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A Model for Assessing and Correcting Construction Project Health

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Abstract
Maintaining the health of a construction project can help to achieve the desired outcomes of the project. An analogy is drawn to the medical process of a human health check where it is possible to broadly diagnose health in terms of a number of key areas such as blood pressure or cholesterol level. Similarly it appears possible to diagnose the current health of a construction project in terms of a number of Critical Success Factors (CSFs) and key performance indicators (KPIs). The medical analogy continues into the detailed investigation phase where a number of contributing factors are evaluated to identify possible causes of ill health and through the identification of potential remedies to return the project to the desired level of health. This paper presents the development of a model that diagnoses the immediate health of a construction project, investigates the factors which appear to be causing the ill health and proposes a remedy to return the project to good health. The proposed model uses the well-established continuous improvement management model (Deming, 1986) to adapt the process of human physical health checking to construction project health.

Keywords
Project health, decision tree, continuous improvement, key performance indicators, critical success factors

1 Introduction

There is a constant stream of public reports and commentary about projects that fail to meet pre-determined objectives. Adverse impacts include cost and time overruns, inadequate build quality, poor project relationships, loss of reputation, public clamour and legal disputation. In some instances poorly performing projects can attract unwanted publicity, particularly those which are publicly funded and enjoy a high profile.

Despite the availability of a large number of published reports, reviews and research treatises providing guidance to successful project execution, this situation continues. The industry continues to suffer from projects failing to achieve outcomes expected by key stakeholders.

In order to improve the potential for a project to achieve the outcomes expected, a model is proposed which will allow assessment of current project condition, identify the reasons why the project is not performing as expected and suggest a means of returning the project to better health. The model evolved from a human health care model using symptoms to evaluate project health, detailed investigation of key symptoms to diagnose cause of problem and proposition of a remedy to return the project to good health.

2 The Concept of Construction Project "Health"

Human physical health can broadly be thought of as the condition of the body. When physical health is poor performance or quality of life can be compromised. Poor physical health often has associated symptoms that can be used to help pinpoint the cause of ill health quickly and accurately. Once the cause has been identified, a remedy can be implemented to return the body to good health. If symptoms are left unchecked, they can develop into critical situations and become much worse.

In many ways the "health" of a construction project is analogous to human physical health. Following are some of the parallels between construction project health and human physical health:

- State of health influences performance
- Health often has associated symptoms
- Symptoms can be used as a starting point to quickly assess health
- Symptoms of poor health are not always present or obvious
- State of health can be assessed by measuring key areas and comparing these values to established norms
- Health changes temporally
- Remedies can often be prescribed to return good health
- Correct, accurate and timely diagnosis of poor health can avoid small problems becoming large

In both human and construction project health regular health checks are integral to maintaining performance. Regular health checks leading to rapid, accurate diagnosis of health problems followed by implementation of an appropriate remedy can prevent small problems becoming critical. On the other hand when health is left unchecked or symptoms of illness are ignored, greater problems can occur leading to reduced performance.

The analogy between human health and construction project health may seem rather straightforward, but it remains to be seen whether the human health model can be adapted to construction project health.

3 Evolution of the Construction Project Health Concept

The major objective of the model is to provide a diagnostics protocol which will address and gauge the health of selected projects which may be in need of assistance. The application of the diagnostic tool assumes that major clients and industry stakeholders believe that the issue of resuscitating failing projects is vitally important to a vibrant, healthy industry. The old adversarial attitudes which are ingrained as part of poor project outcomes for at least some of the key participants are seen as being passé.

In order to develop a useful and practical model, the following aims were used to guide development of the concept. It was agreed that the model should:

- be able to identify poor health,
- be broadly applicable,

- allow rapid accurate diagnosis of health problem and
- suit integration of remedies to return the project to good health.

The first aim infers that the model will look for signs of poor performance, rather than good performance. The model should be designed so that this is possible with or without symptoms.

In order to achieve the second aim, it will be necessary to categorise the health characteristics of construction projects and to ensure that the model addresses all categories. A broad but useful classification strategy can be based on two fundamental variables – a) whether the state of poor health known and b) whether the reason for poor health known. This allows construction project health to be thought of as existing in four states. Table 1 shows the four states.

Table 1 – States of Construction Project Health

State	Poor health	Reason for poor health
1	known	known
2	unknown	known
3	known	unknown
4	unknown	unknown

State 1 would be characterized by a project that is well monitored, and sufficient analysis, understanding or experience is available to allow diagnose of the underlying health problem. State 2 is not so straightforward, but could be characteristic of a project which is not monitored well, but experience, observation or inside knowledge suggests that there are some underlying problems. State 3 could be characterized by a project that is well monitored, but management lacks sufficient experience or analysis to accurately diagnose an underlying problem. State 4 is the worst-case scenario; poor monitoring and lack of experience, understanding or analysis characterize this project.

These four fundamental health states of a construction project would need to be accommodated in first stage of the project health model. In cases where poor health is either known or unknown and the reasons are known (States 1 and 2), the first stage would be used as mechanism to ensure that all health problems are identified and also to help provide clarity on complex health issues. The model should also allow the freedom to bypass the initial health check stage to save time and effort, should the reasons for poor health be known. Where the reasons for poor health are not known (States 3 and 4), an initial health check could be used to provide direction for the more detailed investigation.

The requirement for rapid, accurate diagnosis lead to the concept of an initial broad health checking mechanism which could guide a further more detailed investigation designed to identify the factors contributing to poor health. The use of performance indicators to assess the state of the contributing factors allows remedies to be prescribed, based on the condition of the contributing factors investigated.

A continuous improvement model derived from (Deming's, 1986) management cycle was used to adapt the medical health model to a construction project scenario. The model is based on a four stage process beginning with broad and rapid assessment of current health, followed by a more thorough analysis of the areas identified as unhealthy, which allows prescription of a remedy and finally continued monitoring of condition. Figure 1 shows the construction management health model.

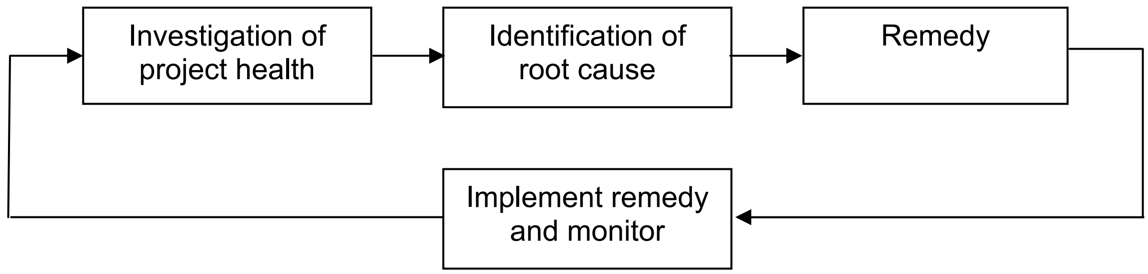

Figure 1 – Construction Project Health

3.1 Construction project health check

As is the case with human physical health, construction projects have a number of critical areas that can facilitate a broad evaluation of project health. The proposed model uses Critical Success Factors (CSFs) in an unconventional way to assess project health. (Rockart, 1979) first introduced the idea of CSF's in terms of management of projects and defined them as those aspects of a project which, if successfully executed, can significantly influence the success of a project. The traditional use of CSFs sees them as ingredients to give the greatest chance of a successful outcome. In the model they are used as the basis for a broadly inclusive fundamental health check to gauge project health in terms of specific success factors agreed to by interested parties.

To achieve rapid diagnosis, a quick initial health check is needed to guide focus for a more detailed investigation. A literature review, including (Parfitt, 1993), (Chua, 1999) & (Cheng, 2000), was undertaken to collect as broad a range of CSF's available as possible. It was then found that a list of more than 120 commonly used construction based CSF's could be grouped into seven primary CSF themes thus; Cost, Time, Quality, Relationships, Safety, Environment, Stakeholder's value.

These represent critical areas of construction project health and are used to form the basis of the project health checkup. In order to use these CSF's as an indication of health, they need to be assessed. This was achieved by developing an associated list of Key Performance Indicators (KPIs) for each CSF.

(Munir, 2002) defines a KPI as a number or value which can be compared against an internal target or an external target benchmark to give an indication of performance. The use of KPIs to assess the performance of the main CSF themes allows the model to be applicable to a project regardless of whether a performance target was set by an interested party, legislation or even by other projects.

Although a large number of KPI's were identified in the literature review, these often lacked certain characteristics that would make them applicable, useful, independent and practical. To increase the robustness and usefulness of the model certain characteristics were chosen which need to be possessed by KPI's used in this model. The KPI characteristics along with description are shown in Table 2.

Table 2: Required KPI Characteristics

Characteristic	Description
Easily measurable	Must able to be measured quickly, directly and accurately with as little effort as possible.
Sensitive	The indicator must be tuned to project health to allow accurate health assessment.
Assessable	Once measured, the indicator must be able to be compared to a known value to allow judgement of health to made.
Independent	Independence from other project variables is desirable to provide clarity in assessment of a specific CSF by avoiding interference which can give misleading results.
Reflect reality	The measured variable must encourage a description of reality rather than 'ideal' or perceived situations.

In cases where the health of the project is unknown, assessment of KPIs should allow unhealthy CSFs to be rapidly identified. On projects where the health is known, this step in the health process can be omitted altogether, or performed as a backup check for other unnoticed problems. A number of KPI fulfilling the above criteria were identified from the literature for each of the seven CSF themes. To facilitate the KPI's application to assess the performance of the CSF's, these could be calibrated using benchmarks from Australia (Coles, 2003), UK (cbpp, 2003) & USA (CII, 2003).

3.2 Diagnosis of construction project health problems

CSFs that are found in poor health can be used as the focus of a more detailed investigation. This will allow the cause of poor health to be diagnosed via Contributing Factors. A list of contributing factors associated with each CSF will be developed through a detailed literature review and in consultation with industry through pilot studies.

Like CSFs, the contributing factors will need to be assessed to pinpoint the areas most likely to be causing poor project health. This will be accomplished with a series of Secondary Performance Indicators (SPI's) for each contributing factor. (cbpp, 2003) defines an SPI as '…an indicator showing the level of performance achieved against an operation that is of secondary importance to the successful completion of the services being provided. An SPI often provides a diagnosis the SPI's of the result of KPI'. To ensure the usefulness of the model to carry out detailed diagnose, the SPI's need to possess the same characteristics as the KPI's. However, the SPI's will also be used as the basis for prescription of remedies and will therefore need to be easily benchmarked.

3.3 Prescription of remedy to return construction project to good health

Correct and timely identification of contributing factors along with accurate assessment of SPI's should allow an effective remedy to be prescribed. The role of the remedy will be to return the project to good health and development of the remedies will be consistent with (McManus et al, 1996) who quotes George Santayana's warning that 'He who does not learn from history is doomed to repeat it'. The remedial measure being adopted for the model are based on an approach already used in literature in which each remedy proposed is intended to ensure that failures are not continually repeated. Recognizing the potential effect up front and taking the proactive steps necessary to avoid consequences can achieve this.

It is possible that single or multiple remedial measures will be associated with each of the contributing factors for the unhealthy CSF. The implementation of the measures may require the coordination of more than one stakeholder and once implemented may require time to bring the project back to good health.

The practical nature of construction suggests that a suitable approach for development of a suite of remedies for a range of health problems would be approach their development on lessons learnt from which would be derived from actual projects or case studies. This suite will be augmented by remedies obtained from a literature review, however preliminary investigation indicates that this information may be sparse.

One of the limitations of using lessons learnt is that remedies tend to be dependent on personal experience. This means that remedies for a given contributing factor may vary from person to person – and potentially in conflicting ways. The approach for this model will be to develop a set of remedies that have proved historically that they are workable and can achieve results.

3.4 Action – continuous improvement and ongoing monitoring

Implementation of the remedy is possibly the most important step towards bringing a project back to good health. It is likely that some time will be required before the effects of the remedy can be seen or even measured. This lag suggests that ongoing monitoring would be essential to ensure that the remedy is having the desired positive effect.

The model uses a continuous improvement loop (Deming, 1986) to allow monitoring to take place. The model has also been designed to allow monitoring to be undertaken without the need to re-enter the loop at the health check stage. It may be possible to save investigation time and effort by simply using the previously identified contributing factors, and re-assessing their performance via the KPI's. It is suggested that the model could be used in a number of modes simultaneously on a project to investigate health and monitor as required.

4 Summary

A model was developed to allow assessment of current construction project health, identify the reasons why the project may not be performing as expected and suggest a means of returning the project to better health. The model was derived from a human physical health model using Critical Success Factors, Key Performance Indicators, Contributing factors and Secondary Performance Indicators.

The model has been designed to facilitate the implementation of remedies which would be chosen depending on the contributing factors identified during the health check. The list of remedies related to each contributing factor will be developed through consultation industry experts and lessons learnt. It is proposed that remedies would be put in to action and their effect on the project monitored. As the cycle continues this should lead to a continuous improvement in project health.

Case studies are currently underway and the results of these studies will be used to help build a comprehensive list of contributing factors and to develop the framework for the model.

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