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Lennon, Niels Joseph

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Niels Joseph Lennon *

Aalborg University Business School, Aalborg University, Denmark

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ABSTRACT

The literature has discussed the introduction of incentive structures as a means of achieving a balance between organizational exploration and exploitation. This study posits that this is not a reasonable approach to achieving such a balance. I used a micro-economic model where the explorative and exploitative activities are modeled in accordance with the definitions in March (1991). This model shows that the personal cost to the employee of performing activities was a crucial factor in determining their balancing of resources between exploration and exploitation. However, these personal costs are also the Achilles' heel of such balance calculations because information regarding this type of cost is incomplete and difficult, perhaps even impossible, for the owner or manager to obtain. Based on this and the process and output characteristics of exploratory activities, I argue that it is not appropriate to design a hard, quantitative performance measurement and incentive system to balance resource allocation between explorative and exploitative activities. The study shows that the solution to achieving such a balance must be found outside of the incentive system. Further, I posit that managing R&D departments requires the management to focus on enforcing productive workspaces and norms and not on performance measurement and associated disbursal of rewards/punishments.

1. Introduction

The concepts of exploration and exploitation have been central to organizational analyzes of adaptation, design, learning, competitiveness, and survival (Benner & Tushman, 2003; Gupta, Smith, & Shalley, 2006) since James March published *Exploration and Exploitation in Organizational Learning* (March, 1991a, 1991b). March (1991a, 1991b) discussed the difficulties of the choices that organizations make regarding the allocation of limited resources to exploration and exploitation. Balancing exploration and exploitation was considered impossible due to the inherent differences between the two concepts (Raisch, Birkinshaw, Probst, & Tushman, 2009). However, more recent research describes *the ambidextrous organization* as one that creates positive results and has the power to simultaneously utilize existing skills and explore new opportunities (Birkinshaw & Gibson, 2004; Gupta et al., 2006; He & Wong, 2004; Posch & Garaus, 2020; Raisch et al., 2009; Tushman & O'Reilly, 1996).

The coexistence of explorative and exploitative activities is critical to the success of many contemporary organizations: exploitative activities (incremental innovation) generate the profits necessary for the short run while profits for the long run are generated from explorative activities (discontinuous or radical innovation). R&D activities have a substantial influence on long-term performance for many organizations, particularly those in the high-technology and service industries, thus, the use and coordination of R&D to

* Corresponding author at: Aalborg University Business School, Fibigerstræde 2, 9220 Aalborg Ø., Denmark.
E-mail address: njl@business.aau.dk.

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generate long-term profit should be considered deliberately (Junni, Sarala, Taras, & Tarba, 2013).

Existing literature has identified two overall strategies for improving innovation: externally oriented and internally oriented.

Externally oriented strategy focuses on improving innovation ambidexterity and the balance of exploration and exploitation by using external knowledge gathered by directly sourcing knowledge from suppliers, customers, and competitors (Ardito, Petruzzelli, Dezi, & Castellano, 2020), making upstream or downstream alliances (Ardito, Petruzzelli, & Albino, 2021), and partnering with other firms based on their status (Petruzzelli, 2019). Internally oriented strategy, on the other hand, focuses on developing internal learning by enhancing innovation in one's own production and IT processes (Ardito, Besson, Petruzzelli, & Gregori, 2018). Petruzzelli (2014) also highlights how knowledge acquisition and search can help balance exploration and exploitation by showing that the value of innovation tended to be higher when the balancing of knowledge exploration and exploitation happened across technological and geographical domains than when it was confined to specific domains.

Mazzelli, de Massis, Petruzzelli, del Giudice, and Khan (2020) discuss the factors affecting the outcomes of explorative and exploitative search by presenting two fundamentally different natures of search: ostensive and agentic. They use this theory of the alternative natures of search to show that the cognitive frameworks and social contexts of decision makers influence their approaches to search (ambidexterity vs. specialization). Thus, factors such as organizational ownership structure (family versus non-family firms) and the personal relation of its CEO to the firm (founder, non-founder, or later-generation family member) greatly inform the optimal search approach for the organization.

Another way to balance exploration and exploitation activities is to use a management control system (Bisbe & Otley, 2004; Grabner & Speckbacher, 2010; Malmi & Brown, 2008) for motivational mechanisms such as performance measurement and economic incentivization that aid in the pursuit of organizational goals (Jensen & Meckling, 1976). Prior studies have explained the problem as an issue of spending too much time on exploration while compromising on exploitation, and vice versa (Grabner, 2014). While earlier research argued that creativity and control are incompatible (Speckbacher, 2021), more recent research shows how certain forms of management control can complement creativity and innovation. An example of this kind of control is the use of non-task related subjective performance evaluation to balance exploration with profit generation (Grabner, 2014; Grabner & Speckbacher, 2016). Another way to impact creativity through management control is to provide employees who are exposed to congruent social incentives with financial incentives, even if the incentives provided are incongruent with the overall objectives of the firm (Brüggen & Moers, 2007).

Economic incentivization alone is not sufficient for achieving the optimal balance between explorative and exploitative activities (Bisbe & Otley, 2004; Grabner, 2014; Grabner & Speckbacher, 2016). The present study focuses on the effects of using performance measurement and economic incentivization to balance exploration and exploitation using R&D activities as an example. This paper describes how cultural controls, particularly social norms, can be used to balance exploration and exploration by presenting the development and exemplification of an economic model of employee effort allocation, consistent with Miller (1993).

The rest of this paper is structured as follows: Section 2 reviews the literature on exploration and exploitation and on ambidextrous organizations. Section 3 describes the economic model used to support the argument of the present study. Section 4 discusses performance-based rewards as a managerial tool to manage R&D activities. Section 5 posits performance measurement and economic incentivization as the approach to balancing exploration and exploitation and presents the study's conclusion.

2. R&D activities: exploration and exploitation

According to Gupta et al. (2006), exploration is related to learning and innovation. March (1991a, 1991b) argued that exploration includes activities such as search, variation, risk-taking, experimentation, play, flexibility, discovery, and innovation, and that it is characterized by prospective, insecure, and often even negative results. Jansen, van den Bosch, and Volberda (2006) showed that explorative activities are used by organizations to meet the demands and wishes of new markets and customers.

Exploitation, on the other hand, is associated with concepts such as improvement, choice, production, efficiency, selection, implementation, and execution (March, 1991a, 1991b). The results of exploitative activities, such as improvements in product design and distribution channels, are characterized as being positive and predictable (Jansen et al., 2006).

It is currently unclear whether all activities associated with learning and innovation should be defined as exploration and, similarly, whether exploitation should refer exclusively to activities associated with the use of previous knowledge (Gupta et al., 2006). Tushman and O'Reilly (1996) argue that evolutionary improvements occur over a long time period featuring revolutionary changes from time to time. Following this reasoning, Benner and Tushman (2002) state:

> "Exploitative innovations involve improvements in existing components and build on the existing technological trajectory, whereas exploratory innovation involves a shift to a different technological trajectory."
> Benner & Tushman, 2002, p. 679).

This is in line with March (1991a, 1991b), who argues that all activities in an organization contribute to learning.

In spite of the disagreements regarding their definitions, researchers agree that the activities of exploration and exploitation are contradictory (Gupta et al., 2006; He & Wong, 2004; Levinthal & March, 1993; March, 1991a, 1991b; Pandey & Sharma, 2009; Raisch et al., 2009; Tushman & O'Reilly, 1996):

> *"Adaptive systems that engage in exploration to the exclusion of exploitation are likely to find that they suffer the costs of experimentation without gaining many of its benefits. They exhibit too many undeveloped new ideas and too little distinctive competence.*

> *Conversely, systems that engage in exploitation to the exclusion of exploration are likely to find themselves trapped in suboptimal stable equilibria."*
> March, 1991a, 1991b, p. 71).

Thus, for organizations to survive, they must simultaneously perform activities of exploration and exploitation simultaneously and balance them in terms of their individual contributions to overall value creation (Benner & Tushman, 2003; Gupta et al., 2006; He & Wong, 2004; Levinthal & March, 1993; March, 1991a, 1991b; Raisch et al., 2009; Tushman & O'Reilly, 1996).

However, the optimal amount of exploration and exploitation activities, and therefore the balance of resource distribution resources between the two, is difficult to determine (Gupta et al., 2006; He & Wong, 2004; Levinthal & March, 1993; March, 1991a, 1991b; Pandey & Sharma, 2009; Tushman & O'Reilly, 1996). Balancing resources is further complicated by the fact that the two activities compete for limited resources (Levinthal & March, 1993; March, 1991a, 1991b) and that it is difficult by nature to congruently monitor innovation activities since aspects of the innovating agent's job cannot be measured. Exploitation tends to produce short-term results while exploration contributes to long-term outcomes (Levinthal & March, 1993; March 1991; Tushman & O'Reilly, 1996). Since organizational performance can be expressed as the sum of the results of its short-term and long-term activities, organizations should be aware of the contradictory elements that comprise exploration and exploitation (March 1991). Further, they should take care in their design of control systems that motivate employees in R&D departments to act congruently with the organization's overall objectives (Brüggen & Moers, 2007; Grabner, Posch, & Wabnegg, 2018; Grabner & Speckbacher, 2016) in their effort-level choice and effort-allocation choice (Brüggen & Moers, 2007).

2.1. Myopia in organizations

Levinthal and March (1993) discuss the vulnerability that resides in balancing resources between exploration and exploitation. Organizations learn from experience: through observation of their surroundings and repetition of their production (Levinthal & March, 1993; March 1991). However, experience may be insufficient as a learning tool in a changing world where the things that are presently close to the organization may be in direct conflict with that which is distant from the organization (Levinthal & March, 1993). Further, organizations simplify problems to avoid noise in decision-making and to learn through experience; however, these simplifications might lead to the myopic prioritization of short-term learning at the expense of long-term learning (Levinthal & March, 1993).

Myopia in organizational decision-making leads to the substitution of exploration for exploitation, which, in turn, makes simultaneously providing energy to ensure present and future survival of the organization difficult (Levinthal & March, 1993; March 1991). Researchers have identified two approaches to balancing an organization's explorative and exploitative activities: punctuated equilibrium (Gupta et al., 2006; Raisch et al., 2009) and organizational structure (Birkinshaw & Gibson, 2004; Levinthal & March, 1993; Raisch et al., 2009). Neither of the methods is based on incentive structures.

The choice of incentive structures, including the choice of measures, is among the implicit decisions that organizations make to create a balance between exploitative and explorative activities (Levinthal & March, 1993). However, such choices are difficult in terms of providing a balance, since these activities are varied in their timing and distribution within the organization (March 1991).

Offering incentives in the form of external rewards seems to have a positive impact on the exploitative activities of individuals (Pandey & Sharma, 2009). This is due to the association of incentive rewards with extrinsic motivation (Dewett, 2007). In contrast, intrinsic motivation seems to have a positive influence on exploratory activities (Pandey & Sharma, 2009). According to Dewett (2007), intrinsic motivation impacts an individual's exploratory activities by increasing their willingness to take risks and, by extension, their creativity (Pandey & Sharma, 2009).

However, both intrinsic and extrinsic motivation impact the use of incentive systems (Kunz & Pfaff, 2002), also in the context of innovation (Grabner & Speckbacher, 2016). Intrinsically motivated individual behaviors are a result of underlying psychological needs and emotions, for example, the need to feel competent or doing something for its enjoyment or satisfaction (Ryan & Deci, 2000). An intrinsically motivated individual finds the activities (s)he decides to do motivating in themselves, despite the lack of output and measurable results (Dewett, 2007). However, determining the level and orientation (effort-allocation choice) of the motivation that underlies internally driven behavior is difficult. Therefore, entrusting intrinstically motivated behavior to coordinate the employees' efforts with organizations' objectives is not ideal because such behavior can easily become incongruent with the organization's interests (Grabner & Speckbacher, 2016).

Due to the relationship between intrinsic and extrinsic motivation, the use of external incentives in the form of mechanistic rewards may enhance exploitation while reducing exploration. With regards to the difficulty of finding adequate performance goals for exploratory activity, recent research argues for the use of subjective evaluations and social incentives as a solution (Brüggen & Moers, 2007; Grabner, 2014).

To sum up, the use of incentives is a classic economic approach to avoiding organizational myopia (Levinthal & March, 1993). Raisch et al. (2009) argue in relation to ambidexterity that.

> *"future studies should develop more finegrained accounts that consider the mediators and moderators that may affect the ambidexterity-performance relationship."*
> Raisch et al. (2009, p. 693).

3. Modelling the problem of allocating effort between exploration and exploitation

3.1. Method

This conceptual study develops a model to explain the dynamics of effort allocation between explorative and exploitative activities in an innovation context. The model systematically defines and describes the characteristics of these activities and relates them to the prerequisites of a well-functioning performance measurement system. The model shows how the micro-foundations of innovation tasks and performance measurement systems render them conceptually inappropriate to balance exploration and exploitation.

The model developed is inspired by Banker and Datar (1989) and Feltham and Xie (1994) and is based on a two-person, single-period micro-economic model in line with the model provided in Banker and Datar (1989). In that way the paper describes effort-allocation choice of employees in an innovation context from a theoretical point of view.

3.2. Development of the theoretical model

The model assumes that, from an organizational value generation perspective, an optimal equilibrium exists between exploration and exploitation.

In the model, employee action ($\boldsymbol{a}$) [1] is a vector of action choices, either exploration (a_1) or exploitation (a_2). It is represented by a two-dimensional set of non-negative real numbers, $A \in R^{2+}$. Thus, $\boldsymbol{a}$ is expressed as a vector summing all actions for all time periods in a performance period, where the allocation of action within one time period is binary (a_1= 0 or 1, a_2 = 0 or 1, and $a_1 + a_2 = 1$). Therefore, $\boldsymbol{a} = (a_2, a_2)$.

For simplicity, performance periods are measured in hours in the model. A typical period in the model lasts 37 h, therefore the model comprises 37 action alternatives with each defined as either exploration (a_1) or exploitation (a_2) that are mutually substituting each other, meaning that $a_1 + a_2 = 37$.

The starting point of the model is a situation in which the allocation of actions between a_1 and a_2 is in equilibrium with the organization's value creation. The focal point in the model is, therefore, not the level of work (the moral hazard motivation problem (Lazear & Gibbs, 2009; Scott, 2003)), but the employee's choice of exploration or exploitation. The employee's utility at a given vector of action choices is denoted as a function of the employee's overall utility[2] H($\boldsymbol{a}$).

It is important to note that it is the employee's intrapersonal view of the action, i.e., how the employee conducts the task and not the nature of the action itself that determines whether the task is characterized as a_1 or a_2. This determination depends on whether the action takes place within the 'organizational code', i.e., using existing technology, knowledge, and work norms to improve already present alternatives), or whether it seeks to change this code, i.e., searching for new alternatives to existing technology, knowledge, and work norms.

The organization's value, i.e., the owner's utility, is expressed by *G(v)* (where v is wealth) and is influenced by the employee's choice of activity at every stage: v(**a**,ε). Thus, v is calculated by discounting future cash flow, which is dependent on employee actions **a** (March 1991). $G(v) = G(v(\boldsymbol{a}))$.

The direct personal cost to an employee of performing the vector of actions **a** is expressed as C(**a**) and is dependent on the employee's personal preferences for exploration and exploitation. This personal cost to an employee is defined by Miller (1993) as an increasing marginal cost of effort. This means that the marginal cost of providing more exploratory activity (a_1) is increasing, in the same way as providing more exploitative activity (a_2) will increase the marginal cost associated with exploitation. This model allows for infinite configurations of marginal curves by having their slopes modeled in algebra.

C(a_1) and C(a_2) are the exponentially increasing cost functions for exploration and exploitation, respectively, because the marginal cost function MC(**a**) is modeled as being linear. Since the two actions a_1 and a_2 are substitutes, the opportunity cost, i.e. the marginal cost of a_1 which is the opportunity cost in the substitution of action a_1 for action a_2, is negative. Therefore, in effect, the marginal cost not incurred by substituting action a_1 for action a_2 becomes a utility (marginal benefit, or simply MB) in the substitution decision. This means that substitution of exploration for exploitation implies that the marginal cost of exploration is sacrified (i.e. it becomes a benefit in the decision situation of the employee) when the marginal cost of exploitation is lower than for exploration at the relevant decision situation.

The model is not introducing performance-based rewards to manipulate the optimum; it is concentrating on personal costs both as cost and benefits (when substituting actions).

3.3. Personal costs

The marginal personal cost functions MC (exploration) and MC (exploitation) are expressed as the following functions:

$$mc(exploration) = p + ma_1 \text{ and } mc(exploitation) = q + na_2 \text{ for } n > 0 \wedge \mathrm{m} > 0,$$

where m, n, p and q are constants that model the marginal costs of each activity as straight lines with the slopes *m* and *n*, in accordance

[1] Vectors are denoted in bold.

[2] The utilities of the owner and the employee are modeled as the functions G of H in accordance with Holmstrom (1979).

with a similar model in Miller (1993). As described earlier, a_1 and a_2 express how many units of a_1 and a_2 respectively, an employee chooses to perform, measured in hours of input on the two activities.

The extent of the a_1 marginal cost avoided when an employee substitutes exploration for exploitation (a_1 substituted for a_2) depends on the value of a_1, with the values denoting that the agent has performed a_1 amount of exploration activities as measured in hours. The first substitution of a_1 for a_2 also exposes the agent to the marginal cost of a_2, which is $q + na_2$.

The personal cost curves are illustrated here:

The problem associated with the personal cost curves means that employees have personal reasons for substituting exploration for exploitation, and vice versa, depending on the personal costs and the point on the curve at which they are performing.

If, for example, the company considers it satisfactory for an employee to perform 12 h of exploration and 12 h of exploitation (a_1 and a_2 must equal 37), then the employee will be expected to perform at this point:

The figures illustrate the full costs at a point that is, from the organization's point of view, the optimal allocation point between exploration and exploitation. The slopes of the tangents on the figures show the levels of marginal costs. The different marginal costs mean that the agent will have to make an effort-allocation choice to substitute exploration for exploitation because, in this case, the marginal cost of exploitation is lower than that of exploration, even though the level of the marginal cost is much higher for exploitation than for exploration (which is the case in situations where employees favor exploratory tasks over exploitative tasks). Because the tangent of exploration at $x = 12$ is lower for exploitation than for exploration, and because the first exploitation effort is carried out at the $x = 0$ point in the exploitation curve, the employee does not have enough incentives to substitute exploitation for exploration again before the 37-h time period has elapsed.

This means that an employee will substitute exploration for exploitation until their marginal optimum is reached. This is the point at which the marginal personal cost of exploitation equals the marginal personal cost of exploration – i.e., the point where the slopes of the tangents are the same.

3.4. Empirical example – R&D employee

I exemplified the theoretical model in a simulated R&D department scenario. An employee is asked by their organization to distribute their effort between radical innovation (exploration) and incremental innovation (exploitation) such that their effort

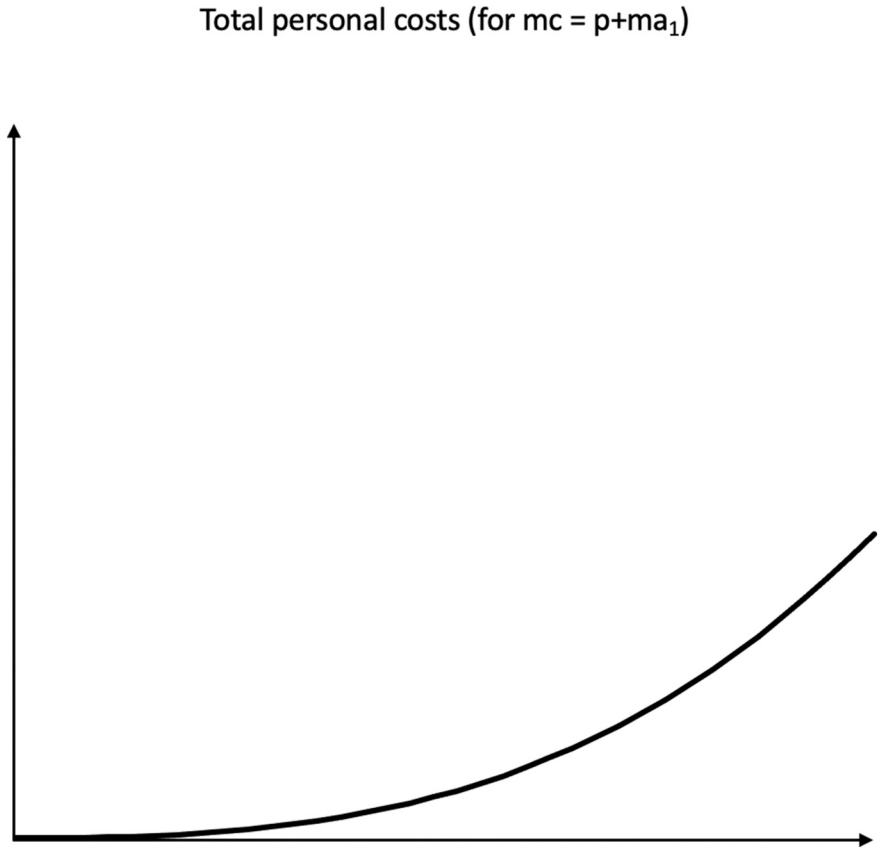

Fig. 1. total costs of exploration and exploitation respectively.
Note: illustrated for low values of mc (p, m q and n).

allocation is aligned with the organization's value creation. Thus, this example assumes that a balance exists between radical and incremental innovation, that this balanced is known by the owner, and that the owner uses this information to instruct the employee on how they should allocate their efforts. However, a potential problem related to this, as Miller (1993) reports, is that the owner essentially does not know the employee's real personal cost function $C(\boldsymbol{a})$, but needs to estimate that to provide reasonable incentives to the employee. This problem implies that the employee can hide or manipulate the owner's perception of the employees personal cost function if (s)he gain personal benefits by doing so (i.e. achieve a different, typically lower, expected performance level on the activities).

The organization in this example derives its value by delivering computer software technology for fighter aircrafts. The employee is highly trained in computer science and gains personal satisfaction from participating in radical innovation since that is where they apply their software skills most intensively. Consequently, participating in incremental innovation entails a larger personal marginal cost to the employee than participation in radical innovation. Thus, the marginal and total costs of exploration and exploitation follow the trends shown in Fig. 1 and Fig. 2, respectively.

In this example, the employee receives a fixed salary and is required to allocate their efforts in accordance with the organization's value creation equilibrium. However, since the owner cannot directly monitor the activities of the employee (explorative or exploitative), they have incomplete information on the effort allocation by the employee. Thus, the employee is ultimately the only one who knows if they have contributed to incremental or radical innovation.

The personal cost to the employee factors into their personal motivation to substitute radical innovation (Fig. 3) with incremental innovation (Fig. 4), which is not in the owner's interest. Consequently, the employee's decision shifts the effort-allocation choice away from the owner's optimum. Since the owner does not achieve the same short- and long-term gains from the two innovation activities, they will not receive the expected value out of the employee's actions.

The owner can try to solve this inexpediency by introducing performance-related rewards that act as stronger incentives for participation in incremental innovation (Brüggen & Moers, 2007).

In essence, the problem is one of risk. The owner wants to encourage the employee to perform more radical innovation activities, such as, in this case, the development of new software. However, the employee is risk-averse and prioritizes the activity with lower risk when offered the same reward (Roberts, 2004). Though this prioritization can be changed by paying a higher risk premium for radical innovation activities, the employee performance of these activities is difficult to measure precisely and completely (Brüggen & Moers, 2007; Friis, 2011) and presents a higher risk for the employee due to the incompleteness of the performance measure (Milgrom & Roberts, 1992). The owner cannot conclusively determine whether the employee is actually performing radical innovation or simply

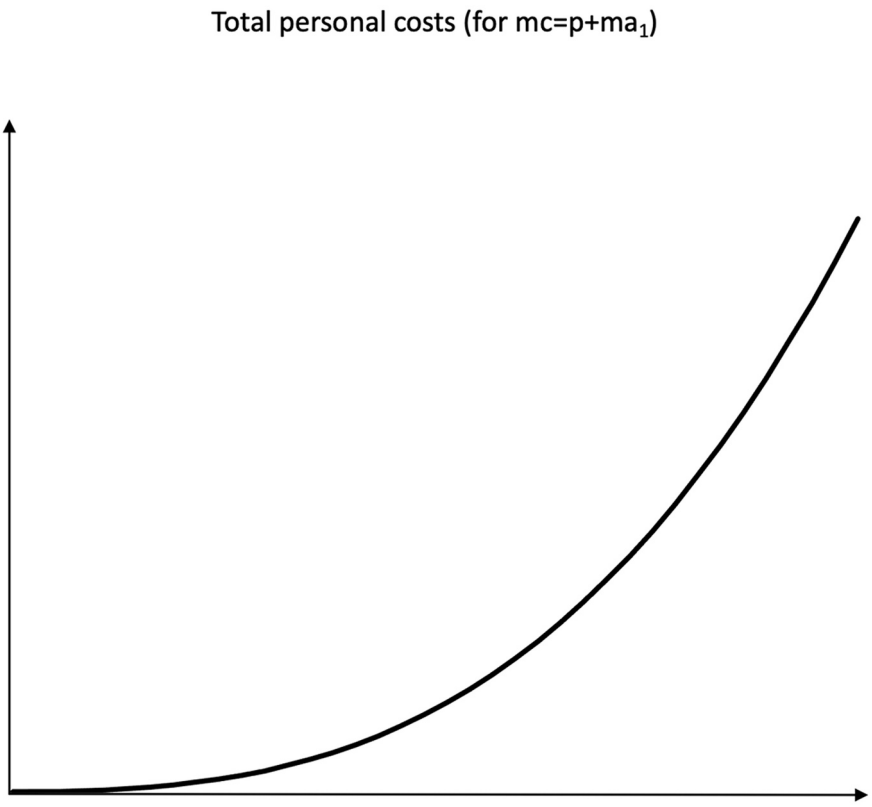

Fig. 2. total costs of exploration and exploitation respectively.
Note: illustrated for high values of mc (p, m, q and n).

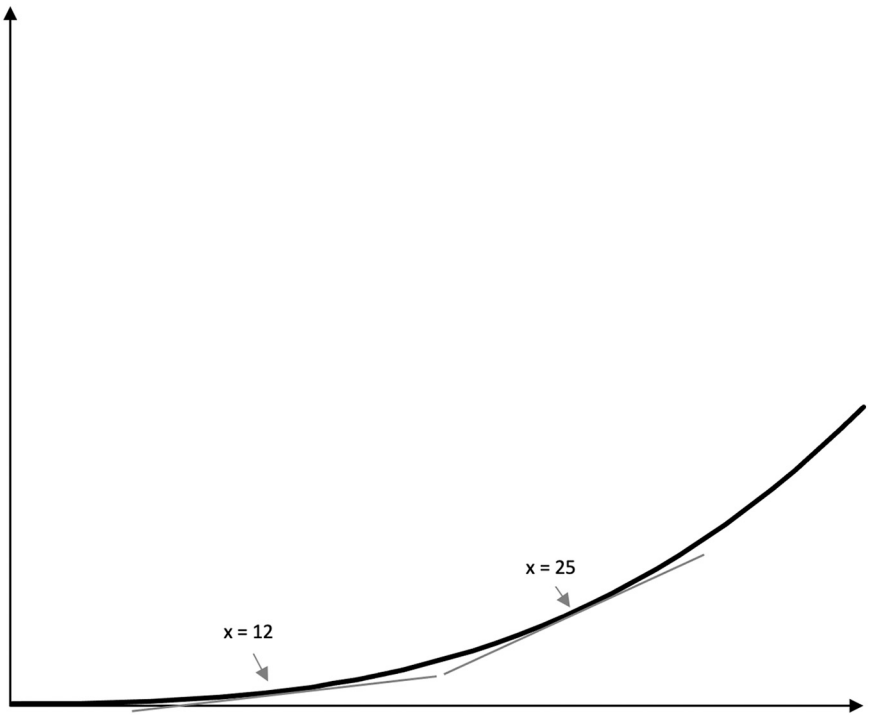

Fig. 3. Example: total costs of exploration.

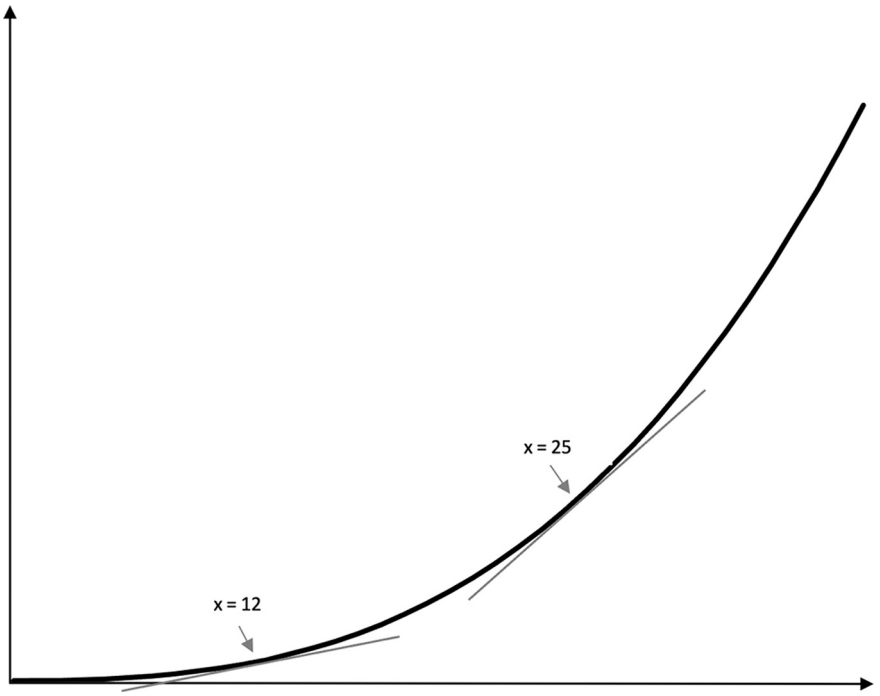

Fig. 4. Example: total costs of exploitation.

pretending to do so while actually performing incremental innovation to increase their own rewards. An example of this is the employee borrowing from existing knowledge and technology in their radical innovation activities, thereby not performing explorative activities and delivering a lower value to the owner than they would expect from radical innovation.

4. Discussion

4.1. Implications – problematizing performance measurement as a solution

This model showcases the problems associated with using incentive structures to balance exploration and exploitation in an ambidextrous organization. It has been exemplified through incremental and radical innovation in an R&D department scenario. The implications of this model resonate with the point made by Grabner, Posch, & Wabnegg, 2018 that performance and behavior monitoring hinder and organization's innovation capability.

4.1.1. The introduction of performance-based rewards

Employee utility is expressed in terms of the utility function, which is dependent on the outcomes of the vector of actions, **a,** and the reward that the owner provides for a_1 and a_2.

Introducing performance-related rewards alter the benefits of the two activities by creating incentive structures that manipulate employees into prioritizing a_1 over a_2 in line with the owner's ambidexterity equilibrium, given that the performance measure reflects the real task-related effort-allocation choice of the employee (Brüggen & Moers, 2007). This leads to two problems when it comes to measuring the performance of exploration activities:

1) The employee's risk exposure: the uncertainty of measurement results in different risk premiums on a_1 and a_2
2) Uncertainty of measurement and distorted behavior: exploration and exploitation performances are measured in accordance with the definitions of their activities and the information produced regarding employee effort allocation (a_1 or a_2) is asymmetric

Both points we be discussed below.

4.1.2. Risk exposure

The risk premium relates to the specific component of the salary that is beyond the control of the employee (uncontrollable events, Holmstrom (1979)).

This model assumes that this risk premium is the same in a_1 and a_2, i.e., the employee is compensated with a fixed salary ($\sigma^2_{\text{pay}} = 0$) and not performance-based rewards. When performance-related rewards are introduced to construct an optimum by aligning the employee's interests to those of the owner, a measurement problem emerges due to the utilization of asymmetric information: the performance measure does not accurately represent the employee's effort allocation.

The determination of risk premium is related to employee risk aversion (Milgrom & Roberts, 1992). Employees are typically risk-averse, meaning that they prefer a fixed salary over variable rewards and will, therefore, bear the risk of receiving a variable reward rather than a fixed salary only when the risk premium associated with the variable reward is high enough to compensate adequately for the risk exposure.

The risk premium is related to measurement uncertainty (Milgrom & Roberts, 1992), and is therefore dependent on the quality of exploration and exploitation performance measurement and employee risk aversion (Holmstrom, 1979; Lazear & Gibbs, 2009), meaning the more risk averse employees the higher the risk premium needs to be. Thus, the amount of risk premium to be paid depends on the marginal cost of a_1 and a_2 to the employee adjusted to their risk aversion and, in situations where the pay is dependent on task-based performance measures, on the completeness of the measure of a_1 and a_2 performance (Friis, 2011). Grabner (2014) suggests that in creativity-dependent settings, the inadequacy related to such performance based pay arrangements can be handled by using it jointly with non-task-related subjective performance evaluations. In order to do so, the organization must be aware of two things: First, the task-based performance measurement of exploratory activities is more expensive than that of exploitative activities since the higher measurement uncertainty of the former necessitates the generation of more information, which is more costly to obtain. Second, introducing subjective evaluations will cause the performance measures to be limited to the motivations and biases of the evaluator (Grabner, 2014; Prendergast & Topel, 1993).

Evaluating the effort-allocation choice of an employee is associated with high degrees of measurement incompleteness since only the employee knows if their actions have been explorative or exploitative for each time period, *t*.

4.1.3. Uncertainty of measurement

Because of the process uncertainty that characterizes exploratory activities (March 1991), they often do not lead to the production of outputs. Thus, the performance of exploratory activities is measured based on input objectives or process goals.

Input measures are also unsatisfactory indicators of whether effort allocation has been explorative or exploitative because potential moral hazard scenarios (e.g., Holmstrom, 1979) can cause ex ante decisions to differ from the actual actions taken by the employee. Miller (1993) argues that the personal costs to the employee of conducting certain activities are responsible for the differences between their ex ante effort decisions and actions; if performing explorative activities comes with higher marginal costs than marginal benefits, then the employee will exploit rather than explore (given that the real-time marginal net benefit of performing the exploitative activity is higher than that for performing the explorative activity).

4.2. Problems associated with using performance measurement to balance incremental and radical innovation

March (1991) describes the problems with finding a balance between exploration and exploitation in the specific social context of

an organization. First, organizational knowledge is not static but evolves with changes in organizational procedures, norms, rules, and structures. This implies a constantly shifting equilibrium, indicating that there is no single balance to be calculated between exploration and exploitation, but that they require continuous balancing. Second, organizations compete against each other for relative superiority. Thus, the balance of resource allocation for exploration and exploitation depends on the investment calculations made during the search for this very balance. However, these investment calculations change continuously, not only due to the production of knowledge in the organization, but also because of the changing strategic importance of knowledge in relation to a competitive environment that is measured against the competitors (March 1991).

Thus, performance measurement that starts out by assuming that a stable optimal balance between exploration and exploitation exists can be rationally determined conflicts with March's definition of organizational learning.

4.3. Possible directions for practice

Miller (1993) suggested reducing the negative impact of personal costs on firm performance through a cooperative management philosophy. Further, in "The technology of foolishness", March breaks away from rational decision-making theory (March, 1971). Based on these perspectives, this study presents the conduct of managers as a determiner of the balance between exploration and exploitation.

Mechanistic approaches to balancing exploration and exploitation are inadequate since they assume that ex ante determination of this balance is effective. However, this contradicts March (1991)'s original discussion and conceptual definitions. Thus, the existence of rational decision models should not be assumed in the continuous balancing of explorative and exploitative activities. March (1971) argues that the ideals of rational decision-making are embedded in both Western theory and culture. Decision makers search for the appropriate rules to follow (i.e., the logic of appropriateness); their search is characterized by the question "what is appropriate for a person like me in a situation such as this" (March, 1991b, p. 105). The evaluation of alternative possibilities requires ex ante ideas of consistent goals. However, as March suggests, differentiating between setting goals and making decisions as two separate and independent processes with the former occurring first is the definitively wrong approach in many cases:

> *"It seems to me perfectly obvious that a description that assumes goals come first and action comes later is frequently radically wrong. Human choice is at least as much a progress for discovering goals as for acting on them. Although it is true enough that goals and decisions are 'conceptually' distinct, that is simply a statement of the theory."*
> March (1971, p. 256).

Thus, managing explorative and exploitative activities is no longer about balancing the resource allocation between the two activities based on presupposed knowledge about the organizational goal. The present approach understands that the organization needs both activities and that the organizational goal develops over time. Thus, the organization cannot reasonably allocate resources to explorative and exploitative activities prior to the process of conducting those activities because the goals change along with the learning that happens in the process.

Management should focus on constructing spaces in which both explorative and exploitative activities can unfold, and where explorative activities have a potential to develop "the scope, complexity, and awareness of the world" (March, 1971, p. 257). By facilitating activities that are inconsistent with the present organizational goals, management should encourage employees to develop more interesting motivations.

Managing organizational spaces for exploration where the goals of such explorations are unknown since they are co-produced as part of the process, comes with fluidity and uncertainty. March writes:

> *"Perhaps we should explore a somewhat different approach to the normative question of how we ought to behave when our value premises are not yet (and never will be) fully determined."*
> March (1971, p. 259).

In the context of balancing exploration and exploitation, this could be read in one of two ways: 1) arriving at a balance of resource allocation between exploration and exploitation is an impossible management objective since we do not know the most adequate task allocation ex ante and 2) in an ambidextrous organization, management is about exploring activities that contradict with conventional decision theory; thus, we should not rely on the assumptions underlying conventional decision theory, namely the preexistence of purpose, necessity of consistency, and primacy of rationality.

Effective management entails dealing with the uncertainty of search without trying to domesticate it by using rational decision-making technologies such as organizational structures, punctuated equilibria, or economic incentives. Here, incentivization is more in line with the creation of efficient social incentives (Brüggen & Moers, 2007), such as updated social norms, at the workplace (Miller, 1993).

5. Conclusion

This study highlights the problems associated with using performance measurement and incentivization constitute a means to balance the resource allocation between exploration and exploitation in ambidextrous organizations and presents two arguments for the same: First, the reliance on performance measurement is based on the assumption that organizations can determine an appropriate balance of resources between explorative and exploitative activities ex ante. This assumption has been shown to be problematic because the balance shifts continuously (March 1991), thus the optimal effort-allocation choice moves over time. Second, even if the

organization is successful in approximating an adequate balance, implementing it reasonably in an incentive-based environment is difficult. This is because it is not possible to measure whether the employee is performing exploration or exploitation, thereby allowing the employee to manipulate their resource allocation. Furthermore, the risk premium for exploratory activities needs to be high for risk-averse employees; thus, allocating the risk to the employee via performance-based rewards is economically inefficient.

Thus, instead of rewarding or punishing employees based on their performance measures, managers should follow the approach suggested by March (1971) and disregard the temptations from rational decision-making and extrinsic incentives, for example through the design of a performance measurement system. Instead, managers in ambidextrous organizations should consider facilitating organizational conditions that allow employees to perform explorative activities, which are characterized by not having explicitly pre-formulated goals. This entails creating organizational conditions that promote both explorative and exploitative activities, which, in turn, leads to more discontinuous radical exploration than can be achieved through economic incentivization alone.

Credit author statement

Niels Joseph Lennon: Conceptualization, Formal analysis, Writing- original draft, Writing- review and editing, Visualization.

Declaration of Competing Interest

None.

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