Harnessing Anomalous Preferences of Anonymous Users for Lean Information Systems Development

Completed Research Paper

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ABSTRACT

When features are added to an existing Information Systems (IS) product in response to market demands it is important to assess their business value before implementing them into the product. But how does one estimate the true value of a new feature? Is it sufficient to consider only the consumer reward for including a feature into the product or is it also useful to evaluate the consumer penalty for not building the feature into the product? The current methods for feature selection capture only the consumer inputs for building a feature into the product. The implications of not building the feature are not captured. This study investigates the adequacy of such an approach and discovers that additional business information can be extracted by considering both, the reward as well as the penalty perspective of the user. This information can be utilized by producers in developing lean IS products, thereby providing salutary benefits to both provider and consumer.

Keywords
Lean Principles, Waste Reduction, Information Systems Development, Feature Selection

INTRODUCTION

Although the lean concept has its origins in manufacturing, specifically the Toyota production system, it is applicable to a large range of processes, from concept design to the factory floor. It is a search for perfection through the elimination of waste and the insertion of practices that contribute to reduction in cost and schedule while improving performance of products. Without eliminating waste from the product development process, the benefits of lean manufacturing cannot be fully realized. Applying Lean principles to the IS product development process can provide the upstream impetus to catalyze downstream efficiencies that will translate to improved business performance and overall competitiveness.

The first critical activity in product development is feature selection. In the product enhancement context, soon after the first release of a product, there is a steady stream of new requirements, improvements suggestions and complaints from existing and potential users of the product (Karlsson, Dahlstedt, Regnell, Dag and Persson, 2007). Producers use these inputs to continually enhance the features of their products to make them more attractive and valuable for the customers and to retain or gain market share. But unlike customized products and services where producers are in close contact with the customer and the scope of the product is guided by a mutual contract, developing products for the market involves dealing with a large number of nameless and faceless customers. The lack of day to day interactions, negotiations and conflict resolution with customers makes the task of selecting the critical requirements to be built into the product challenging.

Producers of products have therefore evolved various mechanisms to capture information such as websites and consumer discussion forums, consumer surveys, focus groups, consumer panels and ethnography. However, by actively engaging the consumers, more feature requests are often elicited than are needed to build into the system (Karlsson et al, 2007; Regnell and Eklundh, 1998). While on the one hand excluding a high value feature may mean losing customers to a competing product, on the other hand including a feature that is unneeded creates wasted development effort, delays in time-to-market, and increased complexity, maintenance and operational costs of the product. The challenge for the producers of goods and services is therefore to be able to distinguish between which features really add value for the maximum number of users and which features do not.

However, most of the methods of information capture from the users consider only the reward perspective aimed at eliciting the consumer response to introducing a feature into the product but not the penalty perspective such as the user response to not introducing a feature into the product. If the user response to the reward and penalty perspective is symmetric, that is the customer penalty for not implementing a feature into the product is the inverse of customer reward for implementing a feature.
into the product, then there is no problem. One can estimate the consumers’ penalty response based on the reward response: For example based on the assumption of a symmetric consumer response one can infer that if a consumer would like a particular to be implemented into the system then he would dislike if the feature is not implemented into the system. If the user is indifferent to a feature not implemented into the system, then he would be indifferent if the feature is implemented into the system. If the user would dislike a feature to be implemented into the system then he would like if the feature is not implemented into the system.

But if the reward and penalty responses are asymmetric, that is, if the user gives a seemingly irrational response by saying that he would expect to have a particular feature implemented into a product but is indifferent if the feature is not implemented into the system then there is a potential issue. Would not the producers then be wasting their scarce resources in implementing a feature that does not significantly add value to the customer? To find out whether the user perspectives are symmetric or asymmetric, we first surveyed existing literature on the subject and then conducted an experiment with actual users of a mobile task manager software product. We then tested whether the asymmetric user response demonstrated higher efficacy in identifying waste, that is features that did not add value to the product.

**LITERATURE REVIEW**

The three factor theory, popular in quality literature as the “theory of attractive quality” (Kano, Seraku, Takahashi and Tsuji, 1984), is based on Herzberg’s two factor theory or Motivation-Hygiene theory (Herzberg, 1966). The Motivation-Hygiene (Herzberg, 1966) theory was developed by Frederick Herzberg as an alternative to Maslow’s theory (1954) for studying job satisfaction. According to the Motivation-Hygiene theory (Herzberg, 1966) job satisfaction and dissatisfaction are determined by two different sets of factors. Factors found to affect job satisfaction (recognition, achievement, work itself, advancement, and responsibility) are called “motivation factors.” Factors found to affect job dissatisfaction (salary, company policies, interpersonal relations and working conditions), are called “hygiene factors” (Brenner, Cormack and Weinstein, 1971).

By implication, customer requirements can be classified into two categories, those that cause customer dissatisfaction if not fulfilled but no significant satisfaction if fulfilled and those that cause customer satisfaction if fulfilled but no dissatisfaction if not fulfilled. “Hygiene” factors are also called “Dissatisfiers” and “Motivation” factors are called “Satisfiers” (Zhang, VonDran, Small and Barcellos, 2000).

Earlier empirical studies (Swan and Combs, 1976; Maddox 1981; Cadotte and Turgeon, 1988; Johnston and Selvestro, 1990) found empirical support for the three-factor theory, the third factor leading to dissatisfaction as well as satisfaction. Today the three factor theory is widely accepted. According to the three factor theory or theory of attractive quality, requirements can be classified into three categories or factors:

Basic factors: They are prerequisites and must be satisfied first, at least at threshold levels, for the product to be accepted. The fulfillment of basic requirements is a necessary but not a sufficient condition for satisfaction. The user takes Basic requirements for granted, and therefore does not explicitly ask for them. They are similar to Herzberg’s “Hygiene factors” or “Dissatisfiers”. The other names used for Basic factors are Minimum Requirements (Brandt, 1988), Must-be requirements (Kano et al, 1993), and Implied requirements (ISO/IEC 9126-1, 2001).

Performance factors: These are requirements that the customer deliberately seeks to fulfill. They are uppermost in her consciousness. Fulfilling these requirements leads to user satisfaction and not fulfilling those leads to dissatisfaction. The other names for Performance factors are One-dimensional requirements (Kano et al, 1993), and Stated requirements (ISO/IEC 9126-1, 2001).

Excitement factors: Excitement requirements are those that the customer did not expect. They surprise the user by adding unexpected value to the product thereby delighting her. The Excitement factors are similar to Herzberg’s “Motivation factors” or “Satisfiers”. Not fulfilling excitement requirements do not lead to user dissatisfaction. The other names for Excitement requirements are Attractive requirements (Kano et al, 1993), and Value enhancing requirements (Brandt, 1988).

Thus a review of literature indicates that except for Performance factors the user reward for fulfilling a requirement and penalty for not fulfilling a requirement are not symmetric. The Kano (Kano, Seraku, Takahashi and Tsuji, 1984) survey method, developed by Dr. Noria Kano of Tokyo Riko University, is a widely accepted method for categorization of requirements by capturing the asymmetry in customer penalty-reward perspectives. The Kano survey includes two questions for every product feature: a functional question “How do you feel if this feature is present?” and a dysfunctional question “How do you feel if this feature is NOT present?” The first question reflects the consumer reward for including the feature into the product and the second question reflects his penalty for not including the feature into the product. The user has to
choose one of the five possible options for the answers for both the functional and dysfunctional question:

1. I like it this way
2. I expect it this way
3. I am neutral
4. I can live with it this way
5. I dislike it this way

If the consumer expects some feature to be present, but can live without the feature, it is not really a mandatory feature. Based on the consumer responses to the questions in both functional and dysfunctional form for each of his requirements, the quickest way to assess the questionnaires is to map each response in Table 1 and determine the category. Aggregating this response across consumers will then determine the category to which a particular requirement belongs according to the majority of consumers.

<table>
<thead>
<tr>
<th>Functional question</th>
<th>Dysfunctional question</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Like</td>
</tr>
<tr>
<td>Like</td>
<td>Q</td>
</tr>
<tr>
<td>Expect</td>
<td>R</td>
</tr>
<tr>
<td>Neutral</td>
<td>R</td>
</tr>
<tr>
<td>Live with</td>
<td>R</td>
</tr>
<tr>
<td>Dislike</td>
<td>R</td>
</tr>
</tbody>
</table>

Table 1: Matrix for Assessing Kano Categories

B-Must have or Basic requirements
P-Linear or Performance requirements
E-Excitement requirements
R-Reverse, i.e. wrong features, that would make the consumer experience worse
Q-Questionable, i.e. the consumer answers is inconsistent
I-Indifferent, i.e. the consumer does not care about this feature

To investigate whether the asymmetry in user response exists for IS products we conducted an experiment.

**METHOD**

An experimental method was used in this investigation for an actual and widely used software product – the Astrid Task Manager. Astrid is a popular open source task tracking application. Two experiments were conducted. As we wanted to have a homogeneous group, all subjects selected for the experiment were from a senior undergraduate class of MIS students of a large public university. The subjects for Experiment 1, 16 male and 7 female students, were all users of the Astrid Task Manager. The test instrument was a list of 15 randomly chosen feature requests from amongst all pending feature requests. The feature requests are posted on the Astrid user community forum (http://getsatisfaction.com/todoroo/products/todoroo_astrid). The feature requests taken from the company web site were re-worded in a simple and standard style, a sample set is shown in Table 2 as shifts in structure, content and format may introduce unwanted sources of variability that may confound subject response.
No | Feature description
---|---
1 | **Choose from a calendar**  
Allow dates to be chosen from a calendar. Currently the user has to manually enter the date
2 | **Auto Color Task**  
As the user browses through the pending task the color of the task should visually indicate to him how far it is from the due date.
3 | **Creating tasks that repeat yearly**  
Allow creation of yearly recurring tasks to remind users about important events such as birthdays, anniversaries etc. Currently the application allows daily, weekly and monthly recurring tasks only
4 | **Geolocation reminders**  
Provide a feature to remind users that they are passing through an important geolocation. For example if the user is passing a favorite supermarket, then remind her that she is doing so and ask whether she needs to purchase anything.
5 | **Grocery shopping list**  
Provide a feature to enable users to create and update a regular grocery list. This will enable the users to tick off the items purchased from the stores, so that they do not miss anything.
6 | **Make Quiet Hours completely quiet**  
Have a new option - “Super Quiet Hours” - during which all reminders should be disabled. Currently during 'Quiet Hours' the vibrator is enabled

Table 2: Sample of Feature Description in the Test Instrument

Each subject responded to two questions of the Kano survey. First, they were asked to give their opinion if the proposed requirement “IS” included in the next release of Astrid. Second, they were asked to give their opinion if the requirement “IS NOT” included in the next release. The reader is directed to Appendix A for more details regarding the questionnaire.

**EXPERIMENT 1: RESULTS AND ANALYSIS**

The results of the experiment 1 are summarized in Table 3. On analyzing the results, the asymmetric user reward-penalty perspective becomes apparent. Out of the total of 15 requirements, 3 requirements were classified in the Basic category, 3 in Performance category, 1 in Excitement category and 8 were classified as Indifferent. If the user reward-penalty was symmetric all requirements would have been classified either as Indifferent or in the Performance category. Of the 8 features which were classified as Indifferent by the Kano survey method, producers of the product may have built 4 features into the product if only the functional survey would have been conducted as the users’ had indicated that they expect these 4 features to be built into the product. But since in the dysfunctional survey users’ had mentioned that they were either neutral or can live with it if those 4 features were not included into the product, they got categorized in the Indifferent category. Hence taking both reward and penalty perspective helped in identifying additional 4 features out of 15 requested by the consumers which may not have added value if implemented into the product.

The features classified in the Basic category are prerequisites. If they are not fulfilled they lead to extreme dissatisfaction. Hence they are absolutely necessary for the product to survive in the market. But as they are taken for granted by the user fulfilling them does not increase user satisfaction. The performance features generate symmetric user response. If they are fulfilled they increase user satisfaction but if they are not fulfilled they lead to user dissatisfaction. Producers should therefore be competitive with respect to fulfilling Performance requirements of the user. The excitement factors lead to user delight and are differentiators in the market place. Producers should therefore ensure that they at least have some features in the product that excite their users.
**Feature Categories**  | **No. of features**
--- | ---
Basic (B) | 3
Performance (P) | 3
Excitement (E) | 1
Indifferent (I) | 8
**Total** | **15**

Table 3: Categories Derived from Kano Survey

**EXPERIMENT 2: RESULTS AND ANALYSES**

A second group of 28 randomly selected subjects, all senior undergraduate MIS students and users of Astrid, then rated their satisfaction with three sets of features categorized based on responses received from the group of students in Experiment 1 (see Table 1) on a 9 point scale that had a low of “extremely dissatisfied” on one end of the scale and a high of “delighted” on the other end of the scale. Set 1 had 6 features: 3 Basic and 3 Performance, 3B+3P. Set 2 had 10 features: 3 Basic, 3 Performance and 4 Indifferent features, 3B+3P+4I. Only those 4 Indifferent features out of the 8 were included in Set 2 which were detected by taking the Penalty-Reward perspective but were not identified by taking only the Reward perspective. Set 3 had 7 features: 3 Basic, 3 Performance and 1 Excitement, 3B+3P+1E. The experiment was designed to verify if the 4 Indifferent features has any impact on user satisfaction levels if included in the product. Set 3 was included in the experiment as a control.

<table>
<thead>
<tr>
<th>Feature Categories</th>
<th>Mean satisfaction level – 3B+3P (3 Basic + 3 Performance)</th>
<th>Testing Method: Two-sample independent t-test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>6.23</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Mean satisfaction level – 3B+3P+4I set (3 Basic + 3 Performance + 1 Excitement)</strong></td>
<td><strong>6.80</strong></td>
</tr>
<tr>
<td><strong>H₀</strong></td>
<td>Mean satisfaction (3B+3P) = Mean satisfaction (3B+3P+4I)</td>
<td><strong>p = 0.449</strong></td>
</tr>
</tbody>
</table>

Table 4: Satisfaction Level Comparison between Set 1 and Set 2

The results in Table 4 demonstrate that the reward-penalty perspective helped identify 4 additional features that users are Indifferent to and which would not have been identified through the reward perspective alone. Building these 4 features into an IS product would not have resulted in a significant difference in user satisfaction level.

<table>
<thead>
<tr>
<th>Feature Categories</th>
<th>Mean satisfaction level – 3B+3P (3 Basic + 3 Performance)</th>
<th>Testing Method: Two-sample independent t-test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>6.23</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Mean satisfaction level – 3B+3P+E set (3 Basic + 3 Performance + 1 Excitement)</strong></td>
<td><strong>7.10</strong></td>
</tr>
<tr>
<td><strong>H₀</strong></td>
<td>Mean satisfaction (3B+3P) = Mean satisfaction (3B+3P+1E)</td>
<td><strong>p = 0.000</strong></td>
</tr>
</tbody>
</table>

Table 5: Satisfaction Level Comparison between Set 1 and Set 3

The results in Table 5 show that the asymmetric reward-penalty perspective also helped identify a useful feature which if implemented into an IS product along with Basic and Performance feature would result in significant difference in user satisfaction level. Taken together, results from Table 4 and Table 5 therefore show that the 4 Indifferent features identified due to asymmetric consumer preferences did not add any value to the consumer while the 1 Excitement feature identified due to asymmetric user preferences did add significant value to the consumer.
**FURTHER ANALYSIS OF RESULTS**

Further analysis of the experimental results show that the users classified the following three of the fifteen requirements of the Mobile app as Basic requirements:

1. Choose date from a calendar – currently users enter the date manually
2. Purging completed tasks - currently tasks have to be purged one by one
3. Create tasks that repeat yearly - presently system allows creation of daily, weekly and monthly tasks only

Intuitively it makes sense to classify these three requirements in the Basic category since the features are so basic that they may be entirely taken for granted by the users that the producer will provide for them in the product. For example ‘choosing date from a calendar’ is now a commonly available feature across applications and users do not expect to enter date manually. But not providing a calendar feature will cause extreme dissatisfaction as the producer has failed to provide an essential product feature.

The following sets of three features out of fifteen were classified by respondents under the Performance requirements category:

4. Auto color Tasks – to indicate to the users how far it is from due date
5. Shortcut to create tasks – currently it requires 3 clicks to go to the task creation option
6. Color tasks based on priority – to enable users to visually see task priority

This classification also made sense because these are user specific requirements that are not basic to this product (a task tracking system) or even this class of products. Satisfying them will enhance user satisfaction while not satisfying them will result in user disappointment.

One requirement was classified in the Excitement (Unstated) category:

7. Grocery shopping list – to enable users to create and update a regular grocery shopping list that will enable them to check and tick off the items purchased from the store.

This is an innovative feature which a typical user would not normally expect, but would be thrilled to have if provided.

Thus the asymmetric user response to product features has helped extract additional business information resulting in a lean set of 7 features that add value to the product out of a total of 15 features requested by the users, thereby preventing waste.

**CONTRIBUTION AND PRACTICAL IMPLICATIONS**

According to the Lean concept there are two types of waste or Muda. Type I Muda and Type II Muda. Type I Muda is found in activities that add no value to the customer, but are presently unavoidable due to constraints in the current development setup. Type II Muda is found in activities that don't create value and can be eliminated immediately, such as slack in scheduling activities. This study contributes to literature by addressing the more difficult Type I Muda in product development.

By demonstrating the asymmetric penalty-reward perspective of the consumer, the study highlights the need for capturing both perspectives to derive additional business information from a consumer feature request to determine its true value. Identifying only the consumer requirements that add value to the consumer frees the producer from pursuing maximum requirements coverage to being empowered with information allowing her to meet user expectations while at the same time optimally utilizing its resources. On the other hand the users have the satisfaction of seeing their critical product upgrade requests quickly implemented into the product. In addition by building only those features that the consumers’ value reduces the complexity of the product. This brings further downstream benefits such as lower costs of manufacturing and easy maintainability of the product.

**LIMITATIONS AND FUTURE RESEARCH**

This exploratory study was conducted with a homogeneous group of senior undergraduate MIS students as subjects. The homogeneity of the subject group was necessary for control and internal validity of the results. However, as the implications of research in the area could be of considerable value to practitioners, for greater validity and generalization of results future research could replicate this study with different products and non-student user segments.
APPENDIX A

Figure 1: Requirements Prioritization Questionnaire

Part A: All questionnaires begin with a textual and graphical overview of the Astrid app.

Part B: Participants were presented with 15 candidate new Astrid features, and then asked for their response. For example, one proposed feature was presented as follows:

Purging completed tasks: Provide a feature to purge all completed tasks. Currently the tasks have to be deleted one by one.

Participants in the Kano survey were asked 2 Multiple Choice Questions:

<table>
<thead>
<tr>
<th>How would you feel if the product <strong>did</strong> have this feature?</th>
<th>How would you feel if the product <strong>did not</strong> have this feature?</th>
</tr>
</thead>
<tbody>
<tr>
<td>• I like it this way</td>
<td>• I like it this way</td>
</tr>
<tr>
<td>• I expect it this way</td>
<td>• I expect it this way</td>
</tr>
<tr>
<td>• I am neutral</td>
<td>• I am neutral</td>
</tr>
<tr>
<td>• I can live with it this way</td>
<td>• I can live with it this way</td>
</tr>
<tr>
<td>• I dislike it this way</td>
<td>• I dislike it this way</td>
</tr>
</tbody>
</table>
REFERENCES


