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Innovation Rules: A method for identifying disruptive innovation opportunities?

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Abstract: Innovation Rules or innovation evolution paths are described in this paper as a mechanism for identifying disruptive innovation opportunities. A generic structure of an Innovation Rule is first introduced followed by a discussion using specific instance of an Innovation Rule. The application of Innovation Rules for the discovery of disruptive innovation opportunities is presented next. Two methods that use Innovation Rules as the basis for identifying disruptive innovation opportunities are described next, one for market pull and the other one for technology push. A framework for dealing with Innovation Rules that represent both big and small disruptions is discussed next. Examples discussed in the paper should convince readers that Innovation Rules can be used effectively for the discovery of disruptive innovation opportunities.

Keywords: Innovation Management; Disruptive Innovation; Innovation Cube; Innovation Engine; Innovation Stack; Innovation Rules

1 Introduction

Disruptive Innovation is a phrase coined by Professor Clayton Christensen of Harvard Business School when he was studying the phenomenon of why market leaders often failed to retain their leadership when their innovative products transitioned into the next generation. He has written two engaging books titled "Innovators Dilemma" [Christensen] and "Innovators Solution" [Christensen and Raynor]. These books have helped individual entrepreneurs, small businesses and large firms to understand the challenges in maintaining their market share when innovations transition from one generation to the next.

Since the publication of these two best sellers, no one has proposed a comprehensive step by step method that would allow individuals and companies to identify disruptive innovation opportunities. This paper examines the possibility of using Innovation Rules as a mechanism for identifying disruptive innovation opportunities. It discusses disruptive innovation opportunity discovery methods for market pull and technology push situations.

The background leading to the definition of Innovation Rules is discussed in Section 2 of this paper. Section 3 of the paper introduces the generic structure of Innovation

Rules and describes them using an example. The link between Disruptive Innovation and Innovation Rules is established in Section 4 of this paper. Section 5 gives an example of how Innovation Rules can be used to identify disruptive innovation opportunities. Additional examples of Innovation Rules that are used in the next section are presented in Section 6. Section 7 discusses how a collection of Innovation Rules could be used as a system to identify more than one disruptive innovation opportunity. Section 8 summarizes the paper and provides conclusions.

2 Background

The motivation for this work was derived from the trilogy of Innovation Cube [Narasimhalu 1], Innovation Engine [Narasimhalu 2] and Innovation Stack [Narasimhalu 3]. These concepts are introduced briefly below for the sake of those readers unfamiliar with them.

Innovation Cube

Innovation Cube examined why certain innovations succeeded while others failed. It defined a three dimensional framework for representing the characteristics of successful innovations. The first dimension of the Cube represented Innovation Drivers which were either the "Needs" or "Wants" of target customers. Successful innovations addressed either a need or a want. The terms Pain and Pleasure were used to represent needs and wants respectively.

Examination of successful innovations revealed that both required technology and the addressable market had to be together ready in order for the innovation to succeed. The second dimension of the Cube represented market and technology maturity. These two characteristics of successful innovations were called Innovation Triggers. The term triggers was used to denote that a successful innovation was triggered when there was a shift in the market and / or technology from a state of immaturity to a state of readiness.

The third dimension of the Cube represented "right pricing" and "ability to scale" as Enablers of successful innovations. This dimension highlighted the need to price an innovation to match the target market segment and the need to have the capacity to meet the demands.

An innovation which satisfied the three dimensions of the Innovation Cube can be expected to have a high chance of success in its market place as long as there were no adoption hurdles.

Innovation Engine

Innovation Engine was a systematic method of generating innovation opportunities using the Innovation Cube framework. An automobile engine was used as a metaphor to describe the method. Needs and Wants were likened to the air-fuel mixture, triggers were mapped to the spark plugs and the enablers were the gears that amplified / transmitted the energy produced by the innovation engine to the wheels. The motion of the wheels represented the dynamic growth of the market addressed by the innovation.

There was a reference to Innovation rules in the discussions on Innovation Engine. Innovation Rules were compared to the cylinders of an automobile engine. However

there was no further elaboration of Innovation Rules. Since then further studies have identified more than sixty innovation evolution paths or Innovation Rules. Twenty five frequently occurring Innovation Rules were released as a monograph [Narasimhalu 4].

Innovation Stack

Innovation Stack is a method to prioritize the different innovation opportunities in the form of a stack so that the innovation opportunity on the top of the stack was the most attractive followed by an ordered set of innovations in the descending order of attraction.

Innovation Evolution Paths

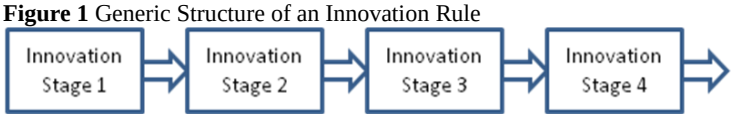
"Six paths to Innovation" that Chan Kim and Rene Mauborgne reported while developing Blue Ocean Strategy [Kim and Mauborgne] triggered further elaboration of Innovation Rules. That there could be different paths leading to different innovation opportunities encouraged a deeper examination of how innovations evolved over time resulting in the creation of the many Innovation Rules.

As innovations pursued different evolution paths they did not merely transition from one stage to the second and final stage. There were sometimes more than two stages of evolution where sometimes the evolution was sequential from one stage to the next while in other cases innovations skipped one or more intermediate stages. And in yet other instances some of the intermediate stages were partially ordered, i.e. they could occur in more than one permutation of the sequences.

3 Innovation Rules / Innovation Evolution Paths

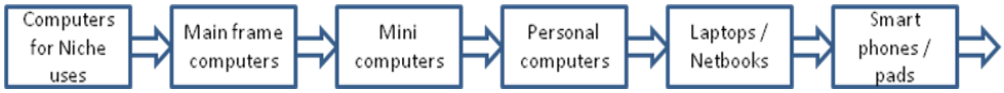
Innovation Rules mentioned in the Innovation Engine paper are described in this section. Figure 1 gives a generic structure of an Innovation Rule.

Figure 1 Generic Structure of an Innovation Rule



An Innovation Rule represents the evolution of an innovation from the first innovation stage to one or more following innovation stages. A transition from one innovation stage to the next represents a disruption in that market. Consider a specific Innovation Rule such as the one in Figure 2 – An evolution path for innovations in computers.

Figure 2 The Innovation Rule for computers



Computers were initially developed for military purposes as represented in innovation stage 1 in Figure 2. University of Pennsylvania was responsible for developing Eniac in response to a request from the US military. War game simulation was one of the key applications of Eniac.

Eniac was succeeded by mainframe computers that were used for corporate applications. Mainframe computing is innovation stage 2 in Figure 2. IBM and B.U.N.C.H. (Burroughs, Univac, NCR, CDC and Honeywell) were the market leaders in this stage. Mainframe computers were initially used for corporate accounting applications.

When corporate offices started using computers, their divisions felt the need for deploying computers at a department level for accounting and other applications that were engineering and scientific in nature. The demand from the divisions of a company for a less expensive (and initially less capable) computer ushered in next category of computers – mini computers. Minicomputer is innovation stage 3 in Figure 2. DEC, Apollo, and HP were the market leaders in this stage.

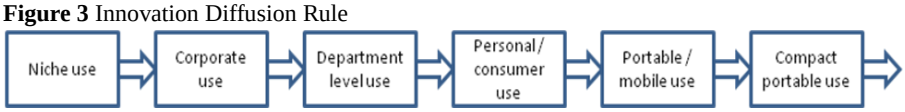
Once departments used computers there arose demands from individuals wanting to have a computer on their table top for local computing and word processing applications. This demand created a new generation of computers – personal computers. Personal computing is innovation stage 4 in the evolution of computers. This market was initially dominated by companies such as IBM, HP, and COMPAQ.

The proliferation of personal computers resulted in the demand for the next generation of computers – computers that can easily be carried around by individuals. This demand for mobile workstations resulted in laptops / notebooks. Mobile computing is innovation stage 5 in Figure 2. The initial market leaders in mobile computers such as laptops were companies such as Toshiba.

Once individuals were used to carrying a laptop with them, they demanded lighter and more usable computers. This led to the birth of tablet computers such as iPADs and Personal Digital Assistants such as smart phones. Compact computing is innovation stage 6 in the evolution of computers. The market leaders in compact computing are Apple and Samsung.

The Innovation Rule shown in Figure 2 applies not just to the computers, but also to several other products innovations such as printers, fax machines and copiers. One can therefore generalize this Innovation Rule as shown in Figure 3. This Innovation Rule is called Innovation Diffusion Rule since innovations diffuse into different segments of the society over time through the successive innovation stages.

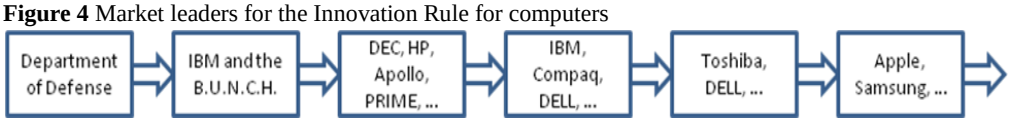
Figure 3 Innovation Diffusion Rule



4 Innovation Rules and Disruptive Innovation

This section establishes the link between Innovation Rules and Disruptive Innovation. Figure 4 shows the market leaders in each of the stages of the Innovation Diffusion Rule.

Figure 4 Market leaders for the Innovation Rule for computers



Close examination of Figures 2 and 4 shows how consistently a market leader at one stage is displaced by a newcomer according to the definition of disruptive innovation by Christensen.

Since the transition from one innovation stage to the next of an Innovation Rule represents an opportunity for disruption, Innovation Rules can be used as an effective representation of a succession of disruptive innovations. This representation can be utilized to design a method to identify disruptive innovation opportunities. It is important to note that some Innovation Rules represent a succession of large disruptions while others represent a succession of smaller disruptions.

5 Using Innovation Rules for Disruptive Innovation Development

Two methods for identifying a disruptive innovation opportunity using Innovation Rules are defined in this section. The methods are constructed to help identify all disruptive innovation opportunities from a set of Innovation Rules. A method for a market pull scenario is described first followed by a second method for technology push scenario.

Market Pull Scenario

Method 1: Disruptive Innovation Identification Method for market pull scenario

Repeat

1. *Select an Innovation Rule*
2. *Consider the stages of the selected Innovation Rule*
3. *Determine the stage at which an innovation is in play*
4. *If the market is ready for an innovation at the next stage*
   Then proceed to the next step
   Otherwise wait until the market is ready
5. *If the technology required for realizing / developing the innovation for the markets at the said next stage is ready*
   Then proceed to develop the innovation
   Otherwise proceed to develop the technology first and then develop the innovation.

Until the set of Innovation Rules have been considered

The above described method will result in one of the following decisions.

1. A disruptive innovation opportunity exists imminently and innovation development must start immediately.
2. A disruptive innovation opportunity exists and innovation development should start once the required technology is developed or acquired.
3. A disruptive innovation opportunity does not exist because the markets and / or the required technology are not ready.

Markets for an innovation can be deemed to be ready based on either “Requests For Information” (RFI) or “Requests For Proposal” (RFP) for that innovation.

An example

We illustrate the use of Innovation Rules for identifying disruptive innovation opportunities by applying the above method to Innovation Diffusion Rule shown in Figure 3.

The following statements describe the scenario:

1. Stage 3 of the Innovation Rule is in play, i.e. department level computers are being supplied to companies.
2. There have been sufficient enquiries asking for personal computers and solutions based on them thereby indicating that the market for personal computers is ready.
3. The only available disk drive technology is 12 inches in diameter. Personal computers do not have the real estate to house 12 inch disks.

An examination of the required technology indicates that the disk drives are not small enough for the production and marketing of personal computers. Hence the disk drives should be developed first before developing the complete personal computer solution.

Technology Push Scenario

In typical "*Technology Push*" scenarios one does not wait for the markets to be ready. Engineers and researchers often anticipate the development of a new market and proceed to develop the technology required for that market.

The successful adoption of the new technology will only happen if the markets are ready by the time the technology is developed. In a number of situations the technology is so far ahead of the market development that it often fades into oblivion. This is true since in most cases the technology development cycle is much shorter than the market development or readiness cycle. Method 2 should be used for discovering disruptive innovation opportunities in a Technology Push scenario.

Method 2: Disruptive Innovation Identification Method for technology push scenario

Repeat

1. *Select an Innovation Rule*
2. *Consider the stages of the selected Innovation Rule*
3. *Determine the stage at which an innovation is in play*
4. *Determine whether the technology required for the next stage is ready.*

If the technology is ready
Then proceed to the next step
Otherwise
If the time required to develop the technology is equal to or less than the time required for the market to develop
Then proceed to develop the technology and transition to the next step

Otherwise wait until this condition is satisfied

5. *Develop the innovation*
   Until the set of Innovation Rules have been considered

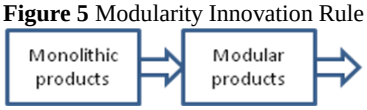
While commercially oriented applied research institutions and companies should adopt the market pull based approach, longer term focused university based research groups can afford to take the technology push based approach.

6 Some examples of Innovation Rules

This section introduces Innovation Rules that will be used for discussions in the next section. Each of these rules will be described in some detail.

When companies initially develop innovations they tend to create most if not all components required to build the innovation in house. As competition sets in, these companies experience compression of profit margins and hence are forced to outsource design, development and manufacturing of some of the components and subsystems. The need to outsource subsystems and components requires them to adopt a modular design with well defined interfaces. This shift from a monolithic to a modular design creates an opportunity for disruption. Once a third party starts creating components and subsystems, nothing prevents them from creating improvements to the components. That company could go on to achieve market leadership for those components and may over time become a major competitor to the original company. The Modularity Innovation Rule shown in Figure 5 captures the evolution of innovations from monolithic state to modular state.

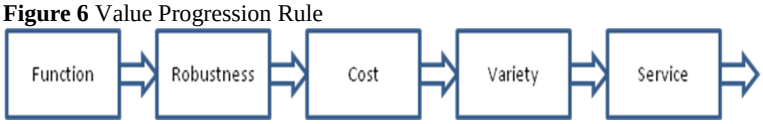
Figure 5 Modularity Innovation Rule



Consider the Value Progression Rule presented in Figure 6. This Innovation Rule is an example where second and later innovation stages can appear in different sequences. The sequence shown in the figure will be used for discussions.

Value Progression Rule represents an innovation evolution path where a market is initially willing to accept innovations that deliver a need or a want even if the solution is not robust. Lack of robustness in an innovation, such as automobiles that breakdown often, can create an opportunity for disruption. A market leader providing innovations that are less than robust, i.e. cars that breakdown often, can lose to a new entrant who could perhaps employ newer technology to create a more robust version of the innovation.

Figure 6 Value Progression Rule



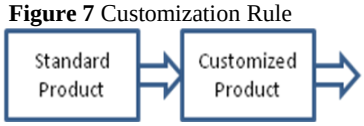
Once competitors appear price wars reduce profit margins. Such a situation creates an opportunity for disruption, using innovations to lower costs so that the profit margins can be retained.

Once robust and affordable innovations flood the market, customers start looking for varieties in the innovation, be it in colour, shape, size or other factors. Such demands will create a third opportunity for disruption that new entrants with newer designs or technologies could exploit. Finally pay per use service innovation opportunity arises from customers who either cannot afford to buy the innovation or do not have a need to own it full time. Such a demand opens up an opportunity for disruption.

Several forms of service innovations can be offered during the different stages of this Innovation Rule. For example if the initial innovation offered is not very robust a service innovation opportunity arises in the form of a maintenance or repair shop. Another opportunity for service innovation occurs is when the innovation is offered at a reasonable cost but the required shape or colour is not offered in the market. A company can be set up to do the modifications to the standard offering. These are all examples of small disruption opportunities.

Figure 7 shows an Innovation Rule relating to customizing an existing innovation for a new category of customers. Consider golf clubs as an example. When they were first introduced they were made for right handed players only. It was much later that golf clubs were developed for the left handed players.

Figure 7 Customization Rule



Another example of customization is that watches and mobile phones for Islamic markets have in-built directional pointers so that the faithful can pray facing Mecca. Yet another instance of customization is Nokia hand phones made for the Indian market. Nokia realized that there was no continuous electricity in several rural parts of India and therefore built a torch into their mobile phone. These examples show that customization creates opportunities for disruption. Some of these disruptions can offer large addressable markets while others will address smaller markets.

7 Systems of Innovation Rules

This section shows how a set of Innovation Rules can be used as an interwoven innovation system for identifying a number of innovation opportunities.

Consider the Innovation Rules introduced in Figures 3, 5, 6 and 7. Although they were presented as independent Innovation Rules, they can also be used as a system of Innovation Rules that can collectively identify several disruptive innovation opportunities. Some of them create disruptions that are larger and others create disruption opportunities that are smaller. The smaller disruption opportunities often occur in between two large disruptions. A generic representation of interdependent Innovation Rules that can offer small and large disruptions is shown in Figure 8.

Figure 8 A system of Innovation Rules

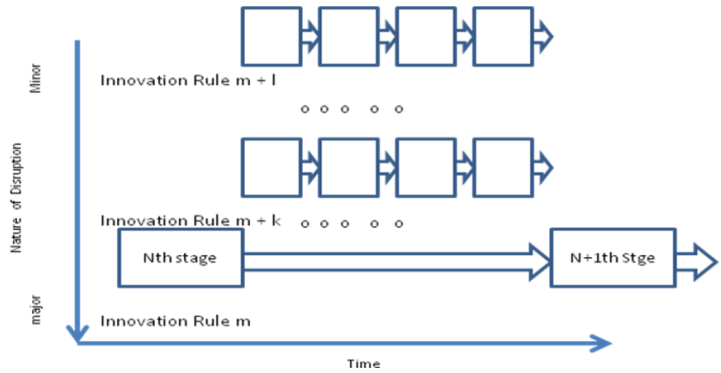
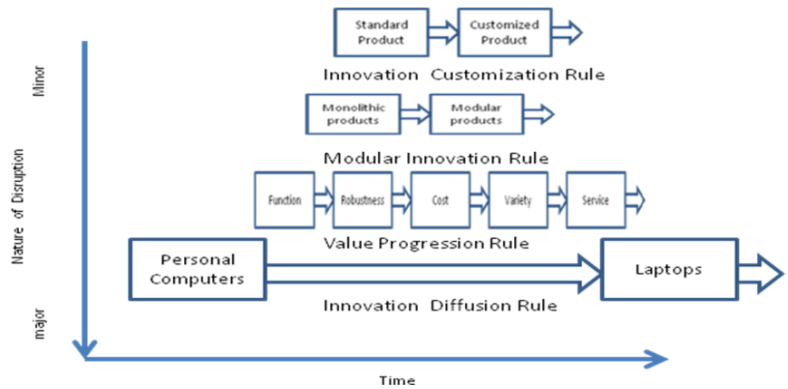


Figure 8 shows a portion of the Innovation Rule **'m'** between **n**th and **n+1**th innovation stages. Some other Innovation Rules such as **M+k** and **M+l** can be embedded between innovation stage **n** and before the innovation stage **n+1**.

Innovation designers and managers seeking disruptive innovation opportunities can focus on the next stage of major disruptive innovation, i.e., **n+1**th stage of Innovation Rule **m**, if the technology and markets are ready. Alternatively, they can also direct their efforts towards leveraging smaller disruptive innovation opportunities available between two major disruptive innovations, i.e. Innovation Rules **m+k** to **m+l**. The second option is especially attractive if the markets and / or technology for the next major disruption is not ready. Figure 9 illustrates a specific example of a system of Innovation Rules. Consider the Innovation Diffusion Rule for computers just after a personal computer was created and just before the laptops or mobile workstations were developed.

Figure 9 An example of a system of Innovation Rules



The Innovation Rules that can come into play in between the Personal Computer innovation stage and Laptops innovation stage are the Value Progression Rule, Modular Innovation Rule and Innovation Customization Rule described in the previous section.

As discussed previously, for any given innovation Modular Innovation Rule will come into play in order for the market leaders to try and retain their profit margins.

A company will need to develop different versions of its computers in order to expand its offering into different markets as represented by the Innovation Customization rule. For example, keyboard and word processing for the non-English speaking markets will be different from those for the English speaking markets. There can be a diversity of customization requirements even within non-English speaking markets. The keyboards for the Japanese markets will certainly be different from those meant for the German market. The need for customization for different markets will offer disruption opportunities. Value Progression Innovation Rule will also apply between two major disruptions.

The above set of Innovation Rules is just one possible system of Innovation Rules. There can and will be several such sets of Innovation Rules that should each be considered collectively for an innovator to get the maximum revenues and profits from potential innovations addressing a given market.

8 Summary and conclusions

In this paper we have defined a generic structure of an Innovation Rule and showed how some Innovations Rules are representations of disruptive innovation opportunities. We then defined two methods for identifying innovation opportunities, one each for market pull and technology push. We then presented additional examples of Innovation Rules to show how a collection of these rules can be used as a system of Innovation Rules to identify innovation opportunities from both large and small disruptions.

As mentioned earlier, there are at present no published methods for identifying disruptive innovation opportunities. The above discussions and examples lead us to conclude that Innovation Rules can be used as a mechanism for identifying disruptive innovation opportunities. We look forward to feedback from our readers on how we can further extend these concepts so that most number of people can benefit from our insights on Innovation Rules.

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