Software Analytics for Planning Product Evolution

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13th June 2016
Introduction

- Software product evolution
- Software product plan is a base for software evolution
- Product plan needs information (e.g. company goals, market trends, product requirements, and stakeholder priorities)
- Product plan is validated by consulting external and internal stakeholders using consultation techniques (e.g. focus group, workshops, survey)

But
- Dependency on stakeholders---> biased information, exposed to politics, no willing for sharing information
- Product managers needs to access to primary, real world data
Knowledge gap

- **Web Marketing** to advertise and sell services [1]
- **Usability Engineering** to improve user experience [2]
- **Reliability Engineering** to guarantee access to functionality and services [2]
- **Business strategy** identification [4]

**Gap:**
- Not clear use of analytics for product planning
- What analytics we need for different decisions

Research Aim

- Literature review
  - Developing an overview on product planning decisions and analytics in terms of categories

- Empirical study
  - Understand whether and when analytics are valuable for product planning (IEEE cloud 2013)
  - Connect software products analytics to product planning decisions
## Taxonomy of product planning decisions

<table>
<thead>
<tr>
<th>Practice Area</th>
<th>Decision Object</th>
<th>Decision Alternatives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portfolio Management</td>
<td>Products in the company’s portfolio</td>
<td>Create</td>
</tr>
<tr>
<td>Product Roadmapping</td>
<td>Features of a product</td>
<td>Enhance, Change</td>
</tr>
<tr>
<td>Release Planning</td>
<td>Requirement in a feature selected for release</td>
<td>Prioritize</td>
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<tr>
<td></td>
<td></td>
<td>Remove</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Allocate Resource</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Allocate to Release</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Confirm Technology</td>
</tr>
</tbody>
</table>
Analytics definition

Analytics definition:

“Software product analytics are the quantitative measures, collected during product use, giving actionable insight to product managers for taking planning decisions.”

Relation with other definitions:

- measures and metrics (as in ISO 25010, ISO 15939)
- actionable insight [1], decision-making (ISO 15939)
- process of satisfying the information needs [2]

General list of analytics

<table>
<thead>
<tr>
<th>Mapped Entities to product</th>
<th>Entities</th>
<th>Attributes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Product</strong></td>
<td>Website</td>
<td>Errors, Downtime, Response time, Throughput, Attacks</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Users, New users, Returning users, Referrers, Location/ISP per use, Search engines and keywords, Campaigns, Browsers, Operating systems, Languages, Plugins, Screen resolutions.</td>
</tr>
<tr>
<td><strong>Feature/content</strong></td>
<td>Page</td>
<td>Errors, Response time</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Users, Search engines and keywords, Campaigns</td>
</tr>
<tr>
<td><strong>GUI Requirement</strong></td>
<td>GUI Element</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-</td>
</tr>
</tbody>
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Study design

- **Research Question:**
  - What analytics do product managers prefer for a given product planning decision?
  - How are analytics used for planning product evolution?

- **Research method:** Interview-based Survey

- **Samples:** 17 product managers

- **Instrument:**
  - Semi-structured questionnaire
    - context facets of products and organization
    - importance of analytics for planning decision
    - Reasoning

- **Analysis:**
  - Quantitative analysis
  - Qualitative analysis
Demography

Organization size

Product Type

New- Evolutionary

Development team size
Preferences of product managers for analytics

Qualitative analysis

Preparation phase
- Select an argument unit from interviews results
- Make sense of data as a whole

Organizing phase
- Perform open coding
- Group data by content
- Perform Categorization
- Perform abstraction

Reporting phase
- Conceptual categories and discussion

Start

Example:

When you are creating an immature product, it is hard to base your decision on statistics. In their product it is good
to create more customer benefit which are get from customer feedback. For
immature product, if we agree on prioritizing feature, the
statistics are not useful for them.
Also for taking “create” decision. Prototype would
be more useful. But for tuning functionality and enhancing, then
this statistic can have benefits.

Sub-Categories
- Maturity of a product
- Decision Oriented
- Decision making support
- Customer benefit based goal
- User Satisfaction based goal
- Web based product
- Intranet based product
- Number of users
- Understand user behavior

Generic Categories
- Maturity
- Product Goal
- Product Characteristic
- Product usability

Conceptual categories and discussion
product managers use *analytics to interpret the product goals while the analytics are constrained by both product characteristics and product goals.*
Conceptual Model: product

Product Characteristics:
- Product users
- Network Type
- Product context
- Product technology
- Product features
- Product maturity

PM: Product has developed for current users, not new users

PM: For IPhone, Dos and worm attacks are not important

PM: Product is only in English, language analytics not important

PM: For intranet-based product, just error and response time

PM: Support all OS, all browsers

PM: Difficult to use analytics for immature product
Conceptual Model: Goal

Product Characteristics → Constrain → Analytics

Product Goals

PM: Referral source is not importance since we sell product to an organization not end users.

PM: Referral source measures is
- important if it shows which segment the user belongs
- less important if it shows from which country

Product Goals:
- Market Positioning
- Customer Satisfaction
- Functional suitability
- Reliability
Conceptual Model: Goal

Product Goals:
- Market Positioning
- Customer Satisfaction
- Functional suitability
- Reliability

PM: Referral source measure is interesting, learn market’s structure, map it to the feature use, input for prioritizing features
Shifting from product characteristics to goals using analytics

**Product**: SaaS-based Knowledge Management

**Goal**: Grab Tacit knowledge and encourage adequate number of users

**PM**: End-users are inside some specific organizations, so referral source measurements are not important for us.

**PM**: Feature-use is very important because it shows which parts of the system the users are engaged

**PM**: For gathering tacit knowledge it is important to understand who are the lead users to target specific users
Analytics process for product planning

**Step 1:**
- Extract product characteristics
- Prepare list of product goals

**Step 2:**
- Filter list of analytics
- General list of analytics

**Step 3:**
- Measure, analyze and interpret
- List of planning decisions

**Step 4:**
- Take product planning decisions
- Planning decisions

**Example of Product characteristics:**
- Context
- features
- users
- Platform
- network type
- maturity

**Example of goals categories:**
- market positioning
- organizational grows
- meeting quality-in-use in ISO/IEC 25010
- (e.g. customer satisfaction, efficiency, effectiveness)
- improving product quality ISO/IEC 25010 (e.g. usability, functional suitability, maintainability, reliability and performance efficiency)
• General list of analytics
• Use Measurement Information Model defined in ISO 15939
Analytic process for product planning

- List of planning decisions
Discussion: Contribution

- A conceptual model
  - Analytics used to interpret product goals and constrained by product goals and product characteristics

- Analytics process for product planning decision

- Using the conceptual model and process to be useful to collect information to evaluate stakeholders claims and become proactive in decision making about the products
  - List of analytics based on literature review
  - List of product planning decision based on literature review
Discussion : Implications

- **Research**
  - The proposed model enables modern development (e.g. agile development, continuous integration, and continuous deployment)
  - Software product/prototype is the pre-requisite for using runtime analytics for product planning

- **Product Manager of software vendors**
  - Interpreting the analytics to use data science as a basis for decision supports
Discussion: Threats to validity

- **Reliability:** reviews of codes second author, developed a research database and a chain of evidence
- **Construct validity:** explain the questions and clarify the answers during the interviews
- **Internal validity:** Chain of evidence from product manager’s statement to the model
- **External validity:** developed the model based on customer and business oriented products
  - Nothing in the model and process constrains the results to SaaS products only
Future Research

- Expanding the decision types to portfolio management and release planning decisions
- Extend the model by understanding which measurements support each product goal
- Expanding the understanding of the generic relationships between combinations of software quality attributes and their impacts as well quality attributes relationship.
Summary and Conclusion

- Study analytics as a mean based on primary real world data to make product planning decisions in the context where product manager were exposed to
  - biased information
  - exposed to politics
  - no willing for sharing information
- Study design: 17 product manager, semi-structured interview, qualitative analysis
- Key contributions:
  - Conceptual model
  - Analytics process for product planning
  - Using the conceptual model and process to be useful to collect information to evaluate stakeholders claims and become proactive in decision making about the products
Thank you