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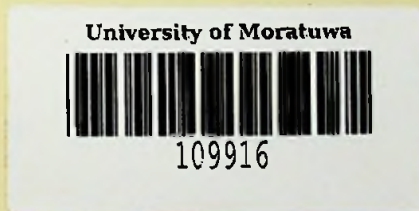
# FRAMEWORK FOR LEAN IMPLEMENTATION IN CONSTRUCTION PROCESSES

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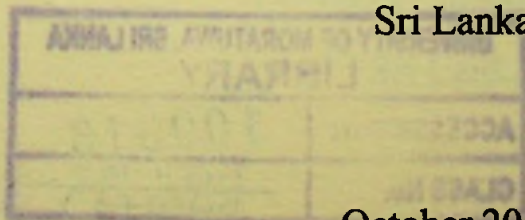
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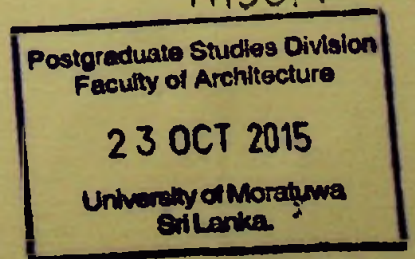
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# **FRAMEWORK FOR LEAN IMPLEMENTATION IN CONSTRUCTION PROCESSES**

**Nilmini Ruwan Kumari Thilakarathna**

**(118042D)**

**Thesis submitted in partial fulfillment of the requirements for the  
Degree of Master of Philosophy**

**Department of Building Economics**

**University of Moratuwa**

**Sri Lanka**

**October 2015**

# DECLARATION

I declare that this is my own work and that this thesis does not incorporate without acknowledgement any material previously submitted for a Degree or Diploma in any other University or Institute of Higher Learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person without making an acknowledgement.

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# ABSTRACT

## Framework for Lean Implementation in Construction Processes

Non Value Adding Activities (NVAAs) generated in a construction process are recognized as one of its major weaknesses since they adversely affect its performance and efficiency and produce unwanted cost. Activities that do not add value to the final product are merely a waste and need to be minimized or eliminated altogether. The major reason for our inability to minimize NVAAs is our failure to recognize them. Most of the NVAAs are intangible and invisible. Only a few attempts have so far been made to minimize the NVAAs in construction processes. Lean construction is one of the attempts made to apply lean production principles to the construction industry to minimize NVAAs in its construction processes and maximize the value provided to clients. Lean is an innovative construction management approach which is linked closely to the overall life of a project to ensure its success. Lean construction is still new to many in the construction industry in the world. There is no implementation framework in the construction industry in Sri Lanka to minimize NVAAs and this research aims to develop such a framework for implementing lean techniques in the construction industry in the country in order to minimize its non-value adding activities. It will also propose a tool for determining the lean maturity of a construction project by assessing the extent to which lean techniques have been applied in that project.

A detailed literature review was carried out to investigate lean implementation in construction processes towards developing a conceptual framework by identifying the research gap and the approach that has to be used to fill the gap by implementing lean techniques. This conceptual framework was improved through an opinion survey. Quantitative research techniques were adopted to collect data from three different surveys. Findings of the first survey revealed with examples, the existence of non-value adding activities in construction processes in the construction industry in Sri Lanka with the second survey revealing their level of implementing the lean techniques. The findings of the third survey map non-value adding activities against lean techniques and emphasize the need for developing a framework for implementing lean techniques that will minimize NVAAs in the construction processes. Based on the data collected from the three surveys, a framework for implementing lean techniques and a tool for assessing lean maturity of a construction project were developed. The framework and the tool were thereafter validated through an expert survey. The study concludes by identifying the significance of implementing the most suitable lean techniques in different stages of construction processes that will make them lean with minimum waste thereby ensuring their long term sustainability.

**Keywords:** *Non-value adding activities, Lean Techniques, Implementing Framework, Construction processes*

## DEDICATION

*To  
my adoring daughter  
Ranmalee  
for  
the special bond  
spans the years  
through  
smiles and tears  
sense of trust  
can't be broken  
depth of love  
sometimes unspoken  
the gift  
I have ever received*

## **ACKNOWLEDGEMENT**

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# LIST OF ABBREVIATIONS

LT	–	Lean Techniques
NVAAs	–	Non Value-Adding Activities
LC	–	Lean Construction
LP	–	Last Planner
JIT	–	Just In Time
RPS	–	Reverse Phase Scheduling
TVD	–	Target Value Design
TQM	–	Total Quality Management
WBS	–	Work Breakdown Structures
BIM	–	Building Information Modeling
IQSSL	–	Institute of Quantity Surveyors in Sri Lanka
IESL	–	Institute of Engineers in Sri Lanka
AIISL	–	Institute of Architects in Sri Lanka
ICTAD	–	Institute of Construction, Training And Development
SLCI	–	Sri Lankan Construction Industry