Early Involvement and Integration in Construction Projects: The Benefits of DfX in Elimination of Wastes

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- Introduction
- Early Involvement anf Integration
- Relational project delivery agrements
- Waste types
- DfX
- Results

Introduction

- Typical construction processes provide waste:
  - material waste
  - process-related waste.
- The majority of this waste can be avoided with efficient planning in the front end of projects.
- DfX is a management approach for coordinating design requirements of all stakeholders
- When applied, DfX creates incentives for project stakeholders to eliminate waste automatically through early involvement and integration.

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Early Involvement

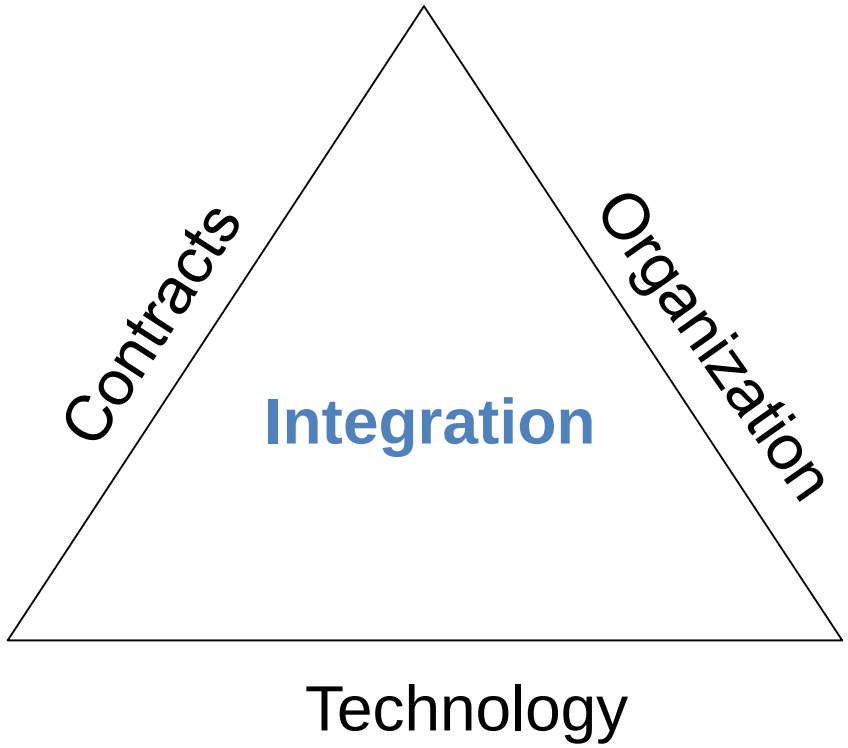
Early involvement gives following benefits (Dowlatshahi, 1998; van Valkenburg, Lenferink, Nijsten, & Arts, 2008):

- Leads to greater client satisfaction regarding the product's function and usage.
- Leads to the lower likelihood of developing poor designs, and a higher probability of improved construction operations and less scrap.
- Enables creation of innovative solutions and intensive exchange of ideas.
- Leads to the procedures that are synchronized and run in phases.

Integration

- Integration is a contrast to fragmentation
- Essential part of improving productivity
- Coordination is an important part of the integration and can be implemented through information systems

- There are three types of integration mechanisms:
  - Contractual - plans and formalized rules, policies, and procedures
  - Organizational - organizational charts and written policies
  - Technological - standardized information and communication systems



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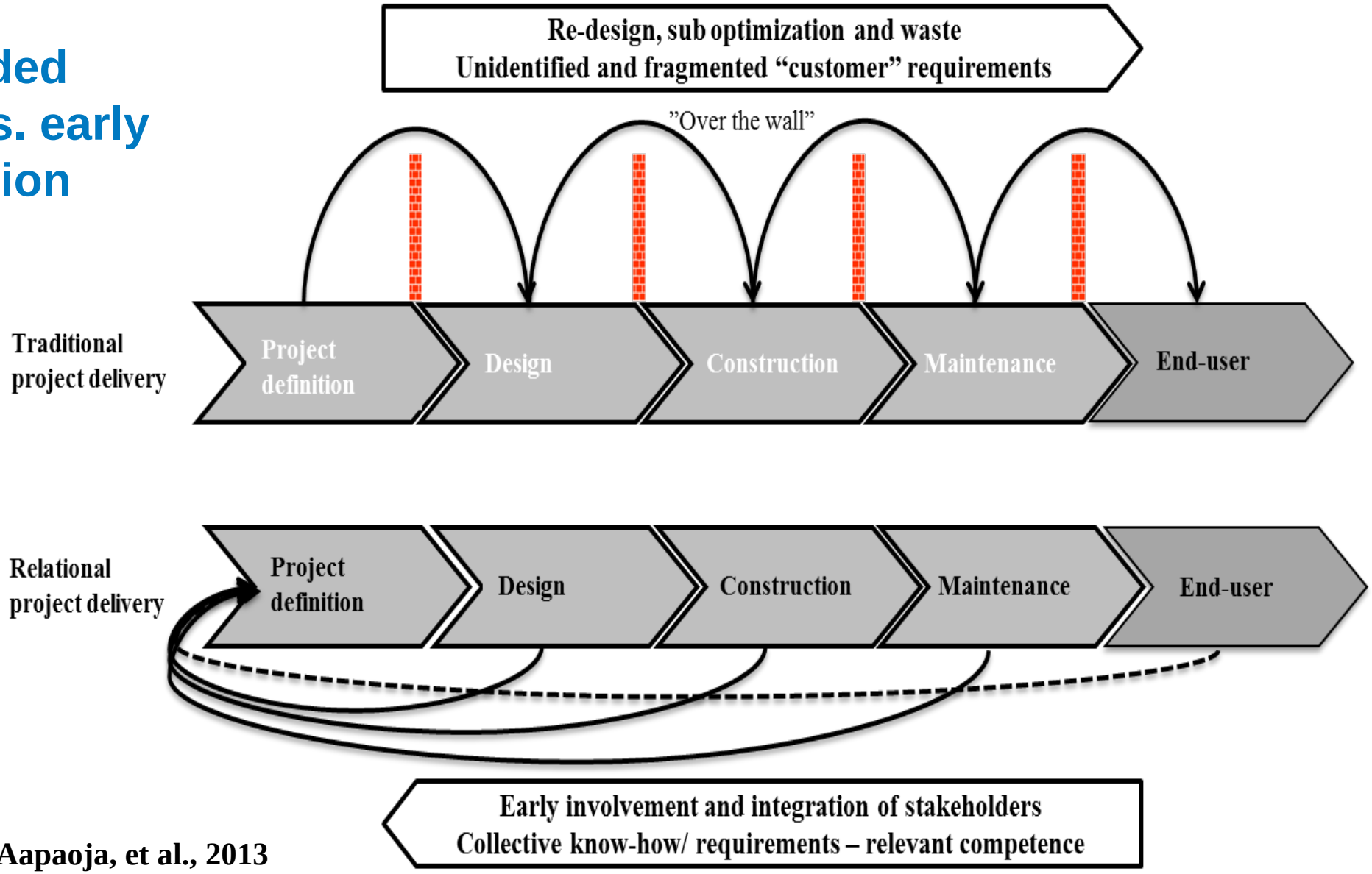
Relational project delivery agreements

- IPD and RPDA are operating models based on early stakeholder involvement and integration.
- Contractors, customers, and other stakeholders work together as an integrated, collaborative team (Ballard, 2008).
- Help clients to understand the consequences of their desires.
- The more complex the project, the earlier the stakeholders should be involved.
- The objective is to work in good faith, acting with integrity and making unanimous, best-for-the-project decisions, jointly managing all risks of delivering the project, and sharing the outcome of the project

Sub-optimization or best for the whole project?

- Construction projects have traditionally been organized in sequential phases in which project tasks follow each other with minimum interaction with other tasks.
- Project stakeholders participate in other phases only on an as-needed basis resulting in minimal and weak communication.
- Weak communication leads to sub-optimization for the best for one organization, not for the best for the whole project (Lohikoski & Haapasalo, 2013; Matthews & Howell, 2005).

As-needed basis vs. early integration



Modified from Aapaoja, et al., 2013

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Waste in the Literature

- The literature recognizes several waste classifications originating from Ohno's (1988) seven initial types of waste:
  - overproduction,
  - waiting,
  - unnecessary transportation,
  - unnecessary movements,
  - over-processing,
  - inventory, and
  - defects.
- Formoso, Isatto, and Hirota (1999) added weather conditions, theft, and vandalism.
- Koskela (2004) added making do and poor constructability (Koskela, 1992),
- Womack & Jones (2003) making the wrong product or service, and
- Liker (2004) added people's unused potential, overloading, and unevenness.

List of Types of Waste According to the Waste Priority Number (WPN = Severity × Occurrence × Detection)

Type of waste	WPN	Severity	Occurrence	Detection
Communication and documentation	328	8.0	7.0	5.9
People's unused potential	251	6.9	5.6	6.6
Defects	238	7.0	7.0	4.9
Making wrong products or services	207	6.9	5.3	5.7
Unnecessary movements	201	4.8	7.3	5.7
Inadequate processing	187	6.0	5.5	5.7
Making do	186	6.4	7.0	4.1
Overloading	176	6.7	6.6	4.0
Poor constructability	152	6.7	5.3	4.3
Overproduction	148	7.1	6.6	3.1
Waiting	146	6.0	5.9	4.1
Unnecessary transportation	144	4.9	7.1	4.1
Safety	51	6.5	2.3	3.3
Inventory	45	4.3	6.2	1.7
Other (weather conditions, theft, vandalism)	30	4.7	4.8	1.3

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Design for X

- DfX has been applied in the electronics industry in complex product development projects.
- DfX is a structured approach to systematically addressing key stakeholders in the early phase of product development, functional integration, and capability creation.
- Life-cycle considerations are important, because project management commits as much as 70% of the total life-cycle costs of products in the early design stages.

How does DfX respond to these types of waste

- Key stakeholders can be addressed in the early phase of a project through the Design for Excellence (DfX) approach.
- In DfX, the X stands for an aspect, life-cycle phase, or stakeholder under consideration, such as manufacturing, environment, maintenance, supply chain, and cost (Bralla, 1996; Lehto et al., 2011; Möttönen, Härkönen, Belt, Haapasalo, & Similä, 2009).
- In DfX, it is important to identify the critical stakeholders (X's) to integrate them early.
- DfX helps functional integration, creates capability, and acquires the best competence for the project (Ulrich & Eppinger, 2008).

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The Use of DfX to Reduce Waste in Construction Projects

Inadequate communication and documentation,

- The proper use of DfX requires better communication between interested parties and an appropriate documentation system of requirements (see e.g. Lehto et al. 2011).

Making wrong products or services,

- DfX forces or allows designers to contact all the chosen stakeholders during the design phase.

Defects

- DfX gives project managers documented guidelines to production to avoid defects.

People’s unused potential

- DfX pays attention to all stakeholders’ needs, which makes it possible to listen to larger crowds’ opinion of the project

Conclusions

- DfX balances all stakeholder needs for “the best for the project.” Traditional commercial models drive for sub-optimization (Merikallio & Haapasalo, 2009).
- DfX is a practical approach that helps project managers include early involvement and integration in the process.
- According to this study, DfX reduces some of the most severe types of waste in construction projects.
- Relational project delivery agreements include incentives for balanced gain and pain which is a reason to use DfX
- It is also possible in a traditional design-bid-build project to provide incentives that support the proper use of Design for X in construction projects.

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Thank You

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