
OPEN INNOVATION AND COST BASED DECISION MAKING MECHANISMS: A REVIEW

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Abstract:

Open innovation has received a considerable focus nowadays. The increasing volume of research on Open innovation (OI) indicates the interest about open innovation. But, still the cost of OI is unrevealed. Researchers are still working on the specification of OI. It seems that the determination of cost of OI is hardly possible in absolute figure. It seems plausible that proactive approach will be matched well with the concept of OI. Hence, OI has been reviewed with mechanisms of cost based decision making with the expectation to make the sense in that paper. It is expected that the sense of common ground between OI and cost based decision making mechanisms will help the OI to make it marketable and vice versa.

Keywords: Open Innovation, Cost Based decision Making mechanism, Sense making, Proactive approach, Individual firm

1. Introduction

The emerged complex business environment stress business to be innovative to survive. The preeminence of the consumer stresses business to meet the contingent demand. Now a days, Research and Development (R&D) department has been using as a core competence mechanism in many organization. Basically, it is difficult to monopolize the knowledge landscape. Open innovation is getting concentration day by day in many organizations. Open Innovation (OI) is considered as a mechanism to accelerate the innovation and enhance the growth. Although open innovation is getting

concentration, there exist many unsolved questions. Cost of the OI is still unrevealed (Dahlander, L. & Gann, D.M., 2010). It is not possible to determine the cost of open innovation objectively as it takes different forms in different organizations. It seems plausible that proactive approach is matched well with the open innovation. Therefore, cost based decision making mechanism is plausible to review with the OI. This paper reviews the concept of open innovation and cost based decision making mechanism and find out the ground to integrate.

2. Methodology

The paper discusses the concept of open innovation from the perspective of recent development and its relevance with the cost based decision making process of the product and vice versa. The paper mainly reviews the concept of open innovation from the perspective of individual manufacturing firm.

To get the recent theoretical development of Open Innovation, ISI database for articles has been searched. ISI is considered as the most comprehensive database for scholarly work. Only the articles from the journal with good impact factor have been used to get the recent development of Open Innovation.

Three cost based decision making mechanisms has been reviewed in that paper; Life Cycle Costing (LCC), Target Costing (TC) and Kaizen Costing (KC). The review has been executed directly from managerial accounting perspective.

This paper has been developed in three phases. First, a review has been made on the open innovation. Open innovation has been discussed with the problem of implementation also. Secondly, cost based decision making mechanisms has been reviewed. And finally common ground has been identified to integrate Open Innovation and Cost based decision making mechanisms.

3. Open Innovation

The main premise of the open innovation is opening up the innovation process. It has been defined in various perspectives. Chesbrough et al., (2006) defined open innovation as the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and to expand the markets for external use of innovation, respectively.

To a single firm, it is difficult to monopolize the knowledge landscape (R, Kirschbaum, 2005). Therefore, open innovation is getting popularity day by day. Organizations are considering OI as an opportunity to accelerate innovation and promote the growth (Zairi M, 1995). OI has been reported as long-term incentives to the innovation also (Fu, Xiaolan, 2012).

There exist many unsolved questions of OI. Questioning about how OI can be implemented is challenging one (Gassmann, O. 2006). Costs of openness is not clear (Dahlander, L. & Gann, D.M., 2010). Researchers are still working on the specification of forms of OI.

After reviewing 150 papers Dahlander and Gann (2010) mentioned that researchers tend to use different definitions and focus their research on different aspects of open innovation. Still, the term Open Innovation is not specific. Open innovation comes in many forms and tastes, which adds to the richness of the concept but hinders theory development (Huizingh Eelko K.R.E, 2011).

Different sets of open innovation practices are visible. On the basis of practices researchers tend to categories the OI. Researchers like Dahlander and Gann (2010) use the dimension of open innovation as inbound versus outbound open innovation and pecuniary versus non-pecuniary interactions. The matrix cells that they developed are shown in table 1

Table 1: Structure of different forms of openness

	Inbound innovation	Outbound innovation
Pecuniary	Acquiring	Selling
Non-pecuniary	Sourcing	Revealing

Source: Dahlander and Gann (2010)

Knowledge flow has been used as a base to classify the open innovation also. Lichtenthaler and Lichtenthaler (2009) use three different knowledge processes that can be performed either internally or externally. These are; knowledge exploration, retention, and exploitation. Hence a 3 X 2 matrix is visible which can identify six knowledge capacities.

Open innovation can be grouped by distinguishing between process and outcome also (e.g., Huizingh Eelko E.R.E, 2011). Huizingh Eelko K.R.E (2011) developed the following model on the basis of research work of Von Hippel (2010).

Table 2: Innovation based on Openness in terms of Process and Outcome

Innovation Process	Innovation Outcomes	
	Closed	Open
Closed	1. Closed Innovation	3.Public Innovation
Open	2. Private Open Innovation	4. Open Source Innovation

Source: Huizingh Eelko K.R.E (2011)

It seems that the tone of grouping and categorizing of open innovation is same. Hence, the open innovation can be discussed in the following manner which is influenced by the research work of Dahlander and Gann (2010).

Revealing

It involves with the exploring the internal resources to the external environment. Firm that practicing the revealing share their designs and performance through verbal interactions and in published material regularly. Allen (1983) mentioned this type of innovation as collective invention.

Selling

It involves with the commercializing the developed resources or inventions and technologies through selling or licensing. Chesbrough et al. (2006) have discussed about how firm can benefit by commercializing inventions by selling or licensing-out ideas. Fosfuri (2006) mentioned that some firms are using out-license technologies and innovations as a strategic priority.

Sourcing

It involves with the external sources of innovation. Basically firms scan the external environment before initiating internal R&D work (Chesbrough et al. 2006). Researchers like Laursen and Salter (2004) view was that larger number of external resources will enhance the firms search strategy.

Acquiring

It involves with the acquiring input to the innovation process through the market place. Researchers like Von Zedtwitz and Gassmann (2002) state that in case of acquiring firms control over a number of elements in their networks.

4. Cost Based Decision Making

Cost based decision making is required to make the decision more realistic. Costing mechanism helps the manager to take decision about the price and reprice of products, short term pricing, substitute products, improve processes and operation strategy, technological investment and eliminate the products (Kaplan & Atkinson, 1998). As mentioned earlier, different costing mechanisms are used at different phases of the products. This paper specially reviews the Life Cycle Costing (LCC), Target Costing (TC), and Kaizen Costing (KC) that are used at different stages of the product life cycle.

4.1 Target Costing

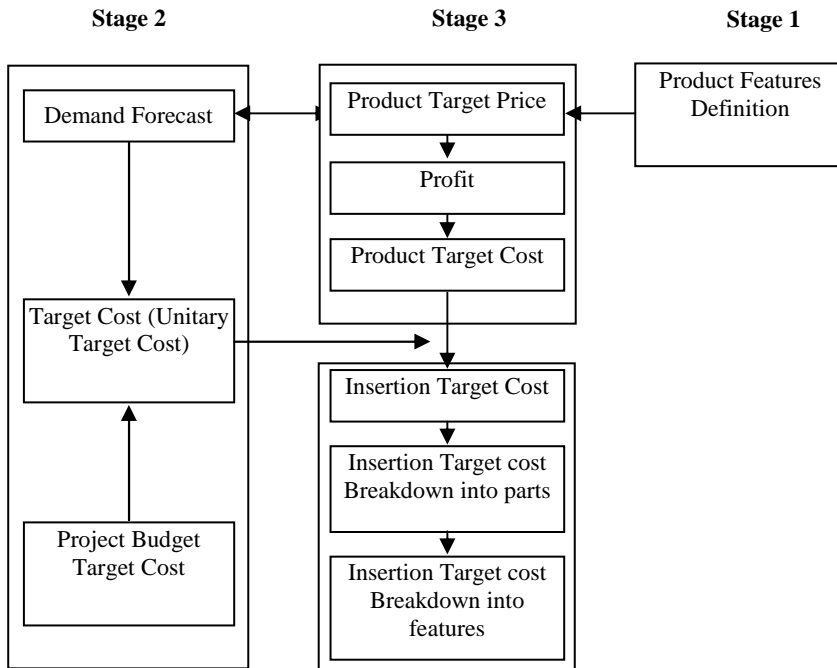
It is agreed that target costing is a technique for economic management, particularly cost management, during the product development (Filomena, T.P et. al., 2005). Kaplan Robert S. & Atkinson A.A (1998) defined target costing as target costing is a cost management tool that planners use during product and process design to drive improvement efforts aimed at reducing the product's future manufacturing costs. The successful use of target costing for the product development has been proven in previous studies. The research of Tani et al. (1994), Dekker and Smidt (2003) and Afonso et al. (2008) represents the use of target costing for product development.

For the practical purpose, target costing has been divided at different stages in different ways. Cooper and Slagmulder (1997, 2002a, b) divided the target costing in two parts; product-level target cost and component-level target cost.

The widely known premise of the target costing is – Target Cost = Target Price – Profit

For the successful application of target costing, detailed information about the product is required. Filomena, T.P et al., (2009) mentioned that careful decomposition of a product’s cost constituent elements, such as information about features, Characteristics, parts and functions are required. They offer the following model for the target costing –

Figure 1: Target Costing Operationalization model



Source: Filomena, T.P et al., (2009)

The model is little bit different than the model of Kaplan Robert S. and Atkinson Anthony A., (1998). The model has been developed in perspective of three stages.

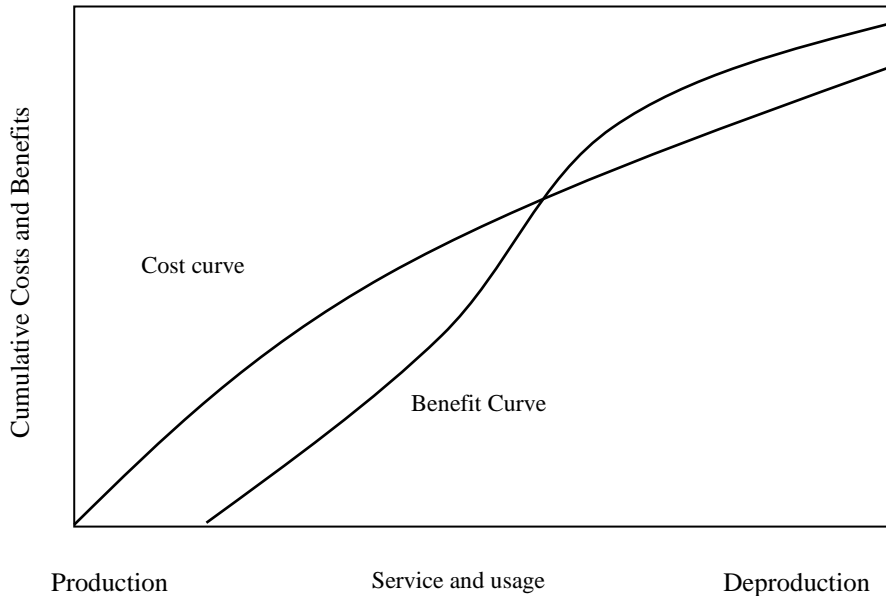
4.2 Product Life Cycle Costing

Life Cycle costing is applicable to the object that has a projected life. Hence, it can be applied to projects or assets, services, products and to the customer. The objective of adopting life cycle costing policy is to maximize the return over the cost objects’ total life.

Considering the entire product life cycle and the total benefit as the target of the optimization, both the life time and the costs of operation and other costs can be

more effectively and efficiently executed. The concept of life cycle costing can be shown by the following well known figure (figure 2).

Figure 2: Cost and Benefit in the Product Life Cycle



4.2.1 Life Cycle Cost Factors

For a successful life cycle costing it is required to identify the cost factors. There are some dominant factors of product life cycle costing. The factors can be decomposed from previous research as shown in table 3 (Alting, L, 1993; Alting L, & Legarth J, 1995).

Table 3: Cost factors with the Product Life Cycle Stage

Life Cycle	Cost Factors
R & D	Market Recognition, Product Development
Production	Materials, Labor, Energy, Facilities, Wages, Wastes, Pollution, Health Damages
Usage & Services	Transportation (means and ways), Storage , Materials, Maintenance, Waste, Breakage, Warranty/Service, Energy, Pollution, Health Damage
Disposal/recycling	Disposal/Recycling Dues, Energy, Waste, Disposal, Pollution, Health Damage

4.2.2 Product Attributes

Product attributes play the key role for incurring the costs. Researchers identified the dominant product attributes for life cycle costing from various

perspectives (Park, J.H, Seo at al., 2001, Sousa I., Eisenhard et al., 2001). Dominant product attributes have been shown in table 4 –

Table 4: Dominant Product attributes for the Life Cycle Costing

Functionality	Distribution Volume	Power Consumption
Durability	Transport Distance	Energy Source
Strength	Transportation Means	Serviceability
Process	Mas	Upgradeability
Materials	Distribution mass	In use flexibility
Volume	Assemblability	Recycled Content
Price	Disassemblability	Recyclability
Performance	Product liability	Reusability
Lifetime	Additional Consumable	
Use time	Mode of Operation	

Notable thing is that the cost factors that have been shown in table 3 are associated with the other cost based decision making mechanisms like target costing also. The dominant product attributes that have been shown in table 4 are associated with other cost based decision making mechanisms also.

4.3 Kaizen Costing

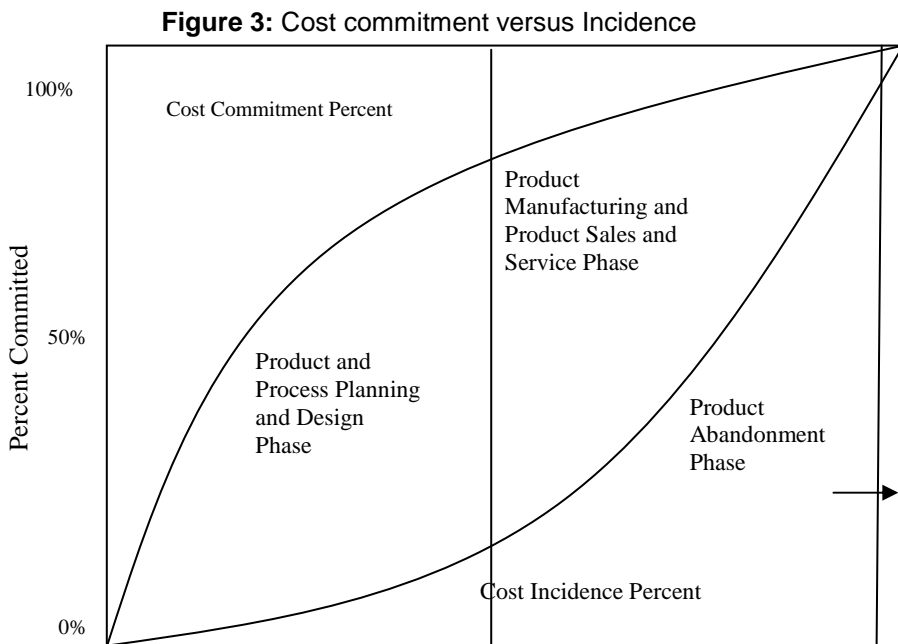
The term Kaizen Costing involves the ‘continuous improvement’. Kaizen costing or Kaizen Management mechanism involves with everyone; both with the manager and with the workers and it consume little expense (Imai, M., 1986). Basically, it is operated by the operations personnel when product is in production. Some observers have criticized both target and kaizen costing on the grounds that they often place huge stress on employees (Kaplan R.S & Atkinson A.A., 1998).

5. Discussion on Integration of Open Innovation and cost Based Decision making mechanism

Most of the product costs are determined in the early stages of product’s life-cycle (Horngren, C.T, 1997, Tornberg, K. et al. 2002). A widely accepted rule is that

80% of a product's costs are committed, or locked in, during the product design stage (Kaplan R.S. and Atkinson A. A., 1998). Design of the product determines the number of components for which costs have to be incurred at the later date i.e., manufacturing stage. During product design phase, planners take the major decision. Figure 3 has depicted the cost commitment and incidence at the major three phase of the product.

Figure indicates that effective cost control has to be exercised during the product's planning and design phase. It is difficult to control the cost when product and process has already been designed and the product is being made. Manufacturing stage is involved with the cost containment of the committed costs. Hence, it is required to make sense about the total cost and benefit of the product at the initial stage i.e., planning and designing phase. It indicates that sense of marketing of innovation has to be considered at the initial stage of the product also.



Source: Kaplan Robert S., Atkinson Anthony A., (1998)

Hence the sense of life cycle costing estimation is useful in the open innovation. The concept of target costing can make good sense in that case also. Under the open innovation product attributes requirement and the nature of cost factors is important also.

It is agreed that there are some problem of open innovation in disclosing of information regarding the individual firm's competitiveness in the market. It is notable that renowned Japanese companies are using internal R&D in relatively closed manner. Researchers suggest that Intellectual Property Right (IPR) may provide safety under the scenario of open innovation. Researchers suggested strong IPR in case of open innovation. It is agreed that protection of intellectual property is required to

provide motivation for innovation. But, prohibition in most cases might be extremely difficult (Jacobs L. et al 2001). It seems plausible that the combination of cost based decision making mechanism and open innovation can make a good sense about the effective cost of open innovation and vice versa. The common area of open innovation and cost based decision making mechanism can be identified from the review. The common area of cost based decision making mechanism and open innovation has been shown in the table 5.

Table 5: Common areas of Open innovation and Cost based decision making mechanisms

	Cost Based Decision Making Mechanism	Common Areas' deal	Significance of combination
Open Innovation	Target Costing	Planning and Product Development	Will make the product Marketable
Open Innovation	Life Cycle Costing	Projected Life	Get the idea about the LC of product and fit the innovation suitable in real world. Innovation management will be benefited.
Open Innovation	Kaizen Costing	Continuous Improvement	Enhance the competitiveness in terms of price of the product

The problem of implementing Open innovation has been discussed by the different researchers. Strong IPR has been suggested by the researchers as a safeguard against the problem of implementation of OI. But, the international researches indicate that IPR may not be enough to provide the safeguard. Jacobs L., Samli A.C et al., (2001) discussed four different types (Counterfeiting, Brand piracy, Near Brand Usage and intellectual property copying) of international product piracy with the potential remedy. They discussed seven (Communication, Government, Legal, Direct Contact, Labeling, Strong Proactive Marketing and Piracy as Promotion) protective responses also. They stress more on the strong proactive marketing rather than fully depending on IRP and other legal actions. Consisting with that it seems plausible that cost based decision making mechanisms can work with the OI successfully also.

As mentioned earlier, researchers classified open innovation in different form and ways. Recently, researchers are tempting to find out the problem of OI in implementing also. A review of problem can make sense on the integration of OI and cost based decision making mechanism also.

The classification review of OI in this study has been drawn from the Dahlander Linus and Gann David M (2010). They classified the OI in four. To make the sense, the implementation problem of these classifications can be reviewed.

The sense of revealing the innovation can be drawn from the research work of Allen (1983). Allen (1983) focused on the collective invention in the iron production in 19th century in England and he found that in most cases new ideas were not protected by patents. As a result competing firms were able to use the information. Obviously, it has a cumulative advancement on the total industry. But individually a firm will suffer from various perspectives. If the competitors can be better positioned with the advanced technologies, the innovator firm may suffer in terms of product targeted volume, price, functionality and even the life time. Hence, more consciousness is required at the planning and designing phase of the product in case of revealing the information.

It is agreed that selling or out-licensing helps the firm to leverage the investments in R&D through partnering. But, the problem is that when two or more parties are involved, there exist significant challenges in reaching agreements based on the information (Arrow, K., 1962). The widespread of information is a threat against the competitiveness of the firm also. Two types of challenges are involved there. One is whether licensor is informing the updated information to the licensee. If licensor or inventors don't disclose the update to others, a market failure will take place. In contrast, disclosing information without reliable environment will reduce the competitiveness of the individual firm. Researchers like Lichtenthaler and Ernst (2007) mentioned that while many firms are open to licensing technologies, they lack a conscious strategy for bringing this into practice. They discussed how the combination of strategic planning and out-licensing can be potential to the firm also (Lichtenthaler and Ernst, 2009). Researchers like Arrow (1962) mentioned about the strong IPR to overcome the information disclosing problem. But, as mentioned earlier, patent or other legal actions may not be enough in many cases. It is plausible to think that the targeted volume, price, functionality and other costs factors will fall in challenges for the individual firm in the market.

Through the sourcing, it's possible to create the synergy between the firm internal resources and the external ideas. In case of sourcing, available and usable ideas (match with the internal environment) are the focal point. The "parallel-path strategy" has been discovered as a positive dominant factor on the organizational success (Leiponen, A., Helfat, C.E, 2005). But, it is agreed that some organizations over-search by spending too much time looking for external sources of innovation (Dahlander, L., Gann, D.M, 2010). This tendency may take more time to market the product. As a result the product may suffer from the various threat of market e.g., price, demand of product and others.

Open innovation through acquiring has numerous benefits. But, at the time of acquiring expertise is required. Researchers mentioned that firms need some degree of control over a number of the elements in their networks also (e.g., Von Zedtwitz., Gassman, 2002). Integration of ideas is difficult under the different cultural landscape.

Moreover, under the similar knowledge bases, noble combination is difficult (Sapienza, H.J., 2004). This situation may impact the Mode of Operation, Performance, and Upgradeability of the product.

With the review of four different OI, the cost dominant factors can be identified. Table 6 represents the cost dominant factors in case of cost based decision making mechanisms under the open innovation environment.

Table 6: Cost based decision making under the environment of Open innovation

Open Innovation	Cost Based Decision Making Mechanisms' dominant factors
Revealing	Volume, Price, Functionality, Life Time
Selling	Volume, Price, Functionality
Sourcing	Time
Acquiring	Mode of Operation, Performance, Upgradeability

Therefore it seems plausible that the sense of common ground between OI and cost based decision making mechanism will be cooperative for both the OI and cost based decision making mechanism.

6. Utility of the Study

The paper has been developed to make the sense on the common ground of OI and cost based decision making mechanisms. It is difficult to determine the cost of Open Innovation objectively and in absolute figure. Hence it seems that proactive approach will be well matched with the OI to make sense about the costs. Consisting with that it is expected that the paper will be helpful to make the sense about the cost factors of OI.

The term Open innovation is developing on specification. It is agreed that firm always relied on outflows and inflows of ideas, resources and individuals (Hargadon, A.B., 2003). But, in the age of complex business environment, consciousness is required. Researchers on openness have suggested that it may be necessary to keep some aspects of the innovation process open while others remain closed (Laursen, K., & Salter, A.J., 2006). Lichtenthaler (2008) find out that most companies, especially in German speaking countries are still operating a closed approach to innovation. Mortara Letizia and Minshall Tim (2011) find that firms seem to feel the need for an increased coordination. Hence, under the above scenario, it is expected that OI will be more realistic with the cost based decision making mechanisms. The sense of common ground of OI and Cost based decision making mechanisms will be helpful to make the innovation marketable and cost based decision more realistic.

7. Conclusions

The increased volume of research on open innovation indicates the interest about open innovation. It is natural that the wave of open innovation will impact on the other area of the firm including the costs. Even now, the cost of open innovation is unrevealed. Hence proactive approach has been used in that paper to make sense about the cost of open innovation. In order to understand the nature of cost, it is required to understand the approach of costs regarding the costs drivers i.e., cost driving parameters. The surrounding environment shapes the nature of cost drivers. Different environment of open innovation has been discussed in the paper with the cost based decision making mechanisms. The paper mainly discussed the issues from the perspective of individual firm's competitiveness.

It is hardly possible to find out a simple solution except the use of experience. The aim of the paper is to make the sense. It seems plausible that a good sense about the combination of Open Innovation and costing mechanism will help the firm to market its product more effectively and efficiently. And a good sense will help to make the cost based decision making mechanism more realistic under the environment of open innovation also.

Researchers are still working to make the term 'open innovation' more specific. Classification of OI has been executed from different perspective also. There is a scope to work on the integration of more specific Open innovation and cost based decision making mechanism.

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