

# Investigating the Sustainability of a Sustained 360 Process

by

Frank Shipper  
Professor of Management & Chair  
Franklin P. Perdue School of Business  
Salisbury University  
1101 Camden Avenue  
Salisbury, MD 21801  
[fmshipper@salisbury.edu](mailto:fmshipper@salisbury.edu)  
Phone: 410 543-6333

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### *Abstract*

The purpose of this study is to investigate the sustainability of improvement in managerial effectiveness from a sustained 360 process. Such a study is needed because most research on 360 feedback has not considered the need for follow-up support. In addition, many of the prior studies have been based a single feedback intervention. Furthermore, much of the research on management is contaminated with common source variance. Thus, this study investigates the changes in managerial effectiveness based on ratings by the superiors of managers who go through the 360 feedback process up to four times over an extended period of time.

## **Investigating the Sustainability of a Sustained 360 Process**

The majority of the research that has been reviewed on 360 feedback has been based on what could be described as one-shot case studies (London & Smither, 1995; Seifert, Yukl, & McDonald, 2003; Smither, London & Reilly, 2005). Any expectation that long practiced patterns of behavior are going to change based on one instance of 360 feedback has been questioned (Shipper, Hoffman, & Rotondo, 2007; Yukl & Lepsinger, 1995). Studies in the other fields such as neuropsychology (Law, 2004) and learning disabilities (e.g., Tallal, Miller, Bedi, Byma, Wang, Nagarajan, Schreiner, Jenkins, & Merzenich, 1996; Vickery, Reynolds, & Cochran, 1987) would suggest that changing in-grained patterns of behavior requires intensive training. Management scholars who incorporate neuropsychology into their understanding of management development would also agree that intensive training is needed to changed long-term patterns of managerial behavior (Boyatzis, 1999; Goleman, Boyatzis, & McKee, 2002).

Much of the research on 360 feedback appears to lack not only intensive training, but any other form of follow-up intervention. For example, in a meta-analysis, all studies were excluded where 360 feedback was combined with any follow-up interventions (Smither, London & Reilly, 2005). In another composite study of 16 research reports of 360 feedback, only five incorporated follow-up interventions. Of the five that incorporated follow-up interventions, three were judged to show significant improvements, whereas only two of the 11 that did not incorporate follow-up interventions were judged to show significant improvements (Seifert, Yukl, & McDonald, 2003). Thus, it appears that most of the studies of 360 feedback have not investigated a sustained 360 process, In addition, although the evidence is sketchy, it would appear that a sustained 360 process would be more effective than 360 feedback alone. Another issue that does not appear to have been addressed in the reviews of 360 feedback, since they have been dominated by one-shot

applications, is what could happen when multiple iterations of 360 feedback with follow-up interventions are carried out? In other words, are sustainable improvements possible from a sustained 360 process?

Before proceeding, the two terms, “360 feedback” and “360 process” need to be defined for purposes of clarification and distinction. The former term, “360 feedback” has through use in the literature come to refer to the providing feedback from peers, superior, subordinates and self without further intervention (Smither, London & Reilly, 2005). The latter term, “360 process” has been defined as the former plus follow-up interventions to assist the recipients of the feedback to make improvements (Shipper, Hoffman, & Rotondo, 2007).

From the reviews of 360 feedback distinction between “360 feedback” and “360 process” interventions appears to be imperative. The reviews have not been supportive of the effectiveness of “360 feedback,” but the limited research on the effectiveness of a sustained “360 process” appears promising (e.g., Shipper, Hoffman, & Rotondo, 2007).

Another concern with the reviews is that multiple 360 feedback instruments were used. Some were custom instruments specific to an organization and others were commercial instruments. Also, the instruments covered different domains including leadership, managerial skills, influence tactics, and coaching. The psychometric properties were questionable for some of the instruments. In a review of forty-five 360 instruments, only 24 had acceptable psychometric properties (Leslie & Fleenor, 1998). Even among the instruments found to have acceptable psychometric properties, domains and response scales varied. Variations in response scales may affect the validity of the instrument (Leslie & Fleenor, 1998; Shipper 1991; Shipper & White, 1999). Thus, including studies based on a variety of instruments tapping different domains, with unknown psychometric properties and varied response scales may have the

unintended consequence of yielding low effect sizes in a meta-analysis. Thus, the meta-analysis of 360 feedback may be misleading. In addition, such meta-analyses do not address the question of what the potential is of a specific sustained 360 process. The lumping together of different approaches under a single term can create confusion about what is occurring and what are the potential outcomes of the different approaches (Herzberg, 1974).

Another study reviewed multiple forms of feedback, including 360 feedback (Kluger & DeNisi, 1996). Including multiple forms of feedback in a single study is not very informative about any one form of feedback. In addition, it too does not address the question of what the potential is of a specific sustained 360 process.

Thus, none of the reviews have really answered the question, “What is the potential effectiveness of a sustained 360 feedback process?” Nor have any of the reviews addressed the following question, “Can sustained improvements be obtained from a 360 feedback process?” Therefore, the purpose of this study is to answer these questions.

## **METHOD**

This study reports on a middle-level management development program that was tracked for approximately 15 years and incorporated action research. In other words, when evidence to suggest that adjustments were appropriate, they were made. The changes will be described in the discussion of this study.

### **Design**

This field study, as portrayed in Table 1, can be viewed as a series of one-group, pretest-posttest designs; static-group comparisons, and pretest-posttest, control group designs (Campbell & Stanley, 1963). Each line that presents Cohorts 1-4 is a series of one-group, pretest-posttest designs with the exception of the line for Cohort 5, which represents a single observation. For

example, the first line represents a group of managers who have gone through the 360 feedback process four times with five observations. Thus, this line represents four one-group, pretest-posttest designs.

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Insert Table 1 about here

The first and second observations for a cohort and the first observation for the next cohort is a static-group comparison design. For example, the first and second observations for Cohort 1 and the first observation for Cohort 2 is a static group design. The question addressed by the four static group comparisons in this study, “Is a single cycle of the 360 process effective?”

The second and third observations for a cohort and the first and second observations for the next cohort represent a pretest-posttest, control group design. For example, the second and third observations for Cohort 1 and the first and second observations for Cohort 2 is a pretest-posttest, control group design. The question addressed in this case is, “Are two cycles of the 360 process more effective than one?” This design is considered to be a true experimental design whereas one-group, pretest-posttest designs, and static-group comparisons are considered to be pre-experimental designs (Campbell & Stanley, 1963). Much of the research that reported in the reviews has been of one-group, pretest-posttest designs. Of the 14 studies included in the Seifert, Yukl, and McDonald’s (2003) review, eight were of this pre-experimental design. Thus, each study is questionable due to many sources of both internal and external invalidity (Campbell & Stanley, 1963). Thus, this study by incorporating multiple pretest-posttests, control group designs in it provides high protection from many internal sources of invalidity.

## **Sample**

The sample consists of 13,661 managers of a large multi-national technology-driven firm who participated in the 360 feedback process during the time frame of this study. The average

age of the participants was 40 with an average length of service of 11 years when they first engaged in this study. Demographically, 25% of the participants were female and 75% male.

## **Interventions**

The first part of each intervention consisted of 360 feedback. The 360 instrument used in this study was The Survey of Management Practices (Wilson & Wilson, 1991). It and a number of other 360 instruments were reviewed by an organizational task force and two were presented to the Chief Executive Officer (CEO) for final selection. The task force reviewed the instrument on face validity, comprehensive nature, and psychometric soundness. The CEO selected the instrument largely based on its face validity (Personal Communication, May 1990).<sup>1</sup>

In this instrument evaluation of skills is assessed using 48 items which are broken down into multiple item scales. Direct reports of each manager rated the manager on each of these scales. Both scale and item feedback were presented to each manager receiving more than five anonymous responses.

Both research prior to the beginning of the study and during it found the instrument to be psychometrically sound (Clark, Clark, & Campbell, 1992; Leslie & Fleenor, 1998; Morrison, McCall & DeVries, 1978; Rosti & Shipper, 1998; Shipper, 1995b; Shipper & Davy, 2002; Shipper & White, 1999; Van Velsor & Leslie, 1991; Wilson, 1975, 1978). These studies have examined the questionnaire and found its test/re-test reliability, internal consistency, interrater reliability, aggregation suitability, construct validity, and criterion validity to be acceptable. For example, all of the scales within the instrument have been reported in prior studies to exceed Nunnally's (1978) criteria of .70 for reliability. Thus, the instrument had both face and psychometric validity.

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<sup>1</sup> To protect the anonymity of the company the individual interviewed is not identified.

Theoretically, the 360 intervention used in this study was drawn from Wilson's Task Cycle Theory, which is based on Tolman's (1932) learning theory and Bolles's (1972) updating of it (Wilson, O'Hare, & Shipper, 1990). Prior research on the Wilson model has validated the skills and demonstrated their impact on managerial performance (Shipper & Wilson, 1992; Shipper, 2004; Shipper, Kincaid, Rotondo, & Hoffman, 2003; Shipper, Hoffman & Rotondo, 2007). One advantage of this model is that it presents the skills such as goal setting, planning and problem solving, coaching, conducting a performance appraisal, exercising control, and reinforcing performance in an integrated model.

Managers were given skills and performance feedback in the form of a report summarizing the data from superior, subordinates, self and peers. In the early years of the study this feedback was part of a 5-day management retreat with colleagues from multiple work sites from around the world. In the half-day dedicated to the report, the focus was on how to interpret the report. After some research into the effectiveness of the program the five-day management retreat was reduced to a 1-day in situ management workshop with the majority of managers from the same work site. In this workshop, the participants received a report, and instructions on how to interpret it early in the day. During the middle of the day what resources were available to improve a specific skill, how to develop each skill, and what skill to focus on for the biggest payoff were discussed. By the end of the day the participants were encouraged to have developed a preliminary learning agenda. To further develop the learning agendas, each participant was encouraged to share the results with his/her superior, peers, and subordinates, and based on that input, to finalize his/her learning agenda. As part of the learning contract, participants were expected to experiment with different skills and techniques, to practice them, and to receive feedback from their subordinates and peers. The organization also provided additional skill

training support via a variety of sources. The explicit use of learning contracts resulted from the use of action research during this study. Early in the program, some participants were observed to have made significant improvement and the converse was also true. Informal interviews were conducted to learn why this was occurring. From the interviews, it was thought that those who had developed learning contracts, even informally, were making progress, whereas those who did not may or may not have been. A survey was conducted to confirm the results of the interviews. The results were that 100% of the managers who had developed learning contracts had improved, whereas the same was not true for those who did not develop such (Personal communication, May 17, 1994). Given that learning contracts are considered to be one of the most powerful tools for helping people to reprogram the neuro-pathways of even stroke victims, these findings should not be surprising (Law, 2004).

To build trusting relationships groups of managers from the same facility were organized into intact teams, asked to share problems and develop action plans to solve them. The use of intact teams of managers was initiated at some facilities. Intact teams consisted of all the managers in a facility participating in the 360 process together. As part of the action research model, statistical analysis was conducted on improvements made by participants in intact teams versus those not in such teams. The results suggested that those in intact teams were making statistically significantly ( $p \leq .01$ ) greater improvements than those not in such teams. This prompted the adoption of the 1-day workshop described earlier as the normal way to deliver the feedback.

Members of the team who scored high on their skill profiles were asked to serve as mentors to others. These development activities are similar to those used in two of the four multilevel, pre-post studies identified by Seifert, Yukl, and McDonald (2003) as having shown

significant improvements. Those two studies were reported in Wilson, O'Hare, and Shipper (1990). Additional description of the training activities can be found in other studies (Shipper, Hoffman & Rotondo, 2007; Wilson & Shipper, 1992).

After a period of time, the participant's skills and performance were assessed again to determine the level and impact of learning that had occurred. Each iteration of the 360 feedback process lasted approximately 18 months. The time lag on prior 360 studies has varied from 3 to 48 months, with an average lag of 13.4 months (Seifert, Yukl, & McDonald, 2003). Because learning can be characterized as a permanent change in behavior, it may take significant time to develop improved managerial skills and for them to have observable impact on the manager's effectiveness. Thus, a longer time period between assessments appears to be appropriate rather than a shorter one. In addition, Taylor, Russ-Eft, and Chan (2005) have called for studies that assess training effects for periods greater than one year out, something this study satisfies.

This process parallels the Boyatzis self-directed learning model (Boyatzis, 1999; Goleman, Boyatzis, & McKee, 2002). This model as it pertains to the 360 feedback process is portrayed in Figure 1. The 360 feedback process as delineated is dynamic and iterative, providing for continuous feedback on skill use to allow for future changes in behaviors.

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Insert Figure 1 about here

## **Measures**

To assess managerial effectiveness, four items were asked of the superiors when completing the Survey of Management Practices. A typical item asked if the manager's group "works well." Analysis of the scale found Cronbach's Alpha equal to .90. This measure was chosen as the criterion variable because it is representative of the fourth and ultimate level in Kirkpatrick's

(1959) evaluation model. Kirkpatrick's model is recognized as one of the most influential assessments of development interventions (Smither, Houston, & McIntire, 1996).

### **Data Collection**

Data for both the intervention and the criterion variable were initially collected with paper instruments. As the study progressed, the data were collected electronically via the Internet. Procedures were taken to protect the anonymity of the direct reports who responded by using a third-party to collect data via mail in the early stages and by a secure server in the later stages of the study. The data and the individualized reports were considered to be the property of the participants and not the organization. The researcher was involved early in the process and was granted permission to publish aggregated results. The response rates of the superiors and subordinates were 84% and 63%, respectively. Only the participants whose superiors completed the effectiveness items were included in this study.

### **Analysis**

Analyses were performed both within and across cohorts. The analyses that were performed within cohorts are those that are considered appropriate for one-group, pretest-posttest designs. These were performed using t-tests and a repeated measures MANOVA test. They are reported in Table 1. To fulfill the requirements for static-group comparisons, and pretest-posttest, control group designs, analysis of variance analyses (ANOVA) were performed.

## **RESULTS**

All of the MANOVA tests for the four cohorts for repeated measures were highly statistically significant ( $p \leq .000$ ). The first two ANOVA's were non-significant ( $t_2$  &  $t_3$ ) whereas the latter two were ( $t_4$  &  $t_5$ ). These findings would suggest that significant changes in managerial effectiveness did not occur until participants had been through the 360 process at least twice.

Of the 10 t-tests that were performed across one time period with the same cohort, five were significant and five were non-significant. Three of the non-significant results were performed on Cohort 1, the group with the smallest sample size. Three of the non-significant results were also associated with the first t-test performed on each cohort. In other words, only the fourth cohort showed significant changes over the first intervention. This may have occurred because of changes in the supporting activities and/or due to the 360 process being seen as something beneficial for career success in the organization by this time.

Of the six t-tests that were performed across two time-periods with the same cohort, five were significant and one was non-significant. The one non-significant t-test was performed on Cohort 1, the group with the smallest sample size. Of the three t-tests that were performed across three time-periods and the one t-test performed across four time periods with the same cohort, all were significant. Collectively, the t-test findings reported in this and the prior paragraph would support the contention from the MANOVA and ANOVA analyses that changes in managerial effectiveness did not occur until participants had been through the 360 process at least twice.

A post hoc analysis was performed to indirectly test for vicarious modeling as an explanation for changes in effectiveness. An ANOVA was performed over the beginning value for each cohort. The results across all five initial values were statistically significant ( $F=5.328$ ;  $p \leq .000$ ). To further define what the impact that vicarious modeling may have been having on the results, a series of t-tests were performed between the initial start values. The only start values statistically significant ( $p \leq .05$ ) from the others was for Cohort 5.

For ease of interpretation and discussion, the mean of each observation was standardized for the overall sample. Those standardized means were then transformed into percents and reported as a line graph in Figure 2.

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Insert Figure 2 about here

## **DISCUSSION**

There can be little doubt based on the statistical analysis that the effectiveness of the managers who took part in this 360 feedback process multiple times changed over the life of the study. That did not, however, occur initially. As can be seen In Table 1 the first two iterations of the process with Cohort 1 did not produce statistically significant results. In contrast, statically significant results were found by the second iteration for Cohorts 2 and 3, and for the first iteration for Cohort 4. Part of these findings could be attributed to low sample size for Cohort 1, but part of the finding could be attributed to skepticism on the part of the early participants and lack of effective follow-up. Initially, the 360 process was inserted into a week-long training program as described earlier. At that point, the participants may have viewed it as a one-shot program and not part of an ongoing process that was going to be examined, supported and held accountable by a succession of CEO's. As discussed earlier, both the way the training was delivered and the follow-up provided changed over the course of this study. Given these changes were based on observations and statistical testing, the follow-up activities may have been more important than the feedback. Other researchers have found also, in control studies that follow-up interventions have greater impact than simply feedback (Rosti & Shipper, 1998).

One question that is asked often about statistical studies is, "Are the changes observed meaningful?" Figure 2 provides one way to answer that question. The average manager is all cohorts that have gone through the 360 process at least once improved in superior's evaluation from below average to above average. An additional interpretation from Figure 2 is that the more often a manager went through the process, the greater the improvement. For those managers who went through the 360 process four, three, two and once, their superiors' evaluations improved of

21%, 16%, 10% and 7%, respectively. For both the organization and the individual participants such improvements would certainly have to be considered meaningful.

There were multiple factors that helped to make this happen. First, the CEO at the initiation of this process was intimately and visibly involved in it. He involved himself in the selection of the instrument; he actively took part in the process himself; and he or a senior vice president kicked off the early training programs. In addition, aggregated results were reviewed at the corporate level and at divisional levels. Individual data or reports were not revealed at any time to corporate or divisional officers. Furthermore, goals for management development were established for each senior-level manager and they were discussed in their annual reviews.

Management also supported an ongoing program of research and improvement. Much of the research was for internal consumption. However, some of that research has been reported in the literature (e.g., Shipper & Davy, 2002; Shipper, Hoffman, & Rotondo, 2007). The research was widely presented and discussed in the organization. In fact, the head of management development was accused by one executive of “bludgeoning people with data” (Personal communication, 5/17/94).

Another factor that probably influenced the success of this 360 process is that it became part of the culture of the organization both formally and informally. Formally, the Managerial Task Cycle (MTC) was adopted as the organization’s model of what good managers do (Shipper, 1995a). Both ongoing and new training programs were linked to specific phases of MTC. In implementation, managers were provided with guidelines on how to improve a specific skill area and advised to develop a balanced set of skills. Research conducted on this model of management revealed it was the skill and not the frequency of managerial behaviors that

determined their effectiveness and that a balanced profile was more successful than a varied set of skills (Shipper & Davy, 2002; Shipper & Wilson, 1992).

Informally, participants spoke to each other about being “Wilsonized,” meaning that they had gone through the 360 feedback process. The term was derived from the last name of the author of the instrument, Clark Wilson (Wilson & Wilson, 1991).

This field study could be regarded as double-blind. The subordinates whose feedback formed the basis for advising their participating managers on what skills should be improved did not have access to the managerial effectiveness data that was gathered from the superior. In addition, the superiors were not informed how many times the participant had been through the process. Furthermore, because of the nature of the industry most participants were working on new products and often had new superiors and subordinates within five years. Thus, many of the superiors and subordinates rating participants were changed by the third, fourth or fifth observations of managerial effectiveness, and managerial skills, respectively. Separating those who gave the feedback from those who rated the effectiveness should ameliorate any concerns about common source bias. Whereas some research purists would see changes in the rating individuals as a source of contamination, it strengthens the argument that is a double blind study. Finally, the change in superiors and subordinates rating the participants over time should partially ameliorate any concerns about the maturation effect (Campbell & Stanley, 1963).

### **LIMITATIONS**

One limitation of this field study is that the assignment to cohorts was not randomized as is expected in true experimental designs (Campbell & Stanley, 1963). This condition is seldom met in long-term field studies because operating objectives of the organization could be disrupted by randomized assignment to experimental and control groups.

Another limitation of this study is that the experimental conditions changed overtime. As previously discussed, this research was carried out based on the action research model. Changes were made in the follow-up interventions based on observation and testing, as also previously discussed.

Another limitation that also needs to be recognized is that what occurred in this study may not be repeatable if the same instrument and supporting activities are not provided. First, the 360 instrument selected by the organization has been validated in multiple studies (e.g., Rosti & Shipper, 1998; Shipper, 1995b; Shipper & Davy, 2002; Shipper & White, 1999) and recognized as one of the better 360 instruments (Leslie & Fleenor, 1998; Morrison, McCall & DeVries, 1978; Van Velsor & Leslie, 1991). The validity and usefulness of feedback from some 360 instruments have to be questioned. In addition, a succession of corporate leaders was willing to invest their time and corporate resources into both the feedback process and the follow-up training over an extended period of time. Finally, the corporate culture may also partially account for the success of this 360 process in this study. It is one where openness, honesty, and constructive confrontation are explicitly recognized and reinforced.

## **CONCLUSIONS**

This study supports rather than contradicts the reviews of 360 feedback that found little significant effects from simply providing feedback to participants (London & Smither, 1995; Smither, London & Reilly, 2005). Significant improvements in managerial effectiveness from a single intervention of feedback and support were not found in the first three cohorts of this study either. From the many other statistical analyses performed, this study does support strongly the contention that managers can become more effective if part of an ongoing 360 process as defined in this study. In other words, a sustained 360 process can yield sustainable changes in managerial

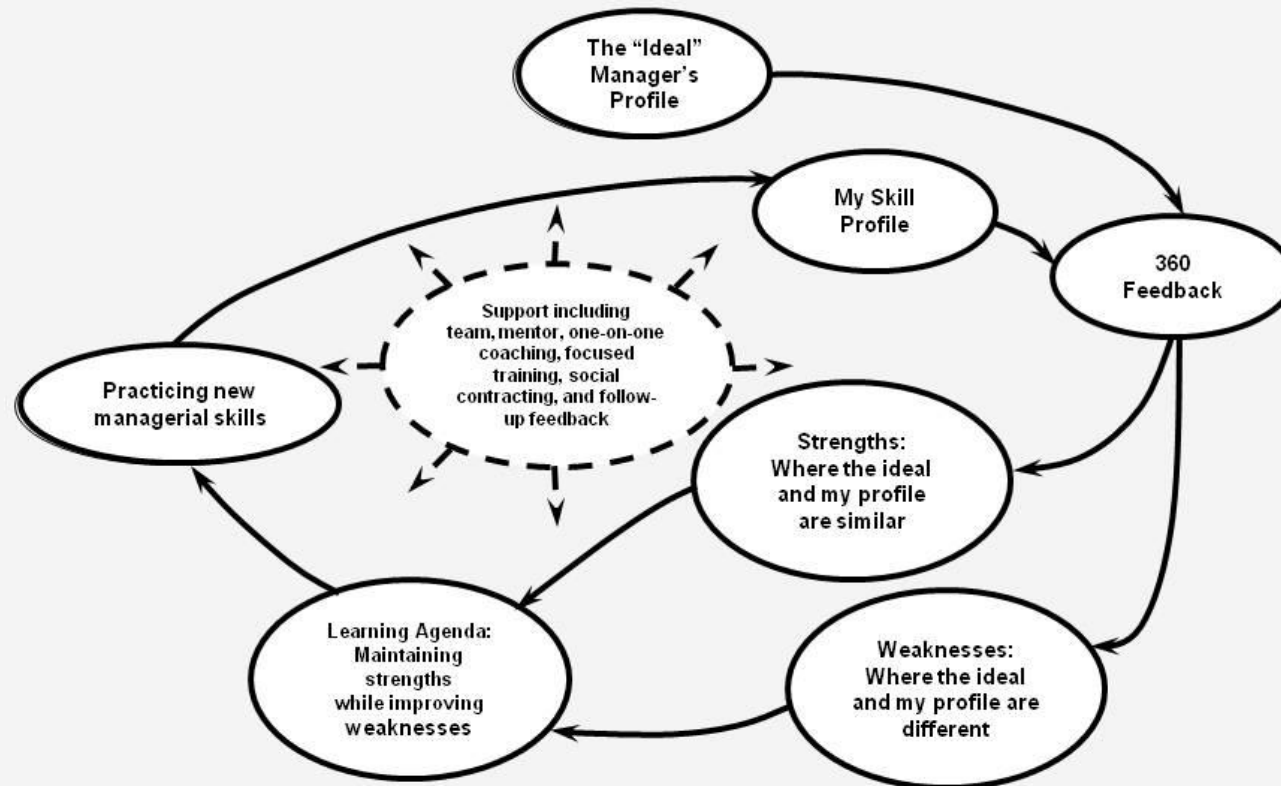
effectiveness. Another way to interpret the results is that there will be no improvements in managerial effectiveness to sustain if the 360 process is not sustained.

These findings are in agreement with studies on what it takes to make meaningful changes in other fields of human behavior (e.g., Law, 2004; Tallal, Miller, Bedi, Byma, Wang, Nagarajan, Schreiner, Jenkins, & Merzenich, 1996; Vickery, Reynolds, & Cochran, 1987). To expect meaningful changes to occur simply from the process of feedback without providing additional assistance and a supportive environment is probably naïve at best.

There are also implications for executives wanting to improve the effectiveness of their managers. First, the chief executive officer's and other key executives' participation and active support are needed throughout the process. This cannot be demonstrated statistically, but it was one of the conditions that existed in the organization where this study occurred. Second, it is probably not going to happen based on one-shot participation in 360 feedback. In this application, the 360 feedback highlighted only what skills a manager needed to target for improvement based on the Managerial Task Cycle. The follow-up organizational support and efforts of the individual managers led to significant changes in effectiveness occurring. Third, creating a supportive environment and activities at the local level will be more effective than centralized activities. This principle was demonstrated when the organization switched from management retreats to intact workshops and when managers were urged to work with their immediate subordinates to assist in improving. Fourth, meaningful change yields a competitive advantage. Improvements in the effectiveness of managers can yield improvements in productivity. Previously, this finding has been demonstrated monetarily (Shipper & Neck, 1994). Thus, a sustained 360 process can be a valuable business practice that leads to sustainable improvements in managerial effectiveness.

Figure 1

## 360 Feedback Process Learning Model



**360 Feedback Process Learning model.** Adapted from Boyatzis R., 1999. Self-Directed Change and Learning as a Necessary Meta-Competency for Success and Effectiveness in the 21st Century. In R. Sims & J. G. Veres, III (Eds.), *Keys to Employee Success in the Coming Decades*.

Table 1

Tests of Differences in Managerial Effectiveness across Observations and Cohorts

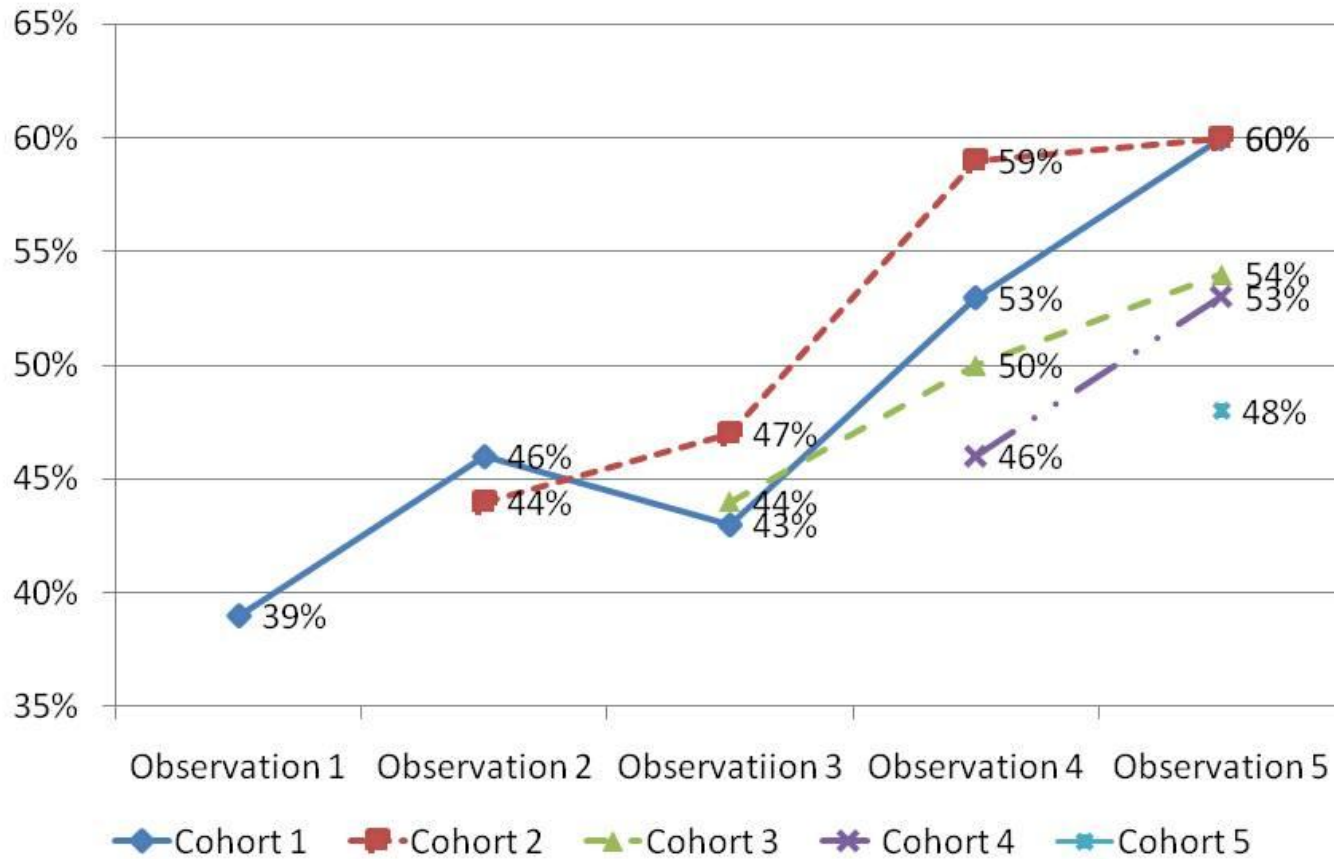
Time Cohort	t <sub>1</sub>		t <sub>2</sub>		t <sub>3</sub>		t <sub>4</sub>		t <sub>5</sub>	Repeated Measures
Cohort 1	O <sub>11</sub>	I <sub>11</sub>	O <sub>12</sub>	I <sub>12</sub>	O <sub>13</sub>	I <sub>13</sub>	O <sub>14</sub>	I <sub>14</sub>	O <sub>15</sub>	MANOVA
Tests Across Observations within Cohort 1 n=54		<b>t<sub>11-12</sub>= -.998 ρ ≤ N/S</b>		<b>t<sub>12-13</sub> = .431 ρ ≤ N/S</b>		<b>t<sub>13-14</sub>= -2.068 ρ ≤ .022</b>		<b>t<sub>14-15</sub>= -1.290 ρ ≤ N/S</b>		<b>F=11542 ρ ≤ .000</b>
			<b>t<sub>11-13</sub>= -.640 ρ ≤ N/S</b>		<b>t<sub>12-14</sub>= -1.322 ρ ≤ N/S</b>		<b>t<sub>13-15</sub>= -2.878 ρ ≤ .003</b>			
				<b>t<sub>11-14</sub>= -2.167 ρ ≤ .018</b>		<b>t<sub>12-15</sub>= -2.260 ρ ≤ .014</b>				
					<b>t<sub>11-15</sub>= -3.001 ρ ≤ .002</b>					
Cohort 2			O <sub>21</sub>	I <sub>21</sub>	O <sub>22</sub>	I <sub>22</sub>	O <sub>23</sub>	I <sub>23</sub>	O <sub>24</sub>	
Tests Across Observations within Cohort 2 n=181				<b>t<sub>21-22</sub>= .050 ρ ≤ N/S</b>		<b>t<sub>22-23</sub>= -1.956 ρ ≤ .027</b>		<b>t<sub>23-24</sub>= -1.779 ρ ≤ .039</b>		<b>F=37637 ρ ≤ .000</b>
					<b>t<sub>21-23</sub>= -1.842 ρ ≤ .034</b>		<b>t<sub>22-24</sub>= -3.302 ρ ≤ .001</b>			
						<b>t<sub>21-24</sub>= -3.357 ρ ≤ .027</b>				

Cohort 3		O <sub>31</sub>	I <sub>32</sub>	O <sub>32</sub>	I <sub>32</sub>	O <sub>33</sub>	
Tests Across Observations within Cohort 3 n=752			<b>t<sub>13-14</sub>= -1.118 ρ≤N/S</b>		<b>t<sub>14-15</sub>= -1.985 ρ≤.025</b>		<b>F=102,344 ρ≤.000</b>
				<b>t<sub>13-15</sub>= -2.806 ρ≤.003</b>			
Cohort 4				O <sub>41</sub>	I <sub>41</sub>	O <sub>42</sub>	
Tests Across Observations within Cohort 4 n=2659					<b>t<sub>14-15</sub>= -1.979 ρ≤.025</b>		<b>F=267,123 ρ≤.000</b>
Cohort 5						O <sub>51</sub>	
ANOVA Across Cohorts within Observations	t <sub>2</sub>		t <sub>3</sub>		t <sub>4</sub>		t <sub>5</sub>
	<b>F=.048 N/S</b>		<b>F=.670 N/S</b>		<b>F=7.876 ρ≤.000</b>		<b>F=11.541 ρ≤.000</b>

Note: O -Observation; I - Intervention

Figure 2

# Improvements in Managerial Effectiveness Across Time by Cohort



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