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Safety management by walking around (SMBWA): A safety intervention program based on both peer and manager participation

Gil Luria [a,*], Ido Morag [b]

[a] Faculty of Welfare and Health Sciences, Department of Human Services, University of Haifa, Mount Carmel, Haifa 31905, Israel
[b] Shenkar College of Engineering and Design, Ramat-Gan, Israel

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ABSTRACT

"Management by walking around" (MBWA) is a practice that has aroused much interest in management science and practice. The purpose of this study is to demonstrate adaptation of this practice to safety management. We describe a three-year long case study that collected empirical data in which a modified MBWA was practiced in order to improve safety in a semiconductor fabrication facility. The main modification involved integrating an information system with the MBWA in order to create a practice that would generate safety leadership development and an organizational safety learning mechanism, while promoting employee safety participation. The results of the case study demonstrate that the SMBWA practice facilitated thousands of tours in which safety leadership behaviors were practiced by managers and by employees (employees performed five times as many tours as managers). The information system collected information about safety behaviors and safety conditions that could not otherwise be obtained. Thus, this study presents a new organizational safety practice SMBWA, and demonstrates the ways in which SMBWA may improve safety in organizations.

1. Introduction

Since Peters and Waterman first introduced management by walking (or wandering) around (MBWA) in their book "In Search of Excellence" (Peters and Waterman, 1982), many organizations have adopted MBWA: Walt Disney World in Atlanta to maintain high quality service (McGough, 1992); American Express to improve its operations (Denton, 1996); St. Marks Breast Center at the New Zealand Health Center to provide quality clinical service (Callan, 2000); and Hewden Stuart, one of Britain's largest independent construction equipment leasing companies, has adopted MBWA as the company's leadership model (Van de Vliet, 1995).

Large chains such as HP and Wal-Mart use MBWA to collect first-hand data and to build relationships of trust in the organization (Clark, 2000) and MBWA is also well documented in management texts (see, for example, Adams, 1997; Harte, 1997; Hickman, 1992; Lewis et al., 2004; Sharp and McDermott, 2001). However, there is still a significant lack of empirical research regarding MBWA in management in general, and no research at all that we could find regarding the use of MBWA for safety management in specific. The intention of this study is to describe a modified MBWA practice that focuses on safety – Safety Management By Walking Around (SMBWA). We will discuss the theoretical aspects of MBWA that were the foundation for the modified SMBWA practice, and describe a case study in which empirical data was collected while SMBWA was practiced successfully in a semiconductor fabrication facility (FAB), and in which an information system was used to support safety managerial activity.

1.1. What is MBWA?

Luthra (2004) explained that MBWA is an unstructured hands-on approach in which managers directly participate in their subordinates' work-related activities. In contrast to rigid and remote management approaches, MBWA managers spend a significant amount of time informally visiting work areas and interacting with employees. The practice is unscheduled, casual and friendly. As managers walk around they can chat with employees. The two main purposes of MBWA are given below.

1.1.1. Leadership

MBWA can build quality relationships between managers and employees which in turn facilitate employee motivation and encourage employee involvement. For example, Fombrun et al. (1984) suggest that when managers 'walk around' the shop floor or assembly line, there is an implicit invitation to the employees to repay the visit. Kunda (1992) argues that the MBWA initiative

* Corresponding author. Tel.: +972 4 828 8663; fax: +972 4 824 9282.
E-mail addresses: gluria@univ.haifa.ac.il (G. Luria), idomorag@shenkar.ac.il (I. Morag).

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encourages and reinforces a managerial 'people-focused' approach. He claims that ongoing interaction between employees and managers builds relationships of trust and good communication. In the field of safety, trust and quality of relationships between managers and employees were found to be essential for safety (Kath et al., 2010; Luria, 2010). Furthermore leadership quality/style was found to be positively related to safety level (Barling et al., 2002; Hofmann et al., 2003; Yagil and Luria, 2010; Zohar, 2002; Zohar and Luria, 2010), and the employees of leaders that interact more about safety were shown to behave in a safer manner and even to have lower injury rates (Zohar, 2002; Zohar and Luria, 2003). Thus we propose that SMBWA can improve manager-employee relationships within organizations and facilitate employee safety motivation.

1.1.2. Learning

Luthra (2004) suggests that the purpose of MBWA is to collect quantitative information, listen to suggestions and complaints and to keep a finger on the pulse of the organization. Callaway (1999) feels that the observant manager can detect problems firsthand by watching the workers, talking to them about their work, and by looking at work results rather than at summaries and reports. Harte (1997) suggests that a good manager can detect problems before they become severe by keeping physically in touch with every facet of a business organization. Another purpose of MBWA is learning how work is done in 'real time'. This is exploring firsthand the existing and potential constraints and obstacles that should be confronted, corrected and controlled in order to achieve management quality and production objectives. In short, SMBWA can be defined as an organizational learning mechanism (OLM) that provides management with opportunities to react and provide feedback on the safety information they have acquired. Safety related OLMs were found to promote high-reliability and improve safety in organizations (Allen et al., 2010; Hofmann and Stetzer, 1996). Thus, we propose that SMBWA can provide practical tool to promote safety learning within organizations.

In the next section we will elaborate on the two main theoretical foundations of the SMBWA practice (leadership and learning) and their relevance to safety practice. Based on these theoretical grounds we will present a case study built on empirical data which describes a three-year long SMBWA initiative in a FAB.

1.2. SMBWA theoretical foundation

1.2.1. Leadership by walking around

The relationship between leader and follower, which is frequently addressed theoretically, is the core of MBWA practice (Peters and Austin, 1985). The following two leadership models may help in analyzing and understanding leadership processes in MBWA and its relevance to safety management.

Leader-member exchange (LMX) concentrates on the relationship between leaders and each of their subordinates (Dansereau et al., 1995). Such relationships are comprised of respect, trust, and mutual obligation (Graen and Uhl-Bien, 1995). One aspect of this relationship that has received particular attention and is particularly relevant to SMBWA is the capability of high-quality LMXs to foster: more open and constructive communication (Fairhurst, 1993); discourse about non-routine problems; strong value congruence; joint decision-making; and minimizing power distance between leader and subordinate (Schiemann, 1977; Fairhurst et al., 1987). Within a LMX, the quality of the relationship that develops between a leader and a follower is predictive of managerial outcomes at the individual, group and organizational level (Graen and Uhl-Bien, 1995; Gerstner and Day, 1997). Studies have shown that employees perform better under high LMX leadership (Graen et al., 1982a); show greater satisfaction (Graen et al., 1982b); are more committed to their organization (Nystrom, 1990); have more positive role perceptions (Snyder and Bruning, 1985) and fewer turnover rates (Graen et al., 1982b).

Furthermore, high-quality LMX supervisors were found to be committed to employees' well-being (Hofmann et al., 2003), and LMX score was found to be predictive of safety related outcomes, such as safety climate and safety compliance (Yagil and Luria, 2010)

Full-range leadership – The full-range leadership model that Bass and Avolio (1994) developed focuses on leadership styles that differ as to the leader's effectiveness and passivity. At the high end of the range Bass and Avolio present the transformational leader who is very effective and active. Transformational leadership includes: vision, role modeling, fostering acceptance of group goals, presenting high performance expectations, and providing socio-emotional support and intellectual stimulation (Bass, 1985; Podesakoff et al., 1990). The closer relationships that transformational leaders foster with subordinates are characterized by accessibility and individualized consideration of members' needs and capabilities in order to offer motivational challenges and rewards (Bass, 2008; Yukl, 2005). The relationship is sustained by such values as trust, honesty, openness, and mutual care (House and Shamir, 1993) as well as by verbal communication between leaders and members (Klauss and Bass, 1982). Transformational leaders stimulate followers to act in the interests of the unit or organization (Podesakoff et al., 1990) and are known to develop abilities, skills, and positive attitudes to performance (Yukl, 2005).

At the low end of the full-range leadership, Bass and Avolio (1997) discuss laissez-faire (LF) leadership, which involves little individualized consideration and limited concern for all aspects of performance. Avolio (1999) noted that LF leadership is "poor, ineffective leadership and is highly dissatisfying for followers" (p. 55). LF leaders tend to avoid making decisions, hesitate to take action, and are absent when needed. In fact, LF leadership, frequently called 'non-leadership', is negatively correlated with such outcomes as satisfaction with leader and leader effectiveness (Judge and Piccolo, 2004).

The full range leadership styles were found also to be related to safety performance. For example, Zohar and Luria (2004, 2010) found that transformational leaders create a safer environment for their employees. On the other hand, LF leadership was found to be negatively related to safety outcomes (Zohar, 2002). One possible explanation for the negative relationship between LF and safety level is that LF offers the lowest level of concern for welfare and ignores responsibility despite rank in the supervisory hierarchy (Zohar, 2002).

Against this background, it seems self-evident that SMBWA should encourage managers to engage in behaviors that are expected of quality leaders according to the two core leadership models presented above. That is, SMBWA can be defined as a safety leadership development program, which is a mechanism for obtaining information that managers do not otherwise receive about aspects of their leadership behavior (London and Smither, 1995; Waldman et al., 1998). This feedback should encourage managers to be more active in face to face safety interactions with their employees, and to facilitate closer manager-employees relationships in which employee safety and well being are central parts. Other safety interventions that aimed to increase managerial safety interactions with employees were proven to be effective in improving safety behaviors and in reducing employee injuries (Luria et al., 2008; Zohar, 2002; Zohar and Luria, 2003).

1.2.2. Learning from walking around

As noted above, MBWA can also be defined as an organizational learning mechanism (OLM), an observable organizational sub-system in which organization members interact for the purpose of learning (Lipshitz et al., 2002); detecting and correcting errors and discovering opportunities (Argyris and Schon, 1996).

Lipshitz et al. (2002) suggested that for a learning process to be productive it must be: (a) conscious and systematic, (b) yield valid information, and (c) result in actions intended to produce new perceptions goals and behavioral strategies. In light of these two theories, MBWA is indeed an OLM that provides "firsthand and undistorted" information (Peters and Austin, 1985), and stimulates thinking about this information that can lead to modifications in organizational behaviors.

The key concerns of learning, from the management science perspective, are the gathering and processing of information (Easterby-Smith, 1997). March and Simon (March and Simon, 1958) linked information with managerial decision-making, and many others continued to develop this theory. Huber (1991), for example, concentrated on four main processes, i.e. knowledge acquisition, information distribution, information interpretation, and organizational memory. MBWA as an OLM can be analyzed accordingly.

Knowledge acquisition – Organizations learn by acquiring information from the consequences of actions (feedback). According to Argyris and Schon (1978), feedback can generate both single-loop and double-loop learning. The first refers to the correction of errors within a given set of governing variables, and the second to the process of changing the governing variables themselves.

Knowledge distribution – Huber (1991) points out that distribution of information can lead to the creation of new information from piecing together of patterns which were not previously apparent. Distribution of information enables organization-level learning from the individual-level experience of each and every member of an organization Argyris and Schon (1978).

Knowledge interpretation – Interpretation of information is limited by the amount of information available. Enough information should be available for correct analysis and interpretation (March and Olsen, 1988).

Organizational memory – can be defined as the means by which knowledge is stored for future use (Huber, 1991). To support and integrate organizational learning systematically, an information infrastructure is mandatory. The organizational memory information system OMIS (Huber, 1991; Stein and Zwass, 1995; Wijnhoven, 1998) is such an infrastructure.

These four ongoing processes occur simultaneously. New information is acquired, distributed, interpreted, and then stored in the organizational memory. The stored information can then generate new information which can again be distributed, interpreted and memorized. For example, if information is acquired by a manager during an SMBWA tour, but is not distributed to other members of the organization, only an individual-level lesson has been learned even though the lesson might be useful to others encountering the same situation or safety problem. Furthermore, if the information is not saved in the organizational memory, or is misinterpreted, it may not be accessible when needed again.

One of the limitations of MBWA for safety use is that it generates mostly informal opportunities for learning. Hence, safety learning may fail to materialize since, due to the informal nature of the MBWA practice, the information acquired during the tours about safety is not stored systematically and therefore it is not distributed or accessible to all members of an organization. Information technology, however, presents a solution to this problem.

Over the last decade, information technology (IT) has become an integral tool for attaining effective information management of most organizational practices and procedures (Davenport and Prusak, 1997). The organizational memory information system (OMIS) is a specific type of IT system that can support SMBWA.

Stein and Zwass (1995) defined OMIS as a system that provides a means by which knowledge acquired in the past is brought to bear on present activities. Their system comprises four subsystems that are central for the integration of MBWA in organization: (1) *Integrative* – sharing organizational knowledge across space and time; (2) *Adaptive* – the means to recognize, organize and distribute knowledge about the environment; (3) P*attern maintenance* – relates to individual and organizational human resources; and (4) *goal attainment* – identifying goals and formulating strategies for achieving them.

Specifically, the goal attainment function assists organizational members in planning and control (Ariav, 1992). It should help to frame and identify goals in the context of previous goals, and formulate strategies for achieving them (Stein and Zwass, 1995). Existing systems concentrate on specific issues or tasks, such as management of meetings (Sandoe and Olfman, 1994). Thus the MBWA can serve the organization more effectively if it will concentrate on a specific goal.

The information infrastructure of the OMIS should be decentralized in order to support individual-level problem solving (Harvey et al., 1997). The intranet, which is a technology that is frequently used in organizations, supports Internet applications inside an organization (Ji and Salvendy, 2001). Indeed, in many organizations the Internet has functions that serve members with communication and knowledge sharing (Coleman, 1997; Zhang and Chen, 1997). It can provide, share, and distribute information to most of the organization's members and it provides the necessary infrastructure to support organizational learning (Harvey et al., 1997; Hills, 1997). Such an infrastructure should encourage participation of all members of an organization, regardless of rank or status.

According to the literature discussed above, the authors suggest that integrating SMBWA practice with IT systems based Intranet can improve the effectiveness of SMBWA in terms of developing a framework that would generate organizational safety learning and safety leadership development.

The importance of safety organizational learning mechanisms and its effect on safety outcome is well documented in the literature about organizations with high risk, known as high-reliability organizations (Weick and Roberts, 1993; Weick and Sutcliffe, 2007). One aspect of high-reliability organizations that is most relevant to this study is the manner in which these organizations perform ongoing learning. For example, in organizations that have mechanisms for learning from errors (such as: analyzing causes of mistakes, communicating and discussing mistakes etc.) employees' were found to behave in a safer manner than in organizations that did not have such mechanisms (Cigularov et al., 2010). In another recent example, a study by Allen et al. (2010) concentrated on an OLM called after-action reviews, which is a review meeting of organizational task that typically occur soon after the task has concluded regardless of whether an accident or some other negative event occurred. Allen et al.'s (2010) study demonstrated that after-action reviews promoted safer climate.

1.2.3. Employees' safety participation and peer-to-peer feedback

Since the emergence of MBWA, organizations are increasingly paying more attention to employee participation in workplace matters. That is, organizations have recognized that employee safety is not only influenced by the employees' interactions with their leader and organizational processes (such as learning processes), but also by horizontal effects of peers. For example, according to the interactive approach, employees interact with their peers in order to understand their organizational environment (Ashforth, 1985; Blumer, 1969). Such workgroup interactions were shown to affect employees' perceptions of safety above the effect of leadership (Luria, 2008).

Clarke and Ward (2006) suggested that in order to achieve better safety leaders need to promote employee participation in safety. This is aligned with growing organizational literature about new leadership and management styles which focus on delegating managerial authority and enhancing employee talent and abilities through increased involvement in decision-making. Frequently

discussed concepts include: participative leadership (Koopman and Wierdsma, 1998); participative decision-making (Scully et al., 1995); collaborative leadership (Raelin, 2003, 2006); self-managed teams (Kirkman and Rosen, 1999); work ownership (Van Dyne and Pierce, 2004); and involvement practices (Guthrie, 2001).

The role of peers was also investigated as an important component in the safety performance literature, which identified two broad dimensions of performance: Employee safety participation and safety compliance. Safety participation relates to contextual dimensions of performance that include behaviors of helping coworkers, promoting organizational safety programs, demonstrating safety initiative, and putting effort into improving safety within the workplace. Safety compliance includes a task related dimension of performance that relates to "adhering to safety procedures and carrying out work in a safe manner" (Neal et al., 2000, p. 101). Neal and Griffin's (2006) research demonstrated that employee safety participation predicts organizational accidents, and provides evidence of the central role of employees in keeping themselves and their peers safe.

Literature about peer-to-peer observation and peer safety communication demonstrated the effect of peers in promoting and maintaining safety. Peers were shown to be effective in improving safety by applying safety practices such as peer-to-peer feedback in behavior based safety interventions (Geller, 2001), and employee participation was discussed as one of the central values in safety assessment processes (McSween, 2003). Evidently, longitudinal behavioral based intervention studies (that are based on employees' observations and feedback) showed significant improvement in safety behaviors and significant reduction of injuries over time (Cooper, 2006; Krause et al., 1999). Furthermore, the use of employees as observers was shown to improve even the safety behaviors of the observers themselves. For example, safety observation process was shown to improve safety postural behavior of observers (Alvero et al., 2008). In the organizational level, organizations that mandate employees' active participation in safety interventions reported higher levels of: employee involvement, trust in management, trust in coworkers, and even satisfaction from the organizational safety practices (DePasquale and Geller, 1999).

In Section 2 and 3 we will present a case study demonstrating an assimilation of SMBWA practice integrated with an IT infrastructure that creates an active SMBWA OMIS to improve organizational safety in a working FAB. Reviewing the results of the OMIS implementation in the FAB will enable us to assess the practice effectiveness in terms of the safety participation of employees, organizational safety learning and safety leadership development, and to locate points for improvement.

2. Method

2.1. Participants

The participants were managers and employees of a semiconductor FAB in Israel. A total of 1697 participants reported about their MBWA tours during the three years period of report sampling. Most of the participants were males (1205) aged 22–55 with an average seniority six years. Most of the supervisors hold engineering diplomas, and most of the operators are practical engineers.

2.2. Procedure

In order to perform SMBWA integrated with OMIS, all managers of the FAB were asked to perform SMBWA once in two weeks (employees were encouraged to perform SMBWA tours but were not required to do so). At the end of each SMBWA tour, each manager/employee reported on a specifically designed intranet MBWA OMIS about what was done during the tour. These tours concentrated specifically on the safety issue. Reports included:

- *Manager details*: name, department and e-mail (only the manager or the employee performing the tour were required to identify themselves. It was not allowed to specify the names of employees or managers who were observed or approached, in order to ensure anonymity and preserve the informal and 'friendly' nature of the original MBWA practice).
- *Location*: building, area (e.g. production, office, kitchen, etc.), work station.
- *Safety topic and sub-topic*: a wide range of safety topics from personal protective equipment to ergonomics (see examples in Fig. 5) were discussed.
- *Action taken*: according to instructions given in the MBWA workshop (feedback, reported a problem in the system, etc.)
- *Participants*: The management of the FAB encouraged group tours, and the system tracked the frequency of group vs. individual tours. In every report the participants in the tour were identified.
- *Managerial presence:* Employees could participate in the safety process and in decision-making in the absence of managers, they could use their discretion about where to tour, what to observe, what action to take and how, etc. The report stated if manager was present during the tour.
- *Free text:* Not all information can be acquired from the above categories. Therefore, a space for free text was left at the end of the report.

To encourage their involvement in the SMBWA, the management of the FAB trained all employees in performing the SMBWA tours and also opened the information system to all employees. Employee participation was implemented in three ways. First, the manager could ask an employee to join him on a SMBWA tour, during which s/he could coach the employee while observing the performance of other employees and improving their work if needed. Another alternative was for an employee to make a SMBWA tour on his/her own, when the opportunity offered itself according to work demands. Although it was not mandatory to participate in a SMBWA, management encouraged the employees to do so in order to improve their sense of motivation and responsibility. Third, employees could participate in a SMBWA tour as a part of group since it was felt that this could promote teamwork and cooperation among members of different units.

It is important to note that SMBWA training was part of the general safety training in the organization in which all employees participated. The management of the FAB insisted that employees (in addition to managers) be trained in performing SMBWA for three reasons: (1) Promoting the SMBWA within the organization as an important safety practice. (2) Educating employees: equipping the employees that are willing to conduct SMBWA with the knowledge on how the conduct this practice and how to use the SMBWA information system and report their findings. (3) Openness to SMBWA – the goal was that even employees on the "receiving end" of the practice (i.e. employees who choose not to perform SMBWA tours but who are approached by SMBWA groups) will be aware of the procedure, its goals, etc., so that, their interaction with managers or peers conducting a SMBWA tour will be productive, and that they will be open to accept the feedback provided to them during SMBWA.

Every few weeks, or on management demand, the system generated feedback summarizing the acquired information. This system was designed to achieve the two goals of SMBWA.

2.2.1. Safety leadership development

All managers and employees in the FAB had to participate in SMBWA training which lasted for 3 h and included background

about the OMIS, expected outcomes, and how to perform effective SMBWA tours. Simulation techniques on how to present safety feedback to peers and/or subordinates were included. These techniques focused on guiding the managers/employees and enhancing their ability to interact constructively with others about safety.

Feedback from each SMBWA participant (manager or employee) was used to facilitate safety leadership development. Each participant was asked to describe her/his interaction with employees during the SMBWA tour, choosing a behavior from a scroll-down menu, e.g. I gave safety training; I gave positive/corrective safety feedback; I corrected an unsafe condition myself; I notified the system engineer about an unsafe condition, etc. These behaviors were then discussed in the training.

These scroll-down leadership action categories create a uniform database that makes it possible to compare different managers and to offer meaningful feedback concerning a wide range of safety leadership actions. Actions that could not be classified according to the list were added to the report and explained in free text. Managers were also requested to practice participative leadership and to allow employees to participate in the SMBWA, as described earlier. During the tour the manager and employees could coach others, give feedback, consult or check employees working in the line. At the end of each tour the SMBWA participant was responsible for documenting in the OMIS the number and identity of employees/managers participating in tour. This provided data about the level of employee involvement in safety matters.

Data included tours per period of time, feedback, training, role modeling, frequency of tours with employees, and frequency of unaccompanied employee SMBWAs. This data was analyzed by higher management and organizational consultants, in order to provide feedback and safety coaching to managers.

2.2.2. Safety organizational learning mechanism (OLM)

2.2.2.1. Knowledge acquisition. Knowledge acquisition by the managers and employees after each tour is relatively easy and based on an easy-to-use web-based application accessible to all employees of the FAB. It is designed so that report writing is not time-consuming and the system can acquire safety information without consuming time from members of the organization.

2.2.2.2. Knowledge distribution. Knowledge distribution was accomplished during the SMBWA by cross-departmental tours in which employees and/or managers toured other departments and distributed the knowledge accumulated in their department about safety. Knowledge distribution was also accomplished using the data accumulated through the SMBWA practice. A steering committee reviewed and distributed all reports according to their relevance to members. For example, reports about layout, workstation, accessories and infrastructure were sent to members of the industrial engineering department while reports concerning driving were sent to the safety and ergonomics team. A weekly e-mail summary was distributed to the managers, which was also accessible on the website to all employees.

2.2.2.3. Knowledge interpretation. Interpretation is based on an advanced database that enables users to analyze data in a variety of ways and to initiate appropriate action. If, for example, an analysis indicates an undesirable trend, such as unsafe use of tools in some departments, the managers can then launch an intensive drive to correct the matter. The system can also respond to individual requests to analyze a particular matter and with user-friendly interfaces, users can create a variety of data intersections using bar graphs, pie graphs, etc. The system can also convert collected data to MS-Excel or MS-Word, enabling users to continuously analyze the data on their personal computers and to cross-check the data with other external metrics.

2.2.2.4. Organizational memory. All information from the SMBWA tours is saved in the OMIS database. Each category of the data is saved separately in order to allow cross-investigations. New information is added to existing data without deleting any previous records, so that the system can follow-up and check whether a problem recurs or if it is a one-time event. The system also saves the location of each report, so that the organization can learn about safety conditions in individual departments.

2.3. Measurements

2.3.1. Overall reports

In order to estimate the frequency with which members of the organization used the system, reports were counted in different time frames (from total reports for three years to average number of reports per quarter).

2.3.2. Managers vs. employees' reports

The number of reports completed by managers and by employees indicated the level of participation and involvement by the two groups.

2.3.3. Individual vs. group tours

The percentage of group tours in each department was calculated separately for groups with and without managers.

2.3.4. Cross-departmental vs. within-department tours

To estimate the level of knowledge distribution we divided the tours into two categories: "within department and across departments". Within-department tours were those that employees or managers working in that department performed. In cross-departmental tours, employees or managers did not work in the department where the tour took place. Therefore two process of knowledge distribution took place: (1) the employees and managers performing the SMBWA distributed the knowledge accumulated in their department by interacting with employees from different departments about their work safety, explaining and providing feedback to improve safety; (2) the employees and managers that perform the SMBWA accumulated knowledge by observing the safety operations of employees in other departments, knowledge which could then be applied back in their own department. For example, employees/managers could learn how employees from other departments protect themselves from risk factors. Furthermore, learning variety of risk factors in other departments could help increase their ability to detect potential hazards.

2.3.5. Safety feedback types

Frequency of feedback during SMBWAs was calculated from the feedback reports divided into three categories: positive, corrective, and on the job training. Positive feedback confirmed safe employee behavior, whereas corrective feedback corrected unsafe employee behavior. On the job training reports were more complex and contained more information since they included detailed explanations about work processes or procedures that were given while the employee (the receiver of the SMBWA) performed the activity the training was targeted to improve. The percentage of positive feedback was calculated for every department for both managers and employees because the leadership development program focuses on positive interaction between them.

Participants in an SMBWA can take action against unsafe conditions by themselves, by presenting proactive safety behaviors or by demonstrating how something should be done. The percentage of corrected unsafe conditions from the total of reported actions was calculated for each department, both for managers and for employees.

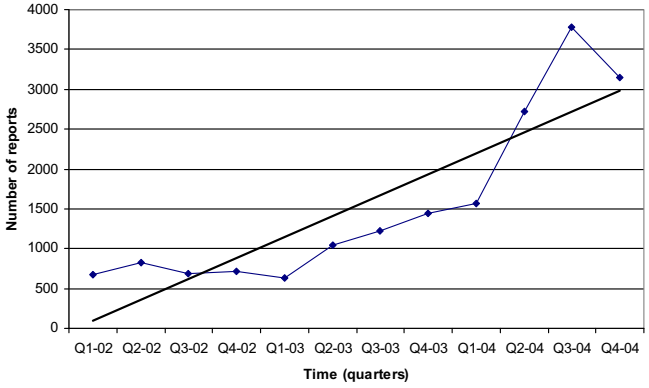

Fig. 1. Frequency of SMBWA tours by quarters (rising trend line).

2.3.6. Detection and repair of unsafe conditions according to maintenance data

In order to provide an additional source of data with which SMBWA data could be cross-validated, we relied on the organizational maintenance data base and calculated the frequency of safety related incidents in the FAB maintenance system per department. These reports were taken from an independent information system used for tracking maintenance activities in the FAB, and included all incidents in which a safety hazard was identified and corrected. For example, some of the hazards related to chemical spills in which maintenance personnel identified the source of the spill and fixed it; a few other hazards related to electric hazards in which an electric cable was exposed and maintenance personnel had to secure it. In total, during the year that was investigated (2004) the maintenance system had 189 safety related reports.

3. Results

Data was collected and entered into the OMIS on a daily basis. The data that we analyzed was based on a total of 18,454 safety reports collected over three years (2002–2004). This metric demonstrates that the system was widely used, and that the number of safety tours in the organization was substantial, suggesting a pattern of in-use safety policies to enforce the formal safety policies (Argyris and Schon, 1978). The numbers of reports increased each quarter showing that SMBWAs with OMIS are now integrated into the organizational daily activities and are an integral part of how the organization deals with safety (see Fig. 1). It is important to note that the marked increase in reports between Q1 and Q3 in 2004 was a result of several effects combined. The effects include high satisfaction within the organization with the SMBWA and management/managers encouragement of employees to participate in SMBWA, both in formal organizational forums and in informal managerial communication. These, in conjunction with more employees being familiar with and knowing how to perform SMBWA, created a "snow-ball" like effect which resulted in a marked increase in the number of tours conducted.

3.1. Leadership development

The system tracked the safety leadership development of each manager (see Fig. 2). On average the number of feedback events to employees increased each quarter, from 89 in the first quarter of 2002 to 338 in the last quarter of 2004. Managers were also more active in safety matters, frequently correcting unsafe conditions themselves. Thus we see an increase from 14 unsafe conditions corrected in the first quarter of 2002, to 50 in the last quarter of 2004. These results indicate that during SMBWAs managers interact more often with subordinates on safety (give more safety feedback) as

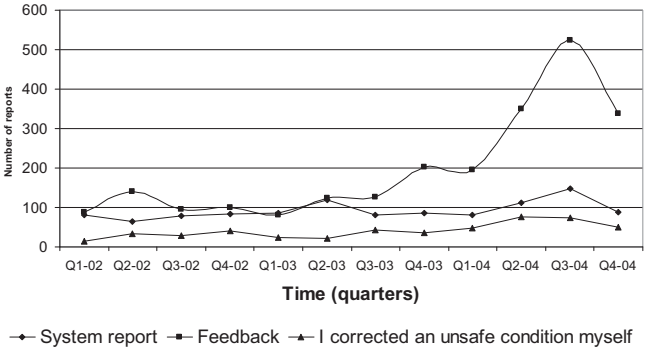

Fig. 2. Frequency of managers' actions in SMBWA tours by quarters.

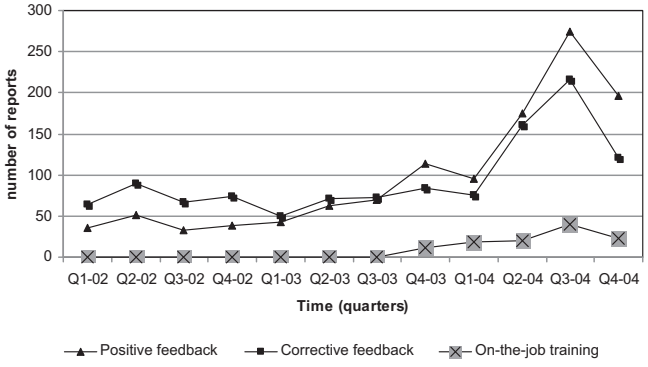

Fig. 3. Frequency of managers' safety feedback (positive, corrective, and on the job training) by quarters.

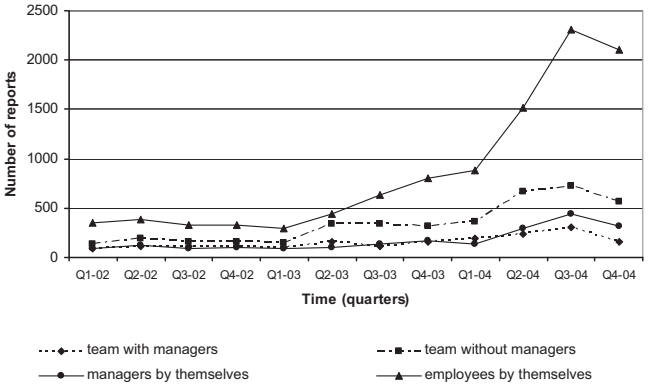

Fig. 4. Employee participation in SMBWA tours, number of tours with and without employees divided into individual and group tours.

predicted by the LMX model of leadership (Dansereau et al., 1995), and that they led by example, taking care of unsafe conditions and actively resolving safety problems on the production line (Bass and Avolio, 1994).

Among the different feedback categories, positive feedback showed the strongest change over time (see Fig. 3). In sum, the results demonstrate that managers gave more positive and corrective feedback about safety issues over time and that they offered more on the job training during the SMBWA tour on safer ways to perform the work they observed.

3.1.1. Employee participation in SMBWA

The effect of the SMBWA on employee safety participation is evident in SMBWA tours data. Managers were asked to include employees in the SMBWA tours, and to encourage them to tour by themselves (see results in Fig. 4). On average, managers conducted

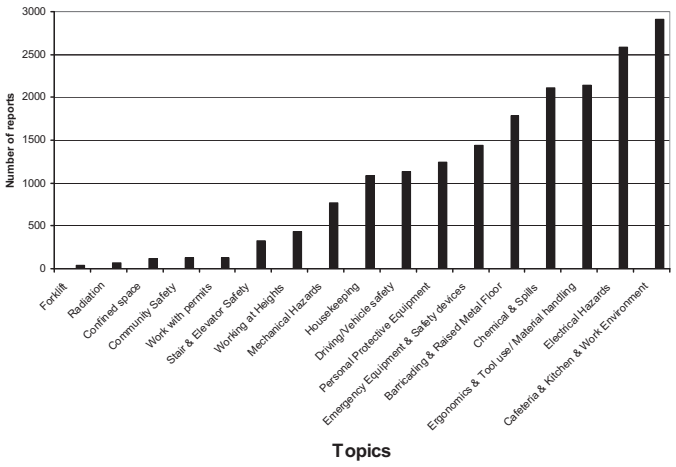

Fig. 5. Number of SMBWA reports per safety topic.

a similar number of tours with employees as individual tours by themselves. The number of tours by managers (individually and, most importantly, with employees) increased every quarter. Although employee participation is not mandatory, most of the tours and reports in the system were done by employees (without managers), indicating that SMBWA increases employee involvement (Guthrie, 2001;Van Dyne and Pierce, 2004). Employees made more tours than managers both individually and as self-managing teams (Kirkman and Rosen, 1999). This ratio increased every quarter. Employee tours had the highest increase, reaching in the last two quarters of 2004 more than 2000 tours per quarter.

3.2. Organizational safety learning mechanisms

We analyzed the SMBWA system according to four learning processes (Huber, 1991): Knowledge acquisition, Information, Information Interpretation and Organizational Memory.

3.2.1. Safety knowledge acquisition

The system acquired safety information every quarter from different sources. On average, managers generated 166 reports and employees 864 reports. Employee participation in MBWA generated five times more information than that of managers alone. Information was acquired about each department separately. There was an average of 96 safety reports per department per quarter. Most reports came from the manufacturing departments (where most of the safety risks exist), but there were also some from the administrative departments.

The OMIS acquired information on safety topics ranging from radiation to electrical hazards (see Fig. 5). It should be noted that the 17 topics listed are only the major topics; each of these was divided into sub-topics, offering an even wider range of information about each department.

3.2.2. Information distribution

Most reports were within-department (95%) but some reports (5–875 of the tours) were cross-departmental, i.e. in some cases a member of one department conducted an SMBWA in another department and knowledge accumulated in one department was distributed in a face to face interaction.

Information was also distributed from the data accumulated in the OMIS to a wide range of organization members using a variety of communication mediums, and was updated at predetermined intervals (see Table 1).

3.2.3. Information interpretation

The system provided a search engine for analyzing the generated data. The search engine provided graphs of trends and raw data about safety topics and behaviors. Managers could view frequency of safety events in their own departments (see, for example, Fig. 5), or trend graphs of employee participation in SMBWA tours (see, for example, Fig. 1) (Argyris and Schon, 1978).

3.2.4. Organizational memory

Each report saved by the system included 24 fields of information. (The total number of information fields saved over three years was 442,896). Information was collected from 1697 different employees and managers. The systems stored the information several times for every working day of the three years (The FAB worked seven days a week apart from one two-day holiday each year). The minimum number of reports per working day was 11, with an average of 17 reports per day, and reaching a maximum 66 reports per day. According to Wijnhoven (1998) such a report infrastructure is a organizational memory mechanism which is central to facilitating organizational learning.

3.3. SAMBWA and safety related incidents

We crossed the frequency of SMBWA tours with frequency of maintenance reports in order to provide preliminary validation for the SMBWA practice within this case study. We hypothesized a positive correlation between the frequency of SMBWA tours, and identification/correction of safety hazards (reported in the maintenance system). As predicted, results show a positive relationship ($r = .473$, $p < .001$, $N = 44$), that is the more SMBWA tours were done within a department during 2004, the more hazards were identified and corrected within the department. In sum, the high correlation with the external source of data (maintenance data) provides evidence from an external and rather objective source that SMBWA tours are related to actual safety improvements and hazards reduction.

4. Discussion

Although MBWA was developed by practitioners, it is not simply a "how-to-do-something" concept but clearly related to key management issues: development of leader-member relationship, and facilitating organizational learning. In this study we presented the use of a modified MBWA practice that focuses on safety and promoted safety leadership and learning in a FAB.

We found MBWA practice to be very relevant to safety management. However, when reviewing the MBWA practice (without the integration to OMIS) in terms of safety, some drawbacks are noticed: The MBWA, by itself, does not systematically collect meaningful information about safety issues or return it as feedback to the managers. Furthermore, MBWA lacks a system to facilitate organizational learning from individual learning events, i.e. it does not collect or maintain information acquired by managers during MBWAs. Nor does it distribute, interpret, or store the information for future use.

We demonstrated that when the SMBWA practice is integrated with information technology, an OMIS, the mentioned drawbacks are overcome and it can contribute to safety leadership development and safety learning. The integrated system that we describe in this paper can acquire information related to safety leadership behavior, analyze that information, and generate meaningful feedback that can assist managers to develop their safety leadership skills. SMBWA can also serve as a managerial platform for involving employees. As an OLM, it can acquire, distribute, and analyze the safety information into trends, saving all this information in a cumulative database for generating new information.

Table 1
Distribution of information collected in the SMBWA OMIS.

Targeted population	Contents	Frequency	Communications during three years	Medium
All managers (mid and high levels)	Weekly performances: reports quantity, trends, areas of focus	Weekly	52 × 3 = 156	Email weekly summary
High management	Periodical summary: performance, findings trends, areas of focus, plans for the future	Quarterly	12	Frontal presentation
Specific work teams (Maintenance, Engineering, etc.)	Periodical performance, findings trends, areas of focus, plans for the future	Bio-monthly	72	Frontal presentation
All population	All findings including search engine to analyze data per request	On going	On going	Website

The three-year implementation of SMBWA with OMIS produced a large number of reports from the production line and some from the administrative offices of the FAB. We found that the high frequency of reports within a department correlated positively with identification and reduction of hazards within a department, and that the more SMBWA tours were done in a department, the more hazards were identified and corrected in the department.

4.1. SMBWA and safety leadership development

We see an increase in interactions about safety between managers and employees in the SMBWA database, which itself is an integral part of safety leadership development. In earlier studies (Zohar, 2002; Zohar and Luria, 2003) increases in manager safety interactions were shown to facilitate safer employee behavior. Managers who increased their personal involvement in employee safety facilitated better safety by presenting safety leadership behaviors: such as training, positive and/or corrective feedback and role modeling. The increase in feedback in general, and positive feedback in particular was very strong in this case study and this is important because feedback is a basic and vital aspect of leadership behavior (see, for example, transactional leadership behaviors (Bass, 1985), especially as concerns safety (Matitila et al., 1994; Simard and Marchand, 1994; Morgeson and Hofmann, 1999). Overall results of this case study show that SMBWA serves as an ongoing safety leadership development program. It increases and improves interaction between managers and employees about safety. The leadership-based approach involves modification of supervisory practices in order to introduce changes on the shop floor. This is a cross-level change, whereby processes taking place at one level influence a lower level (Klein et al., 1994; House et al., 1995; Morgeson and Hofmann, 1999; Zohar and Luria, 2005, 2010).

4.2. SMBWA and employee participation

This case also documents considerable improvement in participative leadership and increase in employees' participation. Managers conducted tours together with employees and encouraged employees to conduct SMBWA tours independently. Eventually, most of the tours were done by employees without managers and demonstrated the power of participation. In a sense, what started as a safety management practice based on the management by walking around approach, evolved into an all-organizational practice of safety by walking around. That is, another contribution of this case study is that it presents a possible tool for implementation of employee participation ideas (Guthrie, 2001; Koopman and Wierdsma, 1998; Raelin, 2003, 2006) in safety, and a practice for implementing the important safety participation dimension of safety performance (see Neal and Griffin, 2006).

These results show that the SMBWA not only develops managerial safety leadership but is also important for developing employee leadership, known as the 'leadership pipeline' (Conger and Fulmer, 2003), which is essential for organizational success (Groves, 2007). We suggest that integrating employee leadership development training with safety training signals the strategic importance of the safety facet in the organization and therefore should contribute to the development of a lasting safety culture in the organization.

4.3. SMBWA and organizational learning

The SMBWA also supported organizational learning. The results of this study show that an integrated system can provide a powerful learning mechanism by continuously acquiring information from a variety of sources in all departments of an organization, on a broad spectrum of topics. Secondly, the information is distributed weekly to managers, while information regarding specific functions is distributed according to those units or personnel who may need it in order to fix a particular problem that may arise in such areas, for example, as maintenance, ergonomics, or chemical engineering. This makes it possible to move from individual-level to organization-level learning.

The SMBWA increases the potential for double-loop learning (Argyris and Schon, 1996). The standard SMBWA tour may generate higher-order learning but concentrates mainly on first order learning, i.e. observing and correcting variations and errors. Conversely, the OMIS analytical results present trends and integration of information that have the potential to generate higher-level learning. For example, a manager may see an employee working contrary to safety procedures and correct this by first-order learning methods. Analysis of data from this and other tours might indicate, for example, that employees contravene safety procedures more frequently during the night shift. This too can be corrected by increasing the night SMBWA tours or the managerial supervision during the night shift.

Observing SMBWA in an organizational setting was beneficial, offering opportunities to study safety leadership behavior and safety learning processes, as well as the information acquired during the organizational learning process. Finally, observing SMBWA in an organizational setting showed how these pieces of information are integrated, interpreted and memorized in the organizational memory. This ultimately contributes to organization-level learning since measuring these variables over several years reveals in-use managerial policies. Unlike formal policy, in-use policy is more dynamic and harder to measure.

This study has its limitations because it derives from a single high-tech industrial organization in which information technology is central to the work environment. This may not be the case in other organizations. Most of the activities in this organization are controlled by computerized systems, including meetings, appointments set up on an intranet diary, and monitoring and analyzing most of the production processes.

In addition, field studies such as this one are, by definition, limited. There are many variables in an organizational setting that

can influence results. However, such studies are essential for management, because leadership and learning can be measured in conditions that are almost impossible to duplicate in the laboratory. Lastly, this study is based on manager and employee reports in an information system. It does not measure leadership and learning processes that are not reported in the system, and may include incorrect reports (either by mistake or from a hidden agenda). Furthermore, all the measures are based on the SMBWA database, and are only cross-checked with maintenance data incidents. We see this as a first step to validating the effectiveness of the SMBWA because the validation was done in one organization and based on one criteria. We suggest that future research cross-check the data collected in the system with other subjective and objective measures. It would be interesting to evaluate leadership behaviors as noted in the SMBWA with data on safety outcomes. One potential outcome variable that should be affected from such an intervention, and has gained much interest in safety research recently (Huang et al., 2010) is safety climate. Safety climate can be defined as the perceptions of employees about the importance of safety in their workplace (Zohar, 2010; Zohar and Luria, 2010). We expect that such an intervention should highlight for the employees the importance of the safety facet relative to other organizational facets, and therefore should promote higher safety climate perceptions. We suggest a cross sectional design in a large sample of organizations as complementary future research to the case study described in this study. This could test the relationships between variables mentioned in this study such as leadership, organizational learning, safety performance and safety climate with validated measures.

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