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THE PHILOSOPHY OF PERFORMANCE MEASUREMENT RESEARCH IN CONSTRUCTION MANAGEMENT: A PHILOSOPHICAL FRAMEWORK FOR DESIGNING PERFORMANCE MEASURES

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Abstract: Construction Performance Measurement (CPM) is an applied methodology to create new knowledge, solve practical problems, and help organizations succeed. The general aim of this study is to develop a philosophical framework for the design of performance measures. To achieve this objective, this study classifies the philosophical positions in Performance Measurement (PM) research based on Creswell's philosophical worldviews. The paper reviews the ten most cited articles in eight peer-reviewed journals and categorizes the literature with the philosophical coordinates of the authors. Among the selected journals, four are construction management specific and four reflect on PM from a managerial and interdisciplinary perspective. The findings reveal that CPM research is governed by post-positivist and pragmatic research philosophies and lacks on participatory/action research. The paper then maps the philosophical shifts of Andy D Neely through his publications in the domain of PM to scheme a philosophical framework for designing performance measures, and advocates that it is necessary to hold different philosophical worldviews in CPM research as indicated by the general PM literature.

1 Introduction

Performance measurement (PM) is a multidimensional domain (Dixon, 1990; Kapłan et al., 1992; Daniel P Keegan et al., 1989; Andy Neely et al., 1995) that is a fundamental part of management. The word 'performance' is related with the assessment of individual and collective efforts (Corvellec, 1997) and 'measurement' is accredited as a key constituent to support improvement and report (Sharma et al., 2005). According to Andy Neely et al. (2005) PM is `The process of quantifying effectiveness and efficiency of actions`. The concept of PM originated from manufacturing industry (Nudurupati et al., 2011) and it was initially introduced and implemented in the manufacturing industry (Haponava et al., 2012). However without any conclusive evidence on benefits and shortcoming of PM (Griffith et al., 2009; Malina et al., 2007) the PM revolution spread across many industries, including the construction industry. Logically the choice of PM should depend upon historical success with PM theory or the success stories of peers. But, the volume of literature suggests construction industry`s overwhelming interest with PM.

In the case of construction industry, inspired by the success stories of Japanese manufacturing industry after the world war 2 (Nudurupati et al., 2011), a plethora of academics prescribed PM for improving

construction performance (Egan, 1998; Latham, 1994). The aim of PM before early 1990s was only productivity management (Bititci et al., 2012), with much focus towards the financial indicators (D. P. Keegan et al., 1989; Andy Neely et al., 1995) and ratio driven measurements to enhance efficiency. Productivity literature on construction industry can be traced back to Florence (1920) although the general concept of productivity has been around since even before the birth of modern statistics during the second half of 17th century. As productivity reflects on the efficient use of resources through a production process the researchers before early 1990s held a strong positivistic ontological positions (Chan et al., 2007). But with the emergence of PM as a social phenomenon effective measures were introduced to traditional efficiency measures to measure performance. Bititci et al. (2012) defined

`*PM as a social phenomenon as its behavior is shaped by the feelings, values and basic beliefs of individuals, organizations, community and society with in which it operates*`.

One of the premiers in publishing the PM approaches were Sink et al. (1989) (1985). As PM revolution in mid 1990s was triggered by common adages like `*what gets measured gets done*` (Kapłan et al., 1992), `*if you cannot measure it, you cannot manage it*` (Garvin, 1994) and (Halachmi, 2002) bridging it altogether `*if you cannot measure it you don't understand it; and if you cannot understand it you cannot control it; and if you cannot control it you cannot improve it*`. The knowledge building in PM suffers from the lack of solid theoretical foundations (Micheli et al., 2014). Solid theoretical foundation is intertwined with solid research philosophy. From a citation co-citation analysis of PM literature Andy Neely et al. (2005) deduced that the PM domain is immature with little consensus. However, relative to the maturity of productivity measurements in construction industry PM is a new concept and it is not prone from the social and behavioural issues of millennials. Moreover, given the social dimension of PM, research philosophies form the social sciences comes into play. Whereas the traditional standing of positivist philosophy might just not be enough for knowledge generation in CPM. The philosophical perspectives around theoretical developments are of high importance and served as a trigger for this study to explore the philosophical standing of the PM literature to develop a philosophical framework for designing performance measures. In order to develop the philosophical framework for the following research questions were probed

1. What is the nature of theory in the PM literature?
2. How does the philosophical position of PM researchers differ from the CPM researchers?
3. What are the data collection methods in PM research?

The paper uses Creswell`s (2013) four philosophical world views as a framework template to categorize philosophical positioning of construction and management literature. The philosophical positions are then validated with an inquiry into the data collection methods of the selected set of research publications. For this particular study, the data collection methods were classified as a case study, questionnaire survey, interviews, experiment, and literature. The review indicates the philosophical gaps in PM literature and the comparison of construction and management PM literature reveal philosophical trends in PM research. Last but not the least the paper presents a stepping trail framework for the future generation of performance measures in construction industry inspired from the critical philosophical review of Andy D. Neely`s academic publications.

2 Philosophical worldviews

In examining the nature of knowledge Creswell (2013) used the expression 'worldview' that is in line with the terminologies of 'epistemology and ontology' (Crotty, 1998) and `research paradigms` (Lincoln; Mertens, 1998). The knowledge classifications encouraged by (Creswell, 2013) behold four philosophical worldviews: post-positivism, constructivism, advocacy/participatory and pragmatism. The post-positivist world view is the predecessor of positive world view. The principles of positivist tradition were aligned with that of physical science (Micheli et al., 2014) and in the perspective of measurement is `a process of empirical, objective assignment of symbols to attributes of objects and events of real world, in such a way to present them, or to describe them` (Finkelstein, 2003). According to Creswell (2013) post-positivist retain a deterministic philosophy and determine the effects and outcomes of the research problem. Post-positivist

work on the same principles of scientific methods, start with a theory, test the theory and make necessary revision before additional tests (Creswell, 2013). Post-positive incline themselves more towards the quantitative research methods, believing data, evidence and rational consideration shape the body of knowledge (Phillips et al., 2000).

As the name indicates in social constructivism researcher creates knowledge through social interaction. Rather than simply impressing knowledge on individuals, social constructivist interact with individuals through historical and cultural norms individuals operate in their lives (Creswell, 2013). Social constructivist give liberty to the individuals to reflect on world as they see it, position themselves with personal, cultural and historical experiences and acknowledge their interpretations that are shaped by the personal experience and background. The process of social constructivism is inductive and develop a theory or pattern of meaning (Creswell, 2013). Moreover, Crotty (1998) associates social constructivist with open-ended research questions with qualitative research methods to indulge participants in a broader discussions.

Advocacy/participatory worldview also referred to as participatory action research by Kemmis et al. (1998), is the practice aimed at investigating reality in order to change it (Borda, 1979). The participatory worldview arose during 1980`s and 1990`s from the researchers that believed post-positivist perspectives imposed structured laws and theories that are not suitable for marginalized individuals of society, whereas constructive perspective not go far enough for action agenda to help the marginalized individuals (Creswell, 2013). Hence participatory worldview intertwined with 'politics and political agenda' and addressed social issues like empowerment, inequality oppression, domination, suppression and alienation (Creswell, 2013). According to Nora et al. (2013) Creswell`s advocacy/participatory world view and Neuman`s (2006) critical and feminist world views in social science have similarities, both agree upon the political dimension of research. Neuman (2006) describe feminist research as `action-oriented research that seeks to facilitate personal and societal change`.

Table 1: The characteristics of Creswell`s (2013) philosophical world views

Worldviews*	
Post-positivism* • Determination • Reductionism • Empirical observation and measurement • Theory verification	Constructivism* • Understanding • Multiple participant meaning • Social and Historical construction • Theory generation
Advocacy/Participatory* • Political • Empowerment issue-oriented • Collaborative • Change-oriented	Pragmatism* • Consequences of actions • Problem-centered • Pluralistic • Real-world practice oriented

Pragmatic world view developed as a school of thought in late nineteenth and twentieth century in America (Scott, 2016). Early pragmatists believed a single scientific method for a social inquiry was not enough to access the `truth` about the real world (Mertens, 1998) and advocated for paradigm that provides the philosophical liberty for mixed-methods research (Abbas et al., 2003; Creswell, 2013; Somekh et al., 2005). Pragmatist emphasized the importance of applying different methods to a research question and evaluating the methods in terms of effectiveness. One of the most distinctive stand position on pragmatism is of Rorty (1990), he believes pragmatic philosophy is judging the idea and practices in terms of usefulness, workability and practicality and that is the scale of their truth, rightness and value. Pragmatists are not loyal to any one research paradigm or philosophy (Scott, 2016), and try to link truth with usefulness. According to Creswell (2013) the type of worldview a researcher beholds is determinant of the qualitative, quantitative and mixed methods a researcher approaches the research questions with. The categorization of PM

literature in this paper is inspired by Creswell (2013) philosophical worldviews. Table 1 by Creswell (2013) represent his four philosophical world views and the key elements he associates with them.

3 Data Collection and Limitations

The domain of PM has been able to capture a great attention and interest of from academic, industrial and business communities in the last couple of decades. The rate of publications on PM surged to a publication registered every 5th hour between 1994 to 2002 (Najmi et al., 2012). Google scholar search with a tag line `performance measurement` reveals a list of 4 730 000 hits. For this particular study Norwegian library database (ORIA) and Scopus were explored for data collection. ORIA connects most of Norwegian academic libraries and maintains one of the biggest Norwegian e-library data pool, with material ranging from books, articles, journals and thesis. Searching ORIA`s search engine with a tag line `performance measurement` results in 2 667 247 search hits, whereas the same tagline revealed 413 282 hits on 1st April 2017 with Scopus.

Synthesizing a workable data pool from search hits, search limitations were applied to search engines in the form of filters, restricting the results to articles published only in selected peer reviewed journals. The results were still varied ranging in different domains of engineering, which led to the limitation of restricting the research to eight popular journals among the construction and management professionals with highest number of publications in PM domain. The selected journals presents a blend of four construction management specific journals and four general management journals. The selected journals are listed in Table 2, the exercise shrunk the number of articles to 3169 in SCOPUS. Ten most cited relevant peer reviewed articles were than selected from each journal forming a dataset of 80 articles for investigation into research philosophy. As different search engines may report a different citation count, the citation analysis for the selected journals was cross checked with SCOPUS, Google Scholar and ORIA. Even though the 80 publications are the most cited publications from their respective journals. The data set is small as compared to the volume of literature on PM. Thus, the findings cannot be generalized, a much larger data set could be helpful in gaining additional insight.

Table 2: Primary data set (SCOPUS)

Journal title		No. of Articles (Primary set)
Management Journals		
International Journal of Operations and Production Management	IJOPM	602
Journal of Operations Management	JOM	462
International Journal of Productivity and Performance Management	IJPPM	416
International Journal of Project Management	IJPM	406
Construction Journals		
Automation in Construction	AIC	447
Journal of Construction Engineering and Management	JCEM	366
Construction Management and Economics	CME	306
Journal of Management in Engineering	JME	164
Total		3169

4 Results and Discussions

From the set of 80 publications inquired for their nature of theory, a majority of authors lacked the clarity on philosophical coordinates of the study. The literature scrutiny with the help of a checklist based on Creswell (2013) philosophical worldviews criteria presented in Table 1 made it conceivable to report the philosophical coordinates from the literature in a systematic way. The result summary of philosophical investigation of literature is on offer in Figure 1. The results presented in Figure 1 indicate that the most cited literature on

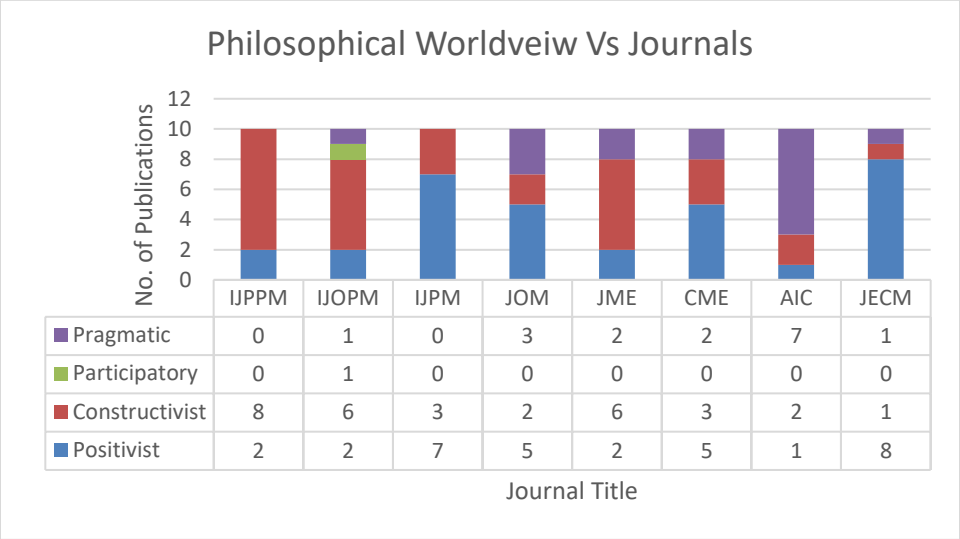

Figure 1: Philosophical worldviews of Performance Measurement Research

PM has a representation form all four of Creswell`s (2013) philosophical worldviews. However, Towards the buildup of the performance revolution Micheli et al. (2014) stated that both in physical sciences and engineering, measuring effectiveness triggered the export of cross discipline paradigmatic knowledge acquisition. The aim of which Rossi (2007) indicates as achieving objectivity in evaluation of physiological, behavioral and social phenomenon's. As a young field PM research in construction is more prone to paradigmatic shifts, a phenomenon described by (Cohen et al., 2013) of fluid nature with epistemological approaches that can change epistemological orientations with a field over time. Though the PM literature is only 30 years old it reflects the practice of different philosophical views as presented in Figure 1, which also defies the general perception of PM research being pragmatic in nature.

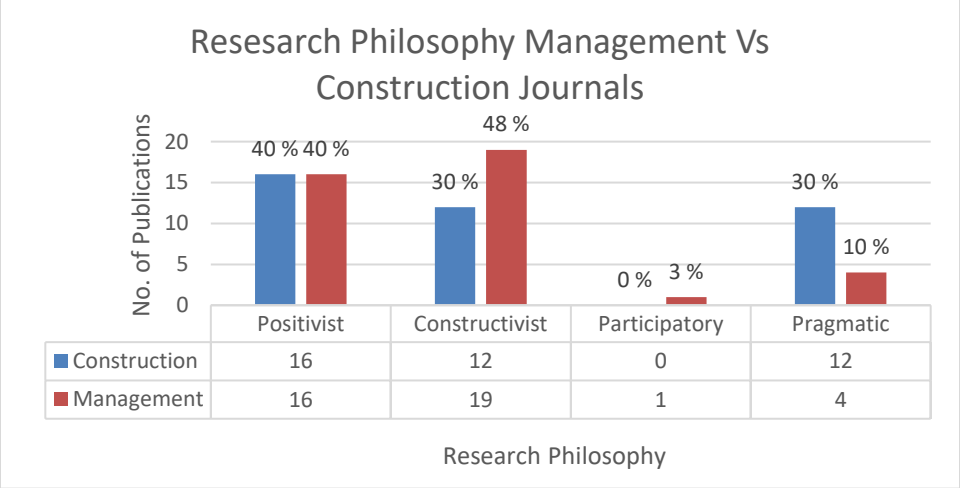

Figure 2: Philosophical worldview comparison

A graphic comparison of research philosophies in construction management journals with management journals is presented in Figure 2, which visibly indicates a research gap on action and participatory worldviews. Where construction management journals failed to report any publication with participatory/action research philosophy, management journals only reported one publication. Neely (1997) is the author that incorporated participatory/action research agenda in his research queries and made it to the set of highly cited research, although the article is heavily cited it does not ensure the authors citing this

article persuaded their research with an action or participatory orientation. The extreme positions to explain the paucity of literature with participatory/action worldview could be: the participatory/action research fails to capture audience, construction industry has already overcame the issues like gender inequality, empowerment, suppression and oppression or construction industry is yet to experience a real performance revolution. As revolution may trigger volumes of action and participatory research.

Predominantly the theoretical analysis revealed that the pragmatic and post-positivist worldview`s govern the nature of theory in CPM research, where 70% of the literature represent post-positivist and pragmatic worldviews. Phillips et al. (2000) inferred that there is no true knowledge when studying behavior and actions of humans in his articulation of post-positivism, which means CPM research with a post-positive perspective can only report or provide an insight into a phenomenon or activity that has occurred to a certain degree without creating new scientific knowledge. The post-positive paradigm might align with the CPM studies that measure performance for control and decision making, but the whole post-positivist philosophical scenario may lead the concept of pro-active management and leading performance measures to shallow waters.

Furthermore it is conspicuous that a bulky set of review articles which build the theory with the constructivist perspective are amongst the most cited articles in PM research. Figure 2 also reveals a visible trend in relation to the research philosophies, where management journals tends to lean towards the constructivist philosophies, whereas the construction journals incline themselves towards post-positivist and pragmatic philosophies. From the Figure 1 AIC and IJPPM strengthens the argument of philosophical trends, with AIC reporting 80 % of publications with a post-positivist and pragmatic research perspective and IJPPM reflecting major inclination towards constructivist research philosophy with 80% of the publications aligning constructivist worldview.

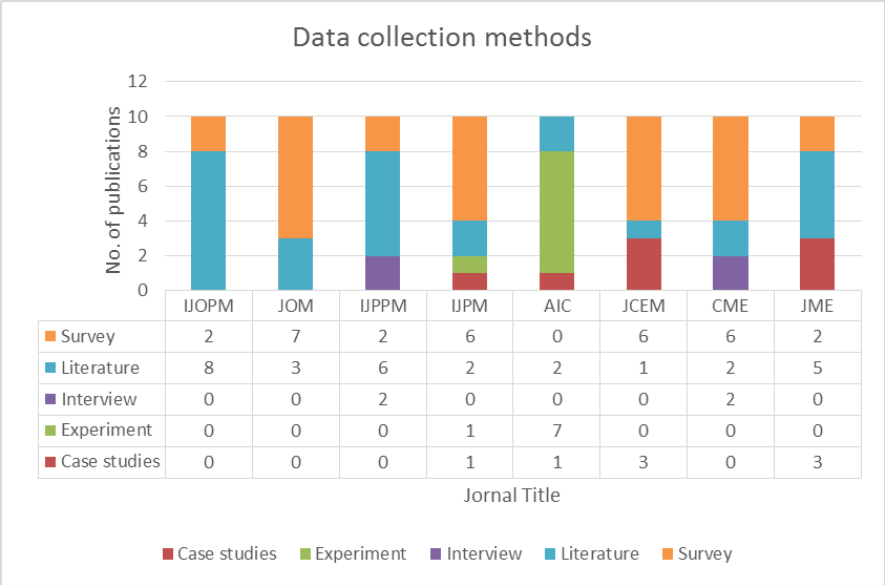

Figure 3: Data collection methods

To further investigate the trend and the characteristics associated with the heavily cited articles. An investigation into the type of problem addressed by the author, strategy of inquiry (qualitative, quantitative, and mixed methods) and data collection methods (literature, case studies, questionnaire surveys, interviews and experiments) was generated for each research article in the selected data set and the results are presented in Figure 3. The volume of literature that only used one data collection method for inquiry remains low. Although a considerable amount of publications opted for multiple data collection strategies, Figure 3 only classify the publications with their primary data collection method. Researchers are quick to associate mixed data collection methods to pragmatic worldview, but mixed methods can be used with any

research paradigm (Scott, 2016). Pragmatic approach places the problem centrally and applies all methods to understand the problem (Creswell, 2013). The literature review also indicated that: not a single publication made it to the group of most cited articles using only interviews or expert panel as a data collection method, researchers with experiment as a prime source of data never used a questionnaire survey and researchers using questionnaire surveys never incorporated an experiments in their research. Questionnaire surveys are majorly complimented with literature and case studies. Whereas literature is mainly complemented with questionnaire surveys, interviews and case studies.

4.1 The Philosophical Framework

To acquire inspirations and learnings for the construction industry the management journals from the data set were more critically explored. JOM and IJOPM are the most cited journals with 6911 and 5447 citations, whereas Andy D. Neely and Barbara B. Flynn are the most cited authors. Neely remains the most cited author with his four hugely cited publications in the literature set of IJOPM, though Neely`s work does not particularly target CPM but the relevance remains high. As the PM research is based on similar principles of construction management research, which according to Lucko et al. (2009) is the examination of the real-world means and methods to enhance efficiency and effectiveness. Focusing on Neely`s work we expanded our data set and created a new sub data set with all the up to date publications from Neely. The new sub data set revealed a complete cycle of paradigmatic shifts by Neely, providing an inspirational trail for future design of performance measures and PM system.

First publication from Neely under the performance domain was published in (AD Neely et al., 1992), where he discussed the material flow and schedule performance based on manufacturing philosophies (Just-in-time (JIT), optimized production technology (OPT)) with a computer simulation purely in a post-positive perspective. Leading to a co-authored study into human factors in performance (Wilson et al., 1993). Followed by a detail reviews in PM system`s design and influential factors in PM system design (Andy Neely, 1998, 1999; Andy Neely et al., 1995; Andy Neely et al., 1996; Andy Neely et al., 1997) building the theory around development of PM system and presenting frameworks in more of a constructivist worldview through incorporating some participatory research strategies. The real pragmatic approach started in publications (Andy Neely & Adams, 2001; Andy Neely, Adams, et al., 2001; Andy Neely, Filippini, et al., 2001; Andy Neely et al., 2000) where Neely tested the performance frameworks and started discussing the implementation issues. As PM is an evolutionary cyclic process, Neely shifted again to post-positivist philosophy in (Andy Neely et al., 2003) and constructivist in (Andy Neely, 2005; Andy Neely et al., 2006; Andy Neely et al., 2005), with a citation co-citation analysis of the performance literature in (Andy Neely, 2005). Publications of Neely provide a sound philosophical template to the PM researchers and provides evidence that PM research is a closed looped cyclic process and it is the mere intent of PM that defines its research epistemology given its multi-perspective nature.

5 Conclusions

The nature of PM theory in construction is still governed by positivist and pragmatic school of thought, whereas the PM theory in management has evolved in a constructivist perspective. Construction industry might share similarities with other industries, but the nature of research questions in construction PM maybe of problem centric or practice oriented nature, still it is significantly important to approach the research questions with different philosophical worldviews to gain advance understanding and systematic knowledge generation. A majority of PM researchers in construction explore casual verifications and recommend the practitioners to adopt PM theory. This is in defiance with (Popper, 1959) school of thought that science progress with falsification of theories, but it seems to be no better alternative than PM at the moment for the construction industry. Moreover, sticking with one school of thought is a compromise with innovation and scientific knowledge generation. That may well be the reason that construction industry have adopted frameworks and models from different industries and trying to integrate it to a construction hybrid version.

The study indicates a scarcity of publications on participatory/action research philosophy and advocates a philosophical framework for design of performance measures based on Andy D Neely publications summarized as

1. Start with an issue based post-positivist approach to highlight the importance of issue.
2. Adopt constructive and participatory approach to build theory and requirements for measures
3. Apply pragmatic approach to design and test the performance measures
4. Post-positive approach to implement the performance measures and problems associated with its integration in organizations
5. Constructivist approach to refine the theoretical standing of the measures
6. And again pragmatic approach to solve problems with the performance measures

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