Modeling the Effects of Innovative Leadership on Productivity and Profitability

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The purpose of this paper is to analyse the effects of innovative leadership on organisational productivity and profitability. A deterministic mathematical model using Runge-Kutta integration was utilised to analyse the effect of innovative leadership. A numerical simulation of the model differential equations disclosed how innovation leadership enables a company to change and adapt to its external environment and by implication enhance its performance. The study revealed that without innovative leadership, the production efforts remain stagnant with low productivity and profitability. Due to a change in the production efforts introduced by innovative leadership, an increase in the level of productivity and profitability is observed. The findings further emphasise that productivity increases with time under the innovative leadership. The proposed mathematical model can be broadly used to analyse the effect of innovative leadership on profitability and productivity within different organisations.

**Keywords:** Innovative Leadership, Productivity, Profitability, Mathematical Model, Numerical Simulation

**Introduction**

Productivity and profitability are commonly used as key performance measurements in organisations. Over the past decades, technologies, work environment and customer needs have evolved. The increasingly global competitiveness has also forced leaders to be innovative. These leaders need to be more creative and innovative than before in order to compete and survive\(^1\). Leadership style has a significant impact on the organisational performance\(^2,3\). Though productivity and profitability can also be used to measure and evaluate the performance of the entire industry, this study looks into the effects of innovative leadership on productivity and profitability in order to measure the organisational performance.

**Productivity and profitability as key performance measurements**

Leadership is a strategy to motivate employees to maximally use their full potentials for the development and growth of the organisation. Thus, the improvement of productivity and profitability is closely linked to the capability and competence of the leadership. In essence, effective leaders understand and accept the complexity and demands of their roles\(^4\). Without an effective and best team leader a company cannot run, not even stand a while in this high competitive world\(^5\). This supersedes how competent the leadership is towards risk orientation. More often, innovation is associated with risk. Many people normally settle for processes and activities which they are comfortable with and exposed to less risk. Therefore, many organisations struggle to see positive changes because their employees are socialised into doing things in the traditional ways of avoiding risk. It is also evident that many organisations are located in the low innovation cultural environment. Consequently, lack of innovative leader and innovation culture within an organisation always manifests itself in low productivity and profitability. Many leaders employed their skills of coaching, mentoring and giving frequent feedback to their employees in order to commit themselves whole heartedly for organisational benefits. It is commonly believed that the impact of innovative leadership plays a significant role on the improvement of productivity and profitability. In order to create an environment that caters for employees’ creativity and wellbeing, it requires an innovative leadership that values the future of the organisation.

**The impact of innovative leadership on productivity and profitability**

Innovation is the successful implementation of creative ideas within a company\(^6\). On the one hand, some studies focused on the importance of innovation leadership in cultivating strategic fit and enhancing organisation performance\(^7\). This gives employees enthusiasm to strive and create opportunities for

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organisational growth. This growth leads to improved productivity and profitability of the organisations. This indicates that innovative leadership enables positive relationships to emerge in organisations which spill off into productivity and profitability. Moreover, successful leaders pay attention to the factors that drive profitability within their organisations. This proves that the harmony between employees and their leaders results in increased productivity and profitability.

On the other hand, the organization must work to develop engagement of employees which encourages and motivates them to develop positive attitudes and behaviours which in turn will enable them to increase their performance to meet the objectives of an organization. However, employees’ participation depends on the attitudes of their leadership. Furthermore, transformational leadership has a weak general effect on profitability. In support of this, a study address that managers need to understand how dynamic capabilities work and will guide them in deploying capabilities in their own organizations. Therefore, this gives an indication why these organisations still struggle to be creative and innovative. Any organization which aspires and thrives to remain competitive in this globalised era should resort to innovative leadership. Indeed, within organisations, communicating leaders should be able to successfully create a balance between their employees, followers, team members and their organisations. Thus, innovation culture depends on the leadership’s ability to develop all potentials of all the employees and their knowledge in contributing to the organizational performance.

Since productivity and profitability are critical to the survival of any company or organisation, the main objective in this study is to propose a deterministic mathematical model that demonstrates the significant role played by innovative leadership in achieving this goal. The model equations are tackled numerically and pertinent results are displayed graphically and discussed quantitatively.

Methodology
Mathematical model formulation

A mathematical model for the effect of innovative leadership on firm productivity and profitability is proposed and tackled numerically using fourth order Runge-Kutta integration method. This study considers a company known for the production of a product y. It is assumed that the production term is of the form

\[ \text{Production term} = qE \text{y} \quad \ldots (1) \]

where \( q \) is the production rate coefficient. The production effort is denoted by \( E \) which represents the amount of time the workers spend in producing y. This production effort also depends on the leadership innovation and the available equipment. The rate of production of y is then given as

\[ \frac{dy}{dt} = qEy \quad \ldots (2) \]

It is also assumed that the company has agreed on an average market price \( P \) per unit product. Thus, the total revenue of the company per unit time is:

\[ \text{Total revenue} = PqEy \quad \ldots (3) \]

The total cost of producing y is assumed to be proportional to the production effort, that is

\[ \text{Total cost} = cE \quad \ldots (4) \]

where \( c \) is the real unit cost of effort for producing y. As a result, the profit of the company for producing y is given by

\[ \text{Profit} = PqEy - cE \quad \ldots (5) \]

From an economic analysis point of view, innovative leadership by the company managers can invariably lead to a change in production effort in order respond to the profit. Therefore, the production effort adjustment due to innovative leadership is defined by

\[ \frac{dE}{dt} = \phi(PqyE - cE) \quad \ldots (6) \]

where \( 0 \leq \phi \leq 1 \) is the innovative leadership parameter. Equation (6) can be easily solved to obtain

\[ E(t) = E_0 e^{-\alpha t} e^\phi q \text{y}^t \quad \ldots (7) \]

where \( E_0 = E(0) \). The expression in (7) revealed that the production effort is higher at the initial stage, however, as time goes by; it decreases as leadership innovative ability improves. It is important to note that \( \phi = 0 \) corresponds to a scenario where the production effort remains constant due to lack of innovation and \( \phi = 1 \) is the parameter limit at which the firm experiences a continuous improvement in the production effort due to innovative leadership.

Results and Discussion
Numerical results and discussion

Equations (6) and (7) can be solved numerically using the fourth order Runge-Kutta integration scheme
and was implemented with MAPLE software mathematics on computer. The following parameter values were used: $P = 10$; $q = 0.05$; $c = 1$; $\phi = 0.1$. At $t = 0$, it is supposed that the quantity of the product $y$ and the production effort $E$ are given by equations (1) and (2) respectively. Figure 1 included the two effects (innovative leadership and a decrease in production cost) on firm’s productivity. From Figure 1a, it is interesting to note that the firm’s productivity increases with time in the presence of innovative leadership as expected. Since an innovative leader managing the firm will stimulate workers’ creativity and commitment to work as well as make available the modern equipment that will enhance the firm production activities. Furthermore, a decrease in the cost of production will also enhance productivity as illustrated in Figure 1b. As the cost of production decreases, the company through innovative managers will be able to increase the production efforts and consequently augment the firm’s productivity. It is observed that the productivity efforts increase over the years under the administration of innovative leadership (Figure 2). This is expected, since an innovative manager encourages workers’ initiatives, making workers responsibility and performance evaluation system clear and explicit, emphasising production task fulfilment, creating an environment in which quality relationships are valued and fostering trust. Figure 3 showed the results demonstrate the effect of innovative leadership (Figure 3a) and a decrease in production cost (Figure 3b) on firm’s profitability. It is noteworthy that innovative leadership is the driving force behind the firm’s increased profitability. As the innovative leader responds effectively to complex technological advancement and events in the external environment, the production efforts change to adapt to the situation leading to an increase in the firm’s net revenue and profitability. Meanwhile, it is interesting to note that the firm profitability also increases with a decrease in the production cost as illustrated in Figure 3. This is expected, since a decrease in the production cost will automatically increase the firm’s net revenue. Based on the results, leadership capability is a key driver of organisational productivity, lack of innovative minded leadership will contribute to the failure for an environment of promoting employees’ creativity and innovativeness. Furthermore, the management of those organisations also struggled to facilitate learning amongst employees. In addition, it is also discovered that organisational learning plays a vital role in enhancing entrepreneurial growth and profitability in those companies focusing on innovativeness and proactiveness. This is confirmed that the leadership style of the wider leadership may have a greater impact on the firm and its performance (i.e. profitability). In addition, leadership communication style
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determines organization productivity. These sentiments support the results of the mathematical model which revealed how important innovative leadership is as far as profitability and productivity.

Conclusion
In conclusion, it is clear that without innovative leadership, the production efforts remain stagnant with low productivity and profitability. Moreover, an increase in the level of company productivity and profitability is observed in the presence of innovative leadership. Organisation seems to strive due to a change in the production efforts introduced by innovative leadership to adapt to the competitive business landscape. In this global village, there are so many reasons that compel companies to innovate, but they require an innovative minded leadership. In addition, the findings emphasise that firm’s productivity increases with time under the innovative leadership. These results show that innovative leadership positively influences companies’ performance.

References