals are involved in developing young talent. The same holds true for senior leaders' involvement in developing young leaders, although to a lesser degree of consensus.

Reply of respondents about leaders conducting a periodic technical talent review reveals unsatisfactory, statement 4.4, Table 4.8. Combining "Considerable degree" with "To a high degree" percentages and "Some degree" with "Not at all" brings focus to the analysis. With that in mind, only 43% (28% + 15%) of respondents stated that there is a periodic review of technical talent. Only 54% replied that such reviews are based on well-defined competencies, statement 4.5. Only 42% stated that there is a succession planning process used to fill critical technical positions, statement, 4.6. 47% replied that development assignments are used to address specific technical development needs, statement 4.7.

These statistics are not comforting and indicate the level of leaders' engagement and accountability towards technical talent development. These results further indicate the

inadequate or lack of appreciation of how technical talent greatly impact the success of any organization in meeting its business objectives.

4.1.2.5 High Potential Technical Talent

Another dimension of technical talent development is the high potential (Hi-Pot) individuals in terms of what attracts them more; managerial or technical career path, and how leaders are managing this pool. This dimension with its six statements and results are shown in Table 4.10.

5. High Potential Technical Talent				
	Not at all	To some degree	To a considerable degree	To a high degree
5.1 High potential (technical) talents are aware of their status	12	32	31	15
	13%	36%	34%	17%
5.2 Technical talent is attracted to a leadership (management) path	5	21	33	31
	6%	23%	37%	34%
5.3 Technical talent is attracted to a technical path	8	37	35	9
	9%	42%	39%	10%
5.4 Management identifies high potential (technical) candidates early and takes action to proactively develop them	13	27	36	13
	15%	30%	40%	15%
5.5 High potential technical talent pool is reviewed and calibrated	18	41	21	9
	20%	46%	24%	10%
5.6 High potential technical talents are given challenging/special projects	11	34	31	14
	12%	38%	34%	16%

Table 4.10 Survey Results – High Potential Technical Talent

Statement 5.1 “High potential technical talent are aware of their status”, in other words; “Do they know that they are viewed as high potential?” The survey choices would have been better if they were “Yes” and “No” rather than the extent or degree of agreement. At any rate, 13% and 36% of respondents indicated that Hi-Pot individuals are either not or somewhat aware of their status respectively. There are two schools of thoughts regarding the transparency on this matter. First school of thought embraces silence. Don’t tell the individual that she or he is a Hi-Pot, but develop her/him as such until the individual assumes the target position. The wisdom behind this act is to reduce implications if the individual is removed from Hi-Pot pool because couldn’t sustain status or the new supervisor has different assessment than the previous one. The claim is to avoid negative psychological impact on employee and maintain flexibility due to the subjectivity of Hi-Pot assessment process. The second school of thought, where the author belongs,

adopts transparency all the way through. Technical talent would be familiar with the Hi-Pot assessment tool, know the result whether Hi-Pot or not and more importantly why and how to be there, and how to sustain it. When performance and behaviour change dictating a drop out of Hi-Pot, a serious discussion takes place between individual being developed, mentor and supervisor. Back to the survey results, it is believed that 36% of "Somewhat" aware of Hi-Pot status represents the unclarity of the school of thought in the organization, where leadership needs to be very consistent in its approach, educate first line management in how to do an objective assessment and handle difficult discussions with talent being in and out of the Hi-Pot pool.

"Technical talent in the Saudi Arabia hydrocarbon business is attracted towards managerial career path or technical career path". Results for statements 5.2 and 5.3 on Table 4.10 are: 34% indicated that attraction is "To high degree" towards managerial path and 37% considered the same "To a considerable degree". The sum of 71% constitutes a threat of sustaining a strong and continuous flow into technical talent pipeline. On the other hand, attraction towards technical path scored only 10% with a high degree agreement.

Referring to Table 4.11, 77% of management respondents stated that attraction is towards technical path and 66% of professional themselves indicated same attraction.

	Management		**Professionals**		**Delta**
5. High Potential Technical Talent (Answers in %)	Dis-agree	Agree	Dis-agree	Agree	
5.1 High potential (technical) talents are aware of their status	51	49	46	54	5
5.2 Technical talent is attracted to a leadership (management) path	23	**77**	34	**66**	11
5.3 Technical talent is attracted to a technical path	45	55	56	44	11
5.4 Management identifies high potential (technical) candidates early and takes action to proactively develop them	29	**71**	54	**46**	25
5.5 High potential technical talent pool is reviewed and calibrated	49	51	77	23	28
5.6 High potential technical talents are given challenging/special projects	29	71	62	38	33

Table 4.11 Survey Results – Hi-Pot Technical Talent – Comparative Perspectives

A key aspect of developing people in general and technical talent in particular, is to identify Hi-Pot individuals as early as possible. This would enable the organization to reap benefits from its intellectual capital swiftly and in the most cost effective manner. This doesn't mean that the development of others will be ignored. It simply focuses and accelerates training and development efforts to the best of the organization's interests. To test for that, the survey asked about early identification of Hi-Pot technical talent, talent pool management, challenging assignments for those Hi-Pot individuals.

Let's use Table 4.11 to view management and professional perspectives. 71% of management respondents claimed that early identification of Hi-Pot is practiced whereas only 46% of professionals agreed to that. 51% of management respondents agreed that technical talent pool being reviewed and calibrated and only 23% of professionals approved this claim. Finally, 71% of management respondents think they assign challenging assignment to Hi-Pot and only 38% of professionals supported that thinking. Considering the high credibility of these results not only because of high response rate, but due to participants' vast experience in the hydrocarbon sector and high level of education, these scores definitely represent areas of improvement.

4.1.2.6 Competency Inventory

To develop technical talent to enhance technology advancement of hydrocarbon sector in Saudi Arabia, the most critical competencies/skills must be identified. This will guide in identifying and building qualified technical talent in the organization. Table 4.12 and Figure 4.2 contain results for the generic technical competencies, attributes/soft skills, and business/financial competencies.

6. Competency Inventory						
6.1 Generic Technical Competencies						
	Management		Professional		Combined	
6.1.1 Computer programming	Not Critical	Critical	Not Critical	Critical	Not Critical	Critical
	49	27	119	91	168	118
	64%	36%	57%	43%	59%	41%
6.1.2.Numerical modeling	42	33	94	106	136	139
	56%	44%	47%	53%	49%	51%
6.1.3 Simulation modeling	35	40	82	118	117	158
	47%	53%	41%	59%	43%	57%
6.1.4 Research techniques	9	65	18	182	27	247
	12%	88%	9%	91%	10%	90%
6.1.5 Analytical methods	8	66	27	173	35	239
	11%	89%	14%	86%	13%	87%
6.1.6 Computational fluid dynamics	42	33	103	97	145	130
	56%	44%	52%	48%	53%	47%
6.1.7 Up-to-date in field	9	65	24	176	33	241
	12%	88%	12%	88%	12%	88%
6.2 Attributes and Soft Skills						
6.2.1 Adaptive and learning	Not Critical	Critical	Not Critical	Critical	Not Critical	Critical
	10	80	26	174	36	254
	11%	89%	13%	87%	12%	88%
6.2.2. Analytical capability	4	85	10	190	14	275
	4%	96%	5%	95%	5%	95%
6.2.3 Innovativeness	8	83	22	178	30	261
	9%	91%	11%	89%	10%	90%
6.2.4 Foster teamwork	11	79	23	177	33	256
	12%	88%	12%	88%	11%	89%
6.2.5 Communicate openly and effectively	5	85	11	189	16	274
	6%	94%	6%	94%	6%	94%
6.2.6 Drive for results	4	86	9	191	13	277
	4%	96%	5%	95%	5%	95%
6.2.7 Influence others	13	76	26	174	39	250
	15%	85%	13%	87%	13%	87%

Table 4.12 Survey Results – Competency Inventory.....Continuation

	Not Critical	Critical	Not Critical	Critical	Not Critical	Critical
6.2.8 Plan and organize work	7	72	13	187	20	259
	9%	91%	7%	93%	7%	93%
6.2.9 Build relationships	9	80	16	184	25	264
	10%	90%	8%	82%	9%	91%
6.2.10 Commitment and reliability	4	85	7	193	11	278
	4%	96%	3%	97%	4%	96%
6.2.11 Practice self-development	8	79	17	183	25	262
	9%	91%	8%	92%	9%	91%
6.2.12 Knowledge sharing	7	82	12	188	19	270
	8%	92%	6%	94%	7%	93%
6.2.13 Mentoring others	11	77	21	179	32	256
	12%	88%	10%	90%	11%	89%
6.2.14 Customer service oriented	16	74	33	167	49	241
	18%	82%	17%	83%	17%	83%
6.2.15 Inspire trust	5	83	11	188	16	271
	6%	94%	6%	94%	6%	94%
6.2.16 Passionate about job	9	79	16	184	25	263
	10%	90%	8%	92%	9%	91%
6.2.17 Risk taking	28	65	54	146	82	211
	30%	70%	27%	73%	28%	72%
6.3 Business/Financial Competencies						
6.3.1 Global and local perspective	Not Critical	Critical	Not Critical	Critical	Not Critical	Critical
	25	57	51	149	76	206
	30%	70%	26%	74%	27%	73%
6.3.2 Economic evaluation methods	28	53	57	143	85	196
	35%	65%	29%	71%	2%	98%
6.3.3 Cost estimation	31	49	68	132	99	181
	39%	61%	34%	66%	35%	65%
6.3.4 Project planning and execution methods	31	48	62	138	93	186
	39%	61%	31%	69%	33%	67%

Table 4.12 Survey Results – Competency Inventory

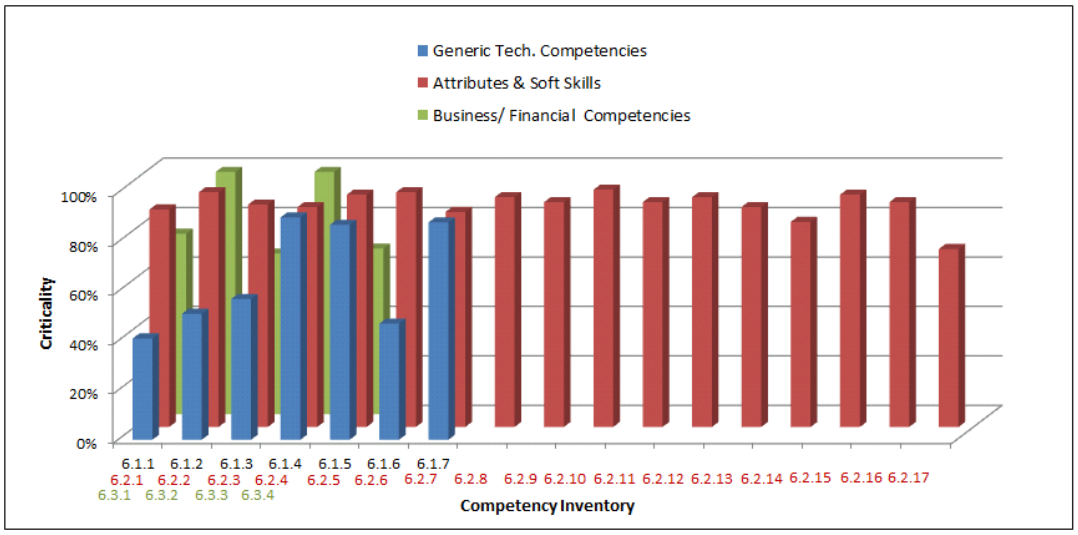

Figure 4.2 – Survey results – Competency Inventory

The combined or overall results of all respondents highlight that top ten critical competencies are:

Generic Technical Competencies:	1) Knowledge of research techniques
	2) To be up-to-date in the field
	3) Simulation modelling
	4) Knowledge of analytical methods
Attributes and Soft Skills:	5) Commitment and reliability
	6) Drive for results
	7) Analytical capability
	8) Communication openly and effectively
Business/Financial Competencies:	9) Economic Evaluation methods
	10) Global and local perspective

It is interesting to examine the data from a management versus professionals' perspectives which are given on Table 4.12. For the generic technical competencies, both management and professional respondents agree on the top four competencies as above. One observes that 100% of management respondents elected "research techniques knowledge" as number one critical competency.

For the attributes and soft skill, again there is a general consensus on top four skills, however, there is a degree of misalignment such as in the areas of knowledge sharing (6.2.12), Table 4.12 and passionate about job (6.2.16), Table 4.12, 100% of management respondents indicated that knowledge sharing is critical skill and 88% of professionals viewed this criticality. This skill is a must in developing others and as such the organization should align between leaders and their professional talent. Similarly, 100% of management respondents showed that a professional being passionate about job is critical attribute to the business where as 84% of participating professionals indicated as such. One might argue that 88% and 84% are very high scores and represent acceptable level of match between management and professionals. However, clear communication and well understood expectation will pay a lot of dividends to the organization.

4.1.2.7 Work Environment

The development of scientists and engineers gets impacted by their work environment. Furthermore, those who work in the R&D are more sensitive towards this

environment in terms of teamwork, innovative atmosphere, and leadership style that promotes risk taking. The survey probed the respondents about this aspect of the business and results are given on Table 4.13.

7. Work Environment					
	Management		Professionals		Delta
	Minor Agreement %	Strong Agreement %	Minor Agreement %	Strong Agreement %	
7.1 Your team fosters collaborative teamwork	6	94	34	66	28
7.2 Your organization creates an innovative environment	29	71	51	49	22
7.3 Your management adapts a leadership style that promotes risk taking	29	71	71	29	42
7.4 Your management makes adequate effort to develop technical talent	13	87	49	51	36

Table 4.13 Survey Results – Work Environment

Let's focus on the difference of reply between management and professionals rather than considering the combined results. In all four statements on Table 4.13, there is a gap between "Strong Agreement" reply of management and professional respondents. The smallest gap is 22% in the aspect of innovative environment. 71% management believes that their research and technology development environment is innovative whereas only 49% of professionals strongly agree with that. 94% of management versus 66% of professional respondents think that their teams foster collaborative teamwork.

"Your management make adequate efforts to develop technical talent" 87% of management against 51% of professional strongly agree to this statement. The largest gap is 42% where 71% of management respondents think they adapt a leadership style that promotes risk taking. On the other hand, only 29% of professionals think along the same line. This is a major mismatch that R&D organizations should not treat lightly. Risk taking is the fuel that drives the innovation engine if R&D Centres are looking for breakthroughs.

4.1.2.8 Technical Talent Development Strategies

Table 4.14 and Figure 4.3 show survey results on fourteen different strategies and tactics that aid in developing technical talent of hydrocarbon sector in Saudi Arabia, especially in advancing the in-house technology development and deployment.

8. Technical Talent Development Strategies/Programs/plans/tactics:			
8.1 Structured technical development program where career paths are well defined by competencies and tasks and are aligned with business objectives. This program will groom the participant from start to an engineering specialist status	Not Effective	Average	More Effective
	8%	29%	63%
8.2 Short and focused orientation program followed by on the job assignments that participants will learn and produce at the same time	11%	26%	63%
8.3 Direct job assignments/projects to meet business needs coupled with a senior individual's supervision to ensure that tasks are completed satisfactorily	11%	24%	65%
8.4 Typical job orientation, followed by job assignments/projects but with the guidance of an assigned mentor to oversee the individual's development and contribution to the business objectives	9%	32%	59%
8.5 Assign the individual to a team that has specific project and he/she will gain experience with time	23%	29%	48%
8.6 Send the individual to obtain an advanced degree (masters/doctorate) in the subject that serves the organization's interest	16%	29%	55%
8.7 Conduct adequate training to strengthen the mentorship role of senior engineers/scientists so the mentorship of young talent becomes more effective (Mentorship Program)	16%	23%	61%
8.8 Conduct joint industry projects and exchange individuals between organizations/countries to exchange knowledge and strengthen talent development.	12%	24%	64%
8.9 Assemble technical talent council to manage technical talent succession planning/technical talent pool and development programs/plans effectiveness.	27%	29%	44%

Table 4.14 Survey Results – Technical Talent Development Strategies…….Continuation

	Not Effective	Average	More Effective
8.10 Define career path for each engineering specialty and map each specialty based on competencies and let individuals demonstrate their capabilities based on self-development efforts.	11%	31%	58%
8.11 Let in-house subject matter experts develop and deliver technical courses to young talent using problems/examples that our organization faces nowadays.	21%	23%	56%
8.12 Mandate that professionals obtain industry recognized certification and maintain that status.	20%	31%	49%
8.13 Make self-development the key element in technical talent development and embed such mandates in the annual performance review cycle.	17%	35%	48%
8.14 Provide venues for knowledge exchange between professionals such as technical exchange meetings, community of practices and others.	9%	29%	62%

Table 4.14 Survey Results – Technical Talent Development Strategies

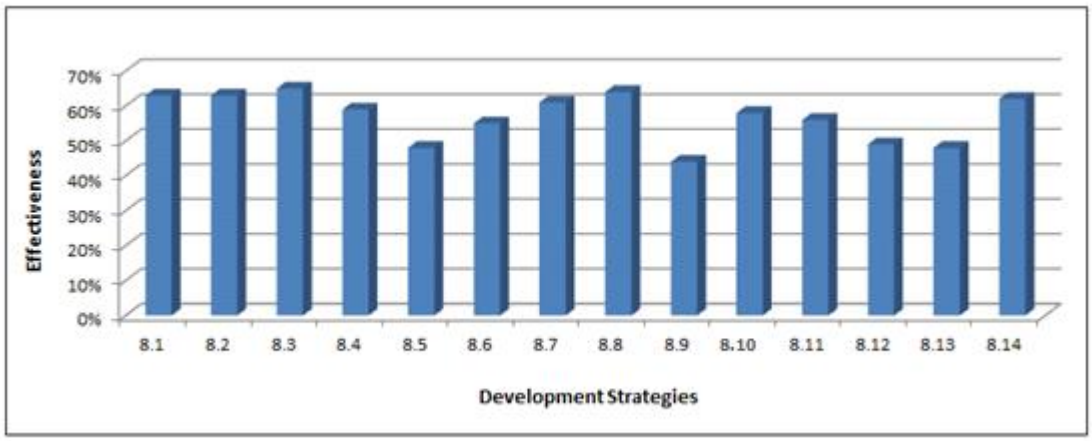

Figure 4.3 Effectiveness of Surveyed Development Strategy

These strategies and programs are a collection from author's experience, literature review, initial interview and discussion with peers and subject matter experts in the field of Human Resource development. From the results there is no single strategy adequate enough to develop technical talent. Every organization, team and individual has its own preferred means that fits the circumstances and objectives of the business. From an effectiveness point of view all strategies were rated between 65% and 44% indicating that all are useful.

The top five strategies extracted from Table 4.14 are:

1. 8.3 Direct job assignments/projects to meet business needs coupled with a senior individual's supervision to ensure that tasks are completed satisfactorily.

2. 8.8 Conduct joint industry projects and exchange individuals between organizations/countries to exchange knowledge and strengthen talent development.

3. 8.1 Design a structured technical development program where career paths are well defined by competencies and tasks and are aligned with business objectives. This program grooms the participant from start to an engineering specialist status.

4. 8.2 Introduce short and focused orientation program followed by on the job assignments that participants can learn and produce at the same time.

5. 8.14 Provide venues for knowledge exchange between professionals such as technical exchange meetings, community of practices and others.

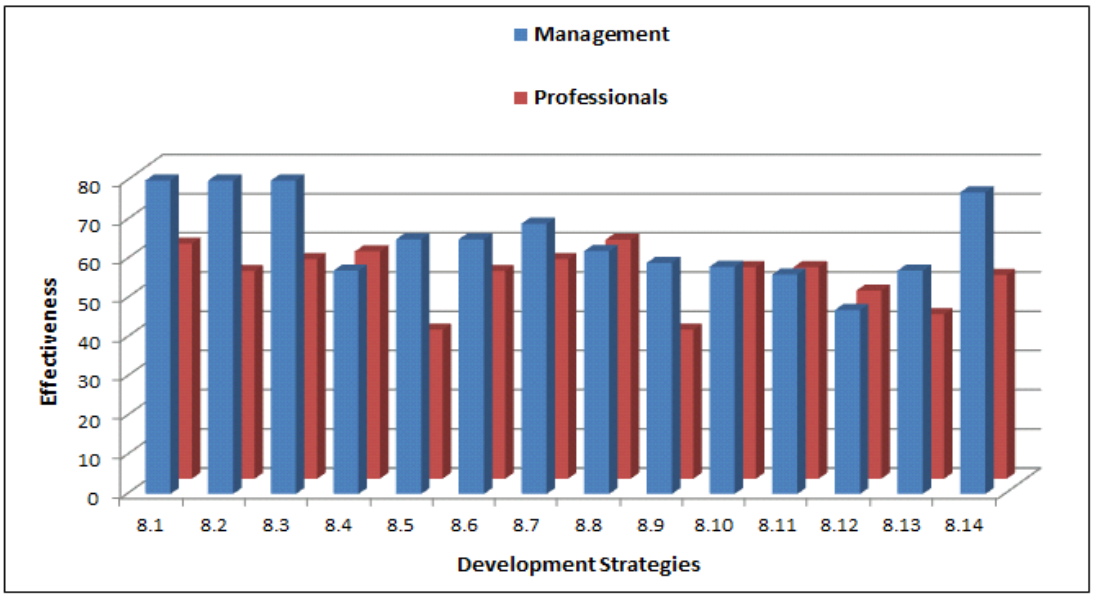

Figure 4.4 Effectiveness of Surveyed Development Strategies

8. Technical Talent Development Strategies/Plans (Answers in %)	Management		Professionals	
	Less Effective	More Effective	Less Effective	More Effective
8.1 Structured technical development program where career paths are well defined by competencies and tasks and are aligned with business objectives. This program will groom the participant from start to an engineering specialist status	20	80	40	60
8.2 Short and focused orientation program followed by on the job assignments that participants will learn and produce at the same time	20	80	47	53
8.3 Direct job assignments/projects to meet business needs coupled with a senior individual's supervision to ensure that tasks are completed satisfactorily	20	80	44	56
8.4 Typical job orientation, followed by job assignments/projects but with the guidance of an assigned mentor to oversee the individual's development and contribution to the business objectives	43	57	42	58
8.5 Assign the individual to a team that has specific project and he/she will gain experience with time	35	65	62	38
8.6 Send the individual to obtain an advanced degree (masters/doctorate) in the subject that serves the organization's interest	35	65	47	53
8.7 Conduct adequate training to strengthen the mentorship role of senior engineers/scientists so the mentorship of young talent becomes more effective (Mentorship Program)	31	69	44	56
8.8 Conduct joint industry projects and exchange individuals between organizations/countries to exchange knowledge and strengthen talent development.	38	62	39	61
8.9 Assemble technical talent council to manage technical talent succession planning/technical talent pool and development programs/plans effectiveness.	41	59	62	38
8.10 Define career path for each engineering specialty and map each specialty based on competencies and let individuals demonstrate their capabilities based on self-development efforts.	42	58	46	54
8.11 Let in-house subject matter experts develop and deliver technical courses to young talent using problems/examples that our organization faces nowadays.	44	56	46	54
8.12 Mandate that professionals obtain industry recognized certification and maintain that status.	53	47	52	48
8.13 Make self-development the key element in technical talent development and embed such mandates in the annual performance review cycle.	43	57	58	42
8.14 Provide venues for knowledge exchange between professionals such as technical exchange meetings, community of practices and others.	23	77	48	52

Table 4.15 Survey Results –Technical Talent Development Strategies Perspectives

When looking at Figure 4.4 and Table 4.15, management and professionals perspectives of same list of strategies, it is noticed that the top three strategies selected by management respondents were:

1. 8.1 Structured technical development program where career paths are well defined by competencies and tasks and are aligned with business objectives. This program grooms the participant from start to an engineering specialist status

2. 8.2 Short and focused orientation program followed by on the job assignments that participants can learn and produce at the same time

3. 8.3 Direct job assignments/projects to meet business needs coupled with a senior individual's supervision to ensure that tasks are completed satisfactorily

Whereas professionals have chosen the following, Table 4.15:

1. 8.8 Conduct joint industry projects and exchange individuals between organizations/countries to exchange knowledge and strengthen talent development.

2. 8.1 Structured technical development program where career paths are well defined by competencies and tasks and are aligned with business objectives. This program will groom the participant from start to an engineering specialist status.

3. 8.4 Typical job orientation, followed by job assignments/projects but with the guidance of an assigned mentor to oversee the individual's development and contribution to the business objectives.

These differences do not represent a misalignment nor a threat, but rather an opportunity for the organization to discuss and enhance technical talent development with the involvement of leaders at all levels, professionals (young and senior) and Human Resources experts.

4.1.2.9 Challenges Facing Technical Talent Development

This is the last section of the survey where the author wanted to seek more understanding about challenges or hurdles facing the development of technical talent who is tasked to enhance in-house technology advancement at the hydrocarbon sector of Saudi Arabia. Table 4.16 and Figure 4.5 show ten challenges and reply of participants.

9. Challenges:			
	Low Impact	Average Impact	High Impact
9.1 Management path is more attractive than technical path in terms of speed of advancement and rewarding opportunities.	12%	15%	73%
9.2 Senior professionals are not well compensated for their efforts in developing young talent.	23%	23%	54%
9.3 Job security acts like a hurdle where senior professionals are not sharing knowledge and experiences with others.	43%	23%	34%
9.4 There is no well defined career path with an individual development plan.	41%	21%	38%
9.5 There are not enough senior professionals to mentor young talent.	23%	16%	61%
9.6 Senior professionals are not well trained as mentors. They lack mentorship skills.	29%	31%	40%
9.7 The assigned leaders (management) are not competent and lack coaching and talent development skills.	30%	32%	38%
9.8 The current HR policies do not differentiate/attract professionals to the technical path.	27%	16%	57%
9.9 This organization does not provide opportunity to learn and grow.	57%	20%	23%
9.10 This organization doesn't provide opportunity to perform challenging and interesting work.	65%	13%	22%

Table 4.16 Survey Results – Technical Talent Development Challenges

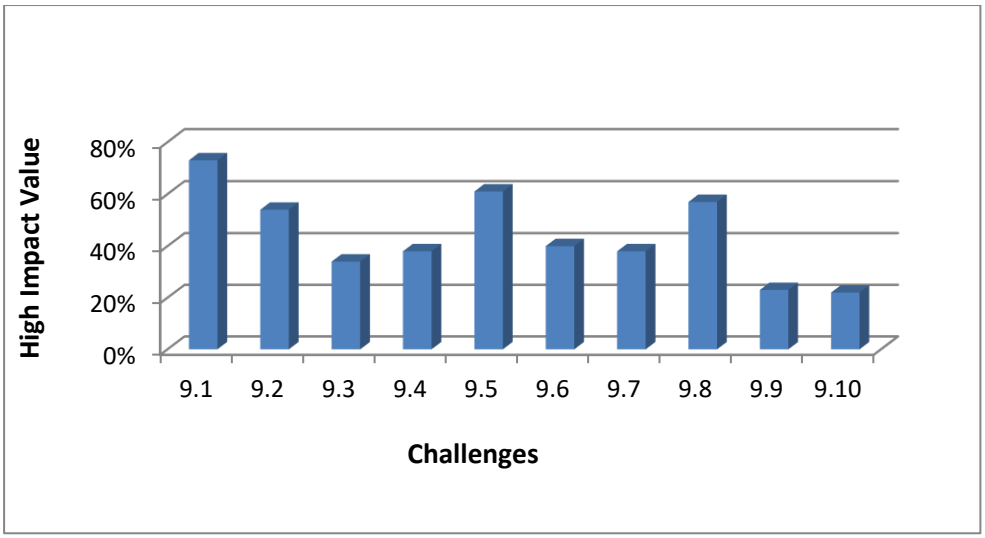

Figure 4.5 - Challenge Impact on Technical Talent Development

There were two choices to obtain answers. Either make an open ended question such as, what are the challenges facing technical talent development? Then leave it to respondents to state their opinion. This is easy at start, but difficult for compilation and analysis. Or, as done, conduct a pre-research to list top possible hurdles, and then ask survey participants audience to rate degree of impact.

It took effort and longer time than expected to develop the technical talent strategies and challenges through interviews, discussion, reading and short questionnaire. The whole objective is to conduct effective survey and obtain meaningful results.

The survey results pinpointed the top five challenges to be, Table 4.16:

1. 9.1 Management path is more attractive than technical path in terms of speed of advancement and rewarding opportunities.

2. 9.5 There are not enough senior professionals to mentor young talent.

3. 9.8 The current human resources policies do not differentiate/attract professionals to the technical path.

4. 9.2 Senior professionals are not well compensated for their efforts in developing young talent.

5. 9.6 Senior professionals are not well trained as mentors. They lack mentorship skills.

Again let's view management versus professionals' perspective as in Table 4.17.

	Management %		Professionals %	
9. Challenges	Low Impact	High Impact	Low Impact	High Impact
9.1 Management path is more attractive than technical path in terms of speed of advancement and rewarding opportunities.	23	77	28	72
9.2 Senior professionals are not well compensated for their efforts in developing young talent.	59	41	38	62
9.3 Job security acts like a hurdle where senior professionals are not sharing knowledge and experiences with others.	66	34	64	36
9.4 There is no well defined career path with an individual development plan.	69	31	59	41
9.5 There are not enough senior professionals to mentor young talent.	39	61	41	59
9.6 Senior professionals are not well trained as mentors. They lack mentorship skills.	55	45	60	40
9.7 The assigned leaders (management) are not competent and lack coaching and talent development skills.	65	35	60	40
9.8 The current HR policies do not differentiate/attract professionals to the technical path.	39	61	43	57
9.9 This organization does not provide opportunity to learn and grow.	80	20	79	21
9.10 This organization doesn't provide opportunity to perform challenging and interesting work.	83	17	75	25

Table 4.17 Survey Results – Technical Talent Development Challenges – Comparative Perspectives

It's amazing how both management (77%) and professional (72%) respondents on Table 4.17, have chosen that "management path is more attractive than technical path" to be the top challenge encountered to retain and develop technical talent. This is risky on the short and long term of R&D business objectives. If the heart and passion of our technologists are not attached and sustained within the technical career path, then efforts of success in people development and technology advancement are fragmented if not lost.

The second answer of the agreement is: "There are not enough senior professionals to mentor young talent." This is to be drilled down further in terms of what is the ratio between mentor and mentees? Are senior professionals qualified/certified mentors? What are the mentorship tools and styles used? And so on. These questions

and others impact the coverage and effectiveness of mentorship. This is apparent in the answer to statement (9.6) in Table 4.17, where 40% of total respondents indicated that senior professionals are not well trained as mentor and will have a high impact on the development process of technical talent. In conclusion, increasing the number of senior professionals is an imperative, but alone does not guarantee the success of mentorship.

4.1.3 2009 Level of Leadership Engagement Questionnaire Outcome and Analysis

During the course of this research work, particularly while conducting interviews and survey, coupled with daily interactions with leaders and technical professionals, it was noticed that there are variation in the degree of buy in and engagement of leaders in the process of people development. Therefore, it was decided to run a short questionnaire aimed at Engineering & Project Management organization of Saudi Aramco since it has the largest number of scientists and engineers involved in technology development. The purpose of the questionnaire is to: (i) enhance the data collection, and (ii) validate the current reality of leaders involvement in developing technical talent. Figure 4.6 shows the statistics of this questionnaire.

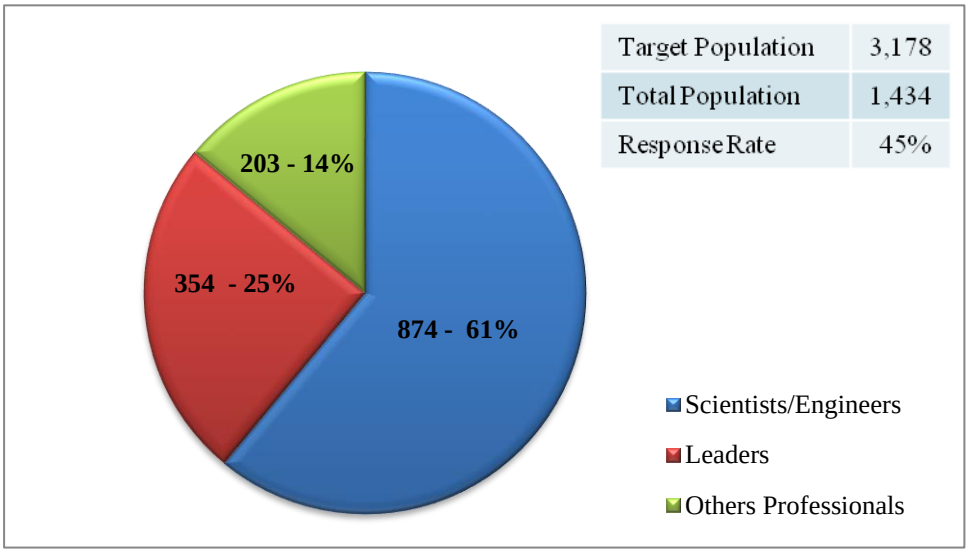

Figure 4.6 - 2009 Level of Leadership Engagement Questionnaire – Participation Statistics

1,434 respondents or 45% responded out of 3,178 targeted participants. This high response rate and the good mix of leaders and professionals make such data very credible. Such outstanding participation is attributed to short and clear questionnaire, networking with key individuals to encourage honest and swift response, and finally testing the questionnaire prior launch on few people to gauge level of understanding and timing to

respond to the four questions of the said questionnaire. Let's examine the outcome of this questionnaire. The answers to the questions are condensed on Table 4.18 and Table 4.19.

Q1) Is there a periodical discussion/dialogue between you and your supervisor regarding your work developmental needs?

Periodic Discussion	Respondents	Response YES	Percentage
Leaders	357	151	42
Scientists/Engineers	874	374	43
Others	203	102	50
Total	1434	627	44

Q2) If you have an Individual Development Plan (IDP), is it being implemented/practised?

IDP Implementation	IDP Implemented	IDP Not Implemented	NO-IDP	Total
Leaders No. - %	80 – 22%	53 – 15%	224 – 63%	357
Scientists/Engineers - %	201 – 23%	154 – 18%	519 – 59%	874
Others - %	44 – 22%	19 – 9%	140 – 69%	203
Total - %	325 – 23%	226 – 16%	883 – 61%	1434

Q3) As a mentor/supervisor, what is the number of hours per week you spend on people development?

Time Spent on Development	Hours/Week
Leaders	3.2
Scientists/Engineers	2.7
Others	1.8

Table 4.18- 2009 Level of Leadership Engagement Questionnaire – Summary Results

Looking at Table 4.18, 44% of total respondents have acknowledged that there is a periodic dialogue between supervisor and employee about work developmental needs. Both management and professionals' replies were very close which are 42% and 43% respectively. It is concluded that there is an agreement across the organization about not having adequate discussion with employees regarding their technical talent development. In other words, 60% of respondents are stating that leaders are not engaged in the making of the cornerstone of people development process. This finding is shocking when compared to the assumption that healthy and vibrant organization should score at least

80% in terms of leadership involvement in direct discussion with employees about work performance and developmental needs.

Second question asked about the existence of individual development plan and its implementation. 61% or 883 respondents stated that there is no IDP to start with. This answer validates the answer of first question about the developmental discussion. Only 23% of respondents indicated that there is IDP and being implemented whereas 16% agreed with IDP generation but without implementation. Furthermore, there is an alignment in the reply between leaders and professionals. It is a wonder that, how the employee's development moves forward without discussion or an IDP. This is a major flaw in the behaviour of involved leaders in terms of accountability and engagement. When introducing a change, the organization worries usually come from employees' slow adoption. In this case the worry is more serious since leaders are not being the role model, disengaged and not held accountable.

Time spent by supervisor and mentor on developing technical talent is on the low side. Leaders expected 3.2 hours per week and scientists/engineers expected an average of 2.7 hours per week. When calculated based on 40 working hours per week, leader's expectation translate to 8% and professional's perspective is 7%. The acceptable hours per week spent on developing people is very subjective, nevertheless the objective of the questionnaire has been met by reply to question one and two.

Table 4.19 lists a high level summary of the common and repeated comments and concerns facing technical talent development in the organization.

Q4: What are your concerns/suggestions about talent development in your organization?

Common Concerns	Times Repeated
1. Inadequate IDP implementation & Maintenance	75
2. Weak leaderships engagement & accountability	74
3. Inadequate mentorship	66
4. Work load and shifting priority	50
5. Fairness in distribution of development assignment	37
6. Average reward and recognition	27
7. Training budget constraint	16
8. Understanding talent development	12
9. Technical and Managerial path competition	9
10. Supervisor's incompetence	5

Table 4.19 - 2009 Level of Leadership Engagement – Answer to Question 4

Concern number 1 and 2 in Table 4.19 further magnify the major weakness in the development process where IDP generation/implementation and leadership involvement are below the expected results. Concern number 3 in Table 4.19 brings to the surface the inadequacy of mentorship which was highlighted on the survey outcome as one of the challenges facing technical talent development.

This level of Leadership engagement has validated survey findings that leaders' involvement and accountability are key success factors and having an effective technical talent development hinges on a full implementation of the "Individual Development Plan" cycle.

The questionnaire overall results inform that one of the major challenges facing people development in the hydrocarbon sector of Saudi Arabia is the low level of belief and passion of the involved leaders. This was clearly demonstrated by the average degree of engagement and loose practice of accountability in the organization.

4.2 Verification of Findings

With the research findings obtained, additional questionnaire and interviews were conducted to verify such findings.

4.2.1 2010 Level of Leadership Engagement Questionnaire

The outcome of 2009 level of engagement questionnaire has recommended several actions to improve current situation of talent development in the target organization. After one year of implementation, the author wanted to check the improvement level and validate if any or all previous findings are still holding. Another questionnaire, therefore, was launched in 2010 on same organization, Engineering and Project Management. The goal is to test level of engagement and calibrate research findings and analysis accordingly.

The same theme of questions is maintained to ease comparison with some modification based on the feedback received from participants who did 2009 questionnaire. 2010 questions are:

1. How many times a year do you have a formal discussion/dialogue regarding your developmental needs with your immediate supervisor?

2. If you have a written Individual Development Plant (IDP), is it being implemented?

3. Are you involved in developing your IDP?

4. What are your concerns/suggestions on talent development in your organization?

The targeted audience is the same as 2009 questionnaire and Figure 4.7 shows the participation statistics.

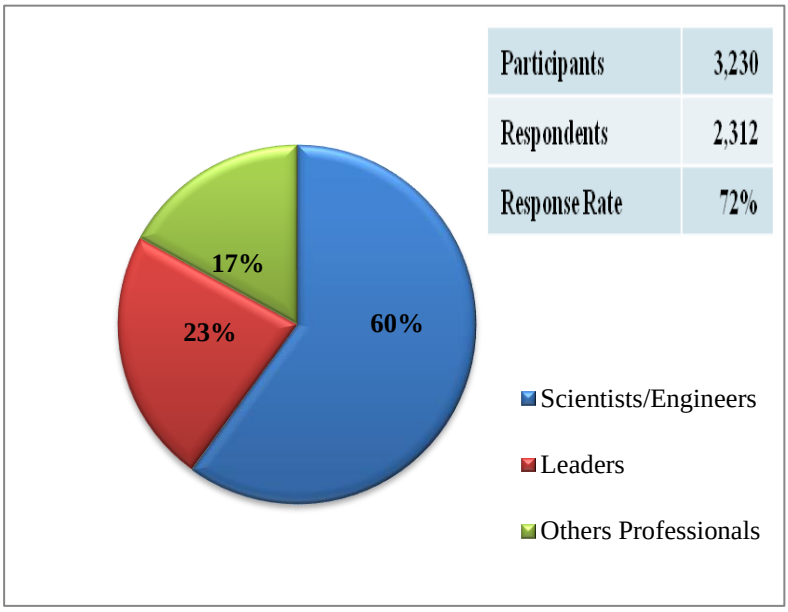

Figure 4.7 - 2010 Level of Leadership Engagement Questionnaire - Participation Statistics

The overall response rate of 2010 questionnaire is 72%. This is very healthy and driven by the 2009 published results and start of implementing corrective actions. Results of the first three questions are depicted in Table 4.20. Details of the results are shown in Appendix – IIB.

1. Discussion on Development Needs:

	None	Once	Twice	Total
Leaders # - %	167 – 32%	215 – 41%	139 – 27%	521
Scientists/Engineers, #-%	452 – 32%	154 – 37%	424 – 31%	1390
Other Professional, # - %	142 – 35%	145 – 36%	114 – 29%	401
Total, # - %	761 – **33%**	874 – 38%	677 – 29%	2312

2. IDP Implementation:

	IDP Implemented # - %	IDP Not Implemented # - %	NO-IDP # - %	Total
Leaders No. - %	193 – 37%	131 – 25%	197 – 38%	521
Scientists/Engineers - %	459 – 33%	373 – 27%	558 – 40%	1390
Other Professionals - %	109 – 27%	80 – 20%	212 – 53%	401
Total - %	761 – **33%**	585 – **25%**	966 – **42%**	2312

3. IDP Involvement

	Yes	No	Total
Leaders No. - %	247 – 48%	271 – 52%	518
Scientists/Engineers - %	642 – 46%	748 – 54%	1390
Other Professionals - %	120 – 30%	281 – 70%	401
Total - %	1010 – 44%	1303 – **56%**	2312

Table 4.20 - 2010 Level of Leadership Engagement Questionnaire Results

Response to “Is there a discussion on development needs between employee and supervisor?” Table 4.20, results came to be very close when comparing the answers of leaders and scientists/engineers and other professionals. There is still room for improvement to increase the engagement of leaders in technical talent development where 761 or 33% of respondents indicated that there is no discussion/dialogue between employee and supervisor. Only 33% replied that there an IDP and being implemented.

42% or 966 out of 2312 respondents replied that there is no individual development plan. Having an IDP but not implemented (25%) is just like no IDP (42%). To generate value to the organization the complete cycle of development has to take place; discussions of developmental needs, followed by an IDP generation which includes the what/how/who/when to bridge identified gaps, and then concludes by implementation of IDP contents or an action plan.

To have an effective individual development cycle, both supervisor and individual must be involved. The third reply in Table 4.20 examined the involvement of employees in the development of their IDP. 56% or 1303 of 2312 stated that they are not involved in their IDP generation.

When this response is cross-checked with the second answer of 42% with no IDPs, it is concluded that 14% (56% minus 42%) have IDP but without the involvement of the technical professional. If the concerned employee is not involved in the process of IDP generation, one might argue that leaders have generated these IDP just to satisfy a reporting system to higher management and not having the belief and passion on technical talent development. Did this targeted organization, which was subjected to 2009 and 2010 level of leadership engagement questionnaire, improve over one year? Table 4.21 illustrates the organization performance.

NO Development Discussion		**NO IDP**		**IDP Implemented**		**NO IDP Implemented**	
2009	2010	2009	2010	2009	2010	2009	2010
56%	**33%**	61%	42%	23%	33%	16%	25%

Table 4.21 - 2009 and 2010 IDP Comparison

In 2009, the participants were asked if there is a discussion between employee and supervisor about employee's work developmental needs, the results is 56% of respondents indicated "there is no development discussion" versus 33% in 2010. This 23% improvement is highly considerable and a major step in the right direction. Likewise, the "NO IDP" category has dropped from 61% in 2009 to 42% in 2010 or 19% improvement. The trend is also positive, where there is 10% increase in IDP implementation. The last category of comparison is "No IDP Implementation" where there is a reverse in the trend. The organization has a reduction of 9% or from 16% in 2009 to 25% in 2010. Having an IDP without implementation is just like there is "No IDP".

The forth question of the questionnaire is about concerns and suggestions regarding technical talent development. The respondents' feedback was grouped and summarized into the followings:

Concerns:

- Some employees are not aware of their IDP since there was no discussion with supervisor.
- Some employees think that IDP is a confidential document to be kept by management.

- Some employees have lost faith in the IDP process since they have not seen real implementation.
- Some employees complain that their involvement in IDP development is merely a formality.
- Some employees indicated that management does not pay full attention to talent development.

Suggestions:

- Organization should study random samples of IDPs for their quality and effectiveness on employee's development.
- Senior management should monitor the implementation of the IDPs.
- The company should establish an IDP panel to oversight and control IDP cycle.

This 2010 level of leadership engagement in technical talent development has validated that: (i) The IDP cycle is a critical process in the development of employees, (ii) although there is a noticeable improvement between 2009 and 2010, but still there is room for improvement, and (iii) most importantly, leadership engagement and accountability is a major challenge and enabler in the same time to enhance and sustain the technical talent development.

4.2.2 2010 Verification Interviews

In 2010 the author has attended a local conference about innovation in Saudi Arabia where inventors displayed their innovative ideas/products. Ten inventors were interviewed using same questions of 2009 interview. This was an extra attempt to validate research findings. The outcome of this interview is summarized in Table 4.22 and the details are shown in Appendix – IIIB.

1) What are the top competencies for an R&D technologist?	
Results: Technical	1) Up-to-date in field
	2) Analytical Methods
	3) Research Techniques
Business:	4) Global and Local perspective
	5) Economic evaluation
Soft Skills:	6) Effective communication
	7) Building relationship
	8) Adaptive and learning
2) What are the strategies to develop technical talent?	

Results • Structured technical development program where career paths are well defined by competencies and tasks. (70% of participants) • Short and focused orientation program followed by on the job assignment. (40%) • Define career path for each specialty and map the competencies and let individual demonstrate their capabilities based on self-development efforts. (30%) 3) What are the challenges facing technical talent development? Results • Management path is more attractive than technical path in terms of speed of advancement and rewarding opportunities. • The assigned leaders are not competent and lack coaching and talent development skills.

Table 4.22 - 2010 Interview – Results.

There were no surprises, on the contrary, more credibility to the research findings. The group of inventors more or less repeated same answers about the researcher's competencies, strategies to develop technical talent and challenges facing such development.

4.3 Major Findings

This section of the thesis captures the major findings out of the data acquisition and analysis. The outcomes of literature review, own experience, main survey, level of engagement questionnaires, and interviews have been integrated into one frame to answer the research questions.

4.3.1 Technical Research Competencies:

Research Question No. 1: What are the common competencies (technical, soft skills and business) of competent researcher/technologists that allow them to excel in technology development and deployment in the hydrocarbon sector of Saudi Arabia?

Research has revealed that top ten competencies are:

Technical Competencies:	1) Adequate field experience
	2) Knowledge of research and analytical methods
	3) Up-to-date in specialty
	4) Computing and Simulation Modeling
Attributes & soft Skill :	5) Effective communication
	6) Analytical Capability
	7) Teamwork
	8) Drive for results
Business Competencies :	9) Economic evaluation
	10) Global and Local perspective

4.3.2 Validation of Talent Development Strategies

Research Question No. 2: What are talent development strategies to be used to attain and sustain such competencies?

Research findings have highlighted the following top five strategies. Based on the data obtained the author attempted to develop a set of criteria for validating these strategies. The process involved identification of three most significant questions in the survey and interview questions for each strategy. This is followed by expressing an arbitrary "Significance Index" for each strategy in terms of the answers to three most significant questions decided by the author based on experience in the form of an equation SI = AX + BY +CZ where SI is the "Significance Index" and X, Y, Z are the answers to three most relevant questions in percentages and A, B and C are coefficients to X, Y and Z respectively. The numerical values of constants A, B and C have been assigned as 0.5, 0.3 and 0.2 respectively based on relative relevance of each question to the Strategy, the total value being 1.0 (100%). The same values of these constants are used for determining the Significance Index for each Strategy.

For Strategy One:

> "Several years of field assignment in the core hydrocarbon business where challenging jobs/projects are assigned to meet business needs and stretch the technical professional capability coupled with senior individual's supervision to guide and develop that professional and ensure that tasks are completed satisfactorily".

$\mathbf{SI_1 = AX_1 + B\,Y_1 + CZ_1}$, where:

$\mathbf{SI_1}$: Significance Index for the First strategy

A: 0.5

$\mathbf{X_1}$: Answer to Survey question 8.3, Table 4.14,

"Direct job assignments with senior individual supervision".

B: 0.3

$\mathbf{Y_1}$: Outcome of interview, question 2, Table 4.1,

"Several years of assignment at field".

C: 0.2

Z_1: Outcome of interview, Table 4.1, question 1,

"Top competing/knowledge are adequate field experience".

For Strategy Two:

"Conduct joint industry projects and exchange individuals between organization/countries to expand knowledge and strength talent development. An internship assignment could be a vehicle to use to implement such exchange."

For instance, developing a deep sea drilling expertise might dictate a joint project with oil operators at Gulf of Mexico or North Sea, since they have a vast experience when compared to shallow sea drilling in the Arabia Gulf.

$\mathbf{SI_2 = AX_2 + BY_2 + CZ_2}$ where:

SI_2: Significance Index for the Second Strategy

A: 0.5

X_2: Answer to survey question 8.8, Table 4.14,

"Conduct joint industry projects".

B: 0.3

Y_2: Outcome of interview, questions 2, Table 4.1,

"Internship assignment".

C: 0.2

Z_2: Answer to survey question 6.1.7, Table 4.12 "Keeping up-to-date in the field of specialty".

For Strategy Three:

"Design and implement a structured technical development program where career paths are well defined by competencies and tasks and are aligned with business objectives." This programme might include an opportunity to attend an advance degree study sponsored by the organization. This programme shall

be administered by a council or committee at the highest possible rank in the organization to ensure sound admission, graduation and accountability policies and practices. This programme grooms the participant from start to an engineering or scientific specialist status.

$\mathbf{SI_3 = AX_3 + BY_3 + CZ_3}$ where:

SI_3: Significance Index for the Third Strategy

A: 0.5

X_3: Answer to survey question 8.1, Table 4.14,
"Structured technical development program".

B: 0.3

Y_3: Outcome of interview, question 2, Table 4.1,
"Advance degree Program".

C: 0.2

Z_3: Answer to survey question 8.6, Table 4.14,
"Advance degree program".

For Strategy Four:

"Establish a mentorship program to help in selecting/qualifying mentors and set roles and responsibilities of mentor, mentee and supervisor."

This enhances knowledge transfer between generations in an efficient and rewarding manner for all participants. The Significance Index of this Strategy is related to the survey and interview answers as follows:

$\mathbf{SI_4 = AX_4 + BY_4 + CZ_4}$ where:

SI_4: Significance Index for the Fourth Strategy

A: 0.5

X_4: Answer to survey question 8.7, Table 4.14, "Mentorship program".

B: 0.3

Y_4: Outcome of interview question 2, Table 4.1,
"Mentorship program".

C: 0.2

Z_4: Answer to survey question 6.2.13, Table 4.12,
"Mentoring others is a critical skill".

Strategy Five:

"Provide and facilitate venues of knowledge exchange between professionals such as technical exchange meetings, community of practice, conferences and others".

The Significance Index of this strategy can be expressed in terms of the survey and interview answers as follows:

$\mathbf{SI_5 = AX_5 + BY_5 + CZ_5}$ where:

SI_5: Significance Index for the Fifth Strategy

A: 0.5

X_5: Answer to survey question 8.14, Table 4.14
"Venues for knowledge exchange".

B: 0.3

Y_5: Answer to survey question 6.2.12, Table 4.12
"Knowledge sharing is a critical skill".

C: 0.2

Z_5: Answer to survey question 6.2.9, Table 4.12,
"Building relationship is a critical skill".

It is proposed that the "Significance Index" for any strategy should be above a threshold value of 50% for it to be adopted for talent development purposes.. The magnitudes of the Significance Index for each of the FIVE Strategies may be determined as below.

(SI) 1 = 0.5 x 65 + 0.3 x 40 + 0.2 x 80 = 61%

(SI) 2 = 0.5 x 64 + 0.3 x 20 + 0.2 x 88 = 56%

(SI) 3 = 0.5 x 63 + 0.3 x 24 + 0.2 x 55 = 50%

(SI) 4 = 0.5 x 61 + 0.3 x 16 + 0.2 x 89 = 53%

(SI) 5 = 0.5 x 62 + 0.3 x 93 + 0.2 x 91 = 77%

From the above it is clear that the Significance Index for each of the Strategies is at least 50% thus qualifying as adoptable for the talent development purposes.

The inference of this observation may be used to postulate strategic policies developed through the survey of the views of organization wide employees before finalizing any process. The author believes that the 50% value of the "Significance Index" would reflect an accurate indication of the perception of the employees as well as practice by the senior management within any organization in general and in hydrocarbon industry in particular.

4.3.3 Challenges and Mitigations:

Research Question No. 3 and 4: What are the challenges facing the development of technical talent and how to mitigate them? Following is the major challenge and suggested mitigation measure.

Challenge No. I

1. Retaining technical talent on the technical path because managerial path is more attractive in terms of career progression pace and rewarding opportunities.

Mitigation of Challenge No. 1:

- Establish stand-alone ladder and salary structure for scientists and engineers and differentiate the pay and merit system to attract and retain professionals to technical path.
- Recognize the R&D function similar to other core businesses of the hydrocarbon sector. Create an R&D organization headed by a senior vice president or equivalent and open the opportunity for professionals to grow to a vice president or at least to a department level equivalent. This will introduce equality, boost morale and eventually contribute to technology development and deployment.

- Design lucrative incentives for patents/invention holders with heavy weight for commercialized patents/products. This may have a double advantage. In one hand it retains professionals in the technical path and on the other hand it enhances our technology creation and application.
- Institute a policy that mandates a professional to stay in technical path before shifting career into managerial path. Such as: (i) mandate a number of years of service in a technical path equal to the number of years the individual studied under the sponsorship of the organization; (ii) mandate or condition the move to managerial position by a certain number of young employees developed, probably number of technologies developed/deployed, and/or the amount of value added to the enterprise.

Challenge No. II

2. There are not enough senior professionals to mentor young talents.

Mitigation of Challenge No. 2:

- Train and qualify mentors. Sometimes it is not the number but rather the quality and desire of mentors. This is one of the main top strategies to develop technical talent, as indicated earlier.
- Assess mentors and mentees to determine the most suitable partnership combination. This match should go beyond technical speciality and team and consider cultural and chemistry dimensions.
- Use virtual mentorship techniques to overcome geographical barriers.
- Use multi-mentoring or cross mentoring technique. Mentoring is not necessarily shadowing. An individual might need some guidance on effective communication skills and his/her assigned mentor is not a good example to emulates, but another person in the department can offer such tips and mentoring. This cross mentoring is based on who has the best competency and attribute the mentee requires help at. The young talent, therefore, might have one overall mentor and several others to address other developmental needs.

- Last resort is to hire subject matter experts to meet business needs and assume a mentor role as well. This mentor role is to be part of the job offer and contract.

Challenge No. III

3. Senior professionals (mentors) are not well recognized and compensated for their efforts in developing young talents.

Mitigation of Challenge No. 3:

- Add "knowledge sharing" and "developing other" as a component in the enterprise performance management program.
- Recognize senior professionals for their efforts in developing young talent. Use high impact recognition methods such as: part of promotion justification, recognition by senior management at large gatherings, and communicate such developing efforts and recognition on the internal media of the enterprise (website, e-mail, newsletter, magazine, etc.).
- Revise job description of senior professionals and include the duties of "developing others". Communicate such obligation and expectation to the
- workforce.

Challenge No. IV

4. Mentors are not well selected and qualified.

Mitigation of Challenge No. 4:

- Establish a formal mentorship program that manages selection, qualification and follow up on mentors' performance. This has been addressed under mitigations of challenge no. 2.

4.3.4 Success Factors:

Throughout the research work, it has been observed that there are certain success factors or enablers that would act as essential catalyst for both the technical talent development and technology advancement.

The following points are the summary of these success factors:

- Development and maintenance of technical talent management strategy at the enterprise level. Such strategy shall address:
  - Alignment with business objectives.
  - Technology needs and technical specialties requirements.
  - Technical talent pool.
  - Succession planning for all critical technical positions.
  - Early identification of high potential technical talent.
  - Roles and responsibilities of leaders and professionals in the process of technical talent development.
- High degree of buy in into technical talent development particularly the engagement and accountability of leaders.
- Transparency and follow through on high potential identification, performance feedback and periodic discussion between supervisor and employee on work developmental needs.
- Establishment of key performance indicators (KPIs) to track and monitor organizations and leaders' performance on technical talent development. One of the critical KPIs would be number of individual development plans (IDPs) that are mutually agreed between supervisors or mentor and the professional, documented, and most importantly implemented.
- Create a flexible working schedule for R&D technologists. Use project deliverables instead of fixed working schedule. This would produce trust atmosphere, introduce space and freedom to innovate and reach to breakthrough ideas. The psychological impact on researchers is great and

positive in terms of bringing value to the enterprise and increasing contribution to young talent development.

4.4 Current Reality

Despite the focus is to answer the research questions, several additional findings have surfaced through the different data collection methods. These findings reflect the current reality of the environment of developing technical talent. Summary of these additional findings is as follows:

- The recruitment forecast is in the short range, less than five years. Since the emphasis is on hiring the nationals and they are mostly available as fresh graduates, the supply and demand forecast for technical professionals shall be at least ten years. It's known in the hydrocarbon industry that it takes 10-12 years to develop a professional to be a specialist in a certain discipline.
- There is a major void in using IDP as a vehicle to develop technical talent. In 2009 52% of professionals had no IDP and in 2010, this figure is 43% after some follow up. This remains a major flaw.
- It is apparent that most leaders at different management levels are not adequately engaged in technical talent development. Furthermore, the accountability practice and processes are not sufficiently rigorous. The corporation is losing its current resources in supporting human development and will lose in the long term since talent would not be ready on the right time.
- There is a major room for improvement in managing technical talent in terms of early high potential identification, using a technical talent pool, and applying an effective succession planning processes. The aim is to prepare the right individual for the right position at the right time.
- The assessment to find and select high potential remains subjective. The transparency of telling the individual whether Hi-Pot or not and associated discussions, is vague to both first line leaders and professionals. This causes uncertainty and mistrust between management and professionals, which produces weak talent management practices and results.

- Through the data mining exercise, there are several gaps between perception of management and professionals. The three largest gaps are:

    a) 42% gap between the answer of management and professionals in the aspect of risk taking environment in the R&D organization.
    b) 32% gap in clarity of who is accountable of technical talent development.
    c) 28% gap in the belief that organization is fostering collaborative teamwork atmosphere

These differences of perception are indicators of the organization health. Roles, responsibilities, authorities and accountability deserve clarity and alignment.

4.5 Implementation Plan

The objective of this section is to translate the current research work into practical solutions. The author, therefore, proposes a plan on how to implement research results for a R&D organization in the hydrocarbon sector and bridge the gap between current reality and desired results. A brainstorming session took place with participation of twenty five leaders and technical professionals. The purpose of this discussion is to further validate findings, generate solutions to the areas of improvement, and collectively designs the said implementation plan.

Figure 4.8 details the steps or road map of the suggested plan. It is highly recommended to involve leaders at all levels and technical professionals early on the making of such plan.

This would increase the sense of belonging and boost the passion about developing people thus a more practical and smoother implementation.

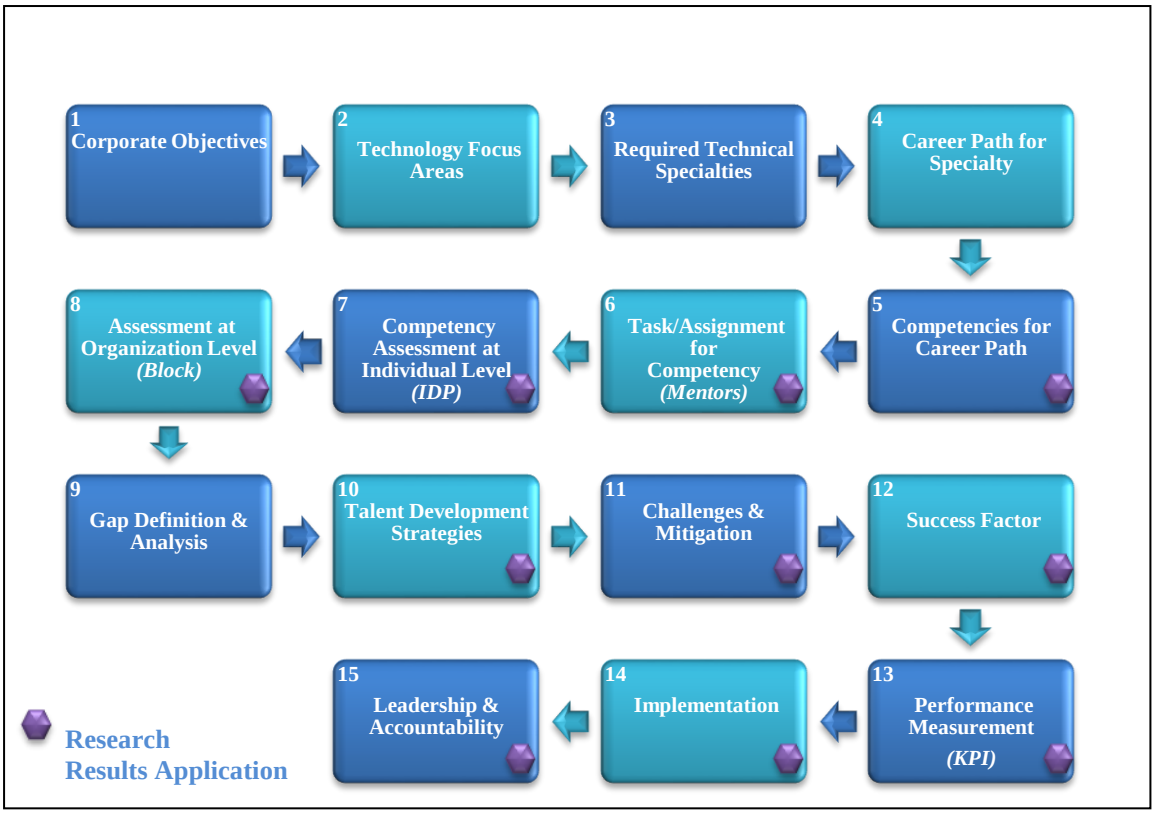

Figure 4.8 - Road Map to Apply Research Results

(1) The plan starts with understanding the defined corporate objectives including the technology objective.

(2) Then choose or examine already selected technology focus areas to ensure priority and alignment with business objectives.

(3) Assess technical specialties needed to excel in the chosen technology areas and determine current and future manning levels and expertise.

(4) With the assistance of subject matter experts craft a career path for each speciality starting from basic level (fresh engineering graduate) all the way to a mastery level (senior consultant).

(5) Determine the required competencies and skills for each level and for each speciality. The research results on technical/business competencies and soft skills can be used as a guide at this step of the plan.

(6) Find out suitable tasks/assignments that if done appropriately the participating individual will attain the desired competency/skill. Leave a room of flexibility for mentor and mentee to modify these tasks as they see fit at the implementation stage. At this step, assign mentors to mentees and commence mentorship program.

(7) Commence in the competency assessment for each technical professional to determine where everyone stands compared to the desired competencies. This can be achieved by self-assessment coupled with supervisor or mentor assessment followed by discussion and mutual agreement on the current gaps between actual competency level versus the desired one. At this step, the application of the individual development plan (IDP) comes into effect. Figure 4.9 depicts the three main stations of the IDP.

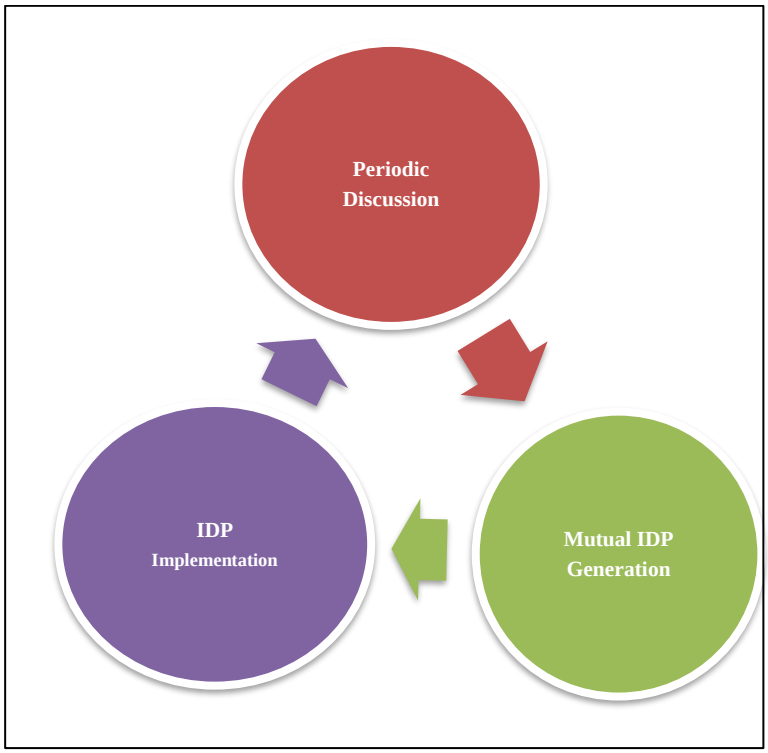

Figure 4.9 IDP Main stations

(8) Complete an organizational assessment on technical talent development building blocks and competency assessment at organization level aggregating inputs from all individual assessments done previously.

To understand and assess the talent development building blocks and their ingredients, Figure 4.10 draws these blocks; Resources, People, Programs and Practices (RP3).

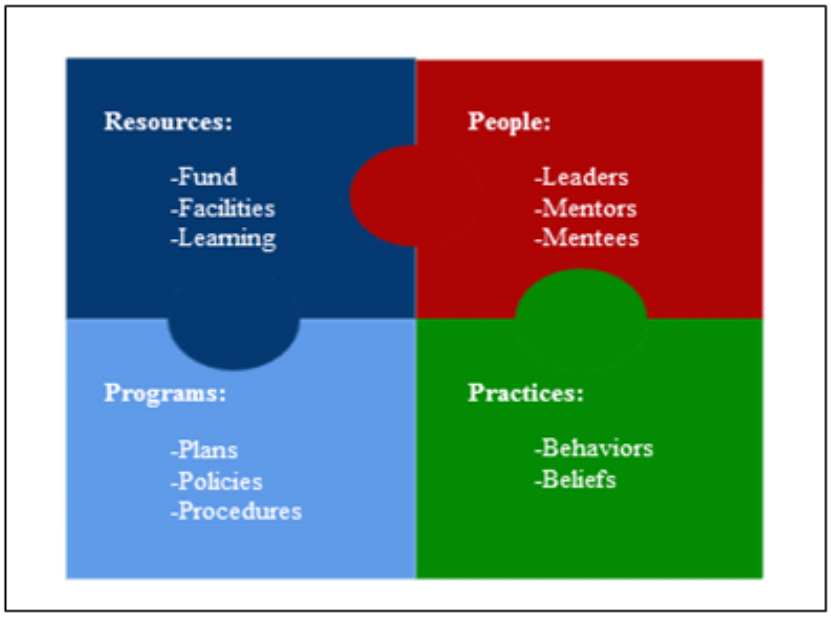

Figure 4.10 Building Blocks of Technical Talent Development RP3

Resources block includes fund allocation for technical talent development and training, facilities and system put in place to house and facilitate the development activities, and learning resources in various types and formats made accessible to all users. The assessment would focus on adequacy, suitability and effectiveness of such resources. People block typically includes leaders, mentors and mentees. The assessment would examine numbers, ratios of mentors to mentees, and most critical the competency and qualification of leaders and senior professionals focusing on "manage and develop talent" competency. Programs block contains programs to train and develop technical talent. This also includes plans, policies and procedures that govern different aspects of talent development. The assessment would look for practicality and effectiveness of these programs and policies. Practices block includes behaviors and beliefs of the involved people in the talent development process. Particular attention is to be paid to the involved leaders at all levels with special emphasis on first and second line management. Most studies and assessments to improve a process or increase an output, direct most analysis to systems and structure and with little attention to the behavioral side of the process. The intent is to check the degree of desire,

engagement and accountability that are self-driven and not system or KPI driven.

(9) Figure 4.8, based on the organizational level assessment, gaps are defined and analyzed. This would greatly help in shaping up development strategies and mitigating challenges.

(10) At this point in the map, the organization should be able to set up its most effective strategies to develop technical talent. Current research results will be used as guidelines for hydrocarbon business in Saudi Arabia.

(11) Discover potential challenges that can face the implementation of the selected strategies and mitigate them. This research has pointed out several challenges and suggested ways to eliminate or reduce the impact of such challenges.

(12) Knowing and capitalizing on success factors and enablers would definitely benefit the process and environment of talent development. The research findings include some of the critical success factors.

(13) Set up and implement a performance measurement system with leading and lagging key performance indicators (KPI's), desired targets, reporting protocol to monitor progress; to intervene timely and to enhance accountability at all levels. Based on research findings a suggested KPI set may include:

- Competency Index to measure the progress of formal certification of professionals through accredited institute and to gauge the participation into the established in-house technical development program.
- Employees IDP Index to track IDP generation and implementation.
- Developmental goal assignment in the existing performance management system.
- E-learning completions per employee per year.
- An annual questionnaire to measure the organization health in terms of discussion between supervisor and professional, mutual IDP generation and application.

(14) Fully communicate and implement strategies of developing technical talent. Organizations are dynamic in nature and the only thing constant is change, therefore, agility and flexibility need to be built in the systems, processes used to implement these development strategies.

(15) Set up administration structure to ensure leadership engagement and accountability at all levels. This current research has found major areas of improvement in leadership engagement in people development, roles/responsibilities of each party involved in the talent development processes and there are inadequate accountability measures in place. This suggested administration structure might include a technical talent council headed by a corporate management officer and membership of technical department heads. The council main charter is to ensure that competent technical talent is adequate and ready for the right position in the right time. The council has the oversight of development strategies implementation and it uses effective and objective tools to identify high potential as early as possible, manages a healthy technical talent pool and maintains a realistic and practical succession plans for each technology specialty in the organization.

4.6 Observations and Discussion

At the start of this research, there were several observations and assumptions on the areas of technical professionals' competencies, talent development strategies and challenges. This section presents discussion about these assumptions against research findings.

It was assumed that technology researchers/developers were not strong on the correlation of global and local perspectives and economic evaluation competencies. The interviews have revealed the same. Furthermore, the research has explored the top technical, business and soft skills that were required for a competent R&D technologist. On the other hand, research findings revealed that global/local perspective and economic evaluation were critical competencies that researchers should acquire.

At the talent development strategies, the early observation indicated that a well-structured development program is a key strategy to achieve long lasting talent development. This research has found that this strategy is one of the selected strategies by most participants in the survey and the interviews. Another assumed development strategy is self-development in an area the individual desires and aligned with business objectives, with full financial and motivational support of the leadership. Through this work, it was found that self-development is an enabler to the development process and not a main strategy that an organization can depend on.

On the challenges side, the author assumed that technical career path is not as attractive as the managerial path which has a faster advancement, better recognized and well compensated. This would lead to escape of technical talent from the technical to managerial ladder within the same enterprise and if the organization forces the individual to remain in the technical path, his/her heart and aspiration continue to be with the leadership path which definitely impacts innovation, focus and loss of research efforts. Survey and interviews results highlighted and confirmed this assumption.

It was also assumed that there is no incentive for senior professionals to mentor and pass knowledge to younger generation to enhance the talent development process. The research has surfaced such a concern as one of the challenges facing technical talent development in the hydrocarbon sector in Saudi Arabia. Despite these observations and assumptions did not cover all aspects of the research, but there is a great match between the research assumptions and findings. This is attributed to the author's thirty plus years of experience in the hydrocarbon business at both professional and managerial paths.

CHAPTER 5

CONCLUSION AND FUTURE WORK

5.0 General

Prosperity or even survival of hydrocarbon organizations in Saudi Arabia is dependent on several pillars, one of which is technology. This technology pillar is standing on the foundation of competent technical talent. There are three equally critical aspects of technical talent management; recruitment, development, and retention. The author research has focused on the development portion and aimed to find the most effective strategies to develop technical talent in order to enhance technology advancement in the hydrocarbon business of Saudi Arabia. The researcher has advised on the critical competencies and skills required for competent researchers/technologists in order to set and calibrate the intended technical talent strategies. The outcome indicates a mix of top ten technical, business and soft skills. The heart of the research is how to develop technical talent. The research has concluded with five strategies that assist the organizations to attain and sustain the required competencies and skills to excel in technology development and deployment.

Additionally, the research has captured the major challenges facing the technical talent development and highlighted some of the success factors or enablers that if available, would accelerate talent development and entice technology advancement.

5.1 Conclusion:

The detailed findings are well covered in Chapter 4. The following is a summary of conclusion:

Technical Research Competencies:

Research has revealed that top ten competencies are:

Technical Competencies:
1) Adequate field experience
2) Knowledge of research and analytical methods
3) Up-to-date in speciality
4) Computing and Simulation Modeling

Attributes & Soft Skills:	5) Effective communication
	6) Analytical Capability
	7) Teamwork
	8) Drive for results
Business Competencies:	9) Economic evaluation
	10) Global and Local perspective

Technical Talent Development Strategies:

Research findings have highlighted the following top five strategies:

1. Several years of field assignment in the core hydrocarbon business where challenging jobs/projects are assigned to meet business needs and stretch the technical professional capability coupled with s senior individual's supervision to guide and develop that professional and ensure that tasks are completed satisfactorily.

2. Conduct joint industry projects and exchange individuals between organization/countries to expand knowledge and strength talent development. An internship assignment could be a vehicle to use to implement such exchange. For instance, developing a deep sea drilling expertise might dictate a joint project with operators at Gulf of Mexico or North Sea, since they have a vast experience when compared to shallow sea drilling in the Arabia Gulf.

3. Design and implement a structured technical development program where career paths are well defined by competencies and tasks and are aligned with business objectives. This program might include an opportunity to attend an advance degree study sponsored by the organization. This program shall be administered by a council or committee at the highest possible rank in the organization to ensure sound admission, graduation and accountability policies and practices. This program grooms the participant from start to an engineering or scientific specialist status.

4. Establish a mentorship program to help in selecting/qualifying mentors and set roles and responsibilities of mentor, mentee and supervisor. This

enhances knowledge transfer between generations in an efficient and rewarding manner for all participants.

5. Provide and facilitate venues of knowledge exchange between professionals such as technical exchange meetings, community of practice, conferences and others.

Major Challenges:

This research has concluded with several challenges, the major ones are:

1. Retaining technical talent on the technical path because managerial path is more attractive in terms of career progression pace and rewarding opportunities.

2. There are not enough senior professionals to mentor young talents.

3. Senior professionals (mentors) are not well recognized and compensated for their efforts in developing young talents.

4. Mentors are not well selected and qualified.

5.2 Future Work

Through the course of this research, several issues that deserve stand-alone research were encountered. It is recommended to study and research intellectual capital management and technical talent management at large.

5.2.1 Intellectual Capital Management:

There are many definitions of intellectual capital (IC) but the simplest is the total knowledge assets an organization has. The IC has three interactive components; human capital (HC), relational capital (RC) and structural capital (SC).

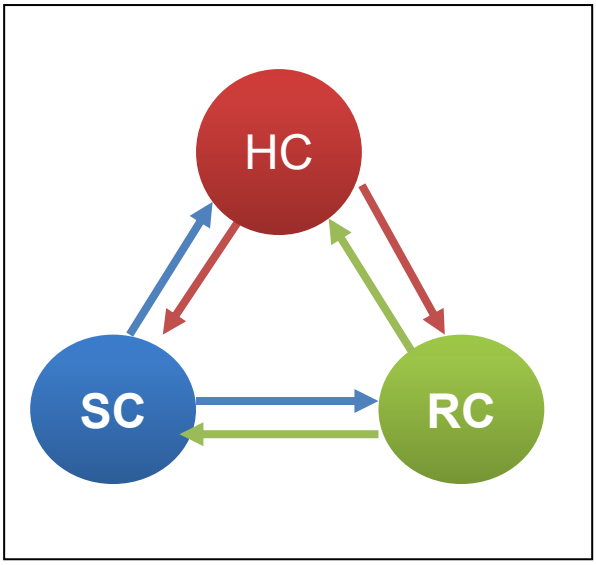

Figure 5.1 Intellectual Capital Components

Figure 5.1 depicts the IC relationship where talent development is within the HC and it is very critical to maintain and enrich any enterprise knowledge assets. A talent development is leverage to increase the human capital.

Human capital is the human knowledge, education, skills and competency or the tacit knowledge of employees. It is the knowledge that would leave the organization at any time. Thus there is a need for a rigorous and continuous talent development program to sustain HC of the organization. Also, there is a need to convert HC and RC into SC.

Relational Capital is the shared know-how between teams and organizations through contracts and agreements. This is useful to boost talent development, exchange knowledge and transfer such gained knowledge into SC.

Structural capital is the captured knowledge in a tangible format with an organization such as written standards, procedures, policies and lesson learned. The challenge is to transfer HC and RC into SC and use SC to expand HC and transform all the knowledge assets into value adding solutions to the best interest of the organization.

Technical Talent development plays a major role in preserving a company intellectual capital and in being a cutting edge advantage to all organizations especially the ones that depend on engineering and research as a feedstock to its survival and

prosperity. It would be a good research project to study how an organization best manages its IC and how talent development correlates within each IC type.

5.2.2 Technical Talent Management:

Technical talent management pertains to three aspects which are recruitment (Rc), development (D) and retention (Rt) as shown in Figure 5.2. The current research has dealt with technical talent development. It is recommended to expand the research and explore the other two aspects, recruitment and retention of technical talent in the hydrocarbon business in Saudi Arabia. Since there is a war on talent in the industry, recruitment becomes critical business and more innovative techniques ought to be used to hunt and attract top technical talent to keep technology wheel running and to assist in developing and mentoring young generation as pointed out by research findings. The retention aspect is the third angle of technical talent management triangle.

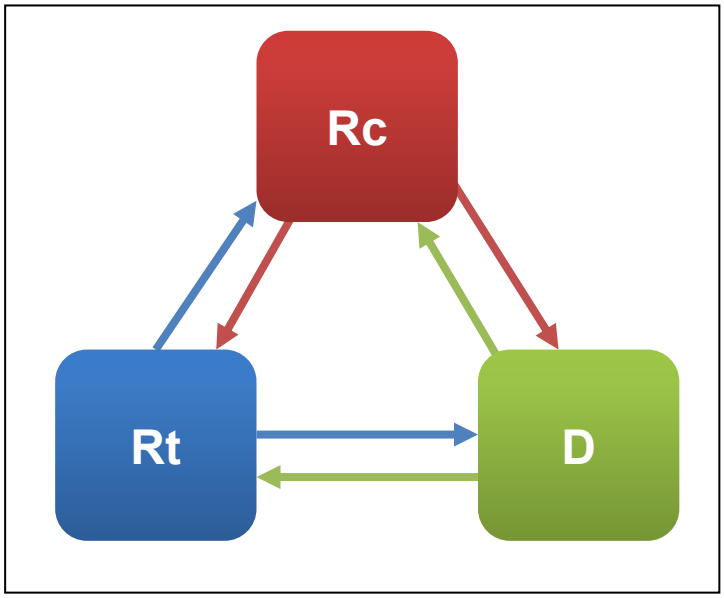

Figure 5.2 Technical Talent Management Components

The current research has revealed that technical professionals are seeking opportunities to escape the technical path into the managerial path, thus, there is a need to retain technical people in this most needed career and equally important to retain such talent in the organization since competitors are hunting for technical talent. It is recommend, therefore, to research this triangle to understand how each aspect impacts and benefits the other and draw a comprehensive approach on how to manage technical talent to the best of the organization's interest.

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APPENDIX – IA

SURVEY STATEMENTS

Professional Talent Development

to support

Technology Advancement in the Hydrocarbon Industry

in the

Kingdom of Saudi Arabia

Survey Statements

Dear Colleagues,

We are eager to know your invaluable contributions towards improving professional talent development to support technology advancement in the Kingdom of Saudi Arabia.

Please spare us a few minutes of your time and answer the following questionnaire to the best of your knowledge. The output of this survey will be a part of a research study conducted by Hasan Jamaan Al Zahrani from Saudi Aramco.

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Mobile: +966 506 801 694

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We highly appreciate your input on or before January 20th 2009.

Respondent's Details

Organization:

Department:

Location (Country, City):

☐ Saudi ☐ Expat

☐ Female ☐ Male

Occupational path: ☐ Professional ☐ Management ☐ Other

Educational level: ☐ Bachelor ☐ Masters ☐ PHD

Experience level: ☐ Less than 10 years

☐ 10-20 years

☐ More than 20 years

If you are interested in receiving a copy of the results of this survey please provide the details requested below:

Name:

E-mail address:

Work phone:

Talent Strategy

Q 1. What is the degree of alignment and integration of talent development and business strategy?

- ☐ Not at all
- ☐ To some degree
- ☐ To considerable degree
- ☐ Consistently across the organization

Q 2. What is the degree to which critical roles and capabilities are identified in your organization?

- ☐ Not at all
- ☐ To some degree
- ☐ To considerable degree
- ☐ Consistently across the organization

Q 3. What is the degree to which individual performance is tied to talent development?

- ☐ Not at all
- ☐ To some degree
- ☐ To considerable degree
- ☐ Consistently across the organization

Q 4. What is the forecast range of supply and demand for technical talent?

- ☐ Not forecast
- ☐ Less than 1 year
- ☐ 1-2 years
- ☐ 3-5 years
- ☐ More than 5 years

Q 5. What is the degree to which team leaders (first line management) are accountable for developing technical talent?

- ☐ Not at all
- ☐ To some degree
- ☐ To considerable degree
- ☐ Highly accountable

Q 6. What is the degree to which department managers are accountable for developing technical talent?

- ☐ Not at all
- ☐ To some degree
- ☐ To considerable degree
- ☐ Highly accountable

Talent Development

Q 7. Do technical professionals have a clear picture of competencies they should build to support business growth?

- ☐ Not at all
- ☐ To some degree
- ☐ To considerable degree
- ☐ Full understanding of what is needed

Q 8. Does every technical professional have an individual development plan?

- ☐ Agree
- ☐ Disagree

Q 9. Can technical professionals easily access accurate information on available development opportunities?

- ☐ Agree
- ☐ Disagree

Q 10. Do managers and technical professionals share accountability for talent development?

- ☐ Agree
- ☐ Disagree

Rewarding Performance

Q 11. What is the degree to which the current compensation package is comparable with individual performance?

- ☐ Not at all
- ☐ To some degree
- ☐ To considerable degree
- ☐ Consistently across the organization

Q 12. What is the degree to which there is a pay differentiation to high performers through both base and variable pay?

- ☐ Not at all
- ☐ To some degree
- ☐ To considerable degree
- ☐ Consistently across the organization

Leadership Involvement

Q 13. Is management involved with technical talent development?

- ☐ Agree
- ☐ Disagree

Q 14. Do senior technical professionals teach and develop young talent?

- ☐ Agree
- ☐ Disagree

Q 15. Do senior leaders teach and develop new leaders?

- ☐ Agree
- ☐ Disagree

Q 16. What is the degree to which leadership conduct technical talent reviews on at least a semi-annual basis?

- ☐ Not at all
- ☐ To some degree
- ☐ To considerable degree
- ☐ To a high degree

Q 17. What is the degree to which technical talent review and development activities are based on well-defined competencies?

- ☐ Not at all
- ☐ To some degree
- ☐ To considerable degree
- ☐ To a high degree

Q 18. What is the degree to which the succession planning process is used to fill critical technical positions?

- ☐ Not at all
- ☐ To some degree
- ☐ To considerable degree
- ☐ To a high degree

Q 19. What is the degree to which developmental assignments are used to address specific developmental needs?

- ☐ Not at all
- ☐ To some degree
- ☐ To considerable degree
- ☐ To a high degree

Q 20. What is the degree to which global assignments are used to develop specific developmental needs?

- ☐ Not at all
- ☐ To some degree
- ☐ To considerable degree
- ☐ To a high degree

High Potential (Technical) Talent

Q 21. What is the degree to which high potential (technical) talent are aware of their status?

☐ Not at all ☐ To some degree
☐ To considerable degree ☐ To a high degree

Q 22. What is the degree to which technical talent is attracted to a leadership (management) path?

☐ Not at all ☐ To some degree
☐ To considerable degree ☐ To a high degree

Q 23. What is the degree to which technical talent is attracted to a technical path?

☐ Not at all ☐ To some degree
☐ To considerable degree ☐ To a high degree

Q 24. To what degree does management identify high potential (technical) candidates early and take action to proactively develop them?

☐ Not at all ☐ To some degree
☐ To considerable degree ☐ To a high degree

Q 25. To what degree is the high potential technical talent pool reviewed and calibrated?

☐ Not at all ☐ To some degree
☐ To considerable degree ☐ To a high degree

Q 26. To what degree is high potential technical talent given challenging/special projects?

☐ Not at all ☐ To some degree
☐ To considerable degree ☐ To a high degree

Competency Inventory

How critical are the following competencies/skills to build a qualified technology developer?

Technical (General Knowledge)

	Not Critical	Some Critical	Critical	Very Critical	N/A
Computer programming	☐	☐	☐	☐	☐
Numerical modeling	☐	☐	☐	☐	☐
Simulation modeling	☐	☐	☐	☐	☐
Research techniques	☐	☐	☐	☐	☐
Analytical methods	☐	☐	☐	☐	☐

Computational fluid dynamics	☐	☐	☐	☐	☐
Up-to-date in his/her field	☐	☐	☐	☐	☐

Soft Skills

	Not Critical	**Some Critical**	**Critical**	**Very Critical**	**N/A**
Adaptive and learning	☐	☐	☐	☐	☐
Analytical capability	☐	☐	☐	☐	☐
Innovative	☐	☐	☐	☐	☐
Foster teamwork	☐	☐	☐	☐	☐
Communicate openly and effectively	☐	☐	☐	☐	☐
Drive for results	☐	☐	☐	☐	☐
Influence others	☐	☐	☐	☐	☐
Plan and organize work	☐	☐	☐	☐	☐
Build relationships	☐	☐	☐	☐	☐
Commitment and reliability	☐	☐	☐	☐	☐

Soft Skills cont.

	Not Critical	Some Critical	Critical	Very Critical	N/A
Practice self development	☐	☐	☐	☐	☐
Knowledge sharing	☐	☐	☐	☐	☐
Mentoring others	☐	☐	☐	☐	☐
Customer service oriented	☐	☐	☐	☐	☐
Inspire trust	☐	☐	☐	☐	☐
Passionate about job	☐	☐	☐	☐	☐
Risk taking	☐	☐	☐	☐	☐

Business Competencies

	Not Critical	Some Critical	Critical	Very Critical	N/A
Global and local perspective	☐	☐	☐	☐	☐
Economic evaluation methods	☐	☐	☐	☐	☐
Cost estimation	☐	☐	☐	☐	☐
Project planning and execution	☐	☐	☐	☐	☐
Methods					

Team/Organization/Leadership

Q 27. To what degree does your team foster collaborative teamwork?

☐ Not at all ☐ To some degree
☐ To considerable degree ☐ To a high degree

Q 28. To what degree does your organization create an innovative environment?

☐ Not at all ☐ To some degree
☐ To considerable degree ☐ To a high degree

Q 29. To what degree does your management adapt a leadership style that promotes risk taking?

☐ Not at all ☐ To some degree
☐ To considerable degree ☐ To a high degree

Q 30. Does your management make adequate effort to develop technical talent?

- ☐ Not at all
- ☐ To some degree
- ☐ To considerable degree
- ☐ To a high degree

Technical Talent Development Strategies/Programs/plans

Q 31. Please rate the effectiveness of the following strategies/programs/plans in developing technical talent where 1 is the least effective and 5 is the most effective.

__ **a.** Structured technical development programs where career paths are well defined by competencies and tasks and are aligned with business objectives. This program will groom the participant from start to an engineering specialist status.

__ **b.** Short and focused orientation program followed by on the job assignments that participants will learn and produce at the same time.

__ **c.** Direct job assignments/projects to meet business needs coupled with a senior individual's supervision to ensure that tasks are completed satisfactorily.

__ **d.** Typical job orientation, followed by job assignments/projects but with the guidance of an assigned mentor to oversee the individual's development and contribution to the business objectives.

__ **e.** Assign the individual with a team that has specific project and he/she will gain experience with time.

__ **f.** Send the individual to obtain an advanced degree (masters/doctorate) in the subject that serves the organization's interest.

__ **g.** Conduct adequate training to strengthen the mentorship role of senior engineers/scientists so the mentorship of young talent becomes more effective (Mentorship Program).

__ **h.** Conduct joint industry projects and exchange individuals between organizations/countries to exchange knowledge and strengthen talent development.

__ **i.** Assemble technical talent council to manage technical talent succession planning/technical talent pool and development programs/plans effectiveness.

__ **j.** Define career path for each engineering specialty and map each specialty based on competencies and let individuals demonstrate their capabilities based on self-development efforts.

__ **k.** Let in-house subject matter experts develop and deliver technical courses to young talent using problems/examples that our organization faces nowadays.

__ **l.** Mandate that professionals obtain industry recognized certification and maintain that status.

__ **m.** Make self-development the key element in technical talent development and embed such mandates in the annual performance review cycle.

__ **n.** Provide venues for knowledge exchange between professionals such as technical exchange meetings, community of practices and others.

__ **o.** Please write down any additional development strategies/plans and rate them.

__ **p.** What is your overall rating for all the above developmental strategies/plans?

Q 32. Please rate the following hurdles/challenges in terms of how they hinder the development of professional talent? Please rate from 1 to 5 where 1 is the least effective and 5 is the most effective.

__ **a.** Management path is more attractive than technical path in terms of speed of advancement and rewarding opportunities.

__ **b.** Senior professionals are not well compensated for their efforts in developing young talent.

__ **c.** Job security acts like a hurdle where senior professionals are not sharing knowledge and experiences with others.

__ **d.** The absence of a well-defined career path with an individual development plan.

__ **e.** There are not enough senior professionals to mentor young talent.

__ **f.** Senior professionals are not well trained as mentors. They lack mentorship skills.

__ **g.** The assigned leaders (management) are not competent and lack coaching and talent development skills.

__ **h.** The current HR policies don't differentiate/attract professionals to the technical path.

__ **i.** This organization doesn't provide opportunity to learn and grow.

__ **j.** This organization doesn't provide opportunity to perform challenging and interesting work.

__ **k.** Please provide any other hurdles or challenges to technical talent development strategies/programs/plans below and rate those challenges.

__ **l.** What is your overall rating for the above hurdles/challenges?

APPENDIX – IB

MASTER CONSOLIDATED SURVEY RESULTS

Professional Talent Development Survey
Master Consolidated Survey Results

1. Talent Strategy	Not at all	To some degree	To a considerable degree	Consistently across the organization
1.1 Talent development is aligned and integrated with business strategy.	6%	32%	38%	24%
1.2 Critical roles and capabilities are identified in your organization.	5%	36%	41%	18%
1.3 Individual performance is tied to talent development.	11%	37%	42%	10%
1.4 Team leaders (first line management) are accountable for developing technical talent.	16%	31%	34%	19%
1.5 Department managers are accountable for developing technical talent.	11%	29%	42%	18%

1.6 The forecast range of supply and demand for technical talent is:		
No forecast	21	23%
Less than 1 year	6	7%
1-2 years	16	18%
3-5 years	30	33%
More than 5 years	17	19%
Total	90	100%

2. Talent Development	Disagree	Agree
2.1 Every technical professional has an individual development plan.	48%	52%
2.2 Technical professionals can easily access accurate information on available development opportunities.	32%	68%
2.3 Managers and technical professionals share accountability for talent development.	36%	64%

2.4 Technical professionals have a clear picture of competencies they should develop to support business growth in your organization.	
Not at all	7	8%
To some degree	25	28%
To a considerable degree	41	45%
Fully understanding what is needed	17	19%
Total	90	100%

3. Rewarding Performance	Not at all	To some degree	To a considerable degree	Consistently across the organization
3.1 Current compensation package is comparable with individual performance.	19%	34%	32%	15%
3.2 There is a pay differentiation for high performers through both base and variable pay.	19%	37%	33%	11%

4. Leadership Involvement	Disagree	Agree
4.1 Management involved with technical talent development	23%	77%
4.2 Senior technical professionals teach and develop young talent	8%	92%
4.3 Senior leaders teach and develop new leaders	32%	68%

	Not at all	To some degree	To a considerable degree	To a high degree
4.4 Leadership conduct technical talent reviews on at least a semi-annual basis	17%	40%	28%	15%
4.5 Technical talent review and development activities are based on well-defined competencies	15%	31%	38%	16%
4.6 The succession planning process is used to fill critical technical positions	22%	36%	26%	16%
4.7 Developmental assignments are used to address specific developmental needs	8%	35%	36%	21%
4.8 Global assignments are used to develop specific developmental needs	13%	29%	39%	19%

5. High Potential Technical Talent	Not at all	To some degree	To a considerable degree	To a high degree
5.1 High potential (technical) talents are aware of their status	13%	36%	34%	17%
5.2 Technical talent is attracted to a leadership (management) path	6%	23%	37%	34%
5.3 Technical talent is attracted to a technical path	9%	42%	39%	10%
5.4 Management identifies high potential (technical) candidates early and takes action to proactively develop them	15%	30%	40%	15%
5.5 High potential technical talent pool is reviewed and calibrated	20%	46%	24%	10%
5.6 High potential technical talents are given challenging/special projects	12%	38%	34%	16%

6. Competency Inventory	

6.1 Generic Knowledge. The following competencies request you to indicate your view of the criticality of certain skills/competencies in building qualified technology developers in your organization. Please click on the box that most closely reflects your view.

	Not Critical	Somewhat Critical	Critical	Very Critical	N/A
6.1.1 Computer programming	21%	36%	22%	13%	8%
6.1.2.Numerical modeling	12%	33%	28%	16%	11%
6.1.3 Simulation modeling	10%	30%	25%	30%	5%
6.1.4 Research techniques	1%	11%	42%	46%	0%
6.1.5 Analytical methods	0%	11%	27%	62%	0%
	Not	Somewhat	Critical	Very Critical	N/A

	Critical	Critical			
6.1.6 Computational fluid dynamics	23%	20%	28%	16%	13%
6.1.7 Up-to-date in field	1%	7%	16%	72%	4%
6.2 Soft Skills	**Not Critical**	**Somewhat Critical**	**Critical**	**Very Critical**	**N/A**
6.2.1 Adaptive and learning	0%	10%	31%	58%	1%
6.2.2. Analytical capability	0%	4%	34%	62%	0%
6.2.3 Innovativeness	3%	4%	38%	54%	1%
6.2.4 Foster teamwork	1%	10%	29%	59%	1%
6.2.5 Communicate openly and effectively	1%	5%	32%	62%	0%
6.2.6 Drive for results	1%	4%	33%	62%	0%
6.2.7 Influence others	1%	13%	41%	45%	0%
6.2.8 Plan and organize work	1%	8%	44%	47%	0%
6.2.9 Build relationships	2%	8%	44%	46%	0%
6.2.10 Commitment and reliability	1%	3%	28%	68%	0%
6.2.11 Practice self development	1%	7%	43%	49%	0%
6.2.12 Knowledge sharing	1%	7%	38%	54%	0%
6.2.13 Mentoring others	1%	10%	47%	41%	1%
6.2.14 Customer service oriented	2%	12%	38%	44%	4%
6.2.15 Inspire trust	1%	5%	43%	51%	0%
6.2.16 Passionate about job	1%	7%	40%	50%	2%
6.2.17 Risk taking	6%	21%	47%	26%	0%
6.3 Business Competencies	**Not Critical**	**Somewhat Critical**	**Critical**	**Very Critical**	**N/A**
6.3.1 Global and local perspective	1%	26%	44%	26%	3%
6.3.2 Economic evaluation methods	2%	28%	37%	29%	4%
6.3.3 Cost estimation	2%	32%	44%	18%	4%

6.3.4 Project planning and execution methods	1%	32%	29%	32%	6%

7. Team/Organization/Leadership	Not at all	To some degree	To a considerable degree	To a high degree
7.1 Your team fosters collaborative teamwork	1%	23%	50%	26%
7.2 Your organization creates an innovative environment	14%	29%	35%	22%
7.3 Your management adapts a leadership style that promotes risk taking	21%	34%	34%	11%
7.4 Your management makes adequate effort to develop technical talent	5%	31%	37%	27%

8. Technical Talent Development Strategies/Programs/plans/tactics:

Please rate the effectiveness of the following strategies/programs/plans in developing technical talent. 5 is the most effective.	1	2	3	4	5
8.1 Structured technical development programs where career paths are well defined by competencies and tasks and are aligned with business objectives. This program will groom the participant from start to an engineering specialist status	0%	7%	26%	27%	40%
8.2 Short and focused orientation program followed by on the job assignments that participants will learn and produce at the same time	3%	8%	26%	32%	31%
8.3 Direct job assignments/projects to meet business needs coupled with a senior individual's supervision to ensure that tasks are completed satisfactorily	1%	10%	23%	33%	33%
8.4 Typical job orientation, followed by job assignments/projects but with the guidance of an assigned mentor to oversee the individual's development and contribution to the business objectives	0%	9%	32%	31%	28%
8.5 Assign the individual to a team that has specific project and he/she will gain experience with time	3%	20%	29%	31%	17%
8.6 Send the individual to obtain an advanced degree (masters/doctorate) in the subject that serves the organization's interest	7%	9%	29%	24%	31%
8.7 Conduct adequate training to strengthen the mentorship role of senior engineers/scientists so the mentorship of young talent becomes more effective (Mentorship Program)	0%	16%	23%	40%	21%
8.8 Conduct joint industry projects and exchange individuals between organizations/countries to exchange knowledge and strengthen talent development.	5%	8%	23%	41%	23%
8.9 Assemble technical talent council to manage 9technical talent succession planning/technical talent pool and development programs/plans effectiveness.	6%	22%	28%	26%	18%
8.10 Define career path for each engineering specialty and map each specialty based on competencies and let individuals demonstrate their capabilities based on self-development efforts.	4%	8%	31%	30%	27%

8.11 Let in-house subject matter experts develop and deliver technical courses to young talent using problems/examples that our organization faces nowadays.	3%	18%	23%	34%	22%
8.12 Mandate that professionals obtain industry recognized certification and maintain that status.	7%	13%	32%	30%	18%
8.13 Make self-development the key element in technical talent development and embed such mandates in the annual performance review cycle.	2%	15%	35%	24%	24%
8.14 Provide venues for knowledge exchange between professionals such as technical exchange meetings, community of practices and others.	0%	9%	30%	36%	25%

9. Challenges:

Please rate the following hurdles on a scale of 1 to 5 in terms of their ability to hinder the development of professional talent. 5 is the greatest hindrance to professional development.

	1	**2**	**3**	**4**	**5**
9.1 Management path is more attractive than technical path in terms of speed of advancement and rewarding opportunities.	1%	10%	15%	25%	49%
9.2 Senior professionals are not well compensated for their efforts in developing young talent.	6%	17%	23%	36%	18%
9.3 Job security acts like a hurdle where senior professionals are not sharing knowledge and experiences with others.	13%	30%	23%	24%	10%
9.4 There is no well defined career path with an individual development plan.	12%	29%	21%	26%	12%
9.5 There is not enough senior professionals to mentor young talent.	8%	15%	16%	28%	33%
9.6 Senior professionals are not well trained as mentors. They lack mentorship skills.	10%	18%	31%	23%	18%
9.7 The assigned leaders (management) are not competent and lack coaching and talent development skills.	10%	20%	32%	23%	15%
9.8 The current HR policies do not differentiate/attract professionals to the technical path.	8%	19%	16%	26%	31%
9.9 This organization does not provide opportunity to learn and grow.	37%	20%	20%	8%	15%
9.10 This organization doesn't provide opportunity to perform challenging and interesting work.	33%	33%	13%	10%	11%

APPENDIX – IC

TALENT SURVEY COMPARATIVE ANALYSIS

COMPARATIVE ANALYSIS OF THE RESPONSES OF THE VARIOUS DEMOGRAPHICS

		Management			Professionals			Saudis			Expats			Combined		
1. Talent Strategy		Not in Favor	In Favor	Delta	Not in Favor	In Favor	Delta	Not in Favor	In Favor	Delta	Not in Favor	In Favor	Delta	Not in Favor	In Favor	Delta
	1.1	22	78	56	43	57	14	34	66	32	45	55	10	36	64	28
	1.2	22	78	56	49	51	2	34	66	32	60	40	-20	39	61	22
	1.3	29	71	42	57	43	-14	46	54	8	50	50	0	47	53	6
	1.4	26	74	48	56	44	-12	44	56	12	53	47	-6	45	55	10
	1.5	39	61	22	42	58	16	38	62	24	50	50	0	41	59	18
	1.6	23	77	54	58	42	-16	48	52	4	40	60	20	47	53	6
2. Talent Development		Disgree	Agree	Delta	Disgree	Agree	Delta	Disgree	Agree	Delta	Disgree	Agree	Delta	Disgree	Agree	Delta
	2.1	52	48	-4	44	56	12	45	55	10	50	50	0	46	54	8
	2.2	26	74	48	47	53	6	32	68	36	70	30	-40	40	60	20
	2.3	29	71	42	40	60	20	36	64	28	40	60	20	37	63	26
		Not in Favor	In Favor	Delta	Not in Favor	In Favor	Delta	Not in Favor	In Favor	Delta	Not in Favor	In Favor		Not in Favor	In Favor	Delta
	2.4	26	74	48	39	61	22	28	72	44	55	45	-10	35	65	30
3. Rewarding Performance																
	3.1	32	68	36	66	44	-22	51	49	-2	70	30	-40	54	46	-8
	3.2	39	61	22	63	37	-26	51	49	-2	70	30	-40	54	46	-8
4. Leadership Involvement		Disgree	Agree	Delta	Disgree	Agree	Delta	Disgree	Agree	Delta	Disgree	Agree	Delta	Disgree	Agree	Delta
	4.1	13	87	74	29	71	42	19	81	62	40	60	20	24	76	52
	4.2	0	100	100	13	87	74	4	96	92	25	75	50	9	91	82
	4.3	23	77	54	37	63	26	30	70	40	40	60	20	32	68	36
		Not in Favor	In Favor	Delta	Not in Favor	In Favor	Delta	Not in Favor	In Favor	Delta	Not in Favor	In Favor		Not in Favor	In Favor	Delta
	4.4	42	58	16	64	36	-28	50	50	0	85	15	-70	57		-57
	4.5	35	65	30	53	47	-28	40	50	10	75	25	-50	47	53	6
	4.6	45	55	10	66	34	-6	54	60	6	75	25	-50	59	41	-18
	4.7	13	87	74	57	43	-32	34	46	12	74	26	-48	43	57	14
	4.8	19	81	62	53	47	-14	35	66	31	70	30	-40	52	48	-4
5. High Potential Tech. Talent																
	5.1	51	49	-2	46	54	8	46	54	8	55	45	-10	48	52	4
	5.2	23	77	54	34	66	32	25	75	50	50	50	0	30	70	40
	5.3	45	55	10	56	44	-12	48	52	4	70	30	-40	53	47	-6
	5.4	29	71	42	54	46	-8	38	62	24	73	27	-46	45	55	10
	5.5	49	51	2	77	23	-54	61	39	-22	90	10	-80	68	32	-36
	5.6	29	71	42	62	38	-24	43	57	14	80	20	-60	51	49	-2

6. Compentecny Inventory																
6.1 Generic Tech. Competencies	6.1.1	64	46	-18	55	45	-10	55	45	-10	40	60	20	58	42	-16
	6.1.2	44	56	12	50	50	0	44	56	12	35	65	30	49	51	2
	6.1.3	35	65	30	47	53	6	40	60	20	35	65	30	43	57	14
	6.1.4	0	100	100	18	82	64	12	88	76	10	90	80	12	88	76
	6.1.5	13	87	74	14	86	72	11	89	78	20	80	60	13	87	74
	6.1.6	41	59	18	62	38	-24	41	59	18	68	32	-36	57	43	-14
	6.1.7	6	94	88	18	82	64	8	92	84	20	80	60	14	86	72
6.2 Attributes & Soft Skills	6.2.1	10	90	80	16	84	68	7	93	86	40	60	20	14	86	72
	6.2.2	0	100	100	10	90	80	1	99	98	25	75	50	6	94	88
	6.2.3	10	90	80	12	88	76	9	91	82	15	85	70	10	90	80
	6.2.4	6	94	88	17	83	66	7	93	86	35	65	30	13	87	74
	6.2.5	3	97	94	8	92	84	4	96	92	15	85	70	6	94	88
	6.2.6	0	100	100	9	91	82	3	97	94	15	85	70	5	95	90
	6.2.7	6	94	88	20	80	60	13	87	74	25	75	50	15	85	70
	6.2.8	3	97	94	10	90	80	7	93	86	10	90	80	8	92	84
	6.2.9	3	97	94	13	87	74	9	91	82	10	90	80	10	90	80
	6.2.10	0	100	100	7	93	86	3	97	94	10	90	80	4	96	92
	6.2.11	7	93	86	10	90	80	8	92	84	12	88	76	9	91	82
	6.2.12	0	100	100	12	88	76	8	92	84	5	95	90	8	92	84
	6.2.13	3	97	94	18	82	64	11	89	78	21	79	58	13	87	74
	6.2.14	10	90	80	23	77	54	9	91	82	50	50	0	18	82	64
	6.2.15	3	97	94	9	91	82	4	96	92	15	85	70	6	94	88
	6.2.16	0	100	100	16	84	68	8	92	84	21	79	58	9	91	82
	6.2.17	16	84	68	38	62	24	27	73	46	40	60	20	31	69	38
6.3 Business/Financial Competencies	6.3.1	10	90	80	41	59	18	24	76	52	60	40	-20	32	68	36
	6.3.2	13	87	74	44	56	12	30	70	40	50	50	0	35	65	30
	6.3.3	23	77	54	45	55	10	34	66	32	45	55	10	37	63	26
	6.3.4	16	84	68	46	54	8	36	64	28	30	70	40	36	64	28
	22a	6	94	88	34	66	32	23	77	54	30	70	40	25	75	50
	22b	29	71	42	51	49	-2	38	62	24	63	37	-26	43	57	14
	22c	29	71	42	71	29	-42	51	49	-2	80	20	-60	57	43	-14
	22d	13	87	74	49	51	2	32	68	36	55	45	-10	37	63	26
8 Business/Financial Competencies																
	8.1	20	80	60	40	60	20	21	79	58	80	20	-60	34	66	32
	8.2	20	80	60	47	53	6	30	70	40	70	30	-40	38	62	24
	8.3	20	80	60	44	56	12	29	71	42	60	40	-20	36	64	28
	8.4	43	57	14	42	58	16	39	61	22	55	45	-10	43	57	14
	8.5	35	65	30	62	38	-24	52	48	-4	59	41	-18	53	47	-6
	8.6	35	65	30	47	53	6	43	57	14	45	55	10	44	56	12
	8.7	31	69	38	44	56	12	36	64	28	53	47	-6	39	61	22
	8.8	38	62	24	39	61	22	33	67	34	55	45	-10	38	62	24
	8.9	41	59	18	62	38	-24	53	47	-6	65	35	-30	56	44	-12
	8.1	42	58	16	46	54	8	41	59	18	60	40	-20	45	55	10
	8.11	44	56	12	46	54	8	43	57	14	56	44	-12	45	55	10
	8.12	53	47	-6	52	48	-4	29	71	42	65	35	-30	53	47	-6
	8.13	43	57	14	58	42	-16	48	52	4	70	30	-40	53	47	-6
	8.14	23	77	54	48	52	4	34	66	32	60	40	-20	41	59	18
	Q25	10	90	80	50	50	0	36	64	28	40	60	20	37	63	26
9. Challenges																
	9.1	23	77	54	28	72	44	22	78	56	43	57	14	27	73	46
	9.2	59	41	-18	38	62	24	45	55	10	42	58	16	45	55	10
	9.3	66	34	-32	64	36	-28	71	29	-42	37	63	26	64	36	-28
	9.4	69	31	-38	59	41	-18	66	34	-32	40	60	20	63	37	-26
	9.5	39	61	22	41	59	18	40	60	20	42	58	16	41	59	18
	9.6	55	45	-10	60	40	-20	62	38	-24	48	52	4	59	41	-18
	9.7	65	35	-30	60	40	-20	61	39	-22	63	37	-26	61	39	-22
	9.8	39	61	22	43	57	14	42	58	16	45	55	10	42	58	16
	9.9	80	20	-60	79	21	-58	80	20	-60	74	26	-48	79	21	-58
	9.10	83	17	-66	75	25	-50	82	18	-64	61	39	-22	77	23	-54
	q28	48	52	4	49	51	2	51	49	-2	94	6	-88	49	51	2

APPENDIX – IIA

2009 – LEVEL OF LEADERSHIP ENGAGEMENT QUESTIONNAIRE & RESULTS

2009 LEVEL OF ENGAGEMENT QUESTIONNAIRE - RESULTS

Q1: Is there a periodical discussion/dialogue between you and your supervisor regarding your developmental needs?

Periodic Discussion with Supervisor on Dev. Needs?		
Yes	627	44%
No	807	56%
Total	1434	100%

Job Title-Wise Periodic Discussion			
Job Title	Have Period Discussion	Don't have Period Discussion	Total
Department Head	10	5	15
Division Head	29	49	78
Front Line	112	152	264
Engineers/Scientis	374	500	874
Others	102	101	203
Total	**627**	**807**	**1434**

Job Title-Wise Periodic Discussion		
Job Title	Have Period Discussion	Don't have Period Discussion
Department Head	67%	33%
Division Head	37%	63%
Front Line	42%	58%
Engineers/Scientis	43%	57%
Others	50%	50%
Total	44%	56%

Q2: If you have a written IDP (Individual Development Plan), is it being implemented/practiced?

		%
Have IDP and Imp	325	23%
Have IDP but not	226	16%
Do not Have IDP	883	62%
Total	1434	1

Grade code-wise IDP implementation				
GC	e IDP and Implemer	IDP but not Implem	Do not Have IDP	Total
GC 11	69	34	66	169
GC 12-14	179	139	465	783
GC 15-17	55	38	256	349
GC 18+	1	1	9	11
GC 3-10	21	14	87	122
Total	**325**	**226**	**883**	**1434**

Job Cluster-Wise IDP implementation				
Job Cluster	e IDP and Implemer	IDP but not Implem	Do not Have IDP	Total
Department Head	3	1	11	15
Division Head	16	9	53	78
Front Line	61	43	160	264
Engineers/Scientis	201	154	519	874
Other Professionals	44	19	140	203
Total	**325**	**226**	**883**	**1434**

Job Cluster-Wise IDP implementation			
Job Cluster	Have IDP and Implemented	Have IDP but not Implemented	Do not Have IDP
Department Head	20%	7%	73%
Division Head	21%	12%	68%
Front Line	23%	16%	61%
Engineers/Scientis	23%	18%	59%
Other Professionals	22%	9%	69%
Total	23%	16%	62%

Q3:As a mentor/supervisor, what is the estimated number of hours per week you spend on People

Hours Mentors spend per week	
	Total Employees
0 hours/week	202
1 hour/week	148
2 hours/week	157
3 hours/week	97
4 hours/week	103
5 hours/week	83
6 hours/week	53
7 hours/week	14
8 hours/week	94
Total	**951**

2009 LEVEL OF ENGAGEMENT QUESTIONNAIRE - RESULTS

Time Spent Job Title-Wise					
Job Title	Hors/Week	Total Employees	Hours	Total	Average
Department Head	0 hours/week	1	0	0	
Department Head	1 hour/week	3	1	3	
Department Head	2 hours/week	5	2	10	
Department Head	3 hours/week	1	3	3	
Department Head	4 hours/week	2	4	8	
Department Head	6 hours/week	1	6	6	
Department Head	8 hours/week	1	8	8	
	Total	**14**	**Total Hours**	**38**	**2.7**
Division Head	0 hours/week	3	0	0	
Division Head	1 hour/week	19	1	19	
Division Head	2 hours/week	13	2	26	
Division Head	3 hours/week	12	3	36	
Division Head	4 hours/week	10	4	40	
Division Head	5 hours/week	6	5	30	
Division Head	6 hours/week	3	6	18	
Division Head	7 hours/week	3	7	21	
Division Head	8 hours/week	7	8	56	
	Total	**76**	**Total Hours**	**246**	**3.2**
FrontLine	0 hours/week	13	0	0	
FrontLine	1 hour/week	37	1	37	
FrontLine	2 hours/week	49	2	98	
FrontLine	3 hours/week	19	3	57	
FrontLine	4 hours/week	40	4	160	
FrontLine	5 hours/week	23	5	115	
FrontLine	6 hours/week	21	6	126	
FrontLine	7 hours/week	3	7	21	
FrontLine	8 hours/week	35	8	280	
	Total	**240**	**Total Hours**	**894**	3.7
Professionals	0 hours/week	139	0	0	
GC-11 Professiona	1 hour/week	80	1	80	
GC-11 Professiona	2 hours/week	80	2	160	
GC-11 Professiona	3 hours/week	57	3	171	
GC-11 Professiona	4 hours/week	49	4	196	
GC-11 Professiona	5 hours/week	49	5	245	
	6 hours/week	24	6	144	
GC-11 Professiona	7 hours/week	8	7	56	
GC-11 Professiona	8 hours/week	46	8	368	
	Total	**532**	**Total Hours**	**1420**	2.7
Technician/Inspect	0 hours/week	46	0	0	
Technician/Inspect	1 hour/week	9	1	9	
Technician/Inspect	2 hours/week	10	2	20	
Technician/Inspect	3 hours/week	8	3	24	
Technician/Inspect	4 hours/week	2	4	8	
Technician/Inspect	5 hours/week	7	5	35	
Technician/Inspect	6 hours/week	5	6	30	
	7 hours/week	0			
Technician/Inspect	8 hours/week	5	8	40	
	Total	**92**	**Total Hours**	**166**	1.8

Time Spent Job Title-Wise	
Job Title	Average Time
Department Heads	2.7
Division Heads	3.2
Front Line	3.7
Professionals	2.7
Others	1.8

Q4:Do you have suggestions/concerns regarding people development?

Summary of 2009 TD Survey Comments

- IDP Implementation and Maintenance (75 times of similar concerns highlighted)
- Communication, Engagement, Commitment and Accountability (74 times of similar concerns highlighted)
- Inadequate Mentorship (66 times of similar concerns highlighted)
- Time (Work Overload & Priorities) (50 times of similar concerns highlighted)
- Fairness and Integrity (37 times of similar concerns highlighted)
- Changes and Instability (27 times of similar concerns highlighted)
- Reward and Recognition (16 times of similar concerns highlighted)
- Budget Constraint (16 times of similar concerns highlighted)
- Unstructured GC13-10/GC15+ Development (12 times of similar concerns highlighted)
- Technical/Managerial Path Conflict (9 times of similar concerns highlighted)
- Supervisor's Competence (5 times of similar concerns highlighted)

APPENDIX – IIB

2010 – LEVEL OF LEADERSHIP ENGAGEMENT QUESTIONNAIRE & RESULTS

2010 Level of Engagement Questionnaire and Results

Q1: How many times a year do you have a formal discussion/dialogue regarding your developmental needs with your immediate supervisor?							
None	761	33%		Yes	67%		
Once	874	38%		No	33%		
Twice	677	29%			100%		
Total	**2312**	**100.00**					
	Yes	**No**					
Department Heads	71%	29%					
Division Heads	73%	27%					
First Line	66%	34%					
Engineers/Scientists	67%	33%					
Other Professionals	65%	35%					
	None	**Once**	**Twice**				
Department Heads	29%	43%	29%				
Division Heads	27%	49%	24%				
First Line	34%	39%	27%				
Engineers/Scientists	33%	37%	31%				
Other Professionals	35%	36%	28%				
Q2:If you have a written IDP (Individual Development Plan), is it being implemented/practiced?							
Do not have IDP	966	42%					
No	585	25%					
Yes	761	33%					
Total	**2312**						
	NA	**No**	**Yes**	**Total**			
Department Heads	57%	5%	38%	100%			
Division Heads	42%	18%	40%	100%			
First Line	35%	28%	36%	100%			
	NA	**No**	**Yes**	**Total**			
Engineers/Scientists	40%	27%	33%	100%			
Other Professionals	53%	20%	27%	100%			
Q3: Were you involved in developing your IDP?							
No	1303	**56%**					
Yes	1010	**44%**					
Total	**2313**	**100%**					
	Yes	**No**	**Total**				
Department Heads	33%	67%	100%				
Division Heads	50%	50%	100%				
First Line	47%	53%	100%				
	Yes	**No**	**Total**				
Engineers/Scientists	46%	54%	100%				
Other Professionals	30%	70%	100%				

2010 – Level of Leadership Engagement Questionnaire

Q4: What are your concerns/suggestions on talent development in your organization?

Concerns:

- Some employees are not aware of IDP. Some are not sure about their IDPs as there was no discussion with their supervisors. Some think that IDP is a confidential document to be kept by their management.
- Some think that PMP business and development goals are their IDPs.
- Some believe that the IDPs are only for the technical employees, i.e. engineers.
- Some employees have lost faith in the IDP system as they have heard a lot about it but have not seen any implementation.
- Some employees complain that their involvement in developing IDP is a mere formality.
- Some employees complain that the IDP formal discussions are seen as chores by the supervisors rather than a chance for better planning, productivity increase and higher performance.
- Management does not pay full attention to the Talent Development.
- IDPs are not implemented as per plan because of workload, manpower shortage, budget constraints, course availability and management ignorance.

Suggestions:

- Organization should study random samples of IDPs and their effectiveness on employee's development.
- That higher management should monitor the implementation of the IDPs to make sure that they are being implemented.
- The company should establish an IDP panel that should randomly contact and meet with employees to make sure that their IDPs are genuine and being followed strictly. Otherwise, an audit item is raised for not fulfilling the objectives of the IDPs.
- The IDP form needs to be reviewed to be aligned with other developmental plans. Furthermore, it should be part of the development goals under PMP.
- Enforce the implementation of the approved IDP or review it on a monthly basis in case if there is a need to revise it.

APPENDIX – IIIA

2009 – INTERVIEWS – RESULTS

2009 INTERVIEW RESULTS

LIST OF PEOPLE INTERVIEWED

Name	Occupation	Group/Dept.
Dr Bashir Daddousi	Sr. Scientist	Saudi Aramco
Dr. Mohd. Hamid Shwehdi	Professor/Academic	EE Dept./KFUPM
Mr. Gabriel Fernandez	Processing Eng. Consultant	Saudi Aramco
Mr. Mohd. Al-Methel	Civil Eng. Specialist	CSD
Mr. Ivan Cruz	Corrosion Eng. Consultant	Saudi Aramco
Mr. Adel Iba	Principle Eng.	Saudi Aramco
Mr. Jason Hubbard	Eng. Specialist	Saudi Aramco
Mr. Richard Horner	Eng. Consultant	Tech. Development
Mr. Yuv Mehra	Eng. Consultant	Saudi Aramco
Mr. Flanders Patrick	Eng. Consultant	Saudi Aramco
Mr. Abdullah Dhafeeri	Eng. II	Saudi Aramco
Mr. Thang Pham	Research Science Consultant	R&D Center
Mr. Sami Mulhem	Leader	Oil Drilling
Mr. John Pasnak	Leader	Saudi Aramco
Mr. M. Saggaf	Manager	Saudi Aramco
Mr. Mohd. Zahrani	General Manager	Drilling
Mr. Phelps Curt	HR Consultant	Boeing Company
Mr. Moon & Bakar	Eng. Specialist	Drilling
Mr. Edwin Niccolls	Eng. Specialist	Chevron
Electrical Team	Eng. Specialist	Saudi Aramco
D. Catte, H. Al-Mahrous & Al-Suwaidan	Eng. Specialists	CSD/Saudi Aramco
CSD Mgmt. Team	Leaders	CSD/Saudi Aramco
IFP - French Petroleum Inst.	Hydrocarbon R&D	IFP
Schlumberger Group	Upstream Hydrocarbon Support Services	Schlumberger Group
Halliburton Group	Upstream Hydrocarbon Support Services	Halliburton Group

2009 INTERVIEW TOP RESULTS

Questions	Top Answer	Total Number
Technical Competencies	Related industry experience & Up to date in field	20
	Computing	10
	Research Method & Up to date in field	7
Business/financial competencies	Solid understanding of financial concept	11
	Techno-economic assessment	11
Soft Skills	Communication with impact	18
	Team Work	12
	Problem Solving/ Analytical ability	12
Technical Talent Development Strategies/Methods	Adequate field exposure	10
	Advance Degree Program	6
	Internship assignment	5
	Mentorship	4
Success Factors (Enablers)	Strong commitment & support by management	6
	Create R&D environment	3
Challenges	Budget Constraints for training & conference	4
	Retention of Talent	3

2009 INTERVIEW PARTICIPANTS

Number of Participants Interviewed	25
Management/Leaders	5
Scientist/Engineer	13
Group/Firms	7
Total	25

APPENDIX – IIIB

2010 – VERIFICATION INTERVIEW – RESULTS

Technical Talent Development

(2010 - Interview)

Name:

Education Level/School:

Specialty:

Nationality:

Patents/Inventions:

Q1 What are the most critical competencies/skills that a technology researcher/develop must have? Please choose only 2-3 competencies form each category below:

1. Competency Inventory

1.1 Technical Competencies:

1.1.1	Computer programming	☐
1.1.2	Numerical modeling	☐
1.1.3	Simulation modeling	☐
1.1.4	Research techniques	☐
1.1.5	Analytical methods	☐
1.1.6	Computational fluid dynamics	☐
1.1.7	Up-to-date in his/he field	☐

1.2 Soft Skills:

1.2.1	Adaptive and learning	☐
1.2.2	Analytical capability	☐
1.2.3	Innovative	☐
1.2.4	Foster teamwork	☐
1.2.5	Communicate openly and effectively	☐
1.2.6	Drive for results	☐
1.2.7	Influence others	☐

1.2.8 Plan and organize work ☐

1.2.9 Build relationships ☐

1.2.10 Commitment and reliability ☐

1.2.11 Practice self development ☐

1.2.12 Knowledge sharing ☐

1.2.13 Mentoring others ☐

1.2.14 Customer service oriented ☐

1.2.15 Inspire trust ☐

1.2.16 Passionate about job ☐

1.2.17 Risk taking ☐

1.3 Business Competencies:

1.3.1 Global and local perspective ☐

1.3.2 Economic evaluation methods ☐

1.3.3 Cost estimation ☐

1.3.4 Project planning and execution Methods ☐

2 Team/Organization Characteristics:

2.1 Team

2.2 Organization

2.3 Leadership Style

Q3 What is the most effective strategy/method to develop technical talent in order to enhance technology advancement? Please choose top (3) methods from the following:

3. Technical Talent Development Strategies/Methods:

☐ 3.1 Structural technical development programs where career paths are well defined by competencies and tasks and are aligned with business objectives. This program will groom the participant from start to an engineering specialist status.

☐ 3.2 Short and focused orientation program followed by on the job assignment that participants will learn and produce at the same time.

☐ 3.3 Direct job assignments/projects to meet business needs coupled with a senior individual's supervision to ensure that tasks are completed satisfactorily.

☐ 3.4 Typical job orientation, followed by job assignments/projects but with the guidelines of an assigned mentor to oversee the individual's development and contribution to the business objectives.

☐ 3.5 Assign the individual to a team that has specific project and he/she will gain experience with time.

☐ 3.6 Send the individual to obtain an advanced degree (master/doctorate) in the subject that serves the organization's interest.

☐ 3.7 Conduct adequate training to strengthen the mentorship role of senior engineers/scientists so the mentorship of young talent becomes more effective (Mentorship Program).

☐ 3.8 Conduct joint industry projects and exchange individuals between organizations/countries to exchange knowledge and strengthen talent development.

☐ 3.9 Assemble technical talent council to manage technical talent succession planning/technical talent pool and development programs/plans effectiveness.

☐ 3.10 Define career path for each engineering specialty and map each specialty based on competencies and let individuals demonstrate their capabilities based on self-development efforts.

☐ 3.11 Let in-house subject matter experts develop and deliver technical courses to young talent using problems/examples that our organization faces nowadays.

☐ 3.12 Mandate that professionals obtain industry recognized certification and maintain that status.

☐ 3.13 Make self-development the key element in technical talent development and embed such mandates in the annual performance review cycle.

☐ 3.14 Provide venues for knowledge exchange between professionals such as technical exchange meetings, community of practices and others,

Q4 What are the potential challenges that might hinder/delay technical talent development? (2-3 challenges)

4. Potential Challenges:

☐ 4.1 Management path is more attractive than technical path in terms of speed of advancement and rewarding opportunities.

☐ 4.2 Senior professionals are not well compensated for their efforts in developing young talent.

☐ 4.3 Job security acts like a hurdle where senior professionals are not sharing knowledge and experiences with others

☐ 4.4 The absence of a well defined career path with an individual development plan.

☐ 4.5 There is not enough senior professionals to mentor young talent.

☐ 4.6 Senior professionals are not well trained as mentors. They lack mentorship skills.

☐ 4.7 The assigned leaders (management) are not competent and lack coaching and talent development skills.

☐ 4.8 The current HR policies do not differentiate/attract professionals to the technical path.

☐ 4.9 This organization does not provide opportunity to learn and grow.

☐ 4.10 This organization doesn't provide opportunity to perform challenging and interesting work.

Q5 What are the enables/success factors to attain and sustain technical talent development? (2-3 success factors).

5. Enablers:

2010 ADDITIONAL INTERVIEW - INVENTORS

Name	Education	Specialty	Patents/Inventions
Tareq Al-Shaalan	PhD	Mech. Eng. PE	Member of Giga Powers Team
Mohd. Al-Hajri	MS	Waste Water	Carbon Enhanced MBR
Mohd. Al-Ansiri	PhD	Intellectual Management	Head of Patent org. Saudi Aramco
Faisal Al-Faqeer	PhD	Downstream Research	Mercury Removal from Natural Gas
Abdullah Asseri	MS	Electrical Eng.	ECRS
Hani Aburahmah	BS Mech. Eng	Water & Oil Pumps	Pipes Vertical Pump from St.
Ahmed Zahrani	MS	Chemical Eng.	N/A
Saleh Alidi	MS	Civil	4 z Granted + z Filed
Maher Al-Khosran	BS	Coating	Use of thermal insulating coating oil/gas
Molid Ayaz	BS	Management	N/A

2010 VERIFICATION INTERVIEW WITH INVENTORS - RESULTS

NO	Questions - Results	Total Number
Q1	What are the most critical competencies/skills that technologies research/develop must have?	
	1.1.5 Analytical Methods	6
	1.1.7 Up to date in his/he field	6
	1.2.5 Communicate openly and effectively	14
	1.2.9 Build relationship	8
	1.3.1 Global and local perspective	8
	1.3.2 Economic evaluation methods	12
	1.3.3 Cost estimation	8
Q2	What is the most effective strategy/method to develop technical talent in order to enhance technology advancement?	
	2.1 Structural tech. development program where career paths are well defined by competencies and tasks and are aligned with business objectives. This program will groom the participant from start to an engineering specialist status.	7
	2.2 Short and focused orientation program followed by on the job assignment that participants will learn and produce at the same time.	4
	2.10 Define career path for each engineering specialty and map each specialty based on competencies and let individuals demonstrate their capabilities based on self development efforts.	3
Q3	What are the potential challenges that might hinder/delay technical talent development?	
	3.1 Management path is one attractive than technical path in terms of speed of advancement and rewarding opportunities.	4
	3.7 The assigned leaders (management) are not competent and lack coaching and talent development skills.	3