Skill Pool Management System (SPMS) as a Strategy for Effective Workforce Management in the Oil and Gas Industry

By

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Abstract:
The organisation is where productive work takes place in the industry. There are different approaches to framing organisational issues as well as several strategies for managing the organisation. Skill pool management system (SPMS) is a strategic tool that enables a systematic management of employee skills. SPMS is underpinned by the specific industry value chain activities for the effective management of the workforce. The benefits of implementing the SPMS in the organisation include building competencies of employees for technical and operational excellence. The paper concludes that the SPMS as industry ‘best’ practice would ensure effective workforce management and deliver profitability and sustainability for the organisation.

1. Introduction
The factors that enable production of services or products in any industry include land (including its derivatives called raw materials), financial capital, technological capital and the human capital or people. However, the people (i.e. employees) factor stands out clearly as the most value adding of these factors. This is because people in the workplace make the organisation what it is in terms of its visible (e.g. gender, race, ethnicity, professional discipline, etc.) and invisible (e.g. thought processes, preferences) diversity, productivity, technology savviness and above all culture. When organisations hire people in the labour market through recruitment process, the intent is to apply their skills for productive work. Therefore, the labour market provides an avenue for trading of skills for both sellers (i.e. employees) and buyers (i.e. employers). The nexus between labour market and the industry where productive work takes place makes it imperative to focus on how the skills people possess are managed in terms of acquisition (i.e. competence development) and application (i.e. competent performance) to impact organisational performance. This focus on skills management has led to the concept of skill pool management system (SPMS). The impact of the focus on SPMS has been significant particularly in the oil and gas industry mainly because the key players (i.e. operators) have a global footprint. Shell, ExxonMobil, and British Petroleum are examples of international oil companies (IOCs) with global profile whilst PETRONAS (the Malaysian national oil company) has both local presence in Malaysia and in Asia and Africa. The NNPC in its quest to become a world class company in the near future has commenced the implementation of the skill pool management system across the Corporation. This is to enable NNPC to achieve its production targets, meet reserve replacement and develop new businesses.

In this article, we aim to explain the skill pool management system (SPMS) concept and how it can be used strategically to manage the employees’ skills in the industry. It is both an explanation of the SPMS concept and its empirical application in the oil and gas industry. The SPMS is built on the theoretical frameworks of how work is organised and managed, organisational strategy and skills-based value chain activities in the industry. Consequently, we briefly discussed the strategies for managing the organisation, skill pools underpinning value chain activities in the oil...
and gas industry. The concept of the skill pool management system, the application areas and benefits of the skill pool management system in the organisation and disciplines in the operations skill pool in the oil and gas industry. Finally, the article is concluded with a summary of key points and suggestions.

2. Organisational Framings and Strategy Types

This paper argues that organisations can be effectively managed if the skills of the employees are systematically identified and managed. The SPMS provides the architecture (i.e. skill pools, disciplines, subject matter areas and skill elements) and tools (i.e. competence scale and competence assurance) to achieve this objective and ensure the organisation meets its set goals. A discussion of how work issues are framed is important to understanding the concept of SPMS. Therefore, some organisational framings and strategy types are outlined as a background to a discussion on the SPMS.

The organisation is usually the place in the industry where productive work occurs. This has over time made the issues of how to organise and manage work topical for research and industry practice discussions. It has been argued that the most useful way to think about issues of work organisation and management is not to focus on either the management of people or the management of systems but to focus on the management of work tasks and the relationships involved in fulfilling those tasks. This approach to studying the organisation requires examining those key features of the activities which contribute to the management of work tasks and the people involved in their execution. This human aspect of work organisation and management offers a holistic approach if it is linked to other relevant academic subject matters such as management learning, critical management studies, strategic management and human resource management. Watson (2006) has advocated that the organisational framing can be done in one of four ways as presented below.

Four organisational framings and seven strategy types are outlined in this paper and a few that are very relevant to the conceptualisation and implementation of the SPMS are briefly discussed. The four organisational framings are a) systems-control of organisations, b) process-relational of organisations, c) systems-control of people and d) process-relational of people. The systems-control framing of organisations assumes that the organisation is an entity and as such it is a system of managerially designed rules and roles existing on its own terms. This means that the organisation is based on an organisation design with a set of structural and cultural characteristics. The process-relational framing of organizations assumes that the organisations are relational phenomena with sets of relationships and associated understandings. Organisations are seen as emergent patterns resulting from processes of exchange, negotiation, conflict and compromise. On the other hand, the systems-control framing of people assumes that the individual person is an entity which exists on its own terms with an essential personality. The needs of people create motives which propel them towards behaviours. Finally, the process-relational framing of people assumes that people are rational beings and their individuality becomes possible only when relating to others. People have emergent identities, are sense making and project oriented.

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In many organisations, elements of the four organisational framings coexist to create the ‘real’ organization as distinct from the ‘ideal’ organisation. The purpose of implementing the SPMS in the ‘real’ organisation is to ensure that skills are effectively managed in alignment with the extant elements of the four organisational framings.

Having reviewed the different framings for examining how to organise and manage work, a brief discussion of the conceptualisation of strategy and types of strategy as they are in the literature and as applied in the industry follows.

**Types of strategy and impact on SPMS**

The SPMS is a tool in the strategic management of the organisation. This makes a brief discussion of strategy types and their impact on the development of SPMS imperative at this point. The seven strategy types identified in the literature and mentioned earlier in this paper are a) classical strategy; b) evolutionary strategy; c) processual strategy; d) systemic strategy; e) dynamic model strategy; f) core competency strategy; g) resource-based view strategy and h) competence-based strategy. Before outlining the key features of each of the strategy types, I would first present a definition of strategy. Strategy is conceptualised as “the match an organisation makes between its internal resources and skills and the opportunities and risks created by its external environment.”

This definition of strategy links the internal dynamics of the organisation with the exogenous factors around it and is amenable to the strengths, weaknesses, opportunities and threats (SWOT) analysis tool. In the literature, the primary strategy types are, namely classical, evolutionary, processual and systemic are identified with the study of strategy. In addition to these four, the dynamic model, core competence, resource-based view and competence-based approaches reviewed below provide a broad and clear understanding of the concept of strategy which is a key factor in the strategic management of the organisation.

The classical approach is the most influential approach to strategy. This approach is seen as a rational process of deliberate planning and actions and it is anchored on the behaviour of the rational economic man. The rational economic man is expected to act as a strategic decision-maker acting with perfect knowledge, etc. The classical approach is rooted in the economic philosophy of free enterprise and has gained prominence in the business schools around the world where profit maximizing business executives go to improve their management skills. The SPMS borrows its simple architecture and assumption of rationality in decision-making from this strategy type.

The evolutionary approach to the study of strategy is based on the premise that the organisation’s environment is unpredictable which makes planning difficult and may be irrelevant. The approach is fatalistic and presumes that organisational survival is a function of its strength in the prevailing market. The criticality of the market forces in determining the fate (i.e. longevity and profitability) of the organisation creates less room for the strategic decisions made by managers. This approach is not realistic and consequently has less influence on the development of SPMS.

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The processual approach is closer to the evolutionary approach than the classical approach. This approach questions the assumption of rationality in strategy making and postulates that strategy emerges in organisations in incremental steps and is conceptually pragmatic. The behavioural theory of the firm and specifically the concept of bounded rationality\textsuperscript{10} has influenced the emergence of this approach. The realistic recognition of the cognitive limits and biases of decision makers has to some extent influenced the development of the SPMS. The complexity and chaos theory has influenced the processual approach to view strategy as a way in which leaders simply rely on logical incrementalism of strategy through self-learning.\textsuperscript{11} The processual strategy approach like the evolutionary approach does not fit an effective decision-making process in some organisations.

The emergence of the SPMS is not significantly influenced by the systemic perspective which is based on the systems theory that strategy making depends on its social context. Strategy is important relative to the environmental conditions in the organisation and decision makers are recognised as being part of the social fabric within which the organisation operates, reflecting the values and norms of that system. This approach does not regard business leaders as rational economic persons who are primarily subject to economic transactions aimed at only profit maximization.

The classical approach reviewed earlier is a static model of strategy process and it is typified by the differentiation between analysis, formulation, and implementation as discrete steps in the strategy process. As a contrast, the dynamic model of strategy process is underpinned by dynamic cognitive processes fundamental to strategy. The dynamic model recognises the interactive and ongoing nature of strategy process and it challenges the classical notions of strategy as a linear, deliberate and static process. The model is regarded as an ongoing interaction between the practice (shared routines) of strategy, the practitioner as strategic agent and the praxis of strategy (i.e. what the practitioner actually does in the practice).

The emergence of the SPMS has been significantly influenced by three strategy types discussed below. The first, is the core competence strategy type. Core competence of an organisation has been described “… as collective learning in the organisation, especially how to co-ordinate diverse production skills and integrate multiple streams of technology.”\textsuperscript{12} The core-competence concept was introduced in the literature by Hamel and Prahalad.\textsuperscript{13} The key aspects of core competence are, long term strategic advantage, contribution to quality, customer service, customer satisfaction and difficulty for competitors to imitate. This strategy approach is similar to the Resource-Based View of the firm below. This approach like the competence-based approach discussed below has influenced the application of competency based employee development in organisations particularly in the technical or engineering dominated industries such as the oil and gas. The conceptualisation of the skill pool management system as part of the strategic human resource management was influenced by this strategy approach.


\textsuperscript{13}Hamel, G., & Prahalad, C. K. (1989). To revitalize corporate performance, we need a whole new model of strategy. Harvard business review, 63-76
Second influential approach, is the resource-based view (RBV) strategy. The rationale for the resource-based view strategy is that the classical approach of opportunity driven, externally focused strategies, was limited by the fact of market volatility and frequency of change. The resource-based view recognises the importance of the firm’s aggregated capabilities, individual’s competencies, networks and other intangible assets in achieving organisational sustainability and competitive advantage. The strategic firm is that which leverages its internal resources and fits in with their strategic goals in the market.14

The third and most influential approach is the competence-based strategy. The competence-based approach is similar to the core-competence strategy approach reviewed earlier. It recognises the importance of the organisational leaders’ cognitive processes in the development of an organization’s core-competencies.15 It also recognises business leaders’ cognition as critically important in leading the development of an organisation’s competencies by enhancing current capabilities, setting new directions and building new capabilities. This approach expects strategies to emerge in different forms due to the bounded rationality and different cognitions of business leaders in the organisation.16 This approach may result to a part of an organisation’s strategy being more emergent than initially intended. A key assumption of this approach which has been criticized is that the competencies (i.e. knowledge, abilities and skills) of the individual employee can be assessed based on observed behaviour and performance on the job. The limitation, however, is that all assessments are subjective and as such do not accurately reflect either the real or potential competencies that the individual employee possesses. Having said this, many organisations consider a competence-based approach to workforce attraction, development and retention as critical to business success. The skill pool management system is anchored primarily on the competence-based strategy.

In the next section, a discussion of the concept of value chain in relation to the SPMS follows. A clear understanding of this concept is critical to understanding the concept of skill pool management system.

3. **Competence-based Value Chain Activities in the Oil and Gas Industry**

The skills underpinning the value chain activities in the industry provide the foundation for the skill pool management system in that industry. Therefore, just as the discussion of strategy types is important so is that on the concept of value chain critical to the understanding of the SPMS. The value chain analysis, which was made popular by Porter,17 investigates the sequence of activities required to bring a product or service from conception and procurement through production and distribution to the final customer. In terms of definition, this concept can be described as the process of organizing the connected group of activities that create value by producing goods or services from basic raw materials for purchase by a consumer. Such value analysis can be done for individual firms, for clusters of firms whose value chains are interlinked.

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(i.e. value systems) and usually involving suppliers, distributors / sellers, and customers. The industry value chain for the petroleum sector includes exploration, development, production, processing, transportation and marketing of hydrocarbons (Figure 1).

**Figure 1: Petroleum Value Chain**

The industry value chain starts with the identification of suitable areas to conduct exploration for oil and/or gas. This is the “upstream” sub sector of the industry. After initial exploration, petroleum fields are appraised, developed, and produced. These activities are generally called exploration and production (E&P) or referred to as “upstream” oil and gas. Oilfield services include a number of auxiliary services in the E&P process, such as geological and geophysical surveys and analysis, drilling, equipment supply, and engineering projects. Infrastructure, including transport (such as pipelines and access to roads, rail, and ports) and storage, is critical at various stages in the industry value chain. This includes the links between production and processing facilities and between processing and final customer. Oil refining and gas processing turn the extracted hydrocarbons into usable products. These parts of the value chain are usually referred to as “midstream”. The processed products are then distributed to wholesale, retail, or direct industrial clients. Refining and marketing is sometimes referred to as “downstream”. Certain oil and gas products are the principal input for the petrochemicals industry. This explains the close historical and geographical links between the two. In terms of the SPMS, certain skill pools such as Geosciences, Petroleum Engineering and Well Engineering are unique to the upstream sector of the industry. This means that functionally skills of a geologist, a reservoir engineer and a well completions engineer are not required in order to run a refinery so would not be deployed there. The SPMS helps the organisation to identify critical skills and where to deploy them for productive use.

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Individual companies can perform one or more activities along the value chain, which implies a degree of vertical integration (“integrated” firms are engaged in successive activities, typically Exploration & Production and Refinery & Manufacturing). Companies can also seek to expand within a given activity, leading to horizontal consolidation (business scale). At the country level, horizontal integration in the upstream is limited by natural resource endowments, and downstream by the size of the domestic market and the country’s ability to export goods and services. Companies’ vertical and horizontal integration choices are affected by country-level industrial policies and the related legal and regulatory frameworks. For example, in some countries, such as South Africa, vertical integration in the petroleum sector is prohibited. Other countries, such as Brazil, limit the market share of industry participants. In Nigeria, the Nigerian National Petroleum Corporation (NNPC) is allowed by the law establishing it to have both vertical and horizontal integration in its operations.

There is no gain saying the fact that the oil and gas industry encompasses a range of different activities and processes which jointly contribute to the transformation of underlying petroleum resources into useable end products valued by industrial and private customers. It is important that these different activities are inherently linked with each other (conceptually, contractually and/or physically), and these linkages might occur within or across individual firms, and within or across national boundaries. This is what value chain analysis entails.

The key factors identified by Tordo et al (2011) for value creation in the oil and gas industry are:

a) Cost efficiency of operations;

b) Technical and operational excellence;

c) Horizontal concentration (i.e. economies of scale) and vertical integration (i.e. transaction costs, economies of scope);

d) Strategic choices (i.e. asset selection, divestment, merger and acquisition).

Therefore, value creation is a function of operational, financial and national mission performance indicators.

Similarly, Tordo et al identified the following as the value drivers in the industry:

a) Geology and geography;

b) State context;

c) Petroleum sector governance and organisation;

d) National Oil Company (NOC) strategy (e.g. skill pool management system as strategy to manage the workforce);

e) NOC corporate governance.

The key findings from the empirical work on value creation in the industry by Tordo et al are:

a) Internal governance mechanisms are more critical to NOC value creation than the ownership structure;

b) NOCs that belong to countries with large resource endowments may find it more difficult to create value than their counterparts in countries with smaller resource endowments;

c) Temporary restrictions on access to petroleum activities can be effective policy tools to enhance value creation by the NOC; and

d) The pursuit of national objectives does not necessarily hamper the creation of value by the NOC.

In a generic sense, the basic objectives of employing value chain management in a business is to integrate communication and increase cooperation between production chain members in order to decrease delivery times, reduce inventories and increase customer satisfaction. And in relation to the topic of this article, the value chain analysis enables a clear focus on the skills sets required for the production of goods and services.

The discussion will now shift to the central theme of this article, the skill pool management system (SPMS).

4. Skill Pool Management System (SPMS)

The concept of skill pool management system (SPMS) is linked to the quantum and quality of skills required to execute the value chain activities in the oil and gas industry or any other industry. The concept might sometimes be confused with a related concept of competency management system (CMS). The two concepts are not the same, as such they are each defined separately and discussed as follow.

Skill pool management (SPM) and competency management system (CMS)

The simple definition of SPMS is the management of skills in unique pools (i.e. Skill Pools and Disciplines) in a systematic manner. The Skill Pool has four levels, namely Skill Pool, Discipline, Subject Matter Area and Skill Element. The working definition of a skill pool in this article is that it is the aggregation of related industry Disciplines (e.g. Geophysics, Drilling Engineering, Process Engineering). Disciplines comprise of subject matter areas (SMAs) which in turn comprise of skill elements (SEs). On the other hand, the competency management system (CMS) is the systematic management of competences based on the competence standards set through an IT software (usually online) to assess employee competencies, identify competence gaps and track improvement impact on employee’s development interventions.

The concept of competence is central to a discussion on skill pool management system and competency management system. So, what is competence? Competence is defined by Kalff and Jones as ‘the required combination of awareness, knowledge, skills and attitude that enable performance at the required standard’. However, this writer defines competence simply as a combination of knowledge, abilities and skills. These two researchers had argued, in a conference organised by the society of petroleum engineers in Malaysia in 2002, the business case for skill pool management in Shell Exploration and Production from the perspective of health, safety and environment (HSE) skill pool. This means that the business case for skill pool management is linked directly to why HSE standards need to be complied with in the work place. Their story which was shared at the conference has been used in this article to explain the concept of skill pool management and the business case. It is noteworthy to state that others have excluded from the definition of competence the notion of attitude because attitude is linked to will power rather than the cognitive ability of the individual.

**Business Case for Skill Pool Management System**

Why do business organisations need to implement a SPMS which enable a systematic skills management? The reasons would be based on the business goals the particular organisation has been set up to achieve. Therefore, Kalff and Jones had argued that Shell Exploration and Production had moved from a managed resource base to an open resourcing and global consultancy market in order to deploy staff effectively worldwide. This implies a change from employees (and their skills) being directed to the next jobs and locations by management to a free market situation of demand and supply where employees are allowed to apply to any job position but only those with the best and relevant skills are selected. This new approach for the Shell business raised challenges in the management of the skill pools. It required Shell to re-evaluate the Health, Safety and Environment (HSE) skills portfolio, staff competency assessment methodology, skill gap identification and personnel development / deployment strategy.

They argued that Shell needed new criteria for decision-making which balances the individual development needs (i.e. employee value proposition) and the short and long-term business requirements. This balance between short-term staff requirements with long-term business needs was going to be in the context of a free market and open resourcing framework. The initial challenges of implementing the SPMS in Shell E&P include:

- Difficulty in the introduction of New Ways of Working e.g. Global HSE Skill Forum concepts, convincing staff of the benefits, sharing and communicating via a Global Interest Network.
- Resource constraints to work HSE global issues.
- Communication to achieve standardisation between other Skill Fora.
- Diversity of the Global Skill Pool.

The overall objective of HSE is to prevent harm to employees in the work place and damage to the operational environment. However, results from Shell audit, serious incidents and HSE assurance processes highlighted the following gaps:

- Reduced level of attention on HSE by line management.
- Limited Global resources and depth of expertise.
- Limited processes in place to manage and assure competence levels.

It was recognized that HSE competence cannot be considered in isolation of the broader range of competence. HSE incidents usually occur because of lack of general operational competence and not only because of shortfalls in HSE competence. Therefore, the broader sense of operational (i.e. the core competences) competence must be addressed. The researchers argued that the possession of HSE competence by general line staff must rely on that being provided in the first instance by HSE professionals. A fundamental component of both operational and HSE competences is having competence assurance processes in place for all levels of line management staff involved in operations. The HSE skills portfolio set these competence standards using “Proof points or proof statements” to determine the depth and application of knowledge for all essential HSE skill elements.

**Determining Employee’s Skill Pool and Discipline**

In order for the SPMS to be usable for workforce management the employees must be mapped into their respective skill pools and disciplines. The skill pool of an employee is determined based on the academic qualification(s) and recent / current job experience and / or entire job history in the organisation. The employee’s preference may be considered in determining his / her skill pool. However, since career paths are defined along the professional disciplines in each skill pool.
the preference of the employee has to align with the approved discipline career path. An employee has a primary professional discipline and in addition, may have a secondary professional discipline. The secondary discipline comes into being when the employee moves into a new job role which is distinct professionally from a previous role. For instance, a process engineer being moved into the role of a security manager, the latter (i.e. security) becomes the employee’s secondary discipline.

Core industry Professional Disciplines
In the oil and gas industry, the core professional career disciplines are grouped into six skill pools, namely, Geosciences, Petroleum Engineering, Well Engineering, Field Engineering, Production Engineering and Health, Safety and Environment. The core disciplines are critical to the oil and gas value chain activities. However, core does not mean more important because all the disciplines are important to the entire value chain. There are nine (9) support skill pools namely Leadership; Commercial; Finance; Accounts, Audit, Taxation and Insurance; Supply Chain Management; Public Affairs; Medical; Legal Security and Human Resource. The SPMS enables a critical but distinct focus on both core and support disciplines which eases workforce management in the organisation. The relationship between the components of skill pool, namely discipline, subject matter area and skill elements is shown in Figure 2 below.

Figure 2: Skill Pools, Disciplines, Subject Matter Areas and Skill Elements Structure

Source: Developed for NNPC Skill Pool Management System Project (Rabiu, 2015)

5. Benefits of SPMS in the Organisation
The skill pool management system (SPMS) is rationalized by the common approach it provides in infusing competence in the various ways the organisation is managed as illustrated in Figure 3 below. The benefits derived from implementing SPMS can be seen in the output improvement (i.e. productivity) from each of the six key processes depicted in Figure 3. These are namely organisation design, resourcing, appraisal, learning and development, development and progression, reward and recognition.

In the design of the organisation, it is important to ensure that business planning unit focuses on the core skill pools, without neglecting the support skill pools, in order to maximize the potential outputs of the value chain activities in the organisation. Also, in resourcing (i.e. recruiting,

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placement and movement of employees in) the organisation the focus on the people with the right skills should be according to the skill pool mapping of the employees. In the labour market, the organisation hires skills rather than a person who applies to the job advertised. So, the focus should be on the skill sets required rather than the personality of the job applicant. Similarly focus on skills provide the basis for individual development through learning and development interventions as well as progression / promotion when the time is right. Another benefit of the SPMS to the organisation is that a focus on skills management through employee recognition and reward would lead to both technical and operational excellence. Finally, the design of the organisation must make functional sense in order to ensure corporate survival and sustainability. Functions in the organization should be skills-based because the skill pool management system enables the design of a functionally aligned organisation.

**Figure 3: Common Competence Management Framework**

**Source:** Adopted from Shell Exploration and Production for this study (Rabiu, 2015)

Further benefits of the SPMS include its utility value in academic teaching and research work. It enables the academia to focus on specific subject matter areas across the disciplines in the sixteen skill pools in the upstream, midstream and downstream sectors of the oil and gas industry. The skill pool structure which has a focus on an expertise area provides a basis for research and empirical studies in the value chain activities (e.g. geoscience, petroleum and well engineering) in the industry. The professional bodies such as Society of Petroleum Engineer (SPE), Institute of Chartered Accountants of Nigeria (ICAN) can easily align with the SPMS. Similarly, regulators of professional practice such as Council of Registered Engineers of Nigeria (COREN), Chartered Institute of Personnel Management (CIPM) of Nigeria would benefit by aligning the professional development of their members with the competence standards in the respective skill pool disciplines.

Finally, there are other benefits of SPMS to the academia. The research into oil and gas industry is usually based on the value chain activities which are linked to the SPMS. The mandate of Petroleum Technology Development Fund (PTDF) is around the oil and gas industry. And PTDF journal can benefit by diversifying the sources of articles across the sixteen skill pools. This would
give the journal a ‘rounded’ profile in terms of articles published from different disciplines. It is expected that contributors of articles for publication in this journal (PTDJ) would base the topic on any of the various professional disciplines in the sixteen skill pools. As a result of the exposition of the sixteen skill pools and several disciplines therefrom, potential article writers for PTDJ have a wide range of topics to select from the numerous professional disciplines.

6. Operations Engineering Skill Pool and its Disciplines
At the operational level, the competence standards set in the disciplines are encapsulated in a job competency profile (JCP) which comprises of the subject matter areas (SMAs) and skill elements (SEs). In the industry, a person who is recognised as an expert in a subject matter area is referred to as a subject matter expert (SME). The discipline SMEs set and review competency standards and also assess the competency of employee in their disciplines. The operations engineering skill pool and process engineering discipline have been used in this paper to illustrate the SMA and SE concepts. See Table 1 below for the selected SMAs and SEs in the process engineering discipline which is within the operations engineering skill pool.

Further to the foregoing discussion on SPMS in relation to the Job Competency Profile (JCP), it is apt to reiterate that the operations engineering skill pool is core in the oil and gas industry and it has several disciplines (both upstream and downstream) as listed below.

a) Production Operations (Upstream)
b) Production Programming (Refining - Midstream)
c) Process (Refining - Midstream)
d) Maintenance Engineering (Instrumentation)
e) Maintenance Engineering (Mechanical)
f) Maintenance Engineering (Electrical)
g) Maintenance Engineering (Civil)
h) Production Chemistry (Upstream)
i) Quality Control (Refining - Midstream)

The discipline provides the platform for a community of practitioners to interact and comprises the subject matter areas (SMAs) and SEs. The typical job roles or job titles of the personnel (i.e. upstream, midstream and downstream) in the Production / Operations skill pool include process engineer, plant operator, maintenance engineer, production programmer, quality control analyst and production chemist.

An illustration of subject matter areas and skill elements in the process engineering discipline is in Table 1 below. These are the minimum competences which process engineers must possess in order to effectively work in the refinery. If they do not have and / or cannot demonstrate the requisite competences then they cannot be assured as competent to work in the refinery as plant operators or engineers.
### Table 1: Minimum Competence Standards for Process Engineering Professionals

<table>
<thead>
<tr>
<th>S/ No.</th>
<th>Production / Operations Skill Pool: Process Engineering Discipline</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Selected Subject Matter Areas and Skill Elements</td>
</tr>
<tr>
<td>1</td>
<td><strong>Objective of the production area</strong></td>
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<tr>
<td></td>
<td>Explain the main business of the Production Area including understanding the FEED and the Yield of the Area.</td>
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<tr>
<td>2</td>
<td><strong>Review of Process Flow Diagrams:</strong></td>
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<td></td>
<td>Demonstrate the understanding of the flow Diagrams including being able to identify various components in the Diagrams and Matching this with actual Equipment in the plant.</td>
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<tr>
<td>3</td>
<td><strong>Product Yield Pattern:</strong></td>
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<tr>
<td></td>
<td>Explain the Product Yield Pattern</td>
</tr>
<tr>
<td>4</td>
<td><strong>Identification of major equipment and their functions:</strong></td>
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<tr>
<td></td>
<td>Need to understand the various Equipment in the Areas-such as Compressors, Pumps Turbines etc.</td>
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<tr>
<td>5</td>
<td><strong>Interpretation of Laboratory Results</strong></td>
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<td></td>
<td>Be able to interpret results and know what corrective measures are possible to addressing Deficits-ph., flash point, viscosity etc.</td>
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<tr>
<td>6</td>
<td><strong>Start up and Short Down Procedures</strong></td>
</tr>
<tr>
<td></td>
<td>Explain the start up and short down procedures</td>
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<tr>
<td>7</td>
<td><strong>Operate main equipment</strong></td>
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<td></td>
<td>Demonstrate how to start, stop and control equipment. Carry out routine check and minor troubleshooting. Be able to monitor main equipment on the control system. Explain the functionality of the equipment. Explain the fundamental principles. Describe the internals of equipment and how it works. Know why particular equipment types are selected. Describe 'normal' operating conditions and parameters. Can highlight anomalies.</td>
</tr>
<tr>
<td>8</td>
<td><strong>Prepare Equipment for Maintenance</strong></td>
</tr>
<tr>
<td></td>
<td>Understand methods of Preparing Equipment for Maintenance Activities including: Steaming, Water Washing, Blinding etc.</td>
</tr>
<tr>
<td>9</td>
<td><strong>Production equipment</strong></td>
</tr>
<tr>
<td></td>
<td>Describe and deploy all basic equipment/systems and utilities. Demonstrate you can read Process &amp; Instrument Diagram (P&amp;ID), cause and effect diagrams. Explain the functioning of the main electrical, mechanical and instrument equipment and systems in your local Operating Unit/Company</td>
</tr>
<tr>
<td>10</td>
<td><strong>Control systems:</strong></td>
</tr>
<tr>
<td></td>
<td>Demonstrate how safeguarding systems function i.e. Fire and Gas, Emergency Shut Down systems. Understand P&amp;ID controllers. Discuss the main process control systems used for plant control and flow control and state the differences or limitations.</td>
</tr>
</tbody>
</table>

Source: Extract from Job Competence Profile for Refinery Operators at NNPC, 2013

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22 The author of this article facilitated the Capability Review Workshops (CRW) where NNPC Subject Matter Experts (SMEs) developed the Job Competency Profiles (JCPs). The author has been the Group Human Resource Consultant at NNPC since January 2012.
Summary and conclusion

The organisation is where productive work takes place in the industry. Therefore, it is important to know how to organise and manage work in the organisation. The different approaches to framing organisational issues as well as several strategies for managing the organisation have been discussed in this article. The recent global trends in the industry and the concept of value chain in relation to the skill pool management system were briefly discussed. Skill pool management system is the oil and gas industry best practice for the effective management of particularly the workforce. There are sixteen skill pools which are underpinned by the value chain activities in the industry. Process engineering discipline is at the heart of the production / operations skill pool in the refinery. Building and applying competences of employees are critical management efforts to ensure technical and operational excellence in the industry. Companies (i.e. NOC, IOCs and Private Oil Companies) and regulators (i.e. Department of Petroleum Resources) operating in the industry are implored to adapt the skill pool management system which is a global industry practice to ensure business profitability and sustainability.

Other References