

# Talent Management through Integration of Talent Value Chain and Human Capital Analytics Approaches

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**Abstract**—Talent management in today's modern organizations has become data-driven due to a demand for objective human resource decision making and development of analytics technologies. HR managers have been faced with some obstacles in exploiting data and information to obtain their effective talent management decisions. These include process-based data and records; insufficient human capital-related measures and metrics; lack of capabilities in data modeling in strategic manners; and, time consuming to add up numbers and make decisions. This paper proposes a framework of talent management through integration of talent value chain and human capital analytics approaches. It encompasses key data, measures, and metrics regarding strategic talent management decisions along the organizational and talent value chain. Moreover, specific predictive and prescriptive models incorporating these data and information are recommended to help managers in understanding the state of talent, gaps in managing talent and the organization, and the ways to develop optimized talent strategies.

**Keywords**—Decision making, human capital analytics, talent management, talent value chain.

## I. INTRODUCTION

**T**ALENT management requires using and integrating relevant data across the value chain in order to link company goals, business and organizational issues and human resource circumstances [1]. It is a fact that most organizations are moving into the era of big data and are working together by sharing and using business data and information intensively [2]. However, it is likely that human resource data and information are less used when planning workforce issues.

The human capital value chain was developed to help managers in understanding the value perspectives of human resources in the organization processes and network [3]. This raises an importance of the human capital value chain studies. This paper proposes predictive and prescriptive analytics approaches to tackle issues of talent management by incorporating the perspectives of the human capital value chain in particular.

## II. LITERATURE REVIEW

### A. Human Capital Value Chain

Based on synthesis of a human capital literature review, the talent supply chain can be illustrated here. In the upstream, there is labor available in the market; they are considered as

the labor inventory. Input labor is produced by talent suppliers such as educational institutes, vocational institutes and enterprises. They are comprised to two groups; new entry group and re-entry group. The new entry group mostly is graduates who enter the workplace for the first time. The re-entry group is a person who used to be in the labor inventory for any period of time and is able to be hired. These talent suppliers produce different types and amounts of input labor at different rates.

Input labor enters the organizations or talent users at the rate depending on the degree to which organizations can offer the jobs or employer market condition. That organizations are able to get people as required is subjected to the effectiveness of their recruitment strategies and input labor market condition.

Once the organizations finalize recruitment and select their employees, they will be allocated according to designated organization structures. The movement of internal labor, i.e. flow of employees within an organization, occurs when there are changes in the organization's direction, objectives, structures, and policies. As employees may decide to stay or leave the organization earlier, firms must balance their internal labor i.e., bench and new hires, in order to perform as targeted. This mainly involves human capital management by means of workforce capacity planning and workforce allocation. Managing the internal labor movement is not only made within an organization boundary but also among an organization's internal and external network.

When employees leave organizations, they are counted in the labor inventory pool. The downstream of the talent supply chain involves utilizing labor inventory by establishing mechanisms to get people back into businesses and organizations. Regarding to aforementioned processes, the next section presents proposed models integrating the talent value chain and human capital analytics concepts for broadening viewpoints of human capital and talent management.

## III. PROPOSED MODELS

### A. Mixed Integer Programming for Talent Planning

According to a simplified context of the labor market and organization, assumptions are set as follows:

1. Labor inventory of both the new entry and re-entry group is specific in type and fixed in number. Talent suppliers produce input labors at a specific rate.

2. Talent users specify fixed amounts, types and requirements of employees they need. No changes applied after their selection process is completed.
3. Organizations in the network have specific amounts and types of employees who leave organization.

Sets:

Mar: Labor inventory (market)

Sup: Talent suppliers

UP: Talent use period (time to use talent)

User: Organization functions requesting talents

LP: Talent leave period (time that talent leave)

Decision variables:

- o  $Emp_{ij}^t$ : Number of employees for function i from labor inventory j at time t;  $t \in UP$
- o  $Emp_{ik}^t$ : Number of employees for function i from talent supplier k at time t;  $t \in UP$
- o  $Oem_i^h$ : Number of employee that leaves a function i at end of time h;  $h \in LP$
- o  $Lem_j^h$ : Number of employees that leave and go to labor inventory j at end of time h;  $h \in LP$
- o  $Sem_k^h$ : Number of employees that leave and go to talent supplier k at end of time h;  $h \in LP$

$$Func_i^t = \begin{cases} 1 & \text{when function i uses employee at} \\ & \text{time t; } \forall i \in User \\ \\ 0 & \text{Others} \end{cases}$$

$$MarE_j^t = \begin{cases} 1 & \text{when employee is from labor} \\ & \text{inventory j use employee at} \\ & \text{time t; } \forall j \in Mar \\ \\ 0 & \text{Others} \end{cases}$$

$$SupE_k^t = \begin{cases} 1 & \text{when employee is from supplier k} \\ & \text{at time t; } \forall k \in Sup \\ \\ 0 & \text{Others} \end{cases}$$

Parameters:

- $COM_j$ : Cost of recruiting from labor inventory j
- $COS_k$ : Cost of recruiting from supplier k
- $COE_i$ : Cost of maintaining and utilizing employees in function i
- $COT_i$ : Cost of employee turnover in function i
- $CapE_i$ : Capacities of function i
- $Demand_i^t$ : Employee demand of function i at time t
- $Demand_i^h$ : Employee demand of function i at time h
- $RoM_j$ : Supply rate of labor inventory j
- $RoS_k$ : Supply rate of talent supplier k
- $RoT_i$ : Turnover rate of employee of function i

Constraints:

$$\sum_{t \in UP: t \leq 12} Func_i^t = 1 \quad ; \forall i \in User \quad (1)$$

Constraint (1) presents an organization function can request employees once a year.

$$\sum_{i \in User} Emp_{ij}^t \leq CapE_i MarE_j^t \quad ; \forall j \in Mar, t \in UP: t \leq 12 \quad (2)$$

Constraint (2) presents the number of employees for a function from labor inventory that cannot exceed the capacities of the function. When employees from one labor inventory are not sufficient, the function can get employees from other pools until fulfilled.

$$\sum_{i \in User} Emp_{ik}^t \leq CapE_i SupE_k^t \quad ; \forall k \in Sup, t \in UP: t \leq 12 \quad (3)$$

Constraint (3) presents the number of employees for a function from talent suppliers that cannot exceed the capacities of the function. In the same manner to (2), when employees from one supplier are not sufficient, the function can get employees from other pools until fulfilled.

$$\sum_{i \in User} Oem_i^h \geq Lem_j^h + Sem_k^h \quad ; \forall j \in Mar, \forall k \in Sup: h \in LP: h \leq 12 \quad (4)$$

Constraint (4) presents number of employees that leave a function will go to labor inventory and/or talent suppliers. Alternatively, they may decide not to be in the labor market.

$$Oem_i^h = Emp_{ij}^{t+3} + Emp_{ik}^{t+3} \quad ; \forall j \in Mar, \forall k \in Sup: h \in LP: h \leq 12 \text{ and } t \in UP: t \leq 12 \quad (5)$$

Constraint (5) presents fulfillment time of employees must not be longer than 3 months.

$$Demand_i^{h+1} = Demand_i^h + Oem_i^h \quad ; \forall i \in User: h \in LP: h \leq 12 \quad (6)$$

$$\sum_{i \in User} Demand_i^t \leq \sum_{i \in User} CapE_i \quad ; t \in UP: t \leq 12 \quad (7)$$

$$\sum_{i \in User} Demand_i^h \leq \sum_{i \in User} CapE_i \quad ; t \in UP: t \leq 12 \quad (8)$$

Constraints (6)-(8) present the circumstance of workforce request of which new employee demand is equal to the number of employees that leave a function to maintain the same level of employees in the function.

There may be additional constraints when the turnover rate is higher than the supply rate among the organizations in the network. The demand of new employee will higher than function capacities. In the same manner, when the turnover rate is lower than the supply rate among the organizations in the network, the demand for the new employee will lower than the function capacities.

$$\sum_{i \in User} Emp_{ij}^t + \sum_{i \in User} Emp_{ik}^t = Demand_i^t \quad ; \forall j \in Mar, \forall k \in Sup: t \in UP: t \leq 12 \quad (9)$$

Constraint (9) presents the summation of the number of employees for the functions from labor inventory and supplier that is equal to employee demand of the functions.

$$Oem_i^h = Lem_j^h + Sem_k^h \quad ; \forall j \in Mar, \forall k \in Sup: h \in LP: h \leq 12 \quad (10)$$

Constraint (10) presents turnover amounts of employees of

the functions equal to the number of employees that leave and go to the labor inventory and talent supplier.

$$ROM_j \geq ROT_i \tag{11}$$

$$ROS_k \geq ROT_i \tag{12}$$

Constraints (11) and (12) present that the supply amounts of labor inventory and talent suppliers are higher than the turnover amounts of employee of the functions.

Objective functions:

Min Total cost Z

$$Z = C^{rec} + C^{main} + C^{turn} \tag{13}$$

$$C^{rec} = \sum_{i \in User} \sum_{j \in Mar} \sum_{t \in UP} COM_j Emp_{ij}^t + \sum_{i \in User} \sum_{k \in Sup} \sum_{t \in UP} COS_k Emp_{ik}^t \tag{14}$$

$$C^{main} = \sum_{i \in User} \sum_{h \in LP} COE_i Oem_i^h - \sum_{i \in User} \sum_{t \in UP} COE_i Emp_{ij}^t \tag{15}$$

$$C^{turn} = \sum_{i \in User} \sum_{h \in UP} COT_i Oem_i^h \tag{16}$$

### B. Linking Skill Gaps to Workforce Planning

Once the number of employees of each function is identified using an optimization model based on the human capital value chain perspective, the organization requires the examining skills of current employees. It can occur that an organization needs more or less employees when taking individual skills into account. A skills gap is the variance between the skills offered by the workforce and the skills required by the organization.

It is a fact that an organization needs to understand the business directions and strategies prior to determining the required types and level of employee skills for achieving business goals. Human resource planning activities, especially skill gap analysis is necessary. Thus, input of such data as roles and jobs according to company directions and strategies, business objectives, organization, and human resource objectives being answered, department, function and section belonging to such roles and jobs, as well as required skills and competencies are essential for linking skill gaps and amounts of workforce to be planned. Table I shows simple examples of business and human resource objectives.

TABLE I  
EXAMPLES OF BUSINESS AND HR OBJECTIVES

Business objectives	HR objectives
Financial	Cost of employee
Customer	Service availability
Internal process	Workload balancing, Workforce productivity
Learning	Successful training hours, Successful up-skill, Successful cross-skill

### C. Dynamic Programming for Aligning Workforce to Organization Structures

Once managers have incorporated talent supply and skills in the analysis and have acknowledged the number of employees, the next issue of workforce planning decisions is to consider the subject of organization structure. Apart from matching employees with demand and supply conditions, workforce

planning must be conducted by taking into account the specified organization structure. In doing this, the organization can maximize the employee's role fit and their utilization while minimizing gaps between employees' perceived benefits from their work and actual pay or incentive. This can stabilize the workforce situations of turnover and performance fluctuation.

An open or restricted organization structure can lead to different mechanisms in managing human capital, for instances, promotion based on performance with less concern for seniority or service years and reallocating the workforce among departments based on individual capabilities. When an organization has the right number of employees but with misleading roles and improper work positions, it can result in their dissatisfaction in doing their jobs. When it continues to exist for period of time, the value obtained from employees is then reduced over time [4].

Allocating workforces based on organization structure criteria such as types of roles, workforce quota or capacities within functions, and cross functional allowance can result in better management of the human capital value chain. When employees' roles and tasks are assigned differently from what it is supposed to be in the organization structure, this presents a signal of poor alignment. Managers need to ensure that employees are doing their tasks and are within the work positions as well as structure of salary and career path accordingly.

Dynamic programming can be used for the analysis [5]. There are states of decision when employees in departments are allocated to specified tasks according to the company's plans and policies. Such as when effectively allocating the right man to the right tasks in the right ways, i.e. plans and policies about position and incentive, it is expected that the highest value from the workforce will be achieved.

### D. Predictive Models for Employee Focus and Employee Performance Gaps

When manpower is known and a person with high potential is selected and entered the work process, one of the factors contributing to successful delivery of the talent value are compatibility of the employee in the light of team and organization culture. Managers must know that this compatibility leads to the effectiveness of the team and organization or not. In order to see the gap and to improve such compatibility and corporate culture, they can consider bringing together a profile of the staff, employee behavior and qualification test with such criteria as team characteristics and predefined organizational culture characteristics. Managers also need to keep track of the status of talents throughout their life within organization. Performance can reflect values from them. However, the received value must encompass from short-term, medium-term to long-term organization's demand, as well as under the supply situations relative to organizational structure characteristics and business strategies. This can affirm achievement from value delivered by talent. The issue of monitoring their performance development and career growth can help managers connecting value that organizations

strategically requires to one that talent offers. Knowing the value gap will benefit improvement of human capital strategies and operations.

Proper career paths can help employees understanding the value that the organization needs and encourage their delivery. It is likely that talent in the organization may focus on continuous self-development in some extent. Therefore, learning and development is necessary to meet the needs of organizations and talent. Managers must consider the learning needs of both employees and organization together with considering the talent supply factors, organizational structure, recruitment and selection, team effectiveness and employee performance. Learning and development planning must be developed and revised according to these upstream circumstances and conduct in a timely manner. Predictive analytics approach such as classification, clustering, and association model can be used to help managers discovering whether or not existing workforce is right for the team and organization. This can increase employee focus when they realize how fit they are in the team or in which they could deliver more value. The causes of performance gap can be seen and the risk of poor performance can be foreseen. Learning and development strategies can be taken place in time.

#### IV. CONCLUSION

The results of talent management from human capital value chain perspectives allow managers assessing talent value from each process and aggregate them for broader point of view. They help managers planning and acknowledging talent situations and being able to improve policies and guidelines for their talent and proactively managing human capital by relying on more accurate prediction and decision. The predictive and prescriptive approaches proposed in this paper can be used as a starting point for managers to enhance ability of human capital management and dealing with more dynamic workforce and organization issues.

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