The Role of Management Commitment in Determining the Success of a Behavioural Safety Intervention

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Abstract
Behavioural safety interventions were implemented in 26 building sites across the United kingdom and quantitative safety data collected for some 24 items grouped into four categories: access to heights; scaffolding; personal protective equipment PPE and housekeeping. In addition behavioural measures of site management commitment, facilitator/observer performance and goal-setting quality were taken over the full duration of the research. All three of these measures were found to correlate positively with improved safety performance. Management commitment was the most significant. Further regression analysis suggested that management commitment was the underlying causal factor in all of these relationships and that both quality of goal-setting and facilitator performance were greatly influenced and significantly determined by management commitment levels.

Keywords: Behavioural, commitment, construction, feedback, goal-setting, safety.

Introduction

Too often safety interventions in organisations occur in response to a specific, often major, accident or injury. Unfortunately the effectiveness of interventions prompted by a specific event can often reduce as the immediate after-effects of the incident abate. This can have the effect of creating cycles of safety performance within an upper and lower limit, whereby safety is 'allowed' to drop to a point at which an accident occurs; resources are then diverted allowing a safety 'blitz' to be introduced. Subsequently, concern for safety gradually reduces until the next injury (colloquially known as the 'safety' wave'). This form of reactive management in response to unpredictable events is not one that would commonly be considered acceptable for other areas of a business such as quality, productivity, or marketing, and is inconsistent with the current management philosophy of continuous improvement. In continuous improvement models such as Total Quality Management, organisations attempt to manage proactively monitoring performance and applying continuous learning principles.

Recently, these principles of monitoring and feedback have been applied to safety management with good results. The Manchester School of Management and Department of Building Engineering, University of Manchester Institute of Science and Technology (UMIST); undertook a five year programme of research, in two phases, for the UK Health and Safety Executive (HSE). In phase one, the effectiveness of behavioural measurement, goal setting and feedback in improving safety behaviour on construction sites was demonstrated. In phase two, the practical problems of the use of these methods by construction contractors' own personnel were studied. This paper concentrates on the fundamental importance of management commitment in determining the success of any such intervention. It also considers the causal mechanisms by which such interventions influence behaviour.

Behavioural programmes

Following the principles of Heinrich's triangle (Heinrich, 1959), behavioural programmes focus on the key behaviours that lead to accidents rather than either accidents or attitudes. Accidents are relatively infrequent and can be difficult to investigate objectively after the event (there are also the numerous controversies regarding the accuracy of figures). Further, reacting to accidents rather than proactively tackling the most likely causes of accidents suggests fate may, have too much influence in dictating the application of resources.

Attitudes can prove difficult to change because of attention, understanding and perception issues. In addition, attitudinal measures can only be validated by a criterion such as behaviour. Finally, the relationship between attitudes and behaviours has been shown to be not necessarily direct. An attitude change may not lead to behaviour change and behaviour change can lead to a change in attitude (Festinger, 1957).

For these reasons, behavioural programmes focus directly' and proactively on potentially risky behaviour. In part, the behavioural approach has become popular following the relative lack of success of other measures. Site inspection blitzes by the HSE (see, for example HSE 1988) and informational safety (see Saarela *et al.*, 1989; Wilson, 1989) have not been consistently successful. Incentives and disciplinary action can have some success. However, incentives are expensive and can remove objectivity (Peters, 1991). Disciplinary action can result in reduced morale and it is difficult for organisations to meet the necessary requirements of immediacy, consistency and severity of punishment that are vital if there is to be a consistent and meaningful impact on behaviour in the long term (Skinner, 1953).

Goal-setting, feedback and the behavioural approach

Goal-setting, behavioural measurement and feedback have traditionally formed the backbone of the behavioural approach to safety management. Indeed, the literature on goal-setting, as an effective procedure for managing behaviour, is substantial (Wood *et al.*, 1987). Goal-setting theory hypothesises that goals are the immediate, though not sole, regulators of human action and that performance will improve when goals are hard, specific and accepted by the actor. Goal-setting is held to affect performance by: directing the attention and actions of the individual/group, mobilising effort, and increasing motivation. In general, the literature on goal-setting supports these propositions (Locke & Latham, 1990). The research literature on the role of feedback in determining performance effectiveness is also supportive (see, for example, Algera, 1990).

These techniques have also been shown to be of value in safety McAfee & Winn (1989), for example, showed that safety behaviour can be improved by systematically monitoring safety-related behaviour and providing feedback in conjunction with goal-setting and/or training. Other supportive research includes Chhokar & Wallin (1984), Reber & Mattilla (1984) and Mattila & Hyödynmaa (1988).

Management commitment

The most frequently researched form of commitment in occupational psychology is organisational commitment. Organisational commitment can be thought of as psychological attachment to, or identification with, an organisation. Although less extensively researched, it is also possible to consider the nature and level of commitment to a specific project such as a safety intervention. For any individual, commitment to a specific project is likely to be related to his or her level of organisational commitment. This relationship is not certain, however, and will depend on that person's perception of the importance of the intervention to the organisation. It is also possible that someone could identify with a specific project, in spite of a low level of commitment to the organisation as a whole.

In terms of the likely success of an intervention it does not matter whether a manager is committed through genuine enthusiasm, 'affective', and continuance' commitment, respectively (See Becker, 1960; Meyer & Allen, 1991). As long as management contributes the necessary time, resources and positive approach to the project, its role in influencing the project's success is capable of being fulfilled. A genuine belief in the value of the project, a desire to receive career recognition; or a generalised belief that one should be committed to all work activities could all be sources of commitment for managers or observers.

Previous research (e.g. Donald & Canter, 1993; Rodgers *et al.*, 1993) has shown that management commitment is important to the success of safety initiatives.

Background research (phase one)

In phase one of the programme, goal-setting and feedback methods aimed at improving standards of safety behaviour were designed and tested on six construction sites in the North West of England. Behavioural

measures of safety performance were developed and used to collect baseline data before introducing the intervention. The measures included four categories of safety performance: access-to-heights; scaffolding, use of PPE; and site housekeeping (site tidiness). Examples of behavioural items include: ladders untied; guard rails missing; PPE not worn; and scaffolds littered with debris. Combinations of training, feedback and goal-setting protocols were used.

Safety performance data were gathered several times a week by an independent observer on each site. After an initial period of data collection, the average percentage safety score was calculated for each category to provide a baseline figure for the safety performance of the site. At this point all personnel on site were asked to attend a safety goal-setting meeting, at which the safety performance measures were explained, current levels of safety were discussed and targets, or goals, for improvement set. Performance monitoring continued and the levels of performance and targets were presented graphically on feedback charts. These were located in prominent positions and updated weekly. The intervention process was carried out for three categories of activities: access to heights; scaffolding; and general housekeeping. The fourth category PPE, was monitored, without feedback, as a control. The experimental procedure involved: measuring safety performance for eight weeks to provide a baseline measure; introducing the intervention for eight weeks; and measuring the change in performance, withdrawing feedback for four weeks, re-introducing the intervention for another eight weeks, and withdrawing feedback for a further eight weeks.

In addition to goal-setting sessions, goal review sessions were held to discuss performance and to review and, if necessary, modify goals.

Results

The three experimental categories showed a statistically significant improvement and the control category a non-significant improvement. (All three experimental categories were significant at one per cent, one-tailed:- i.e. improvements were, in other words, highly significant.) The research in phase one demonstrated that:
i) Safety performance levels on construction sites can be objectively and reliably measured; and
ii) Measuring key behaviours coupled with 'goal-setting and feedback, can be used to produce large, statistically significant improvements in safety performance. A more detailed report on this part of the research is available (Duff *et al.,* 1993). A qualitative finding of the researchers noted that management commitment to the intervention appeared to play an important part in the success. This observation was investigated in depth in phase two of the research.

Objectives of phase two

In phase one, the research team undertook all the safety measurement, goal-setting and feedback activities. In phase two, the responsibility for these activities was transferred to construction company personnel, with the objectives of developing these methods from a research-based technique into a practical and effective management tool. The specific objectives of the research were to investigate the relative importance of management and observer commitment and goal-setting quality in determining the success of the intervention by:

I) Evaluating the success of a self-administered intervention in terms of pre- and post- intervention safety performance scores (as phase one);

ii) Systematically evaluating the relationships between management commitment, facilitator (or observer) commitment, quality of goal-setting and safety performance; and

iii) Investigating how meaningful specific goals were to operatives and how much attention was paid to the feedback provided

Method

Setting
Twenty-six construction sites, representing 13 major construction contractors, participated in the study. Two of these sites provided only qualitative data. The sites included new build, refurbishment and civil engineering projects, and varied in size of labour force from 15 to over 200 operatives. Projects varied in duration from two to 14 months.

Procedure
The experimental methods used in phase two were essentially the same as those described for phase one. There were, however, significant differences in their implementation:

(i) the measures were taken, the goal-setting sessions run, and the feedback charts updated by contractors' own personnel (referred to henceforth as site 'observers') after two days' training from the research team;

(ii) the intervention was of longer duration. The behaviour improvement measures were applied, uninterrupted, until the site construction activity finished or the research team withdrew (on the longest project a period of 14 months); and

iii) PPE scores were included as part of the feedback and not used as a control category.

Members of the research team visited sites approximately once a fortnight to observe important events, such as goal-setting and goal-review sessions, and to collect data returns.

Measurement

Safety performance
Safety performance was measured by observers on site using the safety performance measure developed in phase one of the research (Duff *et al.*, 1993). In terms of the correlational and multi-variate analysis discussed in this paper, safety performance categories were aggregated into an overall Cohen's 'd' score (Cohen 1988).

Following a behavioural model (and because of limited numbers statistically), measures of observer and management commitment focused on the time and resources that the subjects gave to the intervention rather than any self-reported attitudinal expressions of commitment. Using the critical incident analysis technique (Flannagan, 1954), key individual 'commitment behaviours' were identified. Each of the items was then behaviourally anchored in the style of Likert scales (Likert, 1932) and a log updated after each relevant interaction.

Observer commitment
Commitment was measured using systematic researcher ratings of pro-intervention behaviour. Observers were rated on four items: keeping promises; returning telephone calls promptly; proactive, enthusiastic behaviour during site visits (eg being ready at the appointed time and not having to be called off site); and proactive, enthusiastic response to practical problems.

Management Commitment
Management commitment was rated on five behavioural dimensions: attitude to the introduction and placement of feedback charts; attitude to workers stopping work to attend goal-setting sessions; attendance and support at goal-setting sessions; and attitude to observers taking time away from other duties to perform the measures. The fifth, general, rating was based on information provided by the observer at a debriefing session at the end of the project. Again, all items were behaviourally anchored using Likert scales and logs updated after each relevant interaction.

Goal setting
Each goal-setting session was observed by a researcher and rated for its organisational effectiveness on the following scales:

- percentage of management attending and supporting the activity;
- percentage of operatives attending;
- amount of operative participation;
- quality of the arrangements at the session venue, in terms of visibility and audibility;
- performance of the contractor's observer in covering all the important points as per training script.

Again, specific definitions were used as anchors and logs updated after each session. (For the purposes of correlation's and regressions the item relating to management involvement in the session was dropped.)

Operative awareness of intervention
An opportunity sample of at least 20 per cent of operatives was interviewed by researchers on each site. The checklist interviews focused on knowledge of performance goals, current performance levels and intervention methodology, in addition to the amount of discussion of scores and their perceived accuracy and impact.
Qualitative data
Case study data (not directly reported here) included observer diaries, conversations with researchers, researcher observations, and structured interviews at the end of the interventions.

Results

Safety performance improvement
Fifteen of the 26 sites continued the intervention up to completion of the research programme, the other 11 withdrawing for a variety of reasons, including lack of commitment to the research programme at board level (two withdrew before any qualitative data was collected). Fig. 1 summarises the mean safety performance results for the 15 sites completing the study.

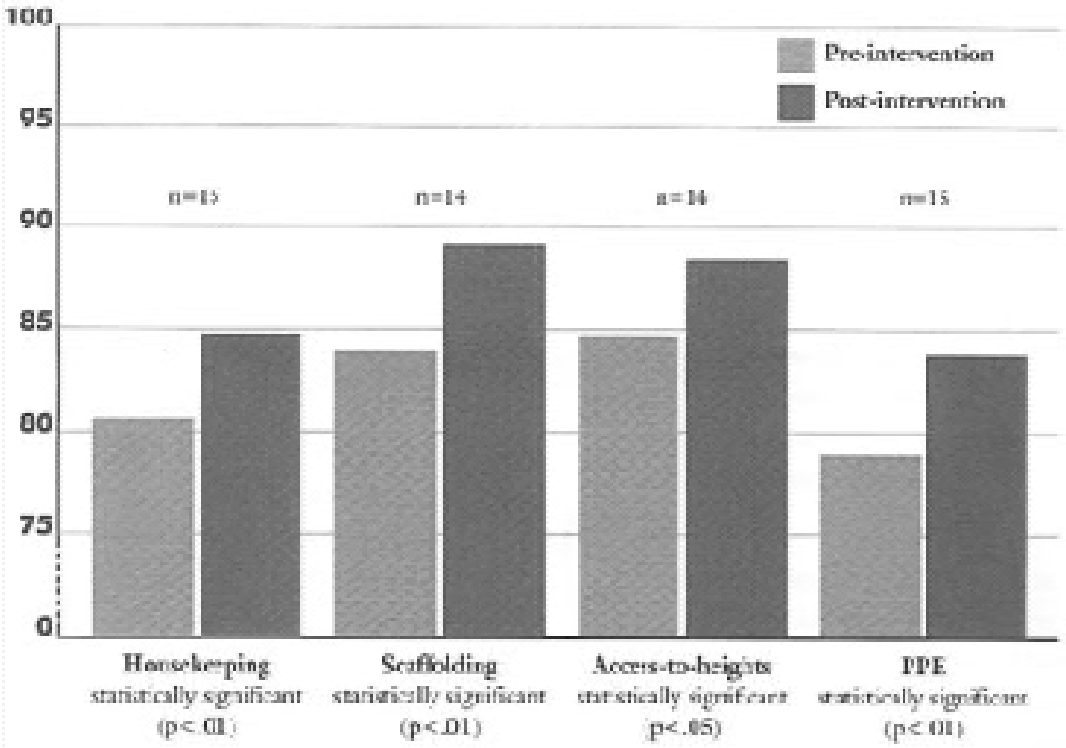

Figure 1: Aggregate scores across all sites completing study (phase 2)

Analysis of the data demonstrated a statistically significant increase in the average safety performance measure across all categories of behaviour for all completed sites (t-test; $p < .01$, one tailed - i.e., in other words, highly significant).

The average safety score improved from 82.5 per cent to 86.5 per cent. As the pre-intervention potential for improvement was 17.5 per cent (100 per cent - 82.3 per cent), this represents a decrease in unsafe behaviour of 22.9 per cent from pre-intervention levels.

It is worth acknowledging that on some of the smaller sites the nature of the work changed radically as the data collection progressed (this was not a major factor on the larger sites). Using percentage figures helped keep comparisons meaningful as numbers of operatives fluctuated. In addition, substantial qualitative work (not reported here) attempted to ensure that these scores reflected a genuine improvement in performance and were not just an artefact of changing work.

Direct benefits to the organisation

It is impossible to determine accurately the cost benefits to the sites involved as no meaningful accident data could be collected. In part this reflected the behavioural philosophy discussed above and also the individual and inconstant nature of the building sites studied. Further, it appeared that the sites that volunteered to participate were atypically safety conscious (being 'good' sites from large and co-operative organisations) so that even comparison with national figures would be impaired (and biased in the researchers' favour).

However, if the percentage reduction in unsafe behaviour from these sites' baseline figures was generalised to accident figures (as Heinrich's triangle suggests) then, broadly speaking, a 23 per cent reduction in accident costs could be postulated for all sites in the research. This figure will be greatly increased for those sites where management commitment was high and behavioural improvement more substantial than this average figure (the five best sites roughly halved their transgression). Given minimal profit margins and suggestions that accident costs can reach eight per cent or more of tender prices (HSE, 1993) direct cash savings can be substantial.

Relational data

Table I shows that management commitment is significantly correlated (at $p<.01$) with safety performance, observer commitment and quality of goal-setting. Quality of goal-setting, but not observer commitment, is significantly correlated with safety performance. Observer commitment shows a positive but not significant relationship with safety performance.

Table 1: Correlations between safety performance, management commitment, observer commitment and quality of goal-setting

1. Safety performance	-		
2. Management commitment	.55*		
3. Observer commitment	.17	.59**	
4. Quality of goal-setting	.39*	.50**	.35*
	1	2	3

N.B. Pearson's product-moment correlations. Critical values of r (n=24) are r=.34 (*) (p<.05) and r=.46 (**) (p<.01). The nine sites that dropped out too soon after going live to provide adequate post-intervention data were given, for the purposes of correlation, a score based on the limited safety performance data that were collected. (A careful review of the data confirmed that there were no spurious improvements based on, for example, only a handful of measures - the data for all nine sites showed little or no impact.)

In Table 2, bands of 'high', medium' and 'low' management commitment were allocated by simply calculating one standard deviation above and below the mean management commitment score. Therefore, high levels of management commitment appear to ensure significant improvements in safety performance and low commitment levels leave the intervention likely to fail.

Table 2: Frequency classification of safety performance outcome under high, medium and low levels of management commitment.

	High	Medium	Low
1. Statistically *significant improvement* in safety performance	6	6	0
2. *No* or *insignificant improvement* or failure to complete programme	0	4	8

Regression analysis

Using a stepwise regression analysis with safety performance the dependent variable (see Table 3), management commitment was identified first by the regression with an R_2 of .31. Once this factor was removed from the equation neither observer commitment nor goal-setting quality explained a statistically significant amount of variation in performance. This is particularly interesting given the statistically significant correlation between quality of goal-setting and safety performance.

Table 3: Stepwise regression :– dependent variable = safety performance

Variable	**t**	**Sig.**	**R_2**
1. Management commitment	3.05	.006	.31
2. Observer commitment	1.10	.285	-
3. Quality of goal-setting	0.22	.832	-

The operatives stopped at random on site were asked (among other questions): whether they were aware of the intervention; if they could tell the researcher where a feedback chart was; how often the charts were updated; and what the category goals and latest performance scores were (see Table 4).

Table 4: Operative awareness of intervention

	Worst site	**Best site**	**Mean Ave.**
1. Aware of intervention	85	100	96
2. Knows position of feedback chart	83	100	94
3. Aware that feedback charts were updated weekly	12	70	36
4. Knows current goals and performance scores*	0	50	9

*. 5% leeway either side was allowed on this question. Had it not been, all sites would have scored 0% as not one interviewee accurately named either all current performance or goal-levels.

It is apparent that awareness of the intervention was high but that detailed knowledge of the performance levels and goals was severely limited.

Discussion

Self administration
Results suggest that even when self-administered a behavioural intervention can substantially improve safety behaviour on UK construction sites. The estimated benefits of accident reduction in direct cost terms are discussed above. Other benefits to the organisation include the easier and more assured mobility around the site that flows from improved housekeeping as well as an increase in communication that was found to be, inevitably; generalised to welfare issues at first, but later extended to productivity.

DeJoy (1986), for example, has shown that employee participation in safety programmes has the effect of generating more open and informal communication from employees and the expectation that management will be receptive to this input. Further, research in the area of social exchange and equity theory has found that the quality of management-operative exchange contributes significantly to organisational citizenship behaviours' such as altruism, courtesy; tolerance of others' logistical problems and conscientiousness (Deluga, 1994).

Management and observer commitment
These results suggest that the role of management commitment to the intervention is vitally important, impacting (In all aspects of the methodology. The management commitment measures showed a statistically significant, positive correlation with safety performance improvement, accounting for 30 per cent of the variation, a large proportion in view of the many other organisational and environmental factors which could have impacted on performance on a UK construction site. The classification data shown in Table 2 is (deliberately) simplistic but is particularly strong evidence for the importance of high management commitment in determining the success of the intervention.

Observer commitment showed a positive, but weaker, relationship with safety improvement than did management commitment. Interestingly there was a much stronger relationship between management commitment and observer commitment and, crucially, on no Site was management commitment 'high' but observer commitment 'low', suggesting that a high level of management commitment is likely to guarantee suitable levels of observer performance.

On two sites, observer commitment remained high despite the fact that management commitment was low, demonstrating that observers can remain committed and 'carry' an intervention even without management support (it is perhaps telling that although these sites completed the intervention methodology, neither showed a significant improvement in safety performance). More typically, however, observers who commenced with high levels of commitment became disillusioned if management was not supportive. In practice, this meant not allowing official 'time off' from other duties by arranging cover, or simply showing little interest in the data and communications generated. One observer who completed an intervention very successfully in the face of limited management commitment and support declined to use the intervention on a virtually identical site later. He commented: "I said I'd do it and I did ... but you saw what it was like for me. I'm not putting myself through that again."

In short, an observer might show high levels of commitment and 'carry" the intervention even where management commitment is low, but this situation will always be tenuous and vulnerable to the 'lone champion' being transferred to another site or forced to stop observation because of pressure of work. On one site, for example, an intervention stalled and failed because the 'champion' took paternity leave.

The results point strongly to the conclusion that management commitment is vital to the success of such an intervention if for no other reason than its influence on observer commitment, quality of goal setting and other practical issues. Indeed, the evidence suggests that the commitment levels of management are significantly more important than the behaviour of those individuals who actually implement the methodology.

Mechanisms through which the intervention worked
Periodic tests of operative awareness showed that, generally, over 90 per cent were aware of the intervention but that the vast majority was uncertain of the current targets and performance levels (See Table 4). While these data raise doubts about the impact of the intervention, both qualitative and quantitative results confirm that there was a meaningful and significant increase in safe behaviour overall and that the intervention played a crucial role in this increase. Possible explanations must therefore reach beyond the bounds of' 'classic' goal-setting and feedback theory.

As there is little evidence that the goals themselves had a direct impact on operatives, it seems probable that the improvements in safety performance arose in part from a general increase in safety consciousness, arising from the knowledge that safety was an important management goal. Highly visible feedback charts were also a daily reminder of the 'minor' individual behaviours that lead to accidents, and the fact that these were being monitored. Obviously the 'Hawthorne effect' is relevant here. Crucial to this view was the finding that when asked as part of the 'awareness' research operatives generally considered scores valid and accurate despite limited detailed knowledge of them. A typical comment was: "Not sure about the actual figures but housekeeping's up a bit and that's about right - it has got a little better recently." In addition, the simple fact that management now had accurate data about day-to-day performance will have helped.

In essence, what was supposed to be participative goal-setting of a specific kind arguably became somewhat assigned goal setting of a general kind, about which operatives have been consulted. It is worth noting, however, that Locke & Latham (1990) suggest that where authority is considered legitimate, workers will accept and commit to an assigned goal unless they have cause to reject it. Importantly, there was never any suggestion of/safety being rejected legitimate goal nor were there any instances of operatives claiming that they had not been consulted.

Communication and information
Perhaps the most important factor, however, was management's attitude to the increase in safety-related communication generated by the intervention. A great deal of information was derived at goal-setting and review sessions and from operatives approaching observers while they took measures. It appeared that the most successful sites were those where management used this information to remove blockages to improved performance. In short, the findings support the widely held view that a behaviour-based goal-setting and feedback intervention works best as an effective tool for managers with a continuous improvement focus. Although the 'Hawthorne effect' can promote intervention, it is understanding and removing the root cause of unsafe acts that enables long term improvement. Krause (1997), for example, says that this aspect "...is the difference between a continuous process and a temporary programme". Further academic research might focus more systematically on the amount and rise of information generated by such an intervention.

This interpretation is also consistent with the fact that scores did not fall away despite a large turnover of sub-contract employees on many sites. If the primary impact of the intervention is on site systems and general awareness, rather than specific individual cognition's focused on goal attainment, it is consistent that new contractors can 'improve' standards, despite not having attended goal-setting sessions, by simply modelling their behaviour on existing personnel. In addition, they will also be affected by improvements to systems and procedures. In other words, the intervention encourages a gradual but self-reinforcing shift in site 'culture' by changing the day-to-day normal behaviour of personnel. Because the measures of commitment were behaviourally based it was not possible to distinguish systematically between affective or continuous management commitment. This might prove another fruitful avenue of further research. If the analysis of the mechanisms by which commitment influences performance are correct then affective commitment might be expected with its more obvious links to using information In a continuous learning approach - to be more strongly related to the success of such interventions.

Other research might focus on the role of management commitment in industries other than construction.

Conclusions

1. This research showed that an approach based on goal-setting, feedback and an effective measure of safety behaviour, can, and if properly applied will, improve safety performance, even in the arguably difficult environment of the construction industry with its high turnover of staff and tight to non-existent profit margins.

2. It appears that, as previous research by, among others, Donald & Canter (1993) and Rodgers et al (1993), has indicated, a high level of management commitment plays the crucial role in ensuring the success of the intervention as it is this that seems to ensure observers execute the methodology effectively.

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