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Using a Value Stream Mapping Tool in the Building Sector

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ABSTRACT
The purpose of this is paper is to understand the applicability and adoption of the value streammapping technique in the construction industry. The applicability of the adopted value streammapping methodology was tested in a pre cast concrete yard which supplies pre cast concretesegments to a bridge construction site. A process mapping tool has been used for value streammapping since it contains high correlation to the existing wastes at the sites. A detailed valuestreammappingprocedurewasdevelopedandvalidatedwithinthiscasestudy.Theeffectivenessof the value stream mapping methodology was also evaluated at the same site as it was producingapproximately five hundred units continuously. The research findings will contribute to a betterunderstanding of the applicability and potential benefits of value stream mapping tool in terms ofcycletime reductionsandqualityimprovements.

Keywords:Valuestreammapping,leanphilosophy &Value addingactivity

1. INTRODUCTION

Theconstructionindustryplaysamajorrolewithina nyeconomyanditinfluences,anditisinfluenced by, the nation's gross domestic product (GDP) ((Enshassi*et al.* 2007). But the constructionindustryiscommonlycharacterizedas abackwardindustry,onethatfailstoinnovateincom parisonto other sectors. While the other sectors modernized through the introduction of interchangeable parts,then assembly lines, new management concepts and automation with continuous improvements whereas construction retained its craft method of operation and fell further and further behind the rest of themanufacturingindustryintermsofproductivity, qualityandhencevaluefor money(Alinaitwe2005).

Around the world construction processes and practices are under examination and the ConstructionIndustryInstitutehasfoundthat57% Wasteandonly10%ValueAddedinputsresultinaco nstruction industry compared with 62% Value Added and 26% waste in a Manufacturing industry.Theperformanceoftheconstructionindus tryintermsofproductivity,qualityandproductfunct ionality has been low in comparison to other industries, and a low rate of innovation has beenprovidedas the majorexplanation tothissituation(Winch 2003).

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Majormotivatorforthisstudyistoidentifywastages existsintheconstructionindustryandconsequently application of lean tools and techniques to minimize those losses. This paper presents acasestudyofapplicationofvaluestreammappingt oolataPreCastConcreteYard.Majorobjectiveof this study was to eliminate prevailing quality issues and reduce the cycle time. Through the studythe process information was collected and current value-stream map was created reflecting the currentoperationstatus.Wastegeneratingactivitie sforeachworkcentrewereidentifiedanddifferenta nalysis tools (Five why, Cause and effect diagram) were used to reveal the root cause for each issueproposingkaizen events assolutions.
A future value stream map was then proposed to serve as a guide for future lean activities. In this casestudy, the Study board approach was used to monitor the progress of each kaizen as well as visualcontrol tools for employees. With the implementation of VSM as a lean tool to the construction site,which differs greatly from a manufacturing organization, researchers identify the correlation betweenleantheoryanditspracticein construction.

2. LITERATUREREVIEW

Having identified the chronic problems existing in the construction industrysuch as low productivity,poor safety, inferior working conditions, poor product delivery to planned budget and quality, lack ofinnovationandclientsatisfaction(Koskela1997, Forbes,AhmedandBarcala2004).Theseproblems of in construction have led to various development efforts such asindustrialized construction,computer integrated construction and construction automation(Koskela 1997). These research projectsmainlyfocusedonnewtechnologiestospee duptheprocesswhichisan“end”sideoftheconstruct ion process. Analysis done by Koselka (Koskela 1992) shows that those concepts initiallyhave been based on the traditional conceptualization, but the negligence of flow processes seems tohavebecomeabarrierforprogress.Butafterward, mostoftheresearchprojectscarriedouttoenhance productivity by focusing on “in” side of the construction process. As a result, Koskela(1992)]foundthatconstructionprocessesc anbecharacterisedbyahighcontentofnonvalue-addingactivities(NVA)which lead tolowproductivityasshown in table 1.

In addition to the existence of high non value adding activities, resource flow variability also hindersproductivity(SerpellandAlarcón1998,We eleng2004,Forbesetal.2004).AstudyofBallard(B allard and Howell 1997) showed that the causes of process variability are complexity,complicated supply chains, environmental conditions, market pressure, extensive process and designchanges. Bertelsen (Bertelsen 2004)presented a study in this regard and it described the two states of asystem: ordered and chaotic. An ordered system reduces its variability and has controlled disorderswith diligent use of buffers, well defined process and procedures and elimination of sources of errors.Construction projects are highly labour intensive with basic hand tools and equipment, as labour costscomprise 30 to 50 % of overall projects costs (Guhathakurta and Yates 1993). Organisations havefound that, by identifying and removing waste, as well as implementing key lean tools, they cancontinuously improve their productivity, increase quality, and become more cost effective(Imai 1997).Howevernumerousconstructionlabourpro ductivityresearchstudieshavebeenundertaken,but onlya few have addressed the productivity issue with respect to lean principles. The primary goal of leanprinciple is to avoid waste of time, money, equipment etc and focused on productivity improvementand cost reduction by stimulating all employees (Shingo 1992).Therefore primary objective of thispaper is to study the implementation of lean tools in the construction industry in order to improveproductivity.
Lean is a management philosophy and its aim is to identify and remove every activity in design,productionandsupplychainmanagement-relatedprocessesthatdoesnotaddvaluefromthecus tomer’spointofview(Womack,JonesandRoos199 0,WomackandJones1996,Marchwinskiand Shook 2003). Lean approach focuses on the elimination of all kind of wastes. Waste takes manyforms and can be found at any time and in any place. It may be found hidden in policies, procedures,processes and product designs, and in operations. Waste consumes resources but does not add anyvalue to the product(Singh and Sharma 2009). In order to identify existing waste generating processesinthe systemdifferenttoolscan beadopted whereVSMtoolis one.
The ultimate goal of VSM is to identify all types of waste in the value stream and to take

steps to tryand eliminate these (Rother and Shook 1999).Waste is anything that creates no value for the partiesinvolvedintheprocessnamelyowner,customer,andconsumer.Thereforewasteisdefinedintermsof value and there is no absolute definition of waste, it is all relative. Therefore the definition of valuestream map should be extended as a tool which uses to identify the waste and waste causes exist incurrent process and find appropriate process design for removal of wastes which only add value to theprocess. Value stream map is identified as an essential tool because it helps to visualise the process,wasteanditssources, information and materialflow.

Further it provides a common language for process owners to identify the current process and processdeficiencies.

Themajor stepsinvolvedinmappingare asfollows:

Preparation–
Identifythemappingteam,theproductorprojecttostudyandhowtheprojector productwillbe mapped

Currentstatemap-
Allthedataforcurrentstatemapwerecollectedaccordingwiththeconsultationto workers, supervisors,engineers and managers

Futurestatemap-
Afteranalysingcurrentstatemap,thegapareasidentifiedsomechangeswereproposed

Planningandimplementation-
Developanactionplantoachievefuturestatemapandimplement(Rotherand Shook1999)

3. RESEARCHMETHODOLOGY

This section describes the methodological approaches adopted for this research. The selected studywill substantially benefit by undertaking a case study based methodology to advance knowledge.According to the findings of O'Brien, action research follows several steps namely systematic cyclicalmethodofplanning,takingaction,observing,evaluating(includingself-evaluation)andcriticalreflecting prior to planning the next cycle. Since it is more suitable for a known problem and it is aprocess to test new ideas and implement actions to change.But the selected case study still does notidentify the existing issues and therefore prior steps must be adopted before considering the actionresearchcycle.

This research can also be classified as an exploratory research case study due uncertainty and little orno information available on similar research issues. Initial stage of this research covers the fieldworkanddatacollectiontodiagnosetheproblem.AccordingtoYin's(2003)definitionexploratoryresearchcasestudiesarecondensedcasestudies,undertakenbeforeimplementingalarge-scaleinvestigation to identify research questions, select measurement constructs, and develop measures.Exploratory Case Studies Where considerable uncertainty exists about program operations, goals, andresults.This Research Methodology is a combination of exploratory case study research technique andaction research technique.This initial study used the basic value stream mapping steps recommendedbyRother&Shook(1999)with some addition of structured tools.

PREPARATIONSTAGE

In this stage on quick walk trough along the entire process was done in order to get sense of materialflow and sequence of flow. General template was used for every process which includes series ofquestions to get back ground information of the individual value stream. It was designed in order togainmoredetailedinformationabouteachoftheprocesswithregardstotheirsuppliers,customersand processes which allow a greater understanding of the process. After that all information weresummarised in to one page document called Supplier Input Process Information Output Customer(SIPIOC) as shownin appendix 1.

Finally select the product/project to be considered based on the production/process matrix. Finallyselect a product family which represent more than 10 % of volume of production capacity to createvaluestreammap.(Maskelland Baggaley2003)

CURRENT STATEMAP

The data collection was started in the raw material receiving bay through each of the individualprocesses identifying the linkages between the states of production and establishing the flow ofinformation and material resources. Different variables such

as cycle time, waiting time, set up time;First Time Through (FTT) was obtained through work study techniques namely timeandmotionstudyandactivitysampling.The currentvaluestreammapcontainsthreelayersmainlycommunication,process and time line (Seeappendix 3)

FUTUREMAP

Having completed the current state map, data was analysed to identify areas in which improvementsmaylie andpossible solutions tothese were discussed(seetable2).

4. CONCLUSIONS

Thissectionsummarisestheresultsobtainedand conclusionsreachedduringtheresearch.Atthisstage ofthe research it is difficultto reach a concrete conclusion aboutthe end results mentioned atthe SIPIOC. One major issue has been addressed at the site and the results demonstrate successfulapplicationofVSM.Sincethesuccessesoftheotherkaizenprojects,identifiedwithVSMcurrentstate map, are progressing differently with operational and managerial difficulties, these are notanalysedinthisarticle.Therefore,atthispoint itcanbeconcludedthattheVSMprocesshasservedas a guide and has met the desired objectives quite satisfactorily, of course with some limitation inrelationto the field ofconstruction.

The VSM tool is a useful method which simply transfers information of the value stream to a userfriendly visual format. But it still has few limitations especially when trying to apply it to other fieldssince it was originally adapted in the automobile industry. The organization considered under thisstudy has a narrow span of product family with relatively constant demand of medium complexproduct which has almost similar features as an automotive plant. Since VSM has been developed andimplemented successfully in the automotive industry, it is evident from the study that the applicabilityoftheVSMtoolinthesaidprecastconcreteyardisappropriate..HoweversinceVSMconsidersa

process in a broad macro level view, it is difficult to identify the process level kaizens. In suchsituations other process mapping tools are preferable. Furthermore it can be improved by adding moreinformation such as available resources and process constraints whenever possible.Meantime VSMdoes not address high variety of product families; Group Technology is recommended in VSM forsuchhighvarietyproductfamilies.Butitstill doesnotreflectthevariationwithintheproductfamily.

The major difficulty in this study was to identify the waste activities with the help of the literaturereviewfor which thedecisiontreeinFigure 1wasdevelopedtoidentifythosewasteactivities.

Even though, it is unfair to generalise on a conclusion at this early stage of the study, it could beconcludedthattheimplementationofVSMtoolintheconstructionindustryisappropriateandadvantageousofcoursewith relevant customisationsto suit the context.

5. REFERENCES

Abdel-Wahab, M. S., A. R. J. Dainty and I. S.G. 1999.A review of the relationship between skills andproductivityinconstruction.In*ASCProceedings of the35thAnnualConference*,,165 –178.

Alarcón,L. A. 1997. Tools for the identification and reductio of waste in construction projects.In*LeanConstruction*, ed. L.Alarcón.Rotterdam,The Netherlands:Balkema.

Alinaitwe, H. 2005. Labor productivity in the building industry. . In *Proceedings of 11th joint CIB internationalsymposium*,210-20. Finland.

Ballard, G. & G. Howell. 1997. Implementing lean construction: Improving downstream performance. In *LeanConstruction*, ed. L.Alarcón.Rotterdam,The Netherlands:Balkema.

Bertelsen,S.2004.LeanConstruction:Wherearewean d howtoproceed?*LeanConstructionJournal*,1,46-69.

Enshassi, A., S. Mohamed, Z. Abu Mustafa & P. E. Mayer 2007.Factors affecting labour productivity inbuildingprojectsintheGazaStrip.*JournalofCivilEngineeringand Management*,13,245-254.

Forbes, L. H., S. M. Ahmed and M. Barcala. 2004. Adapting lean construction theory for practical application indevelopingcountries.In*LatinAmericanandCaribbeanConferenceforEngineeringandTechnology(LACCEI)*.Florida, USA.

Guhathakurta, S. and J. Yates 1993 International

labour productivity *Cost Engineering Journal,*

35, 15-

25.Imai,M.1997.*GembaKaizen:Acommonsense,l*

ow-costapproachtomanagement.

NY,USA:McGraw-Hill.Koskela,

L.1997.Applicationofthenewproductionphilosho

phytoconstruction.81.StanfordUniversity.

Leanproductioninconstruction.In*Leanconstruction*, ed.L.
Alarcón.Rotterdam,TheNetherlands:Balkema.

Marchwinski,C.andJ.Shook.2003.*Leanlexicon:agra phicalglossaryforLeanthinkers*.MA,USA

LeanEnterprise Institute.

Maskell, B. H. and B. Baggaley. 2003. *Practical lean accounting: a proven system for measuring and managingtheLeanEnterprise*NY,USA: ProductivityPress.

Rother,M.andJ.Shook.1999*Learningtosee:valuestr eammappingtocreatevalueandeliminatemuda*.MA, USA:The leanenterprise institute.

Serpell,A.andL.F.Alarcón(1998)Constructionproce ssimprovementmethodologyforconstructionprojects .
*InternationalJournalofProjectManagement,*16,215-221.

Shingo,S.1992.*TheShingoproductionmanagements ystem,*.MA,USA:ProductivityPress.

Singh,B.andSharma,S.K.,2009.Valuestream mappingasaversatiletoolforleanimplementation:anI ndiancasestudyofamanufacturing firm.*Measuring BusinessExcellence,* 1358-68.

Weeleng, T.2004.The applicationofleanconstructiontoreducewastes inconstruction process flow.InSchoolofHousing, Building &Planning,189.
Penang:UniversitySainsMalaysia.

Winch,G.M.2003.Howinnovativeisconstruction?Co mparingaggregateddataonconstructioninnovationan dothersectors—acaseofapplesand pears.ConstructionManagementandEconomics,21,6 51-654.

Womack,J.P.andD.T.Jones.1996.Leanthinking.bani shwasteandcreatewealthin

yourcorporation.London,England:
Touchstonebooks.
Womack,J.P.,D.T.JonesandRoos,D.1990.Themachi nethatchangedtheworld:thestoryofLeanproduction.
NY,USA: RawsonAssociates.

Yin,K.R.,2003,Casestudyresearch.Designand methods.5.London,UK:Sage