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A MODEL TO EVALUATE THE MATURITY OF CONSTRUCTION ORGANIZATIONS' DISABILITY MANAGEMENT PRACTICES

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Abstract: Evidence exists as to what constitutes successful disability management (DM), with many describing recent upsurge in the area as a major paradigm shift. Despite the benefits of return-to-work (RTW) programs in reducing costs and improving workplace morale, many workplaces appear unwilling or unable to develop and implement successful RTW programs. A review of the literature reveals a lack of coherent theoretical frameworks for implementing DM. This paper presents a model developed to assess the maturity of DM practices in construction organizations. The model is part of an overall research project aiming to evaluate DM in the Manitoban construction industry and its relation to health and safety performance. This project is conducted by the University of Manitoba Construction Engineering and Management Group and funded by the Workers' Compensation Board of Manitoba. The proposed model is based on existing construction industry maturity models and the concept of process improvement and relies on leading and lagging indicators of performance at the organizational level, thus enabling a thorough evaluation of it. Once validated, the model should help construction organizations evaluate their DM practices against best practices, identify and address areas where improvements are needed, and assess and benchmark DM performance on a regular basis, thus providing a framework to guide the advancement of DM. Similarly, the model can be used by Worker's Compensation Boards, safety associations and other regulatory bodies across Canada and elsewhere for auditing purposes.

1 INTRODUCTION

Disability management (DM) performance has traditionally been at odds with project and organisational performance. Research in the field (Amick et al. 2000; Rosenthal, 2003; Shrey, 1995; Millington and Strauser, 1998; Ngai et al. 2013) has traditionally argued that disability management (DM) practices used up organizational resources and weakened organizations' competitiveness. With the advancement of knowledge in the field, researchers have begun to realize the benefits of DM practices (Reynolds et al. 2006). A study by Geisen et al. (2008) on workplace DM shows not only economic incentives but also corporate culture and external incentives for establishing in-house DM. With proactive DM practices, companies are able to generate additional business opportunities, and reduce DM costs (Amick et al. 2000; Ngai et al. 2013). Despite the advancement of knowledge in the field, DM in the construction industry receives limited research attention (Lingard and Saunders, 2004: Omerald and Newton, 2013). A review of the literature shows a lack of clear and coherent frameworks for managing disability management, especially in the construction industry (Lucas, 2010). There is in particular a lack of frameworks for the implementation, monitoring and evaluation of DM practices (Tshobotlwane, 2005). This makes it difficult for construction organizations to evaluate the maturity of their DM programs and by extension improve them; leading to a situation wherein the potential benefits of FM cannot be fully realized in the construction workplace.

This research, currently in progress aims to develop and validate a disability management maturity model called the Construction Disability Management Maturity Model (CDM3) for use in the construction industry. The model has two major functions. First, CDM3 provides an assessment framework with five maturity levels for analyzing construction organizations' DM maturity. Second, it provides a progressive framework to guide organizational advancement in the field.

This paper reports on the work that has been done so far by the Construction Engineering and Management (CEM) Group at the University of Manitoba and funded by the Workers Compensation Board of Manitoba as part of this research. This work aims to: 1) review the use of maturity modeling in construction, 2) present an overview of the CDM3, its features and theoretical underpinnings, and 3) describe its proposed implementation. The paper concludes by highlighting the strengths of the CDM3, and future work associated with it. Construction organizations should be able to use the tool/paper as a basis to assess their performance and address issues regarding their DM performance. The tool will be flexible enough to allow for its modification to accommodate changing guidance in the future and thus allow for a more accurate evaluation of existing practices against those changing best practices. The paper additionally provides a foundation from which further investigations can be impelled.

2 LITERATURE REVIEW

This section includes a review of the concept of maturity modelling in general, and as it applies to the construction industry in particular.

2.1 Disability Management

Disability Management originated from the concept of older vocational rehabilitation programs for injured workers and gradually evolved to incorporate the return to work (RTW) model. It incorporates three key domains: prevention, early intervention and proactive RTW interventions to reduce the impact of injury and disability and to accommodate those experiencing functional work limitations (Quaigrain and Issa, 2014). DM a model integrates protection from work hazards and promotes improvement in personal health behaviours (Angeloni, 2013); however this aspect is hardly harmonized and considered in implementing DM in workplaces. Despite the benefits of RTW programs in reducing costs and improving workplace morale (Shrey and Hursh, 1999), many workplaces appear unwilling or unable to implement and sustain successful RTW programs (Brooker et al, 2012). A systematic literature review of evaluative studies of modified work (Krauset al. 1998) noted little documentation of program implementation or the strengths and weaknesses of RTW programs. According to Tshobotlwane (2005) employers have frequently overstated the cost of adjustments in respect to accommodating disabled persons in their workplaces as an excuse to discreetly discriminate in the workplace. A comprehensive DM program enables early preventative actions and intervention, helping to alleviate many of the concerns experienced by injured or ill employees. Most employees want to be able to return to work, whether or not they would is dependent on the comprehensiveness of the DM program (Quaigrain and Issa, 2014).

2.2 Conceptualization

Maturity modeling emanated from the software manufacturing industry (Finnemore et al. 2000) in response to the poor performance of software manufacturers working on US Department of Defense Projects (Paulk et al. 1995). It is based on the earlier concepts of process improvements such as Philip Crosby's quality management maturity grid describing "five evolutionary stages in adopting quality practices" (Crosby, 1979) and the Shewhart plan-do-check-act cycle (Paulk et al. 1995). Process maturity modeling consists of various stages of progression which, when adhered to increases the effectiveness of a process. One of the earlier models is the Capability Maturity Model (CMM) developed by researchers at Carnegie Mellon University (Paulk et al. 1995). CMM uses the original framework of maturity modeling and defines five thresholds or levels of maturity for a given process (Paulk et al. 1995). At the first level, a process is primarily chaotic or ad-hoc. It is made repeatable at the second level, after which it becomes defined or standardized. At the fourth level, a process is usually measured or controlled, before it is optimized at its highest level by subjecting it to continuous improvement and feedback cycles.

Assessing the maturity of a process involves investigating the degree to which the process is defined, managed, measured and controlled (Dorfman and Thayer, 1997). This is usually accomplished by analyzing the policies and practices existing within the process (Paulk et al. 1995). Process maturity modelling was found to reduce the overall software development cycle in the field of software development (Harter et al. 2000) and improve project performance in the field of project management (Ibbs and Kwak 2000). It also improves the forecasting and meeting of goals, costs and performance (Lockamy and McCormack, 2004).

2.3 Maturity Modelling in Construction

In construction, the concept has been applied to develop maturity models such as the Standardized Process Improvement for Construction Enterprises Model (Sarshar et al. 1998), the Construction Supply Chain Maturity Model (Vaidyanthan and Howell, 2007) and the Construction Industry Macro Maturity Model (CIM3) (Willis and Rankin, 2011). A number of maturity models have been developed for project management specifically, with the Project Management Maturity Model being the most notable of all (PMI, 2005) and the Fuzzy Industry Maturity Grid being the most used at the macro level. Only one model has so far been developed for health and safety in construction: the Health and safety Maturity Model (Goggin and Rankin, 2009). The DM model currently being developed builds on these five existing models which are reviewed below. It should be noted that although five models are reviewed in the paper, the model (CDM3) still being developed will incorporate other relevant maturity models not outlined in this paper.

CMM integration (CMMI) is an extension of CMM composed of a collection of the best practices in the areas of product and service development; service establishment, management, and delivery; and product and service acquisition (Ngai et al, 2013). CMMI provides guidance for continuous organizational improvement by integrating inter-organizational functions, setting process improvement goals and priorities, providing guidelines for quality processes, and establishing a reference point for appraising current processes (Mani et al., 2010). CMMI has two different representations of maturity, namely, staged representation and continuous representation. CMMI representation uses six capability levels (‘‘incomplete,’’ ‘‘performed,’’ ‘‘managed,’’ ‘‘defined,’’ ‘‘quantitatively managed,’’ and ‘‘optimizing’’) which enable organizations to track, evaluate, and demonstrate organizational improvement within process areas (Ngai et al, 2013). Staged representation is a more appropriate reference framework for CDM3 because it provides a highly generic measurement of the maturity of DM practices as a whole and not according to the maturity level of each specific process area (Mani et al., 2010).

The Standardized Process Improvement for Construction Enterprises (SPICE) Maturity Model was developed by researchers at Salford University to improve the management of construction processes, as called for in the Latham report on the performance of the UK construction industry (Sharshar et al., 1998). The framework consists of five maturity levels. It involves testing an organization’s key processes against five process enablers (Finnemore et al. 2000). They applied the SPICE maturity model to four construction organizations, while Amaratunga et al. (2002) tested it on a facilities management organization. Both studies found its assessment to be based on facts rather than perceptions. They also found that the model identified process strengths as well as weaknesses, and enabled the development of improvement and implementation plans. Its main limitation is that it does not account for the multi-organizational nature of construction work (Vaidyanathan and Howell, 2007)

The Construction Supply Chain Maturity Model (CSCMM) is based on the concept of process maturity as used in the CMM and consists of four levels of maturity. The CSCMM assumes that for a construction firm to grow with respect to supply chain maturity it must do so along three dimensions: functional, project and firm. The model was proposed with the objective to offer a roadmap for supply chain members to improve performance through operation excellence of process, technology, strategy, and value (Vaidyanathan and Howell, 2007). Although model does address multi-enterprise supply chain aspect of construction, but it does not handle the maturity of other aspects such as BMI and hence cannot be directly applied.

The Construction Industry Macro Maturity Model (CIM3) is based on an adaptation of the concept of process improvement as used in the CMM. The CIM3 assesses the maturity of the construction industry at the macro level and provides leading indicators of project performance. There are three possible maturity levels associated with each key practice. The evaluation of each key practice is based on the presence of specific outcomes/indicators. It utilizes the analytical hierarchy process (AHP) and questionnaires to conduct the assessment. The utilized detailed levels of maturity adopted may be appropriate for use at the macro level given the characteristics of the industry, however from the organizational level perspective may to deemed inadequate and over simplification of the growth process (Willis and Rankin, 2011).

Finally, the Health and Safety maturity model (Goggin and Rankin, 2010) assesses maturity partly through AHP and questionnaires based on six key safety factors. Its scale is restricted to three maturity levels to simplify the data collection and analysis process. The model however inadequately takes covers injury management and preventive practices

A specific comparison can be made of the differences in cumulativeness of the models. In general, a specific trait of maturity models is that levels are assumed to be cumulative. That is, achieving level z implies that level z1 is also fulfilled. Interestingly, although existing construction maturity models provide leading indicators of construction industry performance both at the macro levels and organisational levels, none of them provides a context in which to interpret the performance of the construction industry in relation to its DM practices and subsequently correlated it to its overall health and safety performance. The development of the CDM3 is based on adapting and combining various aspects from the methodologies of the five aforementioned maturity models, although not entirely limited to them. Such aspects include the CIM3 and the safety model's use of AHP as well as SPICE's definition of progressive thresholds or levels of maturity and its five maturity levels. Based on the five specific models reviewed, we are currently developing an integrated framework. This framework incorporates contents of many models as well as our specific findings with respect to model scope, domain focus, and the number of levels.

3 METHODOLOGY

This section provides an overview of the CDM3, its assessment indicators at the individual and organizational levels.

3.1 Model Overview

The CDM3 reflects the perspectives of the DM or Case manager's practical work context. The CDM3 adapts the concept of process improvement epitomized in the process maturity framework, taking into account key DM practices identified in existing DM guidance. It enables the identification of the DM activities currently in place within an organization and the development of a process of iterative improvement for those activities. The goal of the model is to benchmark an organization's existing DM practices against best practices. Its objectives are to:

- Define key DM best practices.
- Evaluate the maturity of construction organizations' DM practices using leading indicators of performance
- Provide guidance and make recommendations on improving construction organizations' management of DM

3.2 Assessment Indicators

Assessment indicators represent clusters of related activities and regulations, which when performed and adhered to enable the achievement of performance goals. They also identify areas of concern that need to be addressed to achieve these goals. Many of the indicators of DM in construction are related to the parameters of project performance as well as construction project management knowledge areas. They cover employer-based strategies aimed at preventing and managing injuries and represent leading indicators of performance. They are divided to two main categories based on their level of implementation and applicability.

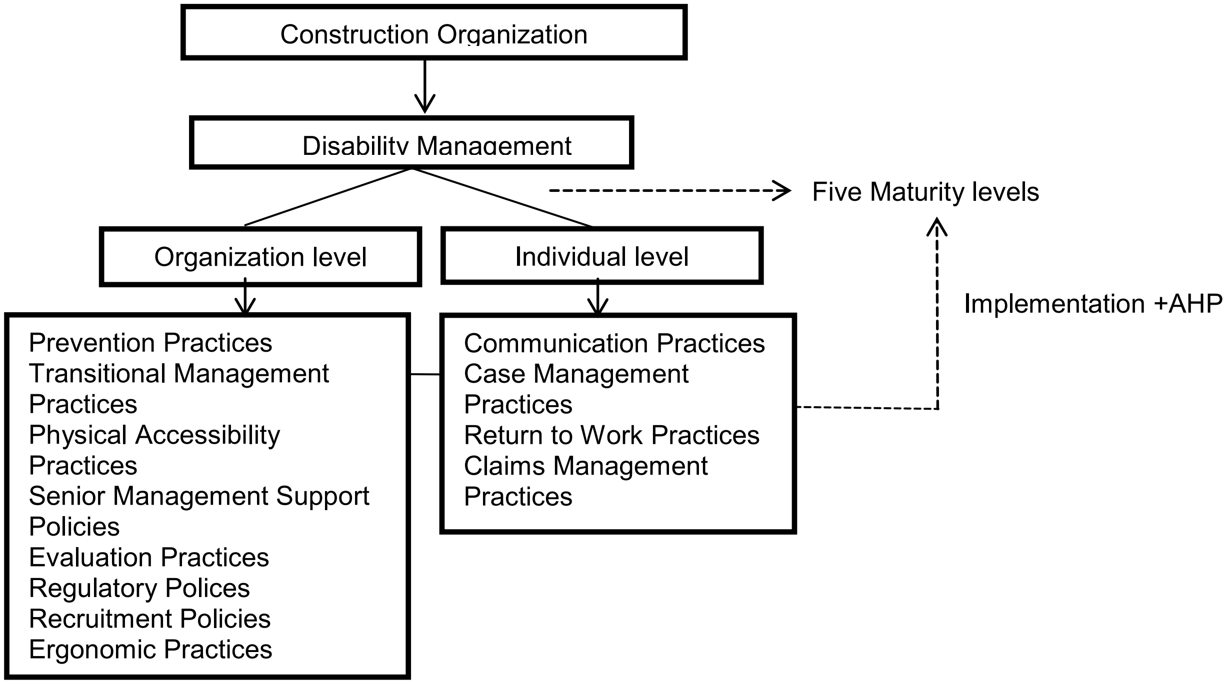

Figure 1: Simplified Structure of CDM3

3.2.1 Individual Level Indicators

Communication practices: Related practices cover information provided to all employees about the organisation's strategy with respect to DM, and accommodations provided at all levels in support of those with disabilities.

Case management practices: These practices deal with the individual employee once an injury occurs with the aim of managing the injury and rehabilitating the employee. Case management is a term used to describe a variety of strategies aiming to manage the health and social services provided to injured employees and their families (Brooker et al, 2012).

Return to work and accommodation practices: These practices involve the completion of a job needs assessment to determine how the DM program can best meet the needs of employees with disabilities and bring them back to work. A comprehensive analysis of employees' skills is conducted to modify their original jobs or identify alternate jobs for which they would be more suited.

Claims management practices: Related practices deal with managing claims related to occupational and non-occupational injuries or illnesses that may entitle the individual employee to long-term disability (LTD) benefits.

3.2.2 Organizational Level Indicators

Disability and Injury prevention practices: These practices cover the preventative aspects of DM programs, which have matured considerably in recent years and are critical to the overall performance of these programs and to controlling related costs. DM programs should educate employees on these aspects before the occurrence of disabling injuries.

Transitional program management practices: These practices cover the development of a generic DM program for injured employees, which can be customized to the individual employee during the individualized case management.

Physical accessibility management practices: These practices aim to improve the physical accessibility of construction workplaces to people with disabilities and as such cover physical workplace accessibility requirements.

Senior Management and leadership support practices: These practices involve getting continuous and consistent support at the senior management level to ensure the effective implementation of DM programs.

Program evaluation practices: These practices encompass the continuous evaluation of DM programs, customized individual RTW programs and injury and illness statistics to identify necessary program modifications and improvements and justify these programs' costs and benefits as well.

Regulatory and compliance policies: These practices cover existing polices both at the federal and provincial levels. Additionally it delves into specific policies developed by the organization in relation to accommodating injured and disabled workers. Policies can cover issues as salary replacement, job accommodation, transitional employment, budgetary responsibility and vocational training when necessary.

Recruitment and retention policies: Practices cover the recruitment process of employees in the construction workplace as well the procedures undertaken to ensure the retention of injured workers. The principle of non-discrimination should be respected throughout the process, to ensure maximal benefit to the employer and equitable opportunities to candidates with and without disabilities.

Ergonomic practices: Related practices should ensure the design of work processes and spaces that minimize injuries, complaints, staff turnover and work absenteeism; meet employers' social and legal obligations and improve employees' health and safety.

3.3 Measurement and Scale

An assessment tool was developed to enable organizations to determine the maturity of a comprehensive range of DM practices under twelve different categories. Responding organizations are expected to rate their level of implementation of these practices using a five-point Likert scale, ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). The tool enables respondents to add additional practices to the ones existing as part of the model and rate them accordingly.

3.3.1 Scaling Framework

This study uses the CMMI and SPICE as reference frameworks for the development of the maturity scale for the CDM3. Similar to the CMMI and SPICE, the CDM3 has five well-defined maturity levels that enable continuous monitoring and improvement with the aim of approaching the highest level of process maturity. The rationale for opting for five levels instead of three or four is to provide a more comprehensive breakdown of the growth process, and avoid overlaps and oversimplification of it. Each maturity level represents a well-defined stage that institutionalizes new process areas for disability management process maturation. The characteristics of each stage are described below.

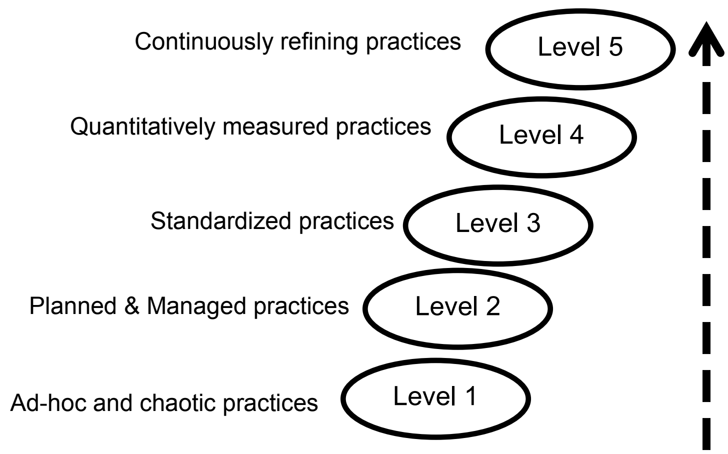

Figure 2: CDM3 Maturity Levels

At maturity level 1, organizational processes are usually ad hoc and chaotic (CMMI Product Team, 2002). No procedures or policies are defined or performed. Organizations' DM performance usually depends on the competence of organizational members rather than the application of specific DM practices.

At maturity level 2, processes are planned, performed, measured, and controlled. This level implies that DM requirements and programs as well as monitoring, control, and measurement mechanisms are managed, with DM practices and results visible to management.

At maturity level 3, a set of standard organizational DM procedures and processes are defined, implemented, managed and used to establish consistency across the organization.

At maturity level 4, organizations perform DM processes accurately and efficiently, practicing standard quality and performance measurement control. Human resource management performance data are collected and evaluated against internal and external benchmarks to identify causes of process variation.

At maturity level 5, organizational DM processes are continually enhanced through technological improvement and the establishment of quantitative objectives and targets.

3.3.2 AHP Implementation

Disability Management (DM) performance measurement will be partly determined using the concept of absolute comparison in analytical hierarchy process (AHP) (Islam and Rasad, 2006; Saaty, 1987). The AHP will provide a controlled and systematic way for determining the weights of importance of the construction industry's indicators for DM and determining the accuracy and reliability of these weights. It is an analytic decision making method used to select the best alternative from a number of alternatives using several criteria.

The indicators will be prioritised by determining the relative weights of the twelve primary indicators using pairwise comparison. A focus group encompassing a minimum of four experts will be set up to determine the indicators weights for the twelve defined leading indicators. The comparisons will be performed using the fundamental scale for pairwise comparison developed by Saaty (1987). A minimum of four such pairwise comparisons will be completed for each indicator and aggregated using geometric means (Yee-Ching and Elea, 1991). The comparisons of indicators will be done using a nine point fundamental scale of values instead of an abbreviated five point scale to reduce the level of fuzziness associated with the pairwise comparison judgements made by the experts. In its use of AHP, the CDM3 considers the indicators (practice areas) as being the decision alternatives that are being compared, with the criteria for comparison being the relative importance of an indicator relative to another to the performance of DM.

The aggregated pairwise comparison values will be normalized by dividing each column value (each indicator) by the sum of column values such that the sum of each column's values will be 1. A consistency check will be conducted to test the consistency of the rating of the various indicators (Saaty, 1987). The pairwise comparison will be repeated if the consistency ratio is greater than or equal to 0.1.

Each construction expert will assess the primary parameters as shown in figure 1 with respect to the methods described in table 1. When comparing the indicators, each expert will ask himself or herself which indicator is more important to the overall performance of the DM. All will be rated on a nine point scale from "Strongly Disagree" (1) to "Strongly Agree" (9). These subjective ratings will be quantified using the same pairwise comparison procedure that is, the same AHP process explained above to determine parameter weights to obtain quantified subjective ratings.

For each indicator, the pairwise comparisons conducted by an expert produce a matrix referred to as a pairwise comparison matrix (Yee-Ching and Elea, 1991). The values of the pairwise comparison matrix are known as pairwise comparison judgments and reflect the relative importance of the indicators as perceived by an expert (Saaty, 1987). The study adopts the scale developed by Saaty (1987) instead of developing its own scale because Saaty's (1987) scale has been adopted and validated by many studies, and was found to produce consistent and uniform results in each. The pairwise comparison judgments which comprise the pairwise comparison matrix are normalized, producing ratio scales in the form of principal eigenvectors or Eigen functions (Saaty, 1987). These eigenvectors or Eigen functions represent the weights of importance of the various assessment indicators.

Table 1: Fundamental Scale for Pairwise Comparison (Saaty, 1987)

Intensity of Importance	Definition	Explanation
1	Equal importance	Two indicators contribute equally to the objective/goal
3	Moderate importance	Experience and judgment slightly favor one indicator over another
5	Essential or strong importance	Experience and judgment strongly favor one indicator over another
7	Very strong importance	An indicator strongly favored over another and its dominance demonstrated in practice
9	Extreme importance	The evidence favoring one indicator over another is of the highest possible order of affirmation
2,4,6,8	Intermediate values between adjacent judgments	When compromise is needed
Reciprocal	If activity i has one of the above numbers assigned to it when compared with activity j, then j has the reciprocal value when compared with i	

The second part of implementing the CDM3: the assessment worksheet is based on a set of close ended questions which require a rating ranging from "Disagree" to "Strongly Agree" response, and which represent specific practice areas under each indicator. This technique is the central technique for implementing maturity modelling. It has been validated for use in a number of maturity models and was therefore adopted for the study. Scoring an organization using the assessment worksheet is straightforward. After answering the questions, evaluate the answer column to determine the maturity level. It is indicated by affirmative answers on all questions above the markers to the right of the answer column. The questions seek to determine the existence of specific outcomes/indicators within the organization and thus the implementation of specific practices. The CDM3 requires that the assessment worksheet be administered to the relevant members of the organization by the researchers. As a check on the accuracy of the responses, the CDM3 requires that random verification be conducted to increase the rigour and validity of the assessment through a review of project and organizational documents, as well as through direct observations and follow up interviews. After completion of the assessment worksheets, additional audit work will be performed to check the organization to ensure the activities prescribed by each practice are in place.

4 CONCLUSION

The paper outlines the development and theoretical underpinnings of the Construction Disability Management Maturity Model or CDM3 and describes its proposed implementation. The primary purpose of the CDM3 is to provide a framework for benchmarking the disability management (DM) performance of the construction industry over time and across countries and regions. Empirical studies on the use of the CDM3 as a tool for continuous improvements should contribute to the development of a better understanding of the problems associated with the implementation of DM programs.

The research, once complete should have research and practical contributions. Theoretically, this research extends the application of CMMI to DM in the construction industry. Furthermore, it develops a progressive framework that defines the advancement of the process of DM from one maturity level to another, thereby helping researchers advance knowledge in the field and helping practitioners implement DM successfully in practice. Once complete, the model will be implemented in practice by applying it to ten construction organizations with the aim of validating it.

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