# Talent Unleashed: Optimizing Human Resource Strategies for Sustainable Growth over the Corporate Life Cycle

Chun-Hung Chen*, Kuan-Wei Chen**, Yu-Fan Chen***, and Yu-Hsin Su****

## Abstract

This study extends the findings of Chen and Su (2019) by focusing on industrial policies for sustainable management over the corporate life cycle, offering key insights into human resource strategies in industrial economics and providing valuable guidance for government planners. The study highlights the benefits of recruiting a team of less efficient managers over recruiting a single manager. The key findings include the following: (1) A team of *n* managers with a collective talent level of 1 is more effective than a single manager with a talent level of *n*. (2) A "rapid deployment system" in which new managers are recruited externally when

---

* Corresponding author: Associate Professor, Department of Accounting, Chaoyang University of Technology, E-mail: shhching@cyut.edu.tw.

** PhD candidate, Doctoral Program in Design, College of Design, National Taipei University of Technology, Email: r24135273@gmail.com.

*** Master's student, Master's Program in Smart Medicine and Health Informatics, National Taiwan University; Master, Institute of Biomedical Informatics, National Yang Ming Chiao Tung University, Email: d25823095@gmail.com.

**** Master, Department of Accounting, Chaoyang University of Technology.

DOI:10.7086/TJAE.202412_(116).0005

current managers cease to add value to their companies outperforms a “talent pipeline system” when the talent pipeline lacks a learning effect and talent differences. (3) Companies using a talent pipeline system with strong on-the-job training achieve greater profitability than do those using a rapid deployment system. (4) A company’s initial investments in its managers, the time before these managers’ human capital is depleted, and profitability when this depletion occurs are critical factors driving growth, with delayed depletion periods correlating with greater profits throughout the corporate life cycle.

**Keywords:** Talent pipeline system, Rapid deployment system, Sustainable management, Life cycle dynamics

**JEL Classification:** J24, L53, M51, O15

Received April 8, 2024; Revised July 10, 2024; Accepted October 4,2024.

# Talent Unleashed: Optimizing Human Resource Strategies for Sustainable Growth over the Corporate Life Cycle

Chun-Hung Chen, Kuan-Wei Chen, Yu-Fan Chen, and Yu-Hsin Su

## I. Introduction

This study explored the intersection of the natural sciences (NSs) and the social sciences and humanities (SSHs), applying rocket theory principles to human resource management within the social sciences. This study pioneers a path of scholarly exploration by highlighting the applicability of scientific principles across diverse disciplinary backgrounds.

Bayir et al. (2014) investigated science education research, focusing on nuanced perspectives of the nature of science (NOS). The literature indicates that naive NOS views are widespread among students and educators; however, few studies have considered scientists' perspectives. One such study, that by Bayir et al., analyzed the views of 69 scientists from various disciplines and uncovered a mix of informed and naive NOS perspectives. Notably, the differences between natural and social scientists' perspectives were minimal, challenging the idea that NOS views are discipline-specific.

The present study explored industrial and personnel advancement, extending on the study of Chen and Su (2019) by conducting a focused analysis of managerial decisions and talent management. This study explored the influence of managers and talent on strategic business decision-making, using simulations to model managerial appointments and eliminations. Notably, whereas Chen and Su (2019) investigated trade-offs related to a company's life cycle and sustainability, the present study focused on optimizing human resource strategies. Specifically, Chen and Su (2019) considered factors such as initial investments in managers, the ratio of core assets and managerial incentives to total company assets, and competitive pressures, whereas the present study emphasized employing strategic human resource management to improve organizational and managerial effectiveness. Both this study and that of Chen and Su (2019) extend the earlier work of Chen and Su (2012), Su (2013), and Chen et al. (2019).

Our findings demonstrate that selecting a collective unit of talented managers is superior to relying on a single highly talented manager. We thus emphasize the value of talent pipeline systems, demonstrating that without a learning effect, their influence is comparable to that of individual talented managers recruited to reshape company practices. However, with robust on-the-job training, talent pipelines are more effective than is rapidly replacing managers who have reached the limit of their ability to benefit the company (a “rapid deployment system”).

This study highlights the value of precise human resource allocation, proposing that optimal talent management strategies enhance a company’s life cycle and support sustainable management practices. This study also connects the fields of NS and SSH, offering a theoretical model with practical value in terms of improving company efficiency and long-term sustainability.

Porter and Miller (1985) emphasized the critical role of competition in driving business innovation, organizational culture, efficiency, and performance, identifying it as a key factor influencing business success. Additionally, Adizes (1988) explored the dynamics among organizational components, external resource use, and adaptability, identifying how these dynamics create value, ensure organizational continuity, and contribute to achieving organizational objectives.

To develop effective business methodologies, managers must understand how actions influence sustainability and financial performance. Such an understanding requires a thorough analysis of interrelated factors and the creation of tailored performance metrics to enhance decision-making.

Walker and Ruekert (1987) and Porter and Miller (1985) have proposed that firms design business methodologies by examining both internal and external factors. Such factors include regulations, geography, mission, strategy, structure, systems, industry dynamics, customer relationships, and product offerings. Human and financial resources are also essential to this framework. These elements can guide leadership decision-making and organizational processes to improve sustainability. Notably, leaders must understand key factors and constraints to make informed decisions, and creating a sustainable organizational structure requires precise customization of all aspects of the company.

Managers must thoroughly assess the key factors affecting organizational effectiveness and understand the broader influence of corporate actions to anticipate stakeholder responses and develop organizational strategies. This has been supported by Bonn and Pettigrew (2009) and Ramaswamy et al. (2008), who have argued that a company's operational strategy substantially influences its performance throughout its life cycle.

Hajkowicz et al. (2023) highlighted the potential of artificial intelligence (AI) to bridge the NSs and SSHs. Their research examined AI adoption from 1960 to 2021 across 333 fields, using the Organization of Economic Cooperation and Development's 214 AI Principles to define AI. Of the 137 million publications Hajkowicz et al. (2023) reviewed, 3.1 million were related to AI, indicating recent growth. AI's influence extends beyond computer science. The technology was employed in 14% of all fields in 1960 and employed in more than 98% in 2023. The current study highlighted ongoing interdisciplinary AI applications.

Gaffney and Zmigrod (2023) argued that unlocking creativity can overcome entrenched conceptual barriers, bridging the gaps between the SSHs and the NSs. Their study examined neural processes during creative tasks, focusing on relational creativity mechanisms and brain function over time. Drawing on Ingold's insights, they advocated for greater awareness of social relationships, which constitute fundamental creative endeavors that influence human neural architecture and behavioral development and are crucial to creativity itself.

Nishikawa's (2023) challenged the notion that the NSs provide only methodological foundations for the SSHs. Their study encouraged a paradigm shift, highlighting the considerable methodological contributions of the SSHs to the NSs. By using citation context analysis, Nishikawa's study revealed that the NSs often cite SSH Methods sections, indicating a reciprocal dynamic of knowledge dissemination across disciplines.

Thurner (2023) emphasized the importance of physics concepts such as universality to understanding tipping points in human societies. The study suggested that agent-based frameworks are essential for identifying pivotal junctures and fostering interdisciplinary collaboration. These frameworks help with navigating data complexities involving societal challenges, such as polarization and the green transition, in which social tipping points lead to rapid shifts, such as economic crises or political regime changes.

In Section II, the present study establishes and analyzes its foundational model, applying rocket theory from the NSs to human resources in the SSHs. This application bridges and validates the interconnected principles of the two fields. Section III presents the Conclusions derived from the research findings.

# II. Fundamental Model and Evaluation

The four delineations presented in this research, with reference to Chen and Su (2019) are summarized as follows: (1) The expression $G = m_0 / r^2$ functions as a gauge of “aggregate competitive pressure” or an “inward force” directly encountered by a company. (2) The expression $m_0 g = m_0 / R^2$ represents the “cumulative competitive pressure” to increase a firm’s profit margin, consistent with the concept of baseline profit. (3) The expression $L = m_0 \times v^2 / r$ denotes a “metric for enhancing profits” or an “outward force.” (4) The expression $\Delta m_0 = -[m_0(t) - m_0(t + \Delta t)] = [\Delta m_0 / \Delta t]\Delta t = [dm_0 / dt]\Delta t$ quantifies the change of assets over a period. Applying the basic principle of differentiation as $\Delta t$ approaches 0, we establish an equilibrium state in which the “inward force” equals the “outward force.” Table 1 presents a comparison between the rocket framework as it applies to physics and the meanings of the components of this framework as used in the present study.

Table 1: Alignment of Rocket Framework with Definitions Used in This Study

| Symbols | Definition in Physics | Definition in This Study |
|---|---|---|
| $G$ | Gravitational constant or inward force | Pressure or aggregate competitive pressure |
| $R$ | Earth’s radius | The disparity between 0 and the minimum loss threshold (presumed to be constant) |
| $r$ | A satellite’s orbital radius | Gross profit |
| $g$ | Gravity at the Earth’s surface | An indicator of market rivalry for every unit of generalized assets at 0 profit |
| $m_0 = m_\rho + m_s + m_F$ | Rocket mass | Generalized assets |
| $m_\rho$ | Net load mass | A company’s core assets |
| $m_s$ | Structural mass | Manager remuneration and retirement benefits |
| $m_F$ | Fuel mass | Entrepreneurial skills of a manager and productive assets in a phase |
| $\lambda$ | $m_s/(m_s + m_F)$ | Ratio of assets allocated to managerial remuneration and retirement benefits, denoted as $m_s$ to total managerial assets $m_s + m_F$ |
| $L$ | Centrifugal force | A metric of increased profits |
| $v$ | Rocket velocity | Profitability (the rate of increase in profit per unit of time) |
| $u$ | Speed of gas stream with respect to the rocket | Sum of investments in managerial training and company profitability |
| $u - v$ | Speed of the gas jet relative to the Earth | A measure of managerial contributions to company profitability |
| $t$ | Time | Time |
| $\Delta t$ | Temporal variation | Temporal variation |

This study integrated concepts from the NSs and the SSHs to explore corporate management and profits. The variables presented in Table 1 can be further described as follows: (1) *G*, the gravitational constant in physics, represents the aggregate competitive pressure or inward force a company faces. This competitive pressure includes both supply and demand. A perfectly competitive market results in higher pressure, whereas a monopoly reduces this pressure. (2) In physics, *R* represents the Earth's radius; in the present study, *R* represents the difference between 0 and the minimum tolerable loss. (3) In physics, *r* represents a satellite's orbital radius; in this study, *r* denotes gross profit, whereas realized profits are denoted by *r* – *R*. Therefore, *R*, the Earth's surface, corresponds to 0 profit, whereas *r* – *R*, the distance from the Earth's surface, corresponds to realized profits. (4) The acceleration due to gravity at the Earth's surface, *g*, indicates market rivalry for every unit of generalized assets with 0 profit in the present study. Thus, *g* is a measure of the reduction in profits incurred when a unit ceases to be optimally productive. (5) In physics, $m_0$ signifies a rocket's mass; in this study, $m_0$ represents generalized assets equal to $m_\rho + m_s + m_F$. (6) In physics, $m_\rho$, the net load mass, represents a company's core assets and is traditionally calculated as the asset value minus $m_s$. (7) $m_s$ represents structural mass in physics and the manager's remuneration and retirement benefits in the present study; these are the proportion of the company's assets paid to the manager. (8) In physics, $m_F$ represents the fuel mass, which in this study, symbolizes the sum of the manager's entrepreneurial skills and the company's productive assets in a period, representing the company's investments in the human capital of its manager. (9) In physics, $\lambda$, denotes the ratio of rocket masses; in this study, $\lambda$ denotes the ratio of assets devoted to managerial remuneration (including retirement benefits) ($m_s$) to the investment in the manager's human capital ($m_s + m_F$). (10) In physics, *L* signifies the centrifugal force generated by a rocket; in this study, *L* represents the company's capacity to sustain profitability. (11) The velocity *v* of a rocket represents, in this study, a company's success or profit growth rate per unit of time, representing the sustained investment required to maintain profitability. (12) In physics, *u* is the speed of the gas expelled relative to a rocket, with *u* – *v* representing the downward speed of the expelled gas and $v$ the rocket's upward speed. In this study, $u$ represents the combined value of the manager and the company. The manager must add value of $u - v$ to enable a company to attain a profitability level of $v$ and increase profits. (13) In physics, $u - v$ is the speed of a gas jet with respect to the Earth. In this study, $u - v$ represents a manager's value to the company. (14) In physics and in this study, $t$ represents time, (15) and $\Delta t$ represents temporal variation in both contexts.

Chen and Su (2019) proposed that the product of a company's profitability and assets remains constant and can be expressed mathematically as

$$v(t)m_0(t) = [v(t+\Delta t)m_0(t+\Delta t)] + [v(t) - u][-(dm_0 / dt)\Delta t].$$

According to the aforementioned discussion, Equation (1) can be derived from Equation (16) in the study of Chen and Su (2019) (the preceding equation) as follows:

$$v = v_0 + u \ln \frac{m_0}{\lambda m_0 + (1-\lambda) m_\rho} \tag{1}$$

The current section of this study presents a discussion of the difference between an individual manager and a managerial team in terms of promoting corporate growth ($v$). Consider the following two scenarios: (1) a firm appoints one highly talented manager, and (2) a firm assembles a team of $n$ managers, each possessing talent equivalent to a single unit of managerial capital. This information was considered to develop strategies to enhance company profits ($v$) and achieve sustainable growth.

Let $m$ represent each unit of managerial capital, and define $\lambda$ as the ratio of the manager's compensation $m_s$ to the total capital $m_s + m_F$, where $0 < \lambda < 1$. With $m = m_s + m_F$, we can express $m_F$ as $(1-\lambda)m$.

$$v = v_0 + u \ln \frac{m_0}{\lambda m_0 + (1-\lambda) m_\rho} = v_0 + u \ln \frac{m_0}{m_\rho + \lambda (m_s + m_F)} = v_0 + u \ln \frac{m_0}{m_\rho + \lambda m} \tag{2}$$

If the company selects a manager with $n$ talent, the manager's remuneration and retirement pension should scale proportionately by $n$ times, yielding $nm = m_s + m_F$. Consequently, the profitability of the company can be expressed as follows:

$$v = v_0 + u \ln \frac{m_\rho + nm}{m_\rho + \lambda nm} \tag{3}$$

By contrast, if the company appoints $n$ managers, each endowed with one unit of talent, when these managers have exhausted their usefulness, the company will compensate them with financial rewards and retirement pensions. Subsequently, new talents must be introduced from a pipeline to replace these managers. In this scenario, company profitability can be expressed as follows:

$$v_1 = v_0 + u \ln \frac{m_\rho + nm}{m_\rho + (n-1)m + \lambda m} \tag{4}$$

$$v_2 = v_1 + u \ln \frac{m_\rho + (n-1)m}{m_\rho + (n-2)m + \lambda m} \tag{5}$$

$$v_3 = v_2 + u \ln \frac{m_\rho + (n-2)m}{m_\rho + (n-3)m + \lambda m} \tag{6}$$

$$\vdots$$

$$v_n = v_{n-1} + u \ln \frac{m_\rho + m}{m_\rho + \lambda m} \tag{7}$$

Consequently, the final profitability of the company can be derived by applying Equations (4) through (7):

$$v_n = v_0 + u \ln\left[\frac{m_\rho + nm}{m_\rho + (n-1)m + \lambda m}\right]\left[\frac{m_\rho + (n-1)m}{m_\rho + (n-2)m + \lambda m}\right] \cdots \left[\frac{m_\rho + m}{m_\rho + \lambda m}\right] \tag{8}$$

If we contrast the results from Equations (4) through (7) with those from Equations (3) and (8), we arrive at the following proposition:

## [Proposition 1]

When the condition

$$\left\{\frac{m_\rho + nm}{[m_\rho + (n-1)m + \lambda m]}\right\}\left\{\frac{[m_\rho + (n-1)m]}{[m_\rho + (n-2)m + \lambda m]}\right\}\left\{\frac{[m_\rho + (n-2)m]}{[m_\rho + (n-3)m + \lambda m]}\right\} \cdots \left\{\frac{[m_\rho + m]}{[m_\rho + \lambda m]}\right\} > 1$$

holds, the decision to select $n$ managers, each possessing talents equivalent to one unit, rather than selecting a single manager with $n$ talent, leads to a higher level of profitability for the company.

**Proof:**

The result derived from Equation (8) exceeds that derived from Equation (3), demonstrating that a team of competent managers outperforms one highly qualified manager.

If Proposition 1 is satisfied, having multiple managers enhances a company's effectiveness and increases its profitability. The company's managerial strategy should focus on harnessing individual strengths, fostering a cohesive vision, aligning efforts, promoting collaboration, and balancing personal goals with collective well-being. This approach supports sustainable management.

When Proposition 1 is satisfied, having multiple managers deepens the company's financial insight, improving performance evaluations and data analysis. Using financial tools, managers can devise strategies that strengthen decision-making, establish a solid financial infrastructure, and improve overall operational performance.

An example of a case that supports Proposition 1 is Zhuge Liang's strategic choice before the Battle of the Red Cliffs (CE 208–209) in ancient China. Originally, Zhuge, a clever strategist, planned to place straw targets on boats to deceive Cao Cao's army. Instead, he adopted a plan proposed by 3 cobblers, using scarecrows dressed in leather to trick Cao Cao's army into shooting 100,000 arrows at the decoys, which he subsequently collected and used against Cao Cao in battle. This case reveals how collective wisdom can surpass individual brilliance.

When organizations meet the criteria outlined in Proposition 1, they should assemble a team of executives to enhance the company's overall financial performance. In addition to the current manager, the remaining $n-1$ individuals in the company constitute a talent reservoir. If these individuals do not exhibit a learning effect, their capabilities resemble those of highly talented individual managers. By contrast, if a company's talent pipelines are such that it can recruit a team of talented managers when required, swift recruitment is likely to improve the company's effectiveness and profitability.

After the initial manager has successfully completed their profit-enhancing responsibilities, denoted as $\tilde{v}_1$ in Equation (9), a company may rapidly deploy a second manager. After this second manager has completed their tasks, the resultant company profitability, $\tilde{v}_2$, can be defined by Equation (10). When a third manager completes their responsibilities, the corresponding company profitability $\tilde{v}_3$ can be given by Equation (11). This pattern persists until the *n*th manager completes their responsibilities, yielding a company profitability of $\tilde{v}_n$, as described in Equation (12). The sequence is illustrated in the following equations:

$$\tilde{v}_1 = v_0 + u \ln\left(\frac{m_\rho + m}{m_\rho + \lambda m}\right) \tag{9}$$

$$\tilde{v}_2 = \tilde{v}_1 + u \ln\left(\frac{m_\rho + m}{m_\rho + \lambda m}\right) = v_0 + 2u \cdot \ln\left(\frac{m_\rho + m}{m_\rho + \lambda m}\right) \tag{10}$$

$$\tilde{v}_3 = \tilde{v}_2 + u\ln\left(\frac{m_\rho + m}{m_\rho + \lambda m}\right) = v_0 + 3u\cdot\ln\left(\frac{m_\rho + m}{m_\rho + \lambda m}\right) \tag{11}$$

$$\vdots$$

$$\tilde{v}_n = \tilde{v}_{n-1} + u\ln\left(\frac{m_\rho + m}{m_\rho + \lambda m}\right) = v_0 + nu\cdot\ln\left(\frac{m_\rho + m}{m_\rho + \lambda m}\right) \tag{12}$$

We can subsequently compare the degree of corporate profitability achieved by the $n$ th manager in the rapid deployment system with that in the talent pipeline system indicated in Equations (12) and (8):

$$\tilde{v}_n - v_n = u\left\{n\ln\left[\frac{m_\rho + m}{m_\rho + \lambda m}\right] - \ln\left[\frac{m_\rho + nm}{m_\rho + (n-1)m + \lambda m}\right]\left[\frac{m_\rho + (n-1)m}{m_\rho + (n-2)m + \lambda m}\right]\cdots\left[\frac{m_\rho + m}{m_\rho + \lambda m}\right]\right\}$$

$$= u\left[\ln(\frac{m_\rho + m}{m_\rho + \lambda m})^n - \ln\prod_{k=1}^{n}\frac{m_\rho + km}{m_\rho + (k-1)m + \lambda m}\right] > 0 \tag{13}$$

## [Proposition 2]

In a scenario in which the talent pipeline lacks a learning effect and does not produce appreciably different results from those of an individual manager, the rapid deployment system for recruiting managers is more effective in increasing company profitability than the talent pipeline system is.

**Proof:**

The conclusion of the final inequality presented in Equation (13) is established through an analysis of the function $f(n)$ and its rate of change:

$$f(n) = \frac{m_\rho + nm}{m_\rho + (n-1)m + \lambda m},$$

$$f'(n)=\frac{m[m_\rho+(n-1)m+\lambda m]-m(m_\rho+nm)}{[m_\rho+(n-1)m+\lambda m]^2}=\frac{-(1-\lambda)m^2}{[m_\rho+(n-1)m+\lambda m]^2} \tag{14}$$

Given that $0<\lambda<1$, it follows that $f'(n)<0$. That is

$$\frac{m_\rho+m}{m_\rho+\lambda m}>\frac{m_\rho+km}{m_\rho+(k-1)m+\lambda m},\forall k=2,3,...,n \tag{15}$$

In essence

$$\left(\frac{m_\rho+m}{m_\rho+\lambda m}\right)^n>\prod_{k=1}^n\frac{m_\rho+km}{m_\rho+(k-1)m+\lambda m} \tag{16}$$

Therefore, in the absence of a learning effect in a multimanager talent pipeline, the rapid sequential recruitment and deployment of managers of talent is superior to investing in internal talents long-term. Q.E.D

When talent pipelines lack a learning effect, they hinder company growth. A company's motivation to recruit from internal talent pipelines is rooted in the objective of closing the generational gap between managers—akin to a president's selection of a political vice president. If the talent within the pipeline matures, resulting in a negative difference $\tilde{v}_n-v_n$ in Equation (13), the company may derive greater profits from the talent pipeline system than the rapid deployment system. If the development of talent within pipelines is constrained, insufficient workplace learning and educational programs may be the cause. Nevertheless, investing in manager development also incurs costs, posing a considerable decision-making challenge in weighing the resulting trade-offs.

The following are case studies exemplifying Proposition 2. First, Google, when it was in its early stages, recruited Eric Schmidt as chief executive officer (CEO). Having held senior management positions at Novell and Sun Microsystems, Schmidt possessed extensive industry experience and management expertise to help Google grow into a global tech giant. Schmidt successfully balanced the technical vision of founders Larry Page and Sergey Brin and implemented a strong management structure for the company. Second, in 2006, Ford Motor Company hired Alan Mulally as CEO to address financial difficulties and a declining market share. Mulally had previously held senior management positions at Boeing, and his appointment represented a dramatic rapid deployment decision. Mulally introduced the “One Ford” strategy, focusing on global product development and brand integration, and reshaped the company’s internal management culture. His leadership helped Ford avoid bankruptcy during the 2008 financial crisis, achieve sustained profitability, and recover its market share. These cases demonstrate that in some scenarios, hiring external managers (the rapid deployment system) can substantially improve corporate profitability and performance beyond those achievable through an internal talent pipeline system.

The preceding discussion reveals that on-the-job training is crucial for both companies and managers. Such training enhances managers’ capabilities, enabling companies to enjoy superior operational methodologies and a competitive edge by catalyzing company growth. In such a system, after the efforts of $n$ managers have been expended, the incumbent manager undergoes experiential learning through hands-on training, as the following equations illustrate:

## 1.Rapid deployment system:

We can derive the following from Equation (12):

$$\tilde{v} = v_0 + nu \ln \frac{m_\rho + m_1}{m_\rho + \lambda m_1} = v_0 + un \ln \left( \frac{m_\rho + m_1}{m_\rho + \lambda m_1} \right) \tag{17}$$

## 2.Talent pipeline system:

In the talent pipeline system, managers undergo experiential learning through hands-on training, resulting in a hierarchical progression of managerial capabilities:

$m_1 < m_2 < m_3 < \cdots < m_{n-2} < m_{n-1} < m_n$. The durability of this talent reserve directly affects $m_s + m_F$, with a longer durability resulting in a larger $m_s + m_F = m$. Let $\lambda = m_s/m$, $m_s = \lambda m$, and $m_F = (1-\lambda)m$. Prolonged on-the-job training corresponds to an increased $m_F$, which proportionally affects managers' remuneration and retirement benefits $m_s$. A company's profitability under the influence of this hands-on managerial learning can be expressed as follows:

$$v_1 = v_0 + u \ln \frac{m_\rho + \sum_{i=1}^{n} m_i}{m_\rho + \sum_{i=2}^{n} m_i + \lambda m_1} \tag{18}$$

$$\begin{aligned} v_2 &= v_1 + u \ln \frac{m_\rho + \sum_{i=2}^{n} m_i}{m_\rho + \sum_{i=3}^{n} m_i + \lambda m_2} \\ &= v_0 + u \ln \frac{m_\rho + \sum_{i=1}^{n} m_i}{m_\rho + \sum_{i=2}^{n} m_i + \lambda m_1} \cdot \frac{m_\rho + \sum_{i=2}^{n} m_i}{m_\rho + \sum_{i=3}^{n} m_i + \lambda m_2} \end{aligned} \tag{19}$$

$$\begin{aligned} v_n &= v_0 + u \ln \frac{m_\rho + \sum_{i=1}^{n} m_i}{m_\rho + \sum_{i=2}^{n} m_i + \lambda m_1} \cdot \frac{m_\rho + \sum_{i=2}^{n} m_i}{m_\rho + \sum_{i=3}^{n} m_i + \lambda m_2} \cdots \\ &\quad \cdots \frac{m_\rho + \sum_{i=n-1}^{n} m_i}{m_\rho + \sum_{i=n}^{n} m_i + \lambda m_{n-1}} \cdot \frac{m_\rho + \sum_{i=n}^{n} m_i}{m_\rho + \lambda m_n} \end{aligned} \tag{20}$$

We contrast the endeavors of $n$ managers in both the rapid deployment system and the talent pipeline system with a learning component. The comparative evaluation of these frameworks is encapsulated in Equations (17) and (20):

$$
\begin{aligned}
&v_n - \tilde{v}_n \\
&= u \cdot \ln \frac{m_\rho + \sum_{i=1}^{n} m_i}{m_\rho + \sum_{i=2}^{n} m_i + \lambda m_1} \frac{m_\rho + \sum_{i=2}^{n} m_i}{m_\rho + \sum_{i=3}^{n} m_i + \lambda m_2} \cdots \frac{m_\rho + \sum_{i=n-1}^{n} m_i}{m_\rho + \sum_{i=n}^{n} m_i + \lambda m_{n-1}} \frac{m_\rho + \sum_{i=n}^{n} m_i}{m_\rho + \lambda m_n} \\
&\quad - un \ln\left( \frac{m_\rho + m_1}{m_\rho + \lambda m_1} \right) \\
&= u \cdot \left[ (\ln \frac{m_\rho + \sum_{i=1}^{n} m_i}{m_\rho + \sum_{i=2}^{n} m_i + \lambda m_1} - \ln \frac{m_\rho + m_1}{m_\rho + \lambda m_1}) + (\ln \frac{m_\rho + \sum_{i=2}^{n} m_i}{m_\rho + \sum_{i=3}^{n} m_i + \lambda m_2} - \ln \frac{m_\rho + m_1}{m_\rho + \lambda m_1}) + \ldots \right. \\
&\quad \left. + (\ln \frac{m_\rho + \sum_{i=n-1}^{n} m_i}{m_\rho + \sum_{i=n}^{n} m_i + \lambda m_{n-1}} - \ln \frac{m_\rho + m_1}{m_\rho + \lambda m_1}) + (\ln \frac{m_\rho + \sum_{i=n}^{n} m_i}{m_\rho + \lambda m_n} - \ln \frac{m_\rho + m_1}{m_\rho + \lambda m_1}) \right] \qquad (21)
\end{aligned}
$$

If

$$
\frac{m_\rho + \sum_{i=j}^{n} m_i}{m_\rho + \sum_{i=j+1}^{n} m_i + \lambda m_j} - \frac{m_\rho + m_1}{m_\rho + \lambda m_1} = \frac{(1-\lambda)[m_p(m_{j-1} - m_1) - m_1 \sum_{i=j}^{n} m_j]}{[m_p + \sum_{i=j+1}^{n} m_i + \lambda m_j][m_p + \lambda m_1]} > 0 \,. \qquad (22)
$$

In Equation (22), $\forall j = 1, \ldots, n.$, and $v_n > \tilde{v}_n$. Therefore, we can derive Proposition 3 as follows:

## [Proposition 3]

If the on-the-job training within its talent pipeline is sufficiently robust, a company will employ a talent pipeline system to achieve greater profitability than that possible under a rapid deployment system. The prerequisite for this scenario is expressed as follows:

$$
m_p(m_{j-1} - m_1) - m_1 \sum_{i=j}^{n} m_j > 0, \forall j = 1, \ldots, n.
$$

Proposition 3 suggests that the term $m_\rho(m_{j-1} - m_1)$ represents the benefit derived from the educational experience of experiential managerial learning, whereas $m_1\sum_{i=j}^{n} m_j$ represents the drawbacks associated with the accumulation of assets within the talent pipeline. The talent pipeline system is superior to the rapid deployment system when the advantages of experiential learning in improving managerial quality exceed the value of the manager's accumulated assets, resulting in a reduced managerial workload. The term $m_{j-1} - m_1$ highlights the distinction in talent between the $j-1$th talent in the pipeline assuming the manager role and the initial manager. This variance is a product of on-the-job training that enhances managerial assets, increasing human capital, bonuses, and pensions. The expression $\sum_{i=j}^{n} m_j$ captures the combined cumulative resource demands imposed by the $j$th and successive talents in the pipeline. Proposition 3 thus highlights the critical role of experiential learning in the talent pipeline.

The following are case studies exemplifying Proposition 3. First, General Electric (GE) is well-known for its leadership development programs, particularly those offered at its Crotonville management center. This facility provides comprehensive on-the-job training focused on management, leadership, and business strategy. GE's internal programs have cultivated top CEOs such as Jack Welch and Jeff Immelt, emphasizing internal talent that deeply understands the company's culture, operations, and strategy. Second, Procter & Gamble relies on a strong internal talent development system, promoting leaders from within and offering extensive training in leadership, cross-functional collaboration, and global operations. Several top executives, such as former CEO A.G. Lafley, rose through the ranks, contributing to the company's growth and innovation. Third, International Business Machines (IBM) has a strong focus on leadership development, providing employees with training that fosters innovation and strategic vision. Internally developed managers, such as current CEO Arvind Krishna, possess a deep knowledge of IBM's technology and operations that enables them to successfully navigate the complexities of company transformation.

These cases demonstrate that a robust internal talent pipeline system can outperform an external rapid deployment system. Internally-trained managers, who have a deep understanding of company culture, processes, and strategic objectives, are well-positioned to lead and drive success.

This study further used the concept of the life cycle to illustrate a company’s transformative trajectory as it navigates the stages of expansion, downturn, and cessation. The core premise of this concept is that a company engaging in sustainable practices overcomes the limitations associated with a life cycle. By contrast, when a distinct life cycle is identifiable within a company, the pursuit of sustained operations poses a substantial challenge. The following section explores corporate life cycles in greater depth.

**Life cycle examination:** The life cycle of a company with a single manager is illustrated in Figure 1.

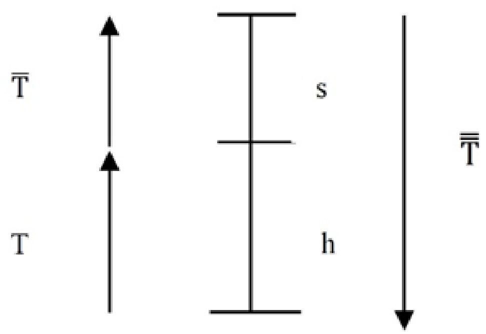


Figure 1. Correlation of Profit Levels with Life Cycle Duration.

The variable $T$ denotes the time frame until a single manager’s human capital is depleted, whereas $\bar{T}$ indicates the time following this depletion of human capital during which the company maintains growth at its current profit level. The combination of $T$ and $\bar{T}$ represents the aggregate expansion interval within the life cycle $(T+\bar{T})$. Moreover, $\bar{T}$ denotes the recessionary phase within the life cycle, and $h$ signifies a company’s cumulative profitability until its manager’s human capital is depleted. The parameter $s$ represents the incremental profit accrued after this human capital depletion, and $(s + h)$ denotes the maximum profits achievable throughout the company's life cycle.

The descending segment in Figure 1 can be expressed by:

$$\int_0^{\bar{T}} v dt = \int_0^{\bar{T}} \left[ 0 + \int_0^t \frac{1}{r^2} d\tau \right] dt = \int_0^{\bar{T}} \int_0^t \frac{1}{r^2} d\tau dt \tag{23}$$

The ascending segment of Figure 1 can be expressed by:

$$s + h = \left[ v_0 + u \ln \frac{m_0}{m_\rho + m_s} \right] \bar{T} + \int_0^{\bar{T}} \int_0^t -\frac{1}{r^2} d\tau dt + v_0 T + \int_0^T \int_0^t (-\frac{1}{r^2}) d\tau dt \tag{24}$$

Equations (23) and (24) are equivalent, as the following equation demonstrates:

$$\int_0^{\bar{T}} \int_0^t \frac{1}{r^2} d\tau dt = \left[ v_0 + u \ln \frac{m_0}{m_\rho + m_s} \right] \bar{T} + \int_0^{\bar{T}} \int_0^t -\frac{1}{r^2} d\tau dt + v_0 T + \int_0^T \int_0^t (-\frac{1}{r^2}) d\tau dt \tag{25}$$

**Postulate 1**: $T + \bar{T} = \bar{\bar{T}}$. Hence:

$$2\int_0^{\bar{T}} \int_0^t \frac{1}{r^2} d\tau dt = \left[ v_0 + u \ln \frac{m_0}{m_\rho + m_s} \right] \bar{T} + v_0 T = v_0 \bar{\bar{T}} + u \ln \frac{m_0}{m_\rho + m_s} \bar{T} \tag{26}$$

$$s + h = \int_0^{\bar{T}} \int_0^t \frac{1}{r^2} d\tau dt = \frac{1}{2} \left[ v_0 \bar{\bar{T}} + u \ln \frac{m_0}{m_\rho + m_s} \bar{T} \right] \tag{27}$$

$$s + h = \frac{1}{2} \left[ v_0 T + v_0 \bar{T} + u \ln \frac{m_0}{m_\rho + m_s} \bar{T} \right] = \frac{1}{2} v_0 T + \frac{1}{2} \bar{T} \left[ v_0 + u \ln \frac{m_0}{m_\rho + m_s} \right] \tag{28}$$

## [Proposition 4]

The variable $v_0$ represents the initial profitability of a company in a manager, *T* denotes the time required to deplete this manager's human capital, and $\left(v_0 + u\ln\dfrac{m_0}{m_\rho + m_s}\right)$ signifies the company's profitability when this human capital is depleted. The longer the growth period ($\bar{T}$) for a manager is, the higher the profit accrued throughout the company's life cycle is. In mathematical terms, $s + h = \dfrac{1}{2}v_0 T + \dfrac{1}{2}\left[v_0 + u\ln\dfrac{m_0}{m_\rho + m_s}\right]\bar{T}$.

Proposition 4 outlines profit dynamics throughout the company life cycle and identifies its key determinants. The expression $s + h$ represents the combined result of the initial investment in the manager and their expertise accrued over two periods, with each period contributing equally to company profits. Specifically, the initial period of investment preceding the depletion of human resources over period $T$ is denoted as $v_0 \times T$. Similarly, the profitability subsequent to the depletion of human capital throughout period $\bar{T}$ is denoted as $\{v_0 + u[\ln m_0 - \ln(m_\rho + m_s)]\}\bar{T}$.

In the aforementioned expressions, $T$ signifies the period during which the company experiences increasing marginal growth, whereas $\bar{T}$ denotes the period characterized by decreasing marginal growth. The terms $v_0 T$ and $[v_0 + u\ln m_0/(m_\rho + m_s)]\bar{T}$ indicate that to maximize profit throughout its life cycle, a company must invest more initial profitability and a longer period. Greater investment's initial profitability also extends longer periods, establishing a company's initial investment in managers as a central determinant of its lifetime profits.

Proposition 4 indicates that a company's initial investment in its managers, the time before their human capital is depleted, and their value to the company once their human capital is depleted all contribute to extending growth and increasing profits throughout the company's life cycle. The following three cases illustrate how these factors enhance profits throughout a company's life cycle.

**Case 1:** Amazon. (a) Initial investment: When Amazon was founded in 1994, Jeff Bezos invested heavily to establish and grow the company. He used the Internet as a sales platform and invested substantial time and capital in developing a website, establishing supply chains, and promoting the brand. (b) Time to deplete human capital: In its early stages, Amazon invested heavily in human capital to develop technology and infrastructure, which resulted in dividends only years later. For example, Amazon’s warehousing and logistics systems, which were critical to its success, required years to develop and perfect. (c) Level of profitability at the time of human capital depletion: By the mid-2000s, Amazon had established a robust infrastructure and technology platform and began reaping the rewards of its initial investments. During this period, the company’s profitability remained high as it continually expanded its product range and market share. (d) Growth period following the depletion of human capital: Amazon continued to increase in size and profitability after its substantial initial investments in human capital and Bezos’s retirement as CEO. Amazon continues to innovate and branch into various domains, including cloud services, AI technologies, and physical retail. (e) Life cycle profits: These sustained investments and long-term growth have made Amazon one of the largest online retailers in the world, generating substantial profits.

**Case 2:** Apple. (a) Initial investment: Founded in the 1970s by Steve Jobs and Steve Wozniak, Apple made substantial initial investments to innovate, creating groundbreaking products such as the Apple I and Apple II. (b) Time to deplete human capital: In the 1980s and 1990s, Apple invested heavily in human capital to develop new products, such as the Macintosh, which required considerable time and resources. (c) Profitability at the time of human capital depletion: By the late 1990s and early 2000s, after Steve Jobs’s return to the company, Apple reached a peak with the iMac and iPod. (d) Growth following human capital depletion: Apple’s continued innovation after Jobs’s death led them to launch the iPhone, followed by the iPad and Apple Watch, initiating a new growth phase. (e) Life cycle profits: These innovations and sustained growth have made Apple one of the most valuable companies globally, with it generating substantial profits.

**Case 3:** Microsoft. (a) Initial investment (profitability): Founded in the 1970s by Bill Gates and Paul Allen, Microsoft focused its early investments on developing MS-DOS and Windows. (b) Time to human capital depletion: Throughout the 1980s and 1990s, Microsoft heavily invested in improving operating systems and office software, which required years to mature. (c) Profitability at the time of human capital depletion: By the late 1990s and early

2000s, Microsoft’s Windows and Office suite dominated the market, and the company continued investing in developing new products and technologies. (d) Growth after human capital depletion: Microsoft sustained growth through innovation after Bill Gates stepped down as CEO, developing the Azure cloud computing platform and expanding into enterprise services. The acquisitions of LinkedIn and GitHub further diversified its business model and strengthened its market position. (e) Life cycle profits: These sustained investments and strategic expansions have made Microsoft one of the largest and most profitable software companies globally, positioning it at the forefront of the technology industry.

# III. Conclusions

This study extends on the work of Chen and Su (2019) by exploring industrial policy in the context of sustainable management and life cycles. Inspired by the principles of rocket theory in physics, this study offers a novel theoretical model that enriches the SSHs and explores the critical role of human resources in emerging industries.

The key findings are as follows: (1) “Two heads are better than one”—a unit of talent spread across multiple managers is superior to a single multitalented single manager. (2) In cases where a company’s talent pipeline lacks a learning effect, a rapid deployment system outperforms a talent pipeline system in increasing company profits, yielding valuable insight into managerial recruitment strategies. (3) A direct correlation exists between financial returns throughout a company’s life cycle and the initial investments made before and after managers’ human capital is depleted.

This study bridges the NSs and the SSHs, revealing potential new research directions by combining theoretical and practical approaches. Future research can extend on this foundation by empirically testing scenarios in which the talent pipeline system outperforms the rapid deployment system across industries and regions or vice versa. Such studies are crucial for informing industrial strategies, policies, and human resource management practices to improve strategic decision-making.

# References


Adizes, I. K., 1988, *Corporate LifeCycles: How and Why Corporations Grow and Die and What to Do About It*, Englewood Cliffs, NJ, Prentice Hall.

Bayir, E., Y. Cakici, and O. Ertas, 2014, "Exploring Natural and Social Scientists' Views of Nature of Science", *International Journal of Science Education*, 36(8): 1286-1312.

Bonn, I. and A. Pettigrew, 2009, "Towards a Dynamic Theory of Boards: An Organisational Life Cycle Approach", *Journal of Management & Organization*, Cambridge University Press, vol. 15: 2-16.

Chen, C. H., K. W. Chen, Y. F. Chen, and Y. H. Su, 2019, "The Application of Assets to Life Cycle and Sustainable Management", Paper presented at *2019 The 3rd International Conference on E-Society, E-Education and E-Technology*, Ming Chuan University, Taiwan.

Chen, C. H. and Y. H. Su, 2012, "A Study on Asset Utilization in Corporate Life Cycle and Sustainable Management", Paper presented at the *Taiwan Economic Association 2012 Annual Conference and the 13th Annual Conference of Empirical Economics*, National Central University, Taiwan.

Chen, C. H. and Y. H. Su, 2019, "The Analysis of Corporation Life Cycle and Sustainable Management by the Manager of Human Resource", *Journal of Economics, Business and Management*, 7: 35-40.

Gaffney, B. and L. Zmigrod, 2023, "Historicising Creativity: An Interdisciplinary Perspective Across the Social and Natural Sciences", in Porr, M. and N. Weidtman, ed., *One World Anthropology and Beyond: A Multidisciplinary Engagement With the Work of Tim Ingold*, Routledge.

Hajkowicz, S., C. Sanderson, and C. Naughtin, 2023, "Artificial Intelligence Adoption in the Physical Sciences, Natural Sciences, Life Sciences, Social Sciences and the Arts and

Humanities: A Bibliometric Analysis of Research Publications from 1960-2021”, *Technology in Society*, 74.

Nishikawa, K., 2023, “How and Why are Citations between Disciplines Made? A Citation Context Analysis Focusing on Natural Sciences and Social Sciences and Humanities”, *Scientometrics*, 128: 2975-2997.

Porter, M. E. and V. E. Millar, 1985, “How Information Gives You Competitive Advantage”, *Harvard Business Review*, 63: 149-160.

Ramaswamy, V., C. J. Ueng, and L. Carl, 2008, “Corporate Governance Characteristics of Growth Companies: An Empirical Study”, *Academy of Strategic Management Journal*, 7: 21-33.

Su, Y. H., 2013, “The Application of Assets to Life Cycle and Sustainable Management”, Master’s Thesis, Chaoyang University of Technology, Taichung, Taiwan.

Thurner, S., 2023, “New Forms of Collaboration Between the Social and Natural Sciences Could Become Necessary for Understanding Rapid Collective Transitions in Social Systems”, *Perspectives on Psychological Science*. 19: 503-510.

Walker Jr., O. C. and R. W. Ruekert, 1987, “Marketing’s Role in the Implementation of Business Strategies: A Critical Review and Conceptual Framework”, *Journal of Marketing*, 51: 15-33.

# 釋放人才潛能：優化人力資源策略以實現永續經營與生命週期

陳俊宏*、陳冠瑋**、陳俞帆***、蘇鈺炘****

## 摘　要

本研究擴展了 Chen 和 Su（2019）的發現，聚焦於永續經營與生命週期動態中的產業政策，提供了關於產業經濟學中人力資源策略的關鍵見解，並爲政府規劃者提供寶貴的指引。本研究強調了招募一支效率較低的管理團隊相較於招募單一管理者的益處。具體研究發現如下：(1) 在特定條件下，選擇 *n* 位才能水準爲 1 倍的經理，比選擇 1 位才能水準爲 *n* 倍的單一經理更具效益；(2) 當「儲備幹部系統」缺乏學習效應且與外部經理之間的才能差異不顯著時，「空降部隊系統」在經理人招募上表現出更高的效能；(3) 在完善的在職培訓機制下，採用「儲備幹部系統」的企業所達成的努力水準超越了「空降部隊系統」；(4) 初始努力程度、人力資本消耗的時間長短，以及人力資本耗盡後的獲利能

---

* 朝陽科技大學會計系副教授，本文通訊作者，E-mail：shhching@cyut.edu.tw。本文作者非常感謝期刊主編、執行編輯與期刊相關人員，以及兩位匿名審查委員的寶貴建議。

** 國立臺北科技大學設計學院設計博士班博士候選人，E-mail：r24135273@gmail.com。

*** 國立臺灣大學智慧醫療與健康資訊碩士學程碩士生、國立陽明交通大學生物醫學資訊研究所碩士，Email：d25823095@gmail.com。

**** 朝陽科技大學會計系碩士。

DOI：10.7086/TJAE.202412_(116).0005

收件日期：民國 113 年 4 月 8 日；修改日期：民國 113 年 7 月 10 日；

接受日期：民國 113 年 10 月 4 日。

力，是驅動成長的關鍵因素，其中延遲消耗期與企業生命週期內更高的利潤呈正相關。

關鍵詞：儲備幹部系統、空降部隊系統、永續經營、生命週期動態

JEL 分類代號：J24、L53、M51、O15