

A Comparison of Two Lead User Measures and an Exploration of their Nature

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Abstract

This research compares and contrasts two lead user measures - one from the field of innovation management and one from the field of consumer study. The first measure, Leading Edge Status (LES) was first proposed by Morrison (1995) . The second measure, which is secondarily reconstructed from consumer characteristics constructs, was first proposed by Katsumata and Ichikohji (2011) . We applied both measures to the same samples and compared the scores to assess whether they measured the same construct. The results showed a significantly high correlation between these two measures, indicating that we can extract approximately the same construct.

Keywords: lead users, measurement scale comparison, consumer research

1 . Introduction

The concept of lead users was first proposed by von Hippel (1986) , who identified a group of product users who, at an early stage of a product release, experienced needs related to the product that would be experienced

by wider users in the future. He proposed that they were uniquely able to predict future needs and thus indicate necessary development strategies. He also found that lead users benefit greatly if these needs are met by the product. This paper attempts to define lead users in more detail, identify some of their specific characteristics and capabilities, and understand their relevance and validity outside von Hippel's field of innovation management. In much of the early research, lead users were used as samples in market research. Von Hippel (1986) named this "the lead user method" because they were found to be very useful in garnering useful information on how best to develop new products and improve existing products. However, over time, researchers have found that assessing lead user behavior and desires is a useful tool in areas other than market research as well. This led to the development of various innovative and creative applications of lead users by researchers; indeed, many stopped thinking of lead users only as consumers, an attitude that had prevailed in the early research. For example, lead users were encouraged to engage in the process of new product development as prototype users; they were also given a tool kit and asked to develop new functions of the products that they would find useful. In the field of user innovation, for instance, lead users are regarded as exemplifying the self-motivated activity that defines user innovation.

Most of the research of this nature was conducted within the field of innovation management; despite this, the lead user construct and the new market that lead users created also drew attention from within the field of marketing and consumer studies. In the field of marketing, the transactional marketing paradigm has largely been replaced by the relational paradigm; this means that the interaction between firms and consumers is the most significant area of research, and the relevance of lead users in this context is

clear. In the process of creating a new consumer market, firms rely on the spontaneous cooperation of consumers. Within the field of innovation management, the explorative research that has been conducted on the motivation that lies behind user-generated innovations is aimed at the same area as the relational marketing paradigm, which aims to interact with the market. Indeed, while their approaches differ, innovation management theory and consumer research theory share a common goal. In recent years, their research objectives have become increasingly close and, today, findings in one field are as relevant to researchers in other fields.

However, it may well be fruitful to examine these findings, which emerge from different fields and backgrounds, as a group in order to identify how the different results may relate to each other and inform the research from different fields. In particular, since innovation management and consumer studies use two different measurement scales in their assessment of lead users, it will be worth ascertaining whether research conducted using these two scales will produce results pertaining to the same construct. To address this issue, in this research, we applied these two measures to the same person and analyzed the results to identify whether any differences emerged. The first measure, Leading Edge Status (LES) , was first proposed by Morrison (1995) ; the second measure, the Leading Consumer scale (LC) , was first proposed by Katsumata and Ichikohji (2011). The latter is secondarily reconstructed from consumer characteristics constructs. In the next section, we will define lead users in more detail and provide a brief description of these two measures.

2 . Previous research on the measurement of the lead user construct

2 . 1 . Definition of the lead user

In this section, we define lead users in a little more detail and outline an overview of the two lead user measurement scales. In his 1986 work, von Hippel defines lead users according to the following two properties:

- (1) Lead users face needs that will be general in a marketplace - but face them months or years before the bulk of that marketplace encounters them.
- (2) Lead users are positioned to benefit significantly by obtaining a solution to those needs.

The first definition clarifies that a lead user will capture the problems of the market in advance of a typical user. Since lead users are sophisticated users of the product or the product category, they are able to capture any potential problems with the product relatively quickly. Furthermore, lead users' ability to perceive these problems *before* the large segment of users means that they neither use the product in a different way nor encounter problems that would not also be encountered by typical users. That is, lead users serve as a kind of early warning system for issues that will arise in the wider user community - lead users are able to quickly identify the problems that many users may face in the future.

The second definition focuses on lead users' particular characteristics. While the first definition focuses on the problems faced by lead users, the second aspect of this definition describes how lead users benefit significantly from any innovations that are developed to solve the problem. Because lead

users have a relatively high level of desire to solve the problem, they are, naturally, more likely to actively seek out a solution; indeed, they are likely to be valuable sources for how best to develop information or generate ideas to solve the problem. Furthermore, users may themselves be able to develop a product or function themselves.

2 . 2 . Lead user measures in the field of innovation management

After von Hippel's 1986 paper, the earliest empirical research that defines lead users is that conducted by Urban and von Hippel (1988) . This research applied a cluster analysis to B-to-B market data in an attempt to identify a lead user cluster; they found that, as predicted, lead user clusters produce a relatively high number of innovations.

However, since the second lead user definition refers to the various inner conditions of the user, including utility or desire, it is not feasible to identify the lead user " cluster " by using cluster analysis in its strictest sense. Lead users should be measured as a construct using rigorously arranged measurement scales. On the basis of this perspective, Morrison (1995) proposed LES as a construct that can be used to measure lead user tendency¹ . Morrison and her collaborators also tested this measure empirically and examined its properties and reliability. They surveyed libraries located in Australia and used the data to test various hypotheses about lead users and user innovations of the library information system OPAC (Online Public Access Catalog); the tests of their hypothesis produced detailed measurement scales and generated some interesting findings hypothesis tests from. The con-

¹ Although Morrison (1995) is an unpublished paper, we can refer to Morrison, Roberts, and von Hippel (2000) for the measurement scale and detailed discussion.

struct scores of LES have also been examined by Morrison, Roberts, and Midgley (2004).

Measurement scales other than LES are also used in this field. For example, Franke, von Hippel, and Schreier (2006) treated two lead user definitions as different constructs - the "Ahead of Trend" construct and the "High Benefit Expected" construct. They found that these two constructs are slightly correlated ($r = 0.14$, $p < 0.05$). Schreier and Prugl (2008) also investigated the relationship between various construct measures and proposed a one-dimensional construct that combined these two scales.

With this variety of interpretations in mind, researchers are able to choose whichever measurement scales they believe are most suitable for their research questions, industries, and hypotheses. Of all the approaches, the reliability and validity of LES is relatively well established, which is why this approach will be used for this empirical analysis.

2.3. Lead user measures in the field of consumer behavior theory

In this section, we examine the definition of lead users from within the context of consumer research. In line with von Hippel (1986), this article proposes that analyzing the behavior and desire of lead users in a sample group is a new and useful way to conduct market research. While lead users only represent one small sector of the marketplace, they are uniquely useful in terms of their knowledge and awareness of the product and market. Clearly, lead users are consumers with a special set of characteristics. In marketing or consumer studies, many researches examine types of consumers and identify their specific attributions or characteristics. These consumer characteristics are often defined as constructs, and many researchers have proposed measurement scales to evaluate these constructs. We can deal with

the lead user construct as a consumer characteristic in much the same manner.

Katsumata and Ichikohji (2011) re-examine von Hippel's definition of lead users by referring to the definition and explanation of lead users mentioned in Urban and von Hippel (1987) and von Hippel (2005); they propose a measurement scale to assess the lead user construct. They focus on the similarity of the definition between the lead users and some constructs developed in the field of consumer studies, and they try to assemble the lead user construct from the following constructs: "market maven" (Feick and Price, 1988), "fashion leadership" (King, 1965; Gutman and Mills, 1982; Goldsmith, Freiden and Kilsheimer, 1993), and "product cognoscente" (Yamamoto and Katahira, 2008)². They identify aspects of the lead user construct within these other constructs. Market mavens are defined as "individuals who have information about many kinds of products, places to shop, and other facets of markets, and initiate discussions with consumers and respond to requests from consumers for market information" (Feick and Price, 1987, pp. 85). This construct corresponds to the first definition of the lead user. King (1965) defines the construct of "fashion leadership" thus: "The fashion leaders play a key role in the diffusion of fashion and fashion information. Fashion leaders learn about new fashions earlier than the average buyer and they purchase new fashion items soon after they are introduced in the market." Following this, Goldsmith, Freiden, and Kilsheimer (1993) developed this notion further: "fashion leaders are more open to the excitement of buying new fashions and enjoy the fashion buying process because of the excitement" (Goldsmith, Freiden and Kilsheimer,

² This construct was originally named "Mekiki."

1993 , pp . 403) . Clearly then, fashion leaders obtain new product information ahead of other consumers; they also tend to purchase new products relatively early. These characteristics reflect a dissatisfaction with existing products, which rises before the average consumer, and a higher motivation than others to solve the problem. This corresponds to both the first and second definitions of the lead user. The product cognoscente defines those consumers who can identify whether a product will be widely adopted by consumers or not, which clearly corresponds to the first definition of the lead user. Katsumata and Ichikohji (2011) combine these three constructs and use this as a definition of a lead user. Their secondarily constructed measure was found to be statistically reliable. Because this scale results from a combination of three constructs from within the field of consumer studies, we call this measure as the Leading Consumer scale (LC) .

3 . Overview of the data collection

The survey research was conducted in the period February to March 2011 via the Internet. We assessed the lead user tendency in the following three markets: music, comics, and software development. We collected data from students aged 18 to 24 (university, college, graduate school, and vocational school students) . The total number of samples was 1,000 - 43.2% were male and 56.8% were female. We surveyed the participants to identify lead user tendencies in all three industries. For each industry, we collected two lead user scores (LES and LC) for each of the three industries. All items were measured using 5-point scales that ranged from 1 (disagree or not at all) to 5 (agree or to a very great extent) .

4 . Results

4 . 1 . Reliabilities of the constructs

Before comparing construct scores, we examined the reliabilities of each measurement scale by establishing whether we could extract construct scores appropriately from the obtained samples. First, we checked the Cronbach's alpha of the market maven, fashion leadership, and product cognoscente; these were used as the sub-constructs of LC for each of the three industries to assess the reliability of LC and LES. The results are shown in Table 1 . A Cronbach's alpha of above 0.7 is widely regarded as demonstrating construct reliability; all values of all constructs and sub-constructs were found to be above this threshold³ . For LES, the Cronbach's alpha values of all three industries were above 0.9 . For LC, the Cronbach's alpha values were all between 0.876 and 0.939 .

These results demonstrate that we can extract reliable construct scores from the two constructs.

Table 1: Reliabilities of the Constructs

		Music		Comics		Software Development	
		Number of Items	Cronbach's (Reliability)	Number of Items	Cronbach's (Reliability)	Number of Items	Cronbach's (Reliability)
LES	LES	7	0.931	7	0.952	7	0.976
LC	Market Maven	6	0.917	6	0.946	6	0.964
	Product Cognoscente	2	0.805	2	0.883	2	0.950
	Fashion Leadership	5	0.788	5	0.852	5	0.870
	LC	3	0.876	3	0.919	3	0.939

³ We omit one item from the market maven construct measure and two items from the fashion leadership construct measure.

4.2. Analysis of two construct scores

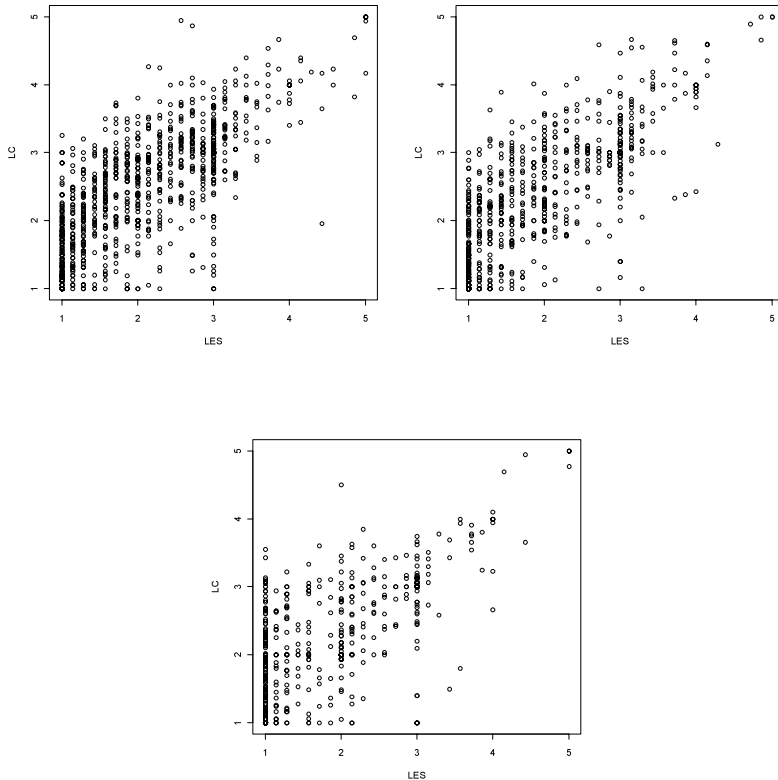
In this section, we will examine the similarities and differences between LES and LC.

First, we assess correlations between the obtained construct scores of LES and those of LC. Figure 1 shows the scatter plot of the two construct scores. As can be seen on the chart, these scores are distributed diagonally for all three industries. The correlation coefficients are 0.747 ($p < 0.01$) for music, 0.825 ($p < 0.01$) for comics, and 0.801 ($p < 0.01$) for software development. These correlation coefficients are high, which means that LES and LC are able to extract almost the same construct. In other words, the construct extracted by the LES measures has considerable similarity to some of the constructs developed in consumer studies. The first lead user tendency to understand market needs ahead of many other users is translatable to the construct of market maven and fashion leadership. Moreover, the characteristic tendency that lead users' needs or problems will become general in this market is also translatable to the concept of product cognoscente.

If we again refer to Figure 1, we can see that distribution of the LES score is relatively low compared to LC. The average LES values for music, comics, and software development are 2.09, 1.78, and 1.54 respectively, and the average values of LC are 2.48, 2.09, and 1.75 respectively. In all of three industries, the average value of LC is higher than that of LES. Since all the items for both LES and LC are measured on 5-point scales and construct scores are obtained by the average score of the items, construct scores would be 1 if all items were 1. This is the minimum score, and this means the respondent does not exhibit any lead user tendency. As Morrison, Roberts, and von Hippel (2000) remark, construct scores of lead users

should be continuously distributed; a high number of respondents scoring 1 should be avoided. A large number of scores of 1 makes it impossible to evaluate and order the consumers. Therefore, in any analysis, it is desirable to minimize the number of samples that score 1. With this in mind, we examine the two constructs and compare them. In LES, the rate of scores of 1 for music, comics, and software were 168 , 392 , and 610 respectively; in LC, these rates were 69 , 392 , and 431 respectively. This result shows that in all three industries, the number of samples that scored 1 for LC was lower

Fig.1 . Scatter plot of construct scores
(Upper Left: Music, Upper Right: Comics, Below: Software Development)



than for LES. This means that LC is better able to identify which samples have higher scores, when LES is unable to order them. From this perspective, LC is more widely applicable as a lead user construct measure than LES. However, in this research, while LES has 7 items, LC has $6 + 2 + 6 = 14$, meaning that the respondent load for LC was twice that of LES.

Table 2 shows the correlation coefficient between LES and LC, and three sub-constructs that constitute LC. There are high correlations between all three sub-construct scores and LES scores. This means that there are also high correlations between LES and each first construct, and LES is equally correlated to each construct.

Table 2: Correlation coefficients of two lead user constructs and three sub-constructs

	Music		Comics		Software Development	
	LES	LC	LES	LC	LES	LC
Market Maven	0.654	0.906	0.748	0.940	0.738	0.938
Product Cognoscente	0.585	0.874	0.701	0.912	0.827	0.954
Fashion Leadership	0.777	0.909	0.858	0.934	0.665	0.851

Note: All coefficients are statically significant at a 1% level.

4.3. Generality of the lead users

In his 1969 study, Rogers (1969) identified many characteristics of innovators. In contrast to many previous studies on this issue, in this study, innovators were defined not in terms of a specific product category but as a general tendency among people. Von Hippel (1986) stresses that in order to identify lead users, we must first determine the target market and trend; only then can we identify the lead users of the market and the trends. The lead users

are defined only in terms of a specific market. If a user has a high lead user score in one market, this may not always transfer to another market. However, very little research has examined lead users across several industries. In this section, we attempt to identify whether there is any generality between lead users of different markets.

Table 3 shows the correlation coefficients of the lead user scores for each industry. From the data on LC correlations, we find that there are high correlations among all three product categories. The correlation between the comics industry and the software development industry is the highest, followed by that of the music industry and the comics industry. Although the correlation between music and software development is the lowest, the coefficient value is still high enough to be statistically significant ($p < 0.01$). The correlation coefficients obtained from LES follow the same order as those for LC, while the values are higher.

All three industries belong to the contents industry; because of this, they share a number of similar characteristics. Indeed, this shared pool of characteristics implies that lead users in any one industry may also be lead users in the other two industries.

Table 3: Correlations among Product Categories
(Lower Triangle: LEC, Upper Triangle: LC)

LES \ LC	Music	Comic	Software Development
Music		0.399	0.341
Comic	0.510		0.459
Software Development	0.473	0.603	

Note: All coefficients are statically significant at a 1% level.

5 . Conclusion

In this research, we compared two lead user construct measurement scales. The first measurement scale, LES, was first proposed by Morrison (1995) , and the second measurement scale, LC, was proposed by Katsumata and Ichikohji (2011); the latter is a secondly obtained construct. The results of our analysis showed that both construct measures were statistically reliable and stable. Furthermore, since both measures showed a significantly high level of correlation with each other, we found that these two measures could be used to extract the same construct. However, LES and LC scores were found to be differently distributed, and the mean values also varied. When researchers conduct a survey to test the lead user hypothesis, they have to choose an appropriate measurement scale that takes into account the characteristics and nature of candidate measurement scales; this research examined two scales - LES and LC. Moreover, since this research surveyed only three product categories, further research on the reliability and property of these two measurements and a rigorous discussion about cross-industrial lead users would also be beneficial.

The concept of lead users and user innovation research are important topics in marketing and consumer studies. Understanding lead users helps firms understand how best to interact with the market. As a quantitative approach is usually used for assessing the benefits of lead users, the comparison between these two measures and the exploration of their nature undertaken by this study should serve as a valuable foundation for subsequent quantitative research. Future research should focus on extending this analysis to other industries as well as comparing other measurement scales that have been proposed in previous research.

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