

Abstract

The purpose of this MBA report is to analyze and evaluate the added-value of additive manufacturing laboratories (AMLs) installed on seagoing vessels and to provide lessons learned from the U.S. Navy's first Additive Manufacturing Shop at Sea, onboard USS John C. Stennis (CVN 74), in the manufacturing (printing) of replacement parts on-demand for immediate use. This project seeks to make three contributions. First, a cost-benefit analysis (CBA) utilizing a selected part manufactured through AM procedures to determine value, cost, and time savings that AMLs installed aboard ships would offer. Second, a comprehensive analysis utilizing the Knowledge Added-Value Methodology (KVA) to determine the KVA of the Surface Navy's 3D printing AM program. Third, a compilation of lessons learned to support or reject the installation and viability of these shops and their equipment installed across the fleet, by utilizing data gathered from firsthand accounts and experiences of the sailors who operated the first AML at sea onboard USS John C. Stennis. At the end of the report general recommendation(s) are provided for the future installation of AMLs across the fleet to maximize benefits, cost savings, and value added to the U.S. Navy as well as for future research.

Methods

CBA

COST BENEFIT ANALYSIS

Cost Benefit Analysis is a systematic approach to calculate and compare the benefits and costs of a project or a given situation.

Determines if an investment or decision is feasible

Provides a basis for comparing investments or decisions

How to Perform Cost Benefit Analysis ?

1

Conduct Brainstorming

2

Calculate Costs

3

Calculate Benefits

4

Compare Costs and Benefits

V.S

KVA

Fundamental Assumptions of KVA

Underlying Model: Change, Knowledge, and Value are Proportionate

Input X → **Process** P → **Output** Y

Fundamental assumptions:

1. If $X = Y$ ($P(X) = Y$) no value has been added
2. "Value" \propto "Change"
3. "Change" can be measured by the amount of knowledge required to make the change.
4. Amount of knowledge can be calculated using the learning time to acquire the knowledge.

So "Value" \propto "Change" \propto "Amount of knowledge required to make the change". (Principle of replication)

Results

The findings from the CBA and KVA provide clear evidence that the overall benefits of AM implementation outweigh the cost of investment with a ROK and ROI of 334% and 234% respectively, and a correlation between them of one. Because AM could potentially play a major role in manufacturing time-sensitive parts on demand for sustainment and readiness for entire Battle Groups at sea, AML installation on naval vessels clearly provides a value-added capability to the Navy.