Use of complaint records of maintenance departments for continuous improvement

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INTRODUCTION
Research Problem

Quality management system are still ineffective!!
High number of customer complaints in the housebuilding market, resulting in waste, high repair costs, and a negative impact on customer satisfaction.

Continuous Improvement
Improvement opportunities must be identified.
It is necessary to follow and assess product performance.

Customer complaints records
It is not enough explored by housebuilding companies;
Unstructured data collection;
Quality indicators rarely provide useful information.
INTRODUCTION
Research Problem

Articles previously published at IGLC:
- Most studies aim to improve production and design management.
- Very few studies on quality evaluation from the perspective of customers.

Importance
- Eliminating defects and complaints is a typical target in Lean implementation programs. However, there are usually customer complaints that should be managed and provide feedback.
- Customer service can contribute to create positive relationships with customers and generate value.
This research investigates how to use the complaints records as a source of learning for continuous improvement in quality management systems of construction companies.
RESEARCH METHOD

Large Brazilian Housebuilding Company

Leading company in the implementation of Lean Production practices in Brazil, including the Last Planner System, Visual Management, and material supply Kanban systems.

Maintenance Department

Provides customer services to all projects that have been delivered. The company has the vision of increasing the engineering role of this department: provide effective feedback to quality management.

Andon

Material kits

Visual Management
RESEARCH METHOD

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Maintenance Department

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Dry Wall prototype

Supply at the workplace
RESEARCH METHOD

Maintenance department of a Brazilian housebuilding company.

- Categorization of defects
- Analyse of 5,628 records of complaints
- Interviews and seminars to discuss results
Hierarchical classification structure.

Definitions of “component”, "elements" and "systems" made by NBR 15575 (ABNT, 2013).

Classifications of defects found in previous studies.
RESEARCH METHOD
Analysis of defects

Fault Tree Analysis (FTA)

Occurrence Probability (OP)

\[ OP = \frac{(\text{un})\text{favourable results}}{\text{Possible results}} \]

\[ OP = \frac{\text{Number of defects}}{\text{Number of houses covered by warranty}} \]
RESULTS
Classification Structure

<table>
<thead>
<tr>
<th>SPACE</th>
<th>SYSTEM</th>
<th>ELEMENT</th>
<th>COMPONENT</th>
<th>TYPE OF DEFECT</th>
<th>DEFECT DETAILING</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Building Systems</td>
<td>Internal Walls</td>
<td>Mortar Coating</td>
<td>Detachment</td>
<td>Walls, near the slab</td>
</tr>
<tr>
<td></td>
<td>Vertical Partitions</td>
<td></td>
<td>Ceramic tile</td>
<td>Mold</td>
<td>Mapped cracks</td>
</tr>
<tr>
<td></td>
<td>Windows and Doors</td>
<td>External Walls</td>
<td>Painting</td>
<td>Cracks</td>
<td>45° Windows</td>
</tr>
<tr>
<td>Bathroom</td>
<td>Horizontal Partitions</td>
<td></td>
<td>Waterproofing</td>
<td>Uneven</td>
<td>Associated with consolidation</td>
</tr>
<tr>
<td></td>
<td>Structure</td>
<td></td>
<td>Wood coating</td>
<td>Cracked or broken</td>
<td>Base and adhesive mortar</td>
</tr>
<tr>
<td></td>
<td>Complementary</td>
<td></td>
<td>Ceramic tile</td>
<td>Detachment</td>
<td>Adhesive mortar and ceramic tile</td>
</tr>
<tr>
<td></td>
<td>Equipment</td>
<td></td>
<td>Painting</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Furniture</td>
<td></td>
<td>Cabinets</td>
<td>broken</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Chairs</td>
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<td></td>
<td></td>
<td></td>
<td>Curtains</td>
<td></td>
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</tr>
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<td>Horizontal Partitions</td>
<td>Roof</td>
<td>Ceramic tile</td>
<td>Cracked or broken</td>
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RESULTS
Sorting of complaint records

5,628 records

Records analysed

Nature of valid records

- Valid records: 69.28%
- Invalid records: 30.72%
- Records on construction defects: 70.30%
- Records on inadequate repair: 27.24%
- Records not related to design and construction failures: 2.46%
RESULTS
Fault Tree Analysis (FTA)
RESULTS
Fault Tree Analysis (FTA)

1251 apartments in warranty period

Complaints
n=111

Complaints
n=93

15% reduction in the probability of the "vertical partitions" failing!
## RESULTS

**Other indicators**

### Vertical Partitions

<table>
<thead>
<tr>
<th>Type of defect</th>
<th>PO</th>
<th>Severity</th>
<th>Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infiltration or leakage</td>
<td>7.25%</td>
<td>1.50</td>
<td>Severe</td>
</tr>
<tr>
<td>Cracks, clenches or disruptions</td>
<td>0.71%</td>
<td>0.50</td>
<td>Light</td>
</tr>
<tr>
<td>Detachment or displacement</td>
<td>0.08%</td>
<td>2.00</td>
<td>Critical</td>
</tr>
<tr>
<td>Detachment or displacement</td>
<td>7.43%</td>
<td>2.00</td>
<td>Critical</td>
</tr>
<tr>
<td>Chipped, cracked or broken</td>
<td>1.12%</td>
<td>1.00</td>
<td>Medium</td>
</tr>
<tr>
<td>Cracks, clenches or disruptions</td>
<td>0.22%</td>
<td>0.50</td>
<td>Light</td>
</tr>
<tr>
<td>Peeling paint</td>
<td>0.07%</td>
<td>0.50</td>
<td>Light</td>
</tr>
</tbody>
</table>
CONCLUSIONS
Theoretical and practical contributions

**Data collection**
Classification Structure: organized, complete and detailed data collection

**Data Analysis**
Indicators and Statistical methods: identify the most critical systems, elements and types of defects in the projects delivered.

Previous studies that have attempted to use data mining for analyzing complaints have not been successful in producing knowledge due to deficiencies in data collection. Therefore, it is necessary to improve data collection and analysis methods.
FURTHER STUDIES

- Full implementation of the proposed classification structure;
- Further developing quality indicators and adapting statistical methods;
- Integrating of complaints database to BIM models;
- Developing of information systems for mobile computing to support data collection in customer service
Use of complaint records of maintenance departments for continuous improvement

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Thank you for your attention!!