IMPROVING COMMUNICATION PROCESS ON CONSTRUCTION SITES USING MOBILE TECHNOLOGIES AND CLOUD COMPUTING

Presented by Daniel Forgues, PhD.
June 8 - 10, 2015, UBC, Vancouver

AUTHORS
Sébastien Frenette, Master Student, Daniel Forgues PhD., Souha Tahrani PhD., GEN-346
RESEARCH SCOPE AND GOALS

MAIN OBJECTIVE

Define how MOBILES TECHNOLOGIES and CLOUD COMPUTING can improve communication process on the construction sites through a context of ADMINISTRATION AND PROJECT MANAGEMENT.

Photos: These photos are the property of GRIDD.
CONTEXT
The **MAJORITY OF INFORMATION** is exchanged during the construction phase to track the progress, the quality and the construction cost, but this step is **THE LESS COMPUTERIZED**.

**WHY?**

This phase is oriented on **TRADITIONAL PAPER-BASED PROCESSES** to collect data and **INEFFICIENT MEANS** of communication.

And it was quickly validated ...

*Photos*: These photos are the property of GRIDD.
What is mobility?

Mobility is a generic term used to refer to tools that allow people to access data or information regardless of where they are.

Source: Utilisation de la mobilité en gestion de projet, Olivier Laquinte et Éric Dupont, janvier 2013
Potential of mobile technologies

- Improve information sharing
- Centralizing project information
- Bring stakeholders together in a single database
- Reduce wasted time
- Reduce duplication of information
- Reduce the use of paper

Sources: Forgues, Tahrani et Frenette 2014
http://www.cefrio.qc.ca/media/uploader Construction_20_final.pdf
METHODOLOGY – PHASES

2013
J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A

2014

PRELIMINARY PHASE
Pilot Project

PHASE 1
Provincial Survey

PHASE 2
Case Studies

EXPERIMENT the use of Mobile technologies on site

DEVELOP AN EVALUATION FRAMEWORK mobile applications

Develop a CONCEPT OF OPERATION to improve the use of Mobile technologies and Cloud Computing

IDENTIFICATION OF INDICATORS OF IMPROVEMENT

ASSESSMENT MATURITY

ASSESSMENT OF IN SITU BENEFITS

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METHODOLOGY - PHASES

2013
J F M A M J J A S O N D J F M A M J J A

PRELIMINARY PHASE
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ASSESSMENT MATURITY

PHASE 2
Case Studies

Develop a CONCEPT OF OPERATION to improve the use of Mobile technologies and Cloud Computing

ASSESSMENT OF IN SITU BENEFITS

ANALYSIS AND WRITING
## METHODOLOGY - CASE STUDIES

<table>
<thead>
<tr>
<th>General Contractor</th>
<th>Consortium General Contractors</th>
<th>Owner</th>
</tr>
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<tbody>
<tr>
<td>CASE STUDY A</td>
<td>CASE STUDY B</td>
<td>CASE STUDY C</td>
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### Building Categories

- **Commercial Buildings**
- **Institutional Buildings**
- **Large public utilities**

### Stakeholders Involved in the Study

- **Superintendent**
- **Foreman**
- **Manager**
- **Quality Monitoring Team**
- **Construction Team**
- **Field Inspector**
- **Project Planner**
- **Cost Controller**
METHODOLOGY – PROCESS

CASE A – GENERAL CONTRACTOR

CASE B – CONSORTIUM OF GENERAL CONTRACTORS

CASE C – OWNER

Step 1
KICK-OFF SURVEY
Case A, n = 32
Case B, n = 12
Case C, n = 0

Step 2
KICK-OFF INTERVIEW
Case A, n = 21
Case B, n = 9
Case C, n = 0

Step 3
ON SITE SHADOWING
Case A, n = 10
Case B, n = 5
Case C, n = 6

Step 4
ENDING SURVEY
Case A, n = 25
Case B, n = 12
Case C, n = 9

Step 5
FINAL INTERVIEW
Case A, n = 0
Case B, n = 0
Case C, n = 8
METHODOLOGY - SAMPLE

 PROJECT MANAGER: 15% (Case A), 9% (Case B), 2% (Case C)
 ON-SITE SUPERVISOR: 4% (Case A), 2% (Case B), 8% (Case C)
 DOCUMENTS ADMINISTRATOR: 10% (Case A)
 ESTIMATOR / PLANNER: 2% (Case A), 8% (Case B)
 INTERN STUDENT: 8% (Case A)
 QUALITY CONTROLLER: 6% (Case A)
 FIELD SUPERINTENDENT: 4% (Case A), 3% (Case B)
 CHEF SUPERINTENDANT: 6% (Case A)
 FOREMAN: 6% (Case A)
 ARCHITECT: 4% (Case A)
 CLIENT: 4% (Case A)
 SECURITY OFFICER: 2% (Case A)
 FIELD ENGINEER: 2% (Case A)

n = 53
SAMPLE PROFILE

Field staffs 23%

Supervisors 32%

Project Managers 45%
PREVIOUSLY

PRELIMINARY PHASE
2013 – 2014
ANALYSIS AND TOOLS

FRAMEWORK DEVELOPED AFTER THE PRELIMINARY PHASE

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<td>Integrate the Field Manager into the management process</td>
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<td>Centralize the data of the project on a unique data base</td>
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<td>Define a sequence of operations unified through all the company involve</td>
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<td>Use the technology to automate the collection and the management of data</td>
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Figure adapted from Egan (2002). The potential of changes defined are aligned with the work of Bowden (2005), Rivard (2000) and Ruwanpura (2008).
ANALYSIS AND TOOLS

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**Identify benefits from the use of MOBILE TECHNOLOGIES AND CLOUD COMPUTING on the construction site**

Figure adapted from *Egan* (2002). The potential of changes defined are aligned with the work of *Bowden* (2005), *Rivard* (2000) and *Ruwanpura* (2008).
PHASE 1 – EVALUATE MATURITY 2014
Uses of mobile technologies

Survey sample (700 responses)

- **39%**
  - Access to e-mail
- **29%**
  - Access to agenda
- **15%**
  - Updating To do list
- **9%**
  - Weather report
- **8%**
  - Notes, photos, etc.

Source: Forgues, Tahrani et Frenette 2014
http://www.cefrio.qc.ca/media/uploader Construction_20_final.pdf
ANALYSIS AND TOOLS

FRAMEWORK DEVELOPED AFTER THE PHASE 1 – 2014

How to assess the maturity level of companies using mobile IT?

**PASSIVE MODE**
Minor incidence

**TRANSITION MODE**
Moderate incidence

**ACTIVE MODE**
Major incidence

Accessing documents → Sharing documents → Communication and conferencing → Project management

Level of maturity with Mobile Technologies

ANALYSIS AND TOOLS

FRAMEWORK DEVELOPED AFTER THE PHASE 1 – 2014

How to assess the maturity level of companies using mobile IT?

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PASSIVE MODE
Minor incidence

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Moderate incidence

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Major incidence

ANALYSIS AND TOOLS

PHASE 2 – TECHNOLOGIES USED IN THE CASE STUDIES

**CASE STUDY A**
General Contractor

- **Smart Use**
- **Level of maturity**: 3
- **Communication and conferencing**
- **Main functions**: Annotation layer per user and Overlay Plans

**CASE STUDY B**
Consortium General Contractors

- **LATÍSTA**
- **Level of maturity**: 4
- **Project Management**
- **Main functions**: Set up workflow between entreprises involved

**CASE STUDY C**
Owner

- **RÉTROACTION DE CHANTIER**
- **Level of maturity**: 4
- **Project Management**
- **Main functions**: Automatisation of daily reports

**Important:** The list of features presented above is not exhaustive.
RESULTS – TIME SAVING

CASE STUDY A
General contractor
SMART-USE

- Improve access to site information: 3.33
- Improve acquisition of information in real time: 3.33
- Optimizing my work efficiency: 2.61

CASE STUDY B
Consortium
LATISTA

- Improve information sharing: 3.56
- Problems identification on site: 3.33
- Information collect in real time: 3.22

CASE STUDY C
OWNER
RÉTROACTION

- Information collect in real time: 3.25
- Improve access to site information: 3.25
- Writing daily reports: 2.88

LEGENDE
0 – NO IMPACT
1 – MINOR IMPACT
2 – MODERATE IMPACT
3 – IMPORTANT IMPACT
4 – MAJOR IMPACT
RESULTS – COST TRACKING

CASE STUDY A
General contractor
SMART-USE

<table>
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<tr>
<td>On site Troubleshooting</td>
<td>2,39</td>
</tr>
<tr>
<td>Reduced rework</td>
<td>1,61</td>
</tr>
<tr>
<td>Predictability</td>
<td>1</td>
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CASE STUDY B
Consortium
LATISTA

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<tr>
<td>Establishing performance indicators</td>
<td>1,78</td>
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CASE STUDY C
OWNER
RÉTROACTION

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LEGENDE
0 – NO IMPACT 1 – MINOR IMPACT 2 – MODERATE IMPACT 3 – IMPORTANT IMPACT 4 – MAJOR IMPACT

GEN - 346
RESULTS – QUALITY MONITORING

CASE STUDY A
General contractor
SMART-USE
Information Standardization
Collecting Information on site
Project Quality Control

CASE STUDY B
Consortium
LATISTA
Tracking site events
Quality Control
Information Standardization

CASE STUDY C
OWNER
RÉTROACTION
Information Standardization
Collecting Information on the site
Tracking site events

LEGENDE
0 – NO IMPACT
1 – MINOR IMPACT
2 – MODERATE IMPACT
3 – IMPORTANT IMPACT
4 – MAJOR IMPACT

GEN - 346
RESULTS – PROJECT MANAGEMENT

CASE STUDY A
General contractor
SMART-USE

Project documents sharing: 3.17
Communication with my team: 2.56
Coordination with the others Entreprises: 2.06

CASE STUDY B
Consortium
LATISTA

Research and information control: 3.33
Sharing information with enterprises: 3.33
Project documents sharing: 2.89

CASE STUDY C
OWNER
RÉTROACTION

Monitoring materials/machinery: 3.13
Research and information control: 2.88
Monitoring site tasks: 2.63

LEGEND
0 – NO IMPACT
1 – MINOR IMPACT
2 – MODERATE IMPACT
3 – IMPORTANT IMPACT
4 – MAJOR IMPACT
ANALYSIS RESULTS

CASE STUDY A
General contractor

CASE STUDY B
Consortium

CASE STUDY C
Owner

LEGEND

0 – NO IMPACT
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PREVIOUSLY

BEFORE

THE USE OF MOBILE TECHNOLOGIES

AND CLOUD COMPUTING
ANALYSIS RESULTS
ANALYSIS RESULTS

SPLIT BETWEEN

FIELD & MANAGEMENT TEAM

QUALITY MANAGER

QUALITY CONTROLLER

MANAGER

FIELD STAFF

GEN - 346
ANALYSIS RESULTS

AFTER

PROPOSITION FOR THE USE OF
MOBILE TECHNOLOGIES
AND CLOUD COMPUTING
ANALYSIS RESULTS
CONCLUSION

THE MAJOR POTENTIALS

- TIME SAVING
- QUALITY MONITORING

THE KEY BENEFITS FROM THE USERS

- The information sharing is **FASTER**
- The information **SHARING** between site stakeholders are **IMPROVED**
- The **IDENTIFICATION** of problems on site is **FASTER** and **ACCURATE**
- The data acquisition is in **REAL TIME**

Photos: These photos are the property of GRIDD.
Thank You - Merci

DANIEL FORGUES
Arch., Ph.D. Professor
Research Director
GRIDD, ETS, Québec

SOUHA TAHRANI
Arch. Ph.D.
Research Associate
GRIDD, ETS, Québec

SÉBASTIEN FRENETTE
B.Eng., M.Sc.A.
Research Assistant
GRIDD, ETS, Québec

Email: sebastien.frenette.2@ens.etsmtl.ca

AUTHORS
Daniel Forgues PhD., Souha Tahrani PhD., Sébastien Frenette, Master Student
GEN-346
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DANIEL FORGUES
Arch., Ph.D. Professor
Research Director
GRIDD, ETS, Québec

SOUHA TAHRANI
Arch. Ph.D.
Research Associate
GRIDD, ETS, Québec

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B.Eng., M.Sc.A.
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