

Can Exploitation and Exploration Help to Sustain Organizational Longevity?

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Abstract

A common belief among management scholars is that exploitation is for ‘current viability’ and exploration is for ‘future viability’; yet this proposition received surprisingly little empirical scrutiny. This study fills this void by investigating longevity implications of exploitation and exploration. An analysis of 20-year data from the hard disk drive industry reveals that exploitation, independent of exploration, has a positive impact on organizational longevity; and exploration, independent of exploitation, has a curvilinear impact on organizational longevity. Jointly, exploitation can weaken the curvilinearity between exploration and organizational longevity.

Introduction

An enduring belief among management scholars is that exploitation is for ‘current viability’ and exploration is for ‘future viability’ [1, 2]; yet this proposition received surprisingly little empirical scrutiny. Much of the work to date has mainly revolved around *time-invariant*- [e.g. 3], *retrospective*- [e.g. 4], *concurrent*- [e.g. 5], *subsequent*- [e.g. 6; 7], and *projected*- [e.g. 8] financial-or-innovation performance consequences of exploitation and exploration – None of these studies have looked into the longevity implications of exploitation and exploration. The lack of empirical verification on the longevity implications of exploitation and exploration is disconcerting since the dual notion of exploitation and exploration received so much attention precisely because researchers are concerned about firms’ long-term prospects [2]. They attribute organizational longevity as the primary motivational factor in explaining firms’ pursuit of exploitation and exploration [2], a necessary condition for positive profits [9], a direct measure of organizational failure [10], and an important parameter in evaluating the long-term prospects of exploitation and exploration [1]; yet they give it disproportionately less empirical scrutiny relative to other performance measures. More work is thus warranted to further advance our understanding of longevity implications of exploitation and exploration. In keeping with the common view of exploitation and exploration [6], this study conceptualizes exploitation as repetition or refinement of a firm’s existing products aimed at improving existing product-market domains and exploration as development of new products aimed at entering new product-market domains. These conceptualizations conform to March’s description of exploitation and exploration as two ends of a single continuum [11, 2]. Based on these conceptualizations, this study posits that an increase in exploitation intensity can undermine organizational longevity; an increase in exploration intensity can potentially extend

organizational longevity up to a level and then undercut it; together, exploitation and exploration can offset each other's longevity impacts to the extent that the curvilinear relationship between exploration intensity and organizational longevity will be weakened in the presence of increasing exploitation intensity. By empirically testing these propositions, this study aims to add additional specificity and insights into research on exploitation and exploration.

Theory and Hypotheses

Longevity Implication of Exploitation

An increase in exploitation intensity can beget a shortened organizational longevity. This is because “adaptive processes in organizations are implicitly local in their time and space perspectives” [12]. Firms are prone to “give a favor position to alternatives whose benefits are local in time and space and whose costs are distant in time and space” [12]. Relative to new alternatives, the existing alternatives tend to produce significantly better outcomes in the near term. Therefore, as firms increase their exploitation intensity, they fall into the competency trap by attending to a number of local peaks in close neighborhood of their original local optima [1, 16]. The attractiveness of local peaks (existing alternatives) drives out the pursuit of novelty (new alternatives) (1). It enhances the degree of automatic responses or mindless behaviors to the extent that firms become increasingly insensitive to small errors or variations [17]. Even though there may be many new alternatives available internally or externally [18, 19], they are largely ignored or silenced [20]. The emphasis on existing alternatives deprives firms of the opportunity to extend their lifespan into the next success. It will inevitably undercut organizational longevity. For that reason, this study hypothesizes that:

Hypothesis 1: A firm's exploitation intensity is negatively related to organizational longevity.

Longevity Implication of Exploration

In respect of exploration intensity, this study suggests that an increase in exploration intensity can extend organizational longevity up to a level and then lead to a diminution. On the one hand, as firms gradually increase their exploration intensity, they tend to experience a prolonged organizational longevity. Two reasons explain why this is the case. First, explicit exploration effort can shift firms' focus from existing alternatives to new alternatives [12]. Even though the notion of competency trap dictates that “alternatives that have experienced relatively good outcomes in the past are more likely to be sampled than the alternatives that have experienced relatively poor outcomes” [12], an emphasis on exploration can break this trap by shifting firms' focus from the immediate payoff of existing alternatives to the long-term prospects of new alternatives [21]. Second, a gradual increase in exploration intensity also helps to realize the performance potential of new alternatives. This is because a gradual increase in exploration intensity enacts a mode of slow learning of choices: Instead of quickly eliminating new alternatives, firms deliberately delay their reactions to these new alternatives – They experiment with the new alternatives for an extended period of time before their benefits or damages to be discovered [12, 2]. Even though the new alternatives generally start with poor returns before producing any good returns, “slower learning allows for greater exploration of possible alternatives” [2] and provides firms with longer time to turn these alternatives into ‘good luck’ [12]. In that sense, a gradual increase in exploration intensity has a greater potential in helping firms to realize the longevity benefit of exploration.

However, as firms turn into frenzies of exploration, their organizational longevity is likely to decrease. This is because too much exploration triggers ‘dynamic failure’ in the sense that firms experiment with too many new alternatives at an escalating rate without gaining much competency [1]. The shorter duration of experimentation deprives each new alternative of the practices it needs to reveal its performance potential; consequently, firms fall into the tendency of quickly eliminating these new alternatives and switching to the next one. By doing so, these firms subject themselves to the vicious cycle of “failure leads to search and change which leads to failure which leads to more search, and so on. New ideas and technologies fail and are replaced by other new ideas and technologies, which fail in turn” [1]. “This puts development activity in a catch-22 mode: Priorities continually shift and people are moved from one project to another as the organization robs Peter to pay Paul in hopes of completing projects as scheduled” [22]. With ‘too many underdeveloped new ideas and too little distinctive competence to sustain their long-term viability’ [2], these firms are likely to lose their organizational longevity. Taken together, the above discussion conveys a central idea that exploration of the next success is essential in sustaining organizational longevity [12], yet the next success is not built overnight [23]. It takes time for any new alternatives to transform from initial seed ideas, to concept development and testing, to business analysis, to market testing, to technical implementation, and to commercialization. Since “the preparatory work for the project in the early phases of the NPD process (‘initial screening’, ‘preliminary market and technical assessment’) are decisive for the success of new products” [24], a frenzy of exploration can only accelerate firms’ failure in their various attempts of exploration [25, 26]. Therefore, “the best way to complete more projects on time, on budget, and on target is to do fewer projects and to assign scarce resources to, at most, one major and one minor project” [22]. In other words, firms need to maintain a moderate level of exploration intensity in order to sustain their organizational longevity.

Hypothesis 2: There is an inverted-U-shaped relationship between exploration intensity and organizational longevity.

Longevity Implication of Both Exploitation and Exploration

Till this point, the discussions have revolved around the individual main effect of exploitation and the individual main effect of exploration on organizational longevity. These main effects may hold if, and only if, exploitation and exploration do not interfere with each other. However, within the same timeframe, exploitation and exploration compete against each other for scarce resources [2], organizational designs [27, 28], strategy [29], legitimacy [30], attention [31], culture [32], and endowments from top management teams [15, 6]. The interaction between them may trigger an offsetting effect in that increasing exploitation intensity can weaken the longevity implication of exploration.

When exploration intensity remains low to moderate, its longevity benefit tends to increase at a diminishing rate in response to increasing exploitation intensity. This is because an increase in both exploitation- and exploration-intensity amplifies the tension between existing alternatives and new alternatives [2]. On the one hand, increasing exploitation intensity elevates the attractiveness of existing alternatives since firms can “develop greater and greater competence” in these existing alternatives [1]; on the other hand, increasing exploration intensity also heightens firms’ prospects for new possibilities [2]. As the salience of both existing- and new-alternatives escalates, tension builds up. The direct head-to-head competition between exploitative and exploratory initiatives overstretchs organizational resources and interrupts firms’ engagement in new alternatives [21]. The greater the interruption from exploitation, the

less likely firms would be able to fully engage in new alternatives. In that sense, increasing exploitation intensity has the potential to reduce the magnitude of the longevity benefit of exploration. Alternatively, as firms turn into frenzies of exploration in the presence of increasing exploitation intensity, they may suffer a less degree of longevity loss. This is because, as pointed out earlier, the heightened tension between exploitation and exploration holds firms back from escalating commitment to exploration. It slows down the cycle of failure in the sense that firms become less enthusiastic about experimentation, change, and innovation. The slowdown of the cycle would thus subject firms to risk of failure at a lower rate.

Taken together, the above discussions suggest that an increase in exploitation intensity can weaken the longevity implication of exploration by decreasing the degree of curvilinearity between exploration intensity and organizational longevity. This leads to the following hypothesis:

Hypothesis 3: Exploitation intensity negatively moderates the relationship between exploration intensity and organizational longevity.

Method

Sample and Data

The primary data are derived from the Disk/Trend Report, an annual journal that details all technical and performance information on each design of disk drives assembled or introduced by firms in the world, including Asia, Europe, and America. From this data set, all firms with more than two years of operational data were selected, which was necessary to construct lagged independent variables and to construct various measurements. The final data set contains 98 firms spanning from year 1980 to year 1999.

Measurements

Dependent variable

Longevity is measured as the number of years a firm has remained in the HDD industry from year $t+1$ to year of exit (or to year 1999 if the focal firm survived 1999).

Independent variables

From 1978 to 1999 the HDD industry had experienced at least four major transitions of product-market domains, and each domain involved different diameter sized disk drives or “form factors,” from the original 14-inch diameter drives, to 8-, 5.25-, 3.5-, and 2.5-inch in size. Using different sized disks (form factors) as indicators of different market segments, this study thus defines exploitation as repetition or refinement of a firm’s existing form factors and exploration as development of new form factors. Accordingly, *exploitation intensity* is measured as the number of designs for existing form factors that are produced by a firm in year t , and *exploration intensity* is measured as the number of designs for new form factors that are first introduced by a firm in year t .

Control variables.

Form factors is measured as the number of products firms produced in year t . *Years lapse* is measured as the number of years elapsed since the year the new form factor was first introduced into the market till the year the new form factor was first assembled by the focal firm. *Leap* is measured as the density difference between a firm’s best drive in year t and the industry’s best

drive in year t-1. *Nation* is measured as a dummy variable for non-US firms, with US firms as the omitted category. *Age* is measured as the number of years elapsed since the firm was founded. *Density* is measured as the number of firms competing in the HDD industry in year t. *Disk sales* is measured as the annual disk sales for each firm in millions of dollars in year t. *Organization types* is measured as three dummy variables (*non-spin-outs*, *incumbent-backed*, and *diversifying entrants*), with *spin-out* as the omitted category. *Industry sales* is measured as the total industry sales in year t, in millions of dollars.

Analysis

To correct the censoring problem in event history analysis, this study employs the Cox Proportional Hazard Model [33].

Results

Table 1 shows the means, standard deviations, and correlations for the key variables, and Table 2 presents the results of the Cox Proportional Hazard analyses. Model 1 is the baseline model of controls; Model 2 and 3 add *exploitation intensity* and *exploration intensity* (to test Hypotheses 1 and 2); and Model 4 includes the interaction terms (to test Hypothesis 3). Model 2 shows that the hazard ratio for *exploitation intensity* is significantly lower than 1 (hazard ratio = 0.98, $p < 0.05$), suggesting that increasing *exploitation intensity* helps to prolong organizational *longevity*. Model 3 reveals that the hazard ratios for *exploration intensity* and *exploration intensity*² are, respectively, significantly smaller than 1 (hazard ratio = 0.08, $p < 0.001$) and greater than 1 (hazard ratio = 2.98, $p < 0.001$), suggesting an inverted-U-shaped relationship between *exploration intensity* and a firm's hazard ratio – meaning relative to those who explore too little or too much, the ones with a moderate level of *exploration intensity* tend to survive longer. Model 4 shows that the hazard ratio for *exploitation intensity***exploration intensity* – the lower order interaction term – is significantly greater than 1 (hazard ratio = 1.03, $p < 0.05$) and the hazard ratio for *exploitation intensity***exploration intensity*² – the higher order interaction term – is significantly lower than 1 (hazard ratio = 0.99, $p < 0.1$), suggesting the curvilinearity between *exploration intensity* and organizational *longevity* is weakened in the presence of high *exploitation intensity*.

Table 1. Descriptive Statistics and Correlation Matrix

Variable	Mean	S.D.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.Longevity	6.54	5.88	1													
2.Exploration intensity	0.44	1.53	0.11*	1												
3.Exploitation intensity	11.98	15.19	0.37*	0.23*	1											
4.Form factors	1.85	2.23	0.19*	0.17*	0.43*	1										
5.Years lapse	2.88	2.66	-0.17	0.25*	-0.06	-0.04	1									
6.Leap	-4120.06	5964.41	0.14*	0.08	0.06	0.10*	-0.08	1								
7.Nation	0.38	0.49	0.08	-0.01	-0.002	0.03	-0.23	-0.06	1							
8.Age	31.97	30.34	0.16*	0.04	0.23*	0.11*	-0.08	0.005	0.44*	1						
9.Density	56.18	15.06	0.04	0.004	-0.19*	0.01	-0.02	0.74*	-0.01	-0.05	1					
10.Disk sales	424.93	1265.51	0.27*	0.10*	0.68*	0.26*	-0.04	0.04	-0.13*	0.21*	-0.22*	1				
11.Non-spin-out	0.09	0.28	-0.06	-0.01	0.01	0.005	0.01	-0.02	-0.21*	-0.17*	-0.01	-0.05	1			
12.Diversifying entrants	0.5	0.5	0.16*	-0.02	0.07	0.03	0.05	0.01	0.47*	0.61*	-0.01	0.11*	-0.31*	1		
13.Incumbent-backed	0.18	0.38	-0.21*	0.01	-0.12*	-0.01	-0.05	0.09*	-0.11*	-0.16*	0.05	-0.13*	-0.15*	-0.47*	1	
14.Industry sales	16952.8	7921.2	-0.22*	-0.004	0.19*	0.05	0.32*	-0.61*	0.08	0.01	-0.46*	0.24*	-0.08	0.04	-0.17*	1

* Values are unstandardized regression coefficients, with standard errors in parenthesis

* $p < 0.01$

Table 2. Results of Cox Proportional Hazard Estimates^a (N = 543)

	Model 1	Model 2	Model 3	Model 4
Exploitation intensity		0.98*	0.95*	0.88***
		-0.01	-0.02	-0.03
Exploration intensity		0.99	0.08***	0.63 [†]
		-0.07	-0.03	-0.17
Exploration intensity²			2.98***	1.03*
			-0.66	-0.02
Exploitation intensity *exploration intensity				1.03*
				-0.01
Exploitation intensity *exploration intensity²				0.99 [†]
				-0.001
Years lapse			0.99	0.86
			-0.04	-0.12
Form factors	0.93	0.98	0.77 [†]	1
	-0.08	-0.04	-0.11	-0.04
Leap	1	1	1.00 [†]	1.00 [†]
	-0.00003	-0.00003	-0.0001	-0.0001
Nation	0.72	0.76	0.92	0.98
	-0.16	-0.16	-0.28	-0.27
Age	1	1	0.99	0.99
	-0.003	-0.003	-0.01	-0.01
Density	1	1	1.01	1.02
	-0.01	-0.005	-0.01	-0.01
Disk sales	1.00**	1.00*	1	1
	-0.001	-0.001	-0.0002	-0.0003
Non-spin-out	1.64	1.77 [†]	7.02***	7.95***
	-0.53	-0.55	-3.91	-4.19
Diversifying entrants	1.32	1.26	3.17*	3.16*
	-0.38	-0.37	-1.64	-1.48
Incumbent-backed	2.17***	2.19***	5.37***	7.01***
	-0.51	-0.51	-2.51	-3.06
Industry sales	1.00***	1.00***	1	1
	-0.00001	-0.00001	-0.00003	-0.00003
Wald chi2(12)	49.75	56.2	82.27	71.67
Log pseudolikelihood	-3286.3573	-3248.1318	-326.70803	-324.63881
Prob > chi2	0	0	0	0

^a Values are hazard rates, with robust standard errors in parenthesis

[†] p<0.1; * p<0.05; ** p<0.01; *** p<0.001

Discussion and Conclusions

This study is designed to explicitly examine the main- and the interaction-effects of exploitation and exploration on organizational longevity. For the main effect of exploration, this study

confirms that there is a curvilinear relationship between exploration intensity and organizational longevity, meaning firms need to maintain “a reasonable level of exploration” in order to sustain organizational longevity [2]. As for the main effect of exploitation, this study reveals a positive, linear relationship between exploitation intensity and organizational longevity – An increase in exploitation intensity can extend, rather than inhibit, organizational longevity. This finding is quite surprising since it contradicts the normative belief that excessive exploitation leads to competency trap which triggers organizational failure. Nonetheless, a closer examination of the exploitation-exploration literature reveals that, the so called “competency trap” – the negative effect of exploitation on organizational longevity – is not merely an independent effect of exploitation on organizational longevity but a ‘dysfunctional rigidity effect’ of exploitation on exploration [34], meaning an increase in exploitation intensity triggers a stronger tension between exploitation and exploration, which suppresses exploration, which in turn undercuts organizational longevity [1, 2]. Exploitation itself, as shown in this study, does not have that dire consequence on organizational longevity – It is the interaction between exploitation and exploration that deserves further scrutiny.

An empirical investigation into the interaction effect further testifies that the tension does exist between exploitation and exploration – An increase in exploitation intensity can reduce the degree of curvilinearity between exploration intensity and organizational longevity. This finding suggests three scenarios firms can choose in managing the tension between exploitation and exploration: 1) they can choose to minimize the tension by decreasing their efforts in both exploitation and exploration, minimizing their effort in exploration, or minimizing their effort in exploitation; 2) they can choose to maximize the tension by intensifying their efforts in both exploitation and exploration; or 3) they can go for the middle ground by keeping a moderate to high level of exploitation and a moderate level of exploration. While it is unwise to keep the tension high due to its offsetting effect on organizational longevity (scenario 2), it is equally unwise to keep the tension low by disengaging in exploitation and/or exploration since too little of either exploitation or exploration can jeopardize organizational longevity (scenario 1). Firms need to maintain a moderate level of the tension between exploitation and exploration so to keep the main effects of exploitation and exploration strong (scenario 3). Ultimately, it is the main effects, not the interaction effect, that can potentially sustain organizational longevity. Firms need to focus their dedication on the main effects, while embracing the tension as an integral part of their endeavors, in pursuing their long-term wellbeing.

Overall, this study made three contributions. First, it is one of the few studies that systematically examined the longevity implications of exploitation and exploration. Second, this study adds specificity and precision to our understanding of the longevity implication of exploitation and exploration. It clarifies that the commonly perceived negative relationship between exploitation and organizational longevity may merely reflect the inhibiting effect of exploitation on adaptation when exploitation crowds out exploration [35], builds up core rigidities [36], or sets up co-evolutionary lock-in [29]. Independently, though, exploitation can prolong organizational longevity.

Third, this study adds to the growing literature on how to balance exploitation and exploration. Existing research on this topic has taken such a deep root in the tension view that the general inquiry of how to balance exploitation and exploration becomes less of how to optimally combine exploitation and exploration, but more of how to avoid the tension between them. This tension-oriented approach is understandable since existing research on ambidexterity has mainly revolved around its immediate payoff when the tension is compellingly strong. Nonetheless, this

study advises from a long-term perspective that the balance may reside less in the minimization of the tension, but more in the optimization of the joint main effects of exploitation and exploration.

In conclusion, this study examined a fundamental question in research on organizational learning and adaptive change: What are the longevity implications of exploitation and exploration? By unpacking and testing this fundamental question, this study provides supportive empirical results in advancing our understanding of exploitation and exploration.

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