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Co-creation Strategies and High-Tech Companies Performance

Samineh Soltanzadeh

Faculty of Entrepreneurship, University of Tehran, 16th Street, North Kargar Avenue, Tehran, Iran,

samin.soltanzade@gmail.com

ABSTRACT

High-tech products have certain salient characteristics that differentiate them from low-tech marketing practices. Technology development is highly relevant to the consumers that want to apply a complex product to their daily life routines. Co-creating value with customers would help increase the high technologies performance that face high uncertainties. The aim of this article is to examine the co-creation strategies relation to performance in high-tech companies. After explaining the different co-creation strategies in the literature we examined these strategies effects on performance via structural equation modeling methodology. Research sample was Tehran university spin-off companies which are located in Science and Technology Park of Tehran University. We developed a questionnaire based on the characteristics of each strategy and asked the managers of companies to evaluate the strategies relevance to their marketing practices. Results indicate that in high-tech companies the open innovation level should be high, and co-creation is considered at a lower level. In this situation, the company follows highly open innovative strategies, but co-creation and customer collaboration is low which leads to its overall performance.

Keywords: *Co-creation, Open Innovation, High-tech, Performance*

1. INTRODUCTION

High technology products have certain salient characteristics that differentiate them from low technology consumer products. The marketers of the products of the latter type may adjust their marketing strategies to reflect relatively unchanging technological conditions. High technology companies, however, must recognize that both technological and market conditions are rapidly changing. This dynamic environment necessitates a greater consideration of both marketing and technology-related aspects. The world of high technology is characterized by unusually high levels of market and technological uncertainties which affect marketing strategies and tactics. For more than a hundred years, a company-oriented, view of value creation has shaped the industrial structure and the entire business environment. While this perspective often conflicts with what consumers' perception of value [1].

Value creation is one of the main purposes and vital processes in economic transactions. Systems are value creation configurations of people, technologies, value propositions connecting internal and external service systems, and shared information [2]. Here, co-creation adds a new dynamics to the relationship between producer and customer through engaging customers directly in the production/distribution of value. In other words, customers can get involved at about any stage of the value chain [3]. In the existing literature on value creation and value co-creation, value is used as an abstract concept that seldom is specified in more concrete terms. In addition, one should note that value is a relationship between what one achieves and what one sacrifices [4].

While contributing substantial creative input/value, the co-creation activities also provide a variety business challenges by disrupting a closed business model of expertise, pushing toward an open

innovation model [5]. Yet, some of the literature falls under the rubric of concepts such as "customization" and "co-production" for the use of a given customer/group of customers, some companies incorporate the ideas/designs suggested by consumers into their open innovation processes or specifically support co-creation activities [6].

In this paper, the authors review the existing literature on open innovation and co-creation strategies, and then discuss the methodological issues. Then, the findings are discussed and the paper concludes with the most appropriate strategies for creating value through co-creation strategies in high-tech companies.

2. LITERATURE REVIEW

2.1 University Spin-Off

University spin-offs transform technological inventions developed from university research that are likely to remain unexploited otherwise [7]. As such, university/academic spin-offs are a subcategory of research spin-offs. Prominent examples of university spin-offs are Genentech, Cru cell, Lycos and Plastic Logic. In most countries, universities can claim the intellectual property (IP) rights on technologies developed in their laboratories. This IP typically draws on patents or, in exceptional cases, copyrights. Therefore, the process of establishing the spin-off as a new corporation involves transferring the IP to the new corporation or giving the latter a license on this IP.

Some universities generate substantially higher numbers of spin-offs than others [8, 9, 10]. Universities with high numbers of successful spin-offs ...

- draw on university-wide awareness of entrepreneurial opportunities and/or benefit from

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a strong entrepreneurship culture at the national or regional level;

- have developed a university culture that thrives on entrepreneurial role models among their alumni and academic staff as well as successful spin-offs that serve as inspiring examples (e.g. Lycos at Carnegie Mellon University);
- actively stimulate the development of entrepreneurial talent and help founders of spin-offs obtain access to investors, consultants and other forms of support; these activities are particularly critical in (e.g. continental European) countries that suffer from an entrepreneurial culture that is weaker than elsewhere (e.g. USA) [11, 12, 13].

Marketing practices due to the nature of the products that spin-offs produce is different from ordinary firms. Certain marketing research concepts such as sampling gain different connotation or are rendered irrelevant when applied to high technology markets. Also, specific research tools or methodologies used in high technology markets such as lead users or outcome-based methods are different from those used in standard marketing research [14].

To ensure that customer needs are met and that market failures are avoided, companies are seeking market-oriented methods of developing new products and services. An increasingly popular means of doing so is to involve users in the early stages of the new product development process by inviting them to suggest ideas for innovative products and services [15].

2.2 Open Innovation

Open innovation has become one of the important topics in the innovation management field. After Chesbrough's groundbreaking works in the last decade [16, 17], it quickly became clear that the roots of open innovation go far back in history, and not just in the last few years. In an extensive literature review, after reviewing a hundred and fifty open innovation papers, Dahlander and Gann (2010) found many references to concepts such as complementary assets, absorptive capacity, and the exploration vs. exploitation discussion, which are different concepts with roots in open innovation phenomenon [18].

In today's information-based atmosphere, firms can no longer afford to rely completely on their own ideas in order to succeed in their business. Moreover, they cannot restrict their innovations to a single direction in the market [16]. Open Innovation describes an emergent model of innovation in which firms draw on research and development (R&D) that may lie outside their own boundaries [19]. The Open Innovation paradigm can be understood as the antithesis of the "traditional vertical integration model" where firm-level research and development activities lead to internally developed products/services that are then distributed by the firm [20].

As Huizingh (2011) argue, the basic premise of open innovation is opening up the innovation process. One of its most often used definition is: "the use of purposive inflows and outflows of knowledge to accelerate internal innovation (inbound open innovation), and to expand the markets for external use of innovation (outbound open innovation), respectively" [21]. These two types of open innovation are broadly studied in the relevant literature [20].

While inbound open innovation refers to the acquisition of external technology in open exploration processes, and the practice of utilizing external sources of innovation, such as suppliers, customers; outbound open innovation describes the outward transfer of technology in open exploitation processes, and profiting from bringing ideas or technologies to market via pathways that lie outside the firm's [22, 23, 24, 25].

Generally speaking, the literature shows that inbound open innovation is more frequently and commonly used and developed than outbound open innovation, which can be explained by insufficiencies of the market or the organization [21, 26, 27].

2.3 Co-creation

The terms "co-production", "presumption", and "co-creation" refer to situations in which consumers/customers collaborate with companies or with other consumers/customers to produce valuable products and services. These situations sometimes appear to differentiate the traditional roles of "producer" and "consumer" [28]. It is extensively studied in the open innovation literature, and derived from open development studies (Enkel et al., 2009), customization [6], and the like. According to the literature, however, the term "co-creation" only implies the mutual collaborative efforts/activities that occur during the consumption process, which was the original implication of presumption [29].

Customers/consumers become active participants in an open innovation process of a firm and take part in the development of new products/services [30]. Piller et al. (2010) also focus on inbound innovation processes and find that the underlying idea, which is shared, is that of an active, creative and communal collaboration process, between producers and customers/consumers. In their eyes, co-creation involves customers who are active in a company's innovation processes and initiatives [31].

Furthermore, in the relevant literature, the term customer/consumer co-creation of value has been frequently used [32]. It was originally defined in the late 1990s by Kambil and his colleagues [33] as co-creation of value by a firm's customers/clients. Then, this concept has been gradually extended toward other individual initiatives for customers and companies [6]. Some authors believe that the key to value creation is to co-produce goods/services that mobilize customers [34]. Matching

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customer practices and provider activities requires that one not only understands the concept of value but similarly prominently the process of value creation, especially through co-production activities [35].

Lusch et al. (1992) provide a general model in order to explain that how much of the co-creation or service provision is performed by customers [36]. Prahalad and Ramaswamy (2000) argue that nowadays the marketplace has become a venue for proactive customer contribution. They argue for co-opting customer involvement in the value-creation process. Moreover, Oliver et al. (1998) elaborate the idea of co-creation in their remarks that marketing is headed toward a paradigm of real-time marketing, which incorporates mass customization and relationship marketing by interactively designing evolving offerings that meet customers' distinctive, altering needs [37].

According to the notion of co-creation, if a consumer/customer is involved in the production of a good or rendering a service, the created value will be improved because the customer can modify the product as he/she desires. This is why co-creation concept refers to collaboration with customers for the purposes of innovation and has become a fundamental premise of the service/product development [38, 15]. Kristensson et al. (2008) compare co-creation and customization and argue that the difference between these two lies in the degree of involvement of the customer; in general terms, the customer plays a less active role in customization than in co-creation. Finally they conclude that based on the notion of co-creation, value can only be determined by the user during the consumption/usage process. von Hippel (1982) studied the contribution of customers to the research and development of new products and services. His concept is broadly recognized in both academic and practitioner spheres [39]. In 1970s, he found that most product innovations come not from within the company but from end-users of the product [40, 41]. Moreover, Thomke and von Hippel (2002) suggested methods for customers to become more like co-innovators and co-developers of custom products [42].

Value co-creation can take place only if interactions between the firm and the customer occur proactively. If there are no direct interactions, no co-creation of value is likely. However, the mere existence of interactions, by itself, does not mean that the firm is engaged in the customer's value creating process [43]. Lusch et al. (2007) argue that an organization requires co-creation in order to renew its value propositions or offered services [38]. In other words, it must be able to comprehend important external trends [29].

Customers play an active role in the creation and provision of services/products and in the realization of its value in different extents. Some customers may be involved with service activities and be regarded as "part time employees" of the firm but all involved in integrating the service they receive with other aspects of

their lives to some degree before there can be benefit. However, although firms are looking for increasing customer co-creation, it is crystal clear that customers normally fail to optimize their co-creation roles [44]. In sum, co-creation entails enabling users to freely experiment and innovate by providing a platform for collaborative innovation [45]. Prahalad and Ramaswamy (2004) analyzed co-creation as a relatively new and critical development within the field of innovation [46]. They provided examples of four building blocks by which co-creation occurs: dialogue, access, transparency and risk [47].

Piller et al. (2010) suggest a typology of co-creation activities, which contributes to a better understanding of enterprise strategies for open innovation. Their first dimension describes the stage in the innovation process that customers can participate in. The second dimension refers to the degree of collaboration between a firm and its customers and among the customers themselves. The third dimension describes the degrees of freedom that customers are given when working on a specific task. Based on these dimensions, eight types of customer co-creation are identified [48].

2.4 Co-creation Strategies

Anbardan and Raeyat (2014) suggested 4 main strategies for creating value through co-creation. These strategies were: (1) Corrective product/service improvement, (2) incremental product/service improvement, (3) Crawling product/service improvement, (4) Radical product/service improvement [49].

2.4.1 Corrective Product or Service Improvement/Proposal (PI)¹

These groups of strategies are appropriate for situations in which, (1) the open innovation level is low, and (2) co-creation is considered at a lower level. In such situations, companies collaborate with a single customer, and use open innovation strategies at a low level. Then they try to correct their product/services based on open innovation and comments from that single customer.

2.4.2 Incremental Product or Service Improvement/Proposal (PI)

These groups of strategies are appropriate for situations in which, (1) the open innovation level is low, and (2) co-creation is considered at a higher level. These strategies are applicable when there is a group of customers or communities who collaborate with the company, but the company is not following strong open

¹ "Improvement" is used for inbound open innovations, and "Proposal" is used for outbound open innovations. The reason behind this is that when companies deal with inbound open innovations, they focus on themselves and "improvements", and when they follow outbound open innovation strategies, they focus on "proposals" to other external bodies/entities.

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innovation strategies. Then, there would be some incremental product/service improvements/proposals.

2.4.3 Crawling Product or Service Improvement/Proposal (PI)

These groups of strategies are appropriate for situations in which, (1) the open innovation level is high, and (2) co-creation is considered at a lower level. In this situation, the company follows highly open innovative strategies, but co-creation and customer collaboration is low. Therefore, the company considers crawling product/service improvements/proposals.

2.4.4 Radical Product or Service Improvement/Proposal (PI)

These groups of strategies are appropriate for situations in which, (1) the open innovation level is high, and (2) co-creation is considered at a higher level. These strategies are so radical and are followed by substantial changes in the company. This is because of the presence of a group of collaborative customers and the open innovation strategies of the company, which could make fundamental revisions in the products/services of the firm.

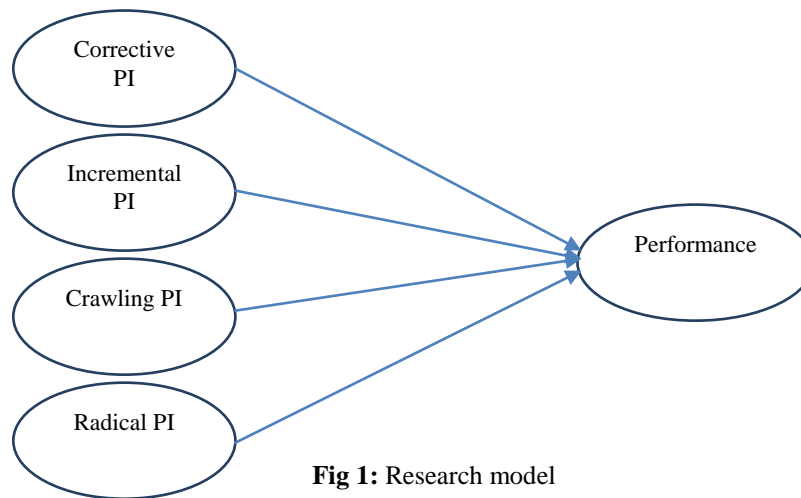


Fig 1: Research model

Based on the suggested co-creation strategies we examined the university spin-offs marketing practices regarding their relation with their customers.

2.5 Performance

Most of the broad empirical studies on the relation between innovation and performance provide evidence that this relation is positive [50]. However, as Simpson et al. (2006) point out, innovation is an expensive and risky activity, with positive outcomes on firm performances but also with negative outcomes, such as increased exposure to market risk, increased costs, employee dissatisfaction or unwarranted changes [51]. In addition, some studies arrive at conflicting conclusions. For instance, Wright et al. (2005), using a sample of small businesses, find that product innovation does not affect performance in benign environments, but has a positive effect on performance in hostile environments [52].

Focusing on a sample of US business service firms, Mansury and Love (2008) also find that the presence and extent of service innovation have a positive effect on the growth of a firm but no effect on productivity [53]. Finally, Damanpour et al. (2009) find that adopting a specific type of innovation every year (service, technological process, and administrative) in public service organizations in the UK is detrimental,

consistency in adopting the same pattern of types of innovation over the years has no effect, and divergence from the industry norm in adopting types of innovation positively affects performance. These results show that the relationship between innovation and performance is complex and requires more research [54].

Despite the likely detrimental effects resulting to an innovation orientation and some conflicting evidence, theory and most of the empirical studies suggest a positive relationship between innovative activity and firm performance.

3. METHODOLOGY

We used the structural equation modeling methodology for analyzing the hypothesis. The constructs validity tested regarding divergent validity. Reliability of constructs, also, was tested regarding Cronbach's alpha and composite reliability. To analyze the effects of each strategy on performance we applied path coefficients results. We used SmartPLS.2 for data analysis.

3.1 Data

To gather the research data we developed a structured questionnaire based on Likert scale (1 strongly ineffective, to 5 strongly effective). The questionnaire had 4 dimension based on each strategies characteristics, and one dimension for performance. Total number of

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questions was 24, 5 questions for each strategy, and 4 questions for performance measurement.

3.2 Population and Sample

To have the most relevant sample we decided to work with Tehran University Science and Technology Park (TUSTP), which the companies located in this institution are university spin-offs and are working on high technologies.

Based on Cochran formula we calculated research sample. Total companies are 73 which yields 61 number of the sample. As there are different categories of technologies in TUSTP we allocated the questionnaire based on each industries percent.

4. RESULTS

We conducted the survey using manager's email and also direct distribution of the questionnaire. Table 1 shows the managers demographic statistics.

Based on the statistics 90% of managers are men and most of them have between 11 and 20 years of working experience. Managers are mostly PhD and only 26 % are master. 44% produce just one new product and 50% produce between 2 to 4 products, only 4 % produce new products between 4 and 10.

Table 1: Demographic statistics

Variable	Group	Number	Percent
Gender	Men	55	90.16
	Women	6	9.84
Work Experience	1 to 3 Years	12	19.67
	4 to 10 Years	19	31.15
	11 to 20 Years	25	40.98
	20 to 30 Years	5	8.20
Education	Master	16	26.23
	PhD	45	73.77
Number of new products	1	27	44.26
	2 to 4 products	31	50.82
	4 to 10 products	3	4.92

Table 2 shows variables descriptive statistics. Results shows that radical product improvement/proposal (PI) have higher mean comparing to other variables. Radical PI mean is 4.1, and Crawling PI mean is 3.8. The mean of Incremental PI is 3.4 and finally Corrective PI mean is 3.2. Variables standard deviation is around 1 which shows an acceptable level of variance.

Table 2: Variables descriptive statistics

Variable	Mean	Max	Min	STdev
Corrective PI	3.2	5	1	0.87
Incremental PI	3.4	5	1	1.1
Crawling PI	3.8	5	1	0.94
Radical PI	4.1	5	1	0.91
Performance	3.6	5	1	0.98

Table 3 shows AVE (Average variance extracted) for convergent validity test, Cronbach's alpha and composite reliability statistics for variables reliability. Based on the results the variables have accepted level of validity and reliability.

Table 3: Reliability and validity tests

Variable	AVE	CR	Alpha
Corrective PI	0.51	0.77	0.79
Incremental PI	0.55	0.74	0.77
Crawling PI	0.58	0.88	0.9
Radical PI	0.52	0.81	0.86
Performance	0.5	0.76	0.78

Table 4 indicates measurement model factor loading. Results shows that the observed variables can be representative of their latent variables. The factor loading are more than 0.4 [55], and T-statistics are more than 1.96.

Table 4: Measurement Model

Variable	Factor Loading	StError	T
Q1--Corrective PI	0.74	0.26	5.23
Q2--Corrective PI	0.72	0.22	3.02
Q3--Corrective PI	0.66	0.28	5.14
Q4--Corrective PI	0.74	0.39	3.6
Q5--Corrective PI	0.82	0.18	2.4
Q6--Incremental PI	0.67	0.35	3.31
Q7--Incremental PI	0.71	0.34	4.55
Q8--Incremental PI	0.81	0.2	2.6
Q9--Incremental PI	0.82	0.31	4.37
Q10--Incremental PI	0.69	0.1	3.18
Q11--Crawling PI	0.69	0.36	5.28
Q12--Crawling PI	0.66	0.14	2.99
Q13--Crawling PI	0.8	0.1	4.76
Q14--Crawling PI	0.78	0.41	3.9
Q15--Crawling PI	0.79	0.13	3.67
Q16--Radical PI	0.81	0.2	4.33
Q17--Radical PI	0.79	0.12	4.15
Q18--Radical PI	0.74	0.28	4.79
Q19--Radical PI	0.75	0.11	4.32
Q20--Radical PI	0.77	0.13	3.34
Q21--Performance	0.71	0.43	2.32
Q22--Performance	0.68	0.25	2.4
Q23--Performance	0.71	0.26	5.21
Q24--Performance	0.8	0.41	3.68

Table 5 indicates structural model path coefficients on high-tech firm's performance. Results shows that Corrective PI relation with performance was not accepted because T statistics for this path was less than 1.96. Incremental PI path with performance, also, were rejected for having T statistic less than 1.96. Crawling PI relation to performance was accepted, this path's T statistic was 2.56, and its coefficient was 0.26 which shows Crawling product improvement can lead to a relative increase in high-tech companies' performance.

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Finally, the relation between Radical PI with performance was accepted for having T statistic more than 1.96 in 95% level of confidence. The Radical PI coefficient on performance was 0.44 which indicates that applying radical product improvement strategy would increase companies' performance in a good level.

Table 5: Structural Model

Path	Coefficients	StError	T
Corrective PI	0.12	0.36	1.83
Incremental PI	0.15	0.18	1.92
Crawling PI	0.26	0.32	2.56
Radical PI	0.44	0.12	3.62

5. CONCLUSION

Use of a co-creation strategy have been the most dominant paradigms for the past decade. Yet its impact on the company's performance is not well understood. Existing literature is mostly conceptual and case based. The few studies that have explored these two practices empirically are incomplete as they primarily focus only on the characteristics of the relation between company and customers. However, relationship is only one of the several determinants of co-creation success. As a result, the literature has remained inconclusive. This study is intended to address this gap in the literature. The study makes several contributions to the co-creation literature and practice. First, these two best practices have emerged from the practitioner literature with no theoretical foundation. This study presented a conceptual framework based on open innovation theory to better understand their interaction with high-tech characteristics and impact on overall performance.

This study found no evidence of a negative impact of project uncertainty and complexity on overall co-creation performance as suggested in the literature. The study found a statistically significant positive relationship between radical IP and crawling IP and overall performance.

Finally, there is a need to involve user groups and market actors so that the elaborated solutions are better accepted by the target groups leading to accelerated dissemination of the technology results. In high-tech companies the open innovation level should be high, and co-creation is considered at a lower level. In this situation, the company follows highly open innovative strategies, but co-creation and customer collaboration is low which leads to its overall performance.

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