The Impact of Six Sigma Training on Leadership Effectiveness

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Abstract

This study examines the relationship between the subordinates' perception of the leadership styles and leadership effectiveness of newly trained Six Sigma professionals. The Multifactor Leadership Questionnaire (MLQ) was given to 150 recipients in aerospace business units at three different sites. It is of special interest to this industry which faces on-going reengineering processes to see the impact of Six Sigma training on the aerospace workers in terms of motivational needs and relationships between perceived leadership style and the self reported leader effectiveness behavior of the employees they supervise. The results showed a positive relationship on the outcome variables. Following Deming's (1986) suggestion of instituting leadership focus, going beyond a managing-only perspective, into organizational effectiveness and quality improvement, a model (Mazouz, A and Hamamoto, 1999) was developed that integrated business conditions, customer values and transformational vision. This study gives food for thought about the impact and usefulness of transformational and transactional leadership styles and their impact on motivation, extra effort and satisfaction when using Six Sigma methodology in business quality improvement initiatives

Keywords: Six Sigma, Leadership effectiveness, Multifactor Leadership Questionnaire (MLQ), Quality improvement

I. Introduction

The primary intent of this research was to investigate the Impact of "Six Sigma Training", in today's workers in industry, given the on-going reengineering processes that industry is experiencing. Of special interest are the motivational needs and relationships if any, between the two variables perceived leadership style of Six Sigma Trained managers and self-reported leader effectiveness behavior of the employees the supervise. The management challenges of the 21st Century require a fundamental paradigm shift in managerial approach and leadership style to address the impacts of rapidly evolving technology accompanied by increasing completion and market globalization. Six Sigma is one of the quality and productivity improvement initiatives employed by some enterprises to address these new challenges. Considerable literature exists analyzing and comparing various theories of leadership and motivation related to effective organizational change management. For Instance Burns (1978) observed that transformational leadership involves the process of influencing major changes in organizational attitudes in order to achieve the organization's objectives and strategies. Bass (1985) described the recursive relationship of the organization culture and leadership style, noting that culture develops in large part from its leadership and also affects the development of its leadership. Bass further observed that transactional leader work their organizational cultures following existing rules, procedures, and norms; while transformational leaders change their culture based on a new vision and a revision of shared assumptions, values, and norms. Transformational leaders inspire, energize, and intellectually stimulate their employees. When an organization must adapt to changes in technology and the environment, its leadership is a critical factor in its successful change.

In the industrial and business sector, Macco by (1979) concluded, "a higher level of leadership than ever before is necessary to survive and prosper in a world of increasing competition, of technology advances, changing government regulations, and changing worker attitudes." A number of researchers in this field concur that leaders can transform followers, can create visions of goals that may be attained, and can articulate the ways to attain those goals (Bass, 1985; Bennis & Nanus, 1985; Burns, 1978; Tichy & Devanna, 1986). The specific research questions are:

1. Does Six Sigma Training Increase Leadership Skills?

2. Do Six Sigma Leaders after Training Influence Major Changes in the Organization And Achieve The Objectives Of The Organization?

Six Sigma can be very beneficial to improving the bottom line- if implemented wisely. However, if the techniques are not used wisely, there is a very large danger that the program will be counterproductive and frustrating. Organizations can sometimes get too involved in "how to count defects" and report defect rates that they lose sight of the real value of Six Sigma- orchestrating process improvement and reengineering and bottom-line benefits through the wise implementation of statistical techniques. (Breyfogle, 1999).If an organization does not apply Six Sigma techniques wisely, it will fail. When this occurs there is a tendency to believe that the statistical techniques are not useful, when in fact the real problem is how the program was implemented and/or how the techniques were not effectively applied. Adapt the discipline and methods of Six Sigma to best improve the unique culture, industry, market position, people and strategy. Six Sigma will not work as a thing- it has to be used in a flexible system. As the use of Six Sigma matures, professionals will quickly spot:

- Problem identification- by utilizing statistical process control and control charts
- Problem definition and root cause analysis- Test of statistical significance: (Chi square, t-test and ANOVA)
- Root cause analysis and prediction of results- Correlation and regression.
- Optimal solution analysis and result validation- Design of Experiments.
- Problem prioritization and prevention- Failure mode and effect analysis.
- Defect Prevention and process improvement- Mistake proofing.
- Product, service and process designs- Quality Function Deployment.

Bass (1985) theory of transformational leadership is derived from Burn's (1978) which indicated that transformational leadership refers to the process of influencing major changes in the organizational attitudes in order to achieve the objectives and strategies of the organization. Burns also stated that transformational leadership occurs when one or more individuals interact with others in such a way that leaders and followers raise each other to higher levels of motivation and moral values. Top level managers will continue to face the challenge of significantly changing organizations in order to maintain a competitive advantage. Because of this, transformational leadership will continue to be the center of management research.

II. Approach and Methodology

The relationship between subordinate perceived leadership styles and subordinate self-reported leadership effectiveness outcomes for managers recently trained in Six Sigma and to determine the perceived tendency for using transactional versus transformational leadership behavior. The most widely used measure of transformational leadership is the Multifactor Leadership Questionnaire (MLQ, Form5x-Short) to assess the independent variables (transformational and transactional leadership) and the outcome (or dependent) variables (extra effort, effectiveness and satisfaction). A direct survey questionnaire was distributed to the business sites to collect the data. The target population for this research was Six Sigma recently trained professionals. The survey was stratified into business unit groups. The actual return with over 150 surveys distributed was 110. This procedure provides for random selection of sample firms and will meet the criteria for simple random samples. As outlined in the MLQ questionnaire the dependent variable are transformational/transactional leadership styles and the independent variables were Idealized attributes (IIA), Idealized behavior (IIB), Inspiration Motivation (IM), Intellectual Stimulation (IS), Individualized Consideration (IC), Contingent Reward (CR), Management by Exception Active (MBEA), Management by Exception Passive (MBEP), Laissez-Faire (LF), Extra Effort (EX), Effectiveness (EFF) and Satisfaction (SAT).

The following hypotheses examine the research questions stated:

$H1_O$ There is no statistical relationship between transformational leadership and satisfaction.
$H1_A$ There is statistical relationship between transformational leadership and satisfaction.
$H2_O$ There is no statistical relationship between transformational leadership and extra effort.
$H2_A$ There is statistical relationship between transformational leadership and extra effort.
$H3_O$ There is no statistical relationship between transformational leadership and effectiveness.
$H3_A$ There is statistical relationship between transformational leadership and effectiveness.
$H4_O$ There is no statistical relationship between transactional leadership and satisfaction.
$H4_A$ There is statistical relationship between transactional leadership and satisfaction.
$H5_O$ There is no statistical relationship between transactional leadership and extra effort.

$H5_A$ There is statistical relationship between transactional leadership and extra effort.
$H6_O$ There is no statistical relationship between transactional leadership and effectiveness.
$H6_A$ There is statistical relationship between transactional leadership and effectiveness.

The multivariate interactive hypothesis and null are stated as follows:

$H7_O$ There is no statistical significant difference between the transformational and transactional leadership scores.
$H7_A$ There is statistical significant difference between the transformational and transactional leadership scores.

The Transformational Leadership Significance is comprised of five segments:

Idealized Influence (Attributed-4 Items): inspires in the followers' unquestioning loyalty and devotion without regard to their own self-interest (Bass, 1985). The leaders are highly respected, and are seen by their followers as having an attainable mission and vision (Bass & Avolio, 1994, 1990; Avolio, Bass & Jung 1995).Idealized Influence (Behavior-4 Items): Specifies the importance of having a strong sense of purpose (Bass & Avolio, 1995).Individualized /consideration (4-Items: is the individualized attention and a developmental or mentoring orientation toward subordinates (Bass, 1995). The leaders communicate personal respect to followers by giving them specialized attention and recognizing each one's unique needs (Tepper & Percy, 1994).Inspiration Motivation (-4 Items): is the arousal and heightening of innovation by persuasively appealing to the faith and emotions of the follower rather than logical discourse (Bass, 1995). The extent to which the leader inspires followers to enthusiastically accept and pursue challenging goals and a mission or vision of the future (Tepper & Percy, 1994), Leader's behavior results in the arousal of a shared vision and in the display of enthusiasm and optimism (Bass, Avolio, 1994).Intellectual Stimulation (4-Items): is the arousal and change in followers of problem solving, of thought and imagination, and of beliefs and values (Bass, 1985). The extent to which the leader enables followers to rethink the ways they do things, to challenge the conventional practice and thinking are important factors (Tepper & Percy, 1994). Followers are encouraged to try new approaches to problem solving, even if their approaches differ from choosing of their leader (Bass, Avolio, 1994).

The Transactional Leadership Significance is comprised of three segments:

Contingent Rewards (-4 Items): This style of leadership involves an interaction between the leader and the followers that emphasizes an exchange. The leader provides appropriate rewards when followers agreed upon objectives. Management by Exception (MBE) (Active-4 Items): Leadership behavior where the leader arranges to actively monitor deviations from standards, mistakes and errors in a followers assignments and to take the corrective action as necessary. Management by Exception (MBE)(Passive-4 Items): Leadership behavior where the leader waits for deviations, mistakes and errors to occur and then takes corrective action.

The Nonleadership Significance is comprised of one segment:

Laissez Faire Leadership (-4 Items): is the absence of leadership and/or the avoidance of intervention by the leader with no attempt to motivate or satisfy the follower's needs (Bass & Aviola, 1990). The extreme degree of inactivity by leaders and this inactive style go beyond even passive MBE, and thus is a "do nothing" approach (Tepper & Percy, 1994).

The Outcome Variable Significance is comprised of three segments:

Extra Effort (-3 Items): Increases other's willingness to try harder
Effectiveness (-4 Items): Effective in representing others to higher authority
Satisfaction (-2 Items): Work with others in a satisfactory way.

Table 1: Displays Regression Analysis- Rater
Variables Entered/Removed [a]

Model	Variables Entered	Variables Removed	Method
1	EX		Stepwise (Criteria: Probability-of-F-to-eneter <=.050, Probability-of-F-to-remove>=.100)
2	IIB		Stepwise (Criteria: Probability-of-F-to-enter <=.050, Probability-of-F-to-remove >= .100)
3	IM		Stepwise (Criteria: Probability-of-F-to-enter <=.050, Probability-of-F-to-remove >= .100)
4	CR		Stepwise (Criteria: Probability-of-F-to-enter <=.050, Probability-of-F-to-remove >= .100)
5	MBEA		Stepwise (Criteria: Probability-of-F-to-enter <=.050, Probability-of-F-to-remove >= .100)

a. Dependent Variable: EFF

Table 2: Displays Model Summary – Rater

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.918[a]	.842	.841	.30564
2	.929[b]	.863	.860	.28674
3	.934[c]	.871	.868	.27870
4	938[d]	.881	.876	.26970
5	.949[e]	.900	.896	.24776

a. Predictors: (Constant) , EX
b. Predictors: (Constant), EX, IIB
c. Predictors: (Constant), EX, IIB, IM
d. Predictors: (Constant), EX, IIB, IM, CR
e. Predictors: (Constant), EX, IIB, CR, MBEA

The dependent variable is EFF. The independent variables are EX, IIB, IM, CR, and MBEA in the final model. We used stepwise regression analysis, to check the final model derived. The model is adequate with F ratio equals to 187.902 and p-value 0.000 which is significant as alpha of 1%. The R square is 0.90 and the R square adjusted is .96. In other words, 96% of the variation of Effectiveness is explained by the following variables: EX, IIB, IM, CR, and MBEA. The model developed is: EFF = 8.282E-03 + 0.894 EX + 0.585 IIB – 0.598 IM + 0.627 CR – 0.529MBEA

Table 3: Displays ANOVA[f]

Model		Sum of Squares	df	Mean Square	F	Sig
1	Regression	53.966	1	53.966	577.701	.000[a]
	Residual	10.089	108	9.341E-02		
	Total	64.055	109			
2	Regression	55.257	2	27.629	336.042	.000[b]
	Residual	8.797	107	8.222E-02		
	Total	64.055	109			
3	Regression	55.821	3	18.607	239.562	.000[c]
	Residual	8.233	106	7.767E-02		
	Total	64.055	109			
4	Regression	56.417	4	14.104	193.910	.000[d]
	Residual	7.637	105	7.274E-02		
	Total	64.055	109			
5	Regression	57.671	5	11.534	187.902	.000[e]
	Residual	6.384	104	6.138E-02		
	Total	64.055	109			

a. Predictors: (Constnnt) , EX
b. Predictors: (Constant), EX, IIB
c. Predictors: (Constant), EX, IIB, IM
d. Predictors: (Constant), EX, IIB, IM, CR
e. Predictors: (Constant), EX, IIB, IM, CR, MBEA
f. Dependent Variable EFF

Table 4: Displays Coefficients[a] – Rater

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std Error	Beta	t	Sig
1	(Constant)	.129	.110		1.174	.243
	EX	.940	.039	.918	24.035	.000
2	(Constant)	9.302E-.03	.108		.086	.931
	EX	.768	.057	.750	13.552	.000
	IIB	.220	.055	.219	3.963	.000
3	(Constant)	5.204E-.03	.106		.474	.636
	EX	.713	.056	.780	14.200	.000
	IIB	.444	.099	.444	4.476	.000
	IM	-.273	.101	-.265	-2.695	.008
4	(Constant)	8.620E-03	.104		.083	.934
	EX	.713	.062	.696	11.472	.000
	IIB	.503	.098	.503	5.124	.000
	IM	-.396	.107	-.385	-3.702	.000
	CR	.168	.059	.169	2.862	.005
5	(Constant)	8.282E-03	.095		.087	.931
	EX	.894	.070	.873	12.814	.000
	IIB	.585	.092	.585	6.360	.000
	IM	-.598	.108	-.582	-5.542	.000
	CR	.627	.115	.633	5.452	.000
	MBEA	-.529	.117	-.539	-4.519	.000

a. Dependent Variable: EFF

Table 5: Displays Excluded Variables [f] – Rater

Model		Beta In	t	Sig	Partial Correlation	Collinearity Statistics Tolerance
1	IIA	.179[a]	3.248	.002	.300	.441
	IIB	.219[a]	3.963	.000	.358	.418
	IM	.105[a]	1.808	.073	.172	.426
	IS	.122[a]	2.373	.019	.224	.528
	IC	.086[a]	1.573	.119	.150	.477
	CR	.132[a]	2.259	.026	.213	.414
	MBEA	.026[a]	.381	.704	.037	.317
	MBEP	-.108[a]	-1.281	.203	-.123	.204
	LF	-.030[a]	-.244	.808	-.024	9.893E-02
2	IIA	.008[b]	.087	.931	.008	.141
	IM	-.265[b]	-2.695	.008	-.253	.125
	IS	-.002[b]	-.027	.978	-.003	.318
	IC	-.013[b]	-.214	.831	-.021	.372
	CR	.081[b]	1.414	.160	.136	.388
	MBEA	.009[b]	.140	.889	.014	.315
	MBEP	-.102[b]	-1.288	.200	-.124	.204
	LF	-.003[b]	-.023	.982	-.002	9.858E-02
3	IIA	-.038[c]	-.399	.690	-.039	.136
	IS	.179[c]	2.268	.025	.216	.187
	IC	.087[c]	1.327	.187	.128	.277
	CR	.169[c]	2.862	.005	.269	.325
	MBEA	.036[c]	.565	.573	.055	.308
	MBEP	-.062[c]	-.787	.433	-.077	.195
	LF	.037[c]	.332	.740	.032	9.687E-02
4	IIA	-.035[d]	-.387	.700	-.038	.136
	IS	.054[d]	.518	.606	.051	.103
	IC	-.171[d]	-1.596	.114	-.155	9.733E-02
	MBEA	-.539[d]	-4.519	.000	-.405	6.741E-02
	MBEP	-.171[d]	-3.536	.001	-.328	.118
	LF	-.329[d]	-1.425	.157	-.138	6.883E-02
5	IIA	-.116[e]	-1.367	.175	-.133	.131
	IS	.072[e]	.750	.455	.074	.103
	IC	-.072[e]	-.707	.481	-.070	9.223E-02
	MBEP	-.154[e]	-1.452	.150	-.142	8.383E-02
	LF	-.006[e]	-.044	.965	-.004	6.123E02

a. Predictors in the model: (Constant) , EX
b. Predictors in the model: (Constant), EX, IIB
c. Predictors in the model: (Constant), EX, IIB, IM
d. Predictors in the model: (Constant), EX, IIB, IM, CR
e. Predictors in the model: (Constant), EX, IIB, IM, CR, MBEA
f. Dependent Variable EFF

Table 6: Dispalys Regression Analysis – Rater Satisfaction
SAT= f (iia,iib,im,cr, mbea, mbep, if, ex)
Variables Entered/Removed [a]

Model	Variables Entered	Variables Removed	Method
1	EX		Stepwise (Criteria: Probability-of-F-to-enter <=.050, Probability-of-F-to-remove>=.100)
2	IIB		Stepwise (Criteria: Probability-of-F-to-enter <=.050, Probability-of-F-to-remove>=.100)
3	IM		Stepwise (Criteria: Probability-of-F-to-enter <=.050, Probability-of-F-to-remove>=.100)
4	CR		Stepwise (Criteria: Probability-of-F-to-enter <=.050, Probability-of-F-to-remove>=.100)
5	MBEP		Stepwise (Criteria: Probability-of-F-to-enter <=.050, Probability-of-F-to-remove>=.100)
6	IS		Stepwise (Criteria: Probability-of-F-to-enter <=.050, Probability-of-F-to-remove>=.100)

a. Dependent Variable: SAT

The dependent variable is SAT. The independent variables derived from the model 6 in ANOVA are: EX, IIB, IM, CR, MBEP, and IS.
The technique used is stepwise regression.

The model is adequate with F ration of 78.473 and p-value 0.000 which is significant at alpha of 1%. The R square is 0.82 and R square adjusted is 0.812. Thus we have 81% of the variation OS satisfaction is explained by the following variables: EX, IIB, IM, CR, MBEP and IS.

The mode is:

SAT = -.459E-02 + 0.989 EX – 0.438 IM + 0.756 CR – 0.678 MBEP – 0.328 IS

All the slopes are significant for the variables in the model. The slopes for variables CR and MBEP are significant at 1%, on the other hand the slopes of IM and IS are significant at 5%.

Table 7: Displays Model Summary – Rater

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.837[a]	.701	.698	.43626
2	.857[b]	.735	.730	.41268
3	.869[c]	.754	.748	.39912
4	.879[d]	.772	.763	.38661
5	.901[e]	.812	.803	.35226
6	.906[f]	.821	.810	.34617

a. Predictors: (Constant) , EX
b. Predictors: (Constant), EX, IIB
c. Predictors: (Constant), EX, IIB, IM
d. Predictors: (Constant), EX, IIB, IM, CR
e. Predictors: (Constant), EX, IIB, CR, MBEP
f. Predictors: (Constant), EX, IIB, IM, CR, MBEP, IS

Table 8: Displays ANOVA[g]

Model		Sum of Squares	df	Mean Square	F	Sig
1	Regression	48.212	1	48.212	253.322	.000[a]
	Residual	20.554	108	.190		
	Total	68.766	109			
2	Regression	50.544	2	25.272	148.394	.000[b]
	Residual	18.222	107	.170		
	Total	68.766	109			
3	Regression	51.881	3	17.294	108.565	.000[c]
	Residual	16.885	106	.159		
	Total	68.766	109			
4	Regression	53.072	4	13.268	88.770	.000[d]
	Residual	15.694	105	.149		
	Total	68.766	109			
5	Regression	55.861	5	11.172	90.036	.000[e]
	Residual	12.905	104	.124		
	Total	68.766	109			
5	Regression	56.423	6	9.404	78.473	.000[f]
	Residual	12.343	103	.120		
1	Total	68.766	109			

a. Predictors: (Constant) , EX
b. Predictors: (Constant), EX, IIB
c. Predictors: (Constant), EX, IIB, IM
d. Predictors: (Constant), EX, IIB, IM, CR
e. Predictors: (Constant), EX, IIB, IM, CR, MBEA
e. Dependent Variable SAT

Table 9: Displays Coefficients[a] – Rater

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std Error	Beta	t	Sig
1	(Constant)	.263	.157		1.669	.098
	EX	.888	.056	.837	15.916	.000
2	(Constant)	.101	.155		.653	.515
	EX	.658	.082	.620	8.063	.000
	IIB	.295	.808	.285	3.700	.000
3	(Constant)	.164	.152		1.084	.281
	EX	.704	.081	.664	8.746	.000
	IIB	.641	.142	.618	4.510	.000
	IM	-.420	.145	-.394	-2.897	.005
4	(Constant)	.106	.148		.711	.479
	EX	.583	.089	.550	6.547	.000
	IIB	.725	.141	.699	5.146	.000
	IM	-.594	.153	-.557	-3.875	.000
	CR	.237	.084	.231	2.823	.006
5	(Constant)	-5.368E-02	.139		-.385	.701
	EX	.976	.116	.920	8.414	.000
	IIB	.686	.129	.662	5.334	.000
	IM	-.647	.140	-.607	-4.619	.000
	CR	.530	.098	.516	5.389	.000
	MBEP	-.558	.118	-.586	-4.741	.000
6	(Constant)	-4.588E-02	.137		-.335	.738
	EX	.989	.114	.932	8.663	.000
	IIB	.683	.126	.659	5.406	.000
	IM	-.436	.168	-.410	-2.599	.011
	CR	.756	.142	.736	5.317	.000
	MBEP	-.678	.128	-.712	-5.286	.000
	IS	-.328	.152	-.312	-2.166	.033

a. Dependent Variable: SAT

Table 10: Displays Excluded Variables [g] – RATER

Model		Beta In	t	Sig	Partial Correlation	Collinearity Statistics Tolerance
1	IIA	.275[a]	3.666	.000	.334	.441
	IIB	.285[a]	3.700	.000	.337	.418
	IM	.121[a]	1.511	.134	.145	.426
	IS	.140[a]	1.952	.054	.185	.528
	IC	.100[a]	1.313	.192	.126	.477
	CR	.169[a]	2.098	.038	.199	.414
	MBEA	.113[a]	1.208	.230	.116	.317
	MBEP	-.231[a]	-.2014	.047	-.191	.204
	LF	-.127[a]	-.759	.450	-.073	9.893E-02
2	IIA	.145[b]	1.093	.277	.106	.141
	IM	-.394[b]	-2.897	.005	-.271	.125
	IS	-.034[b]	-.379	.706	-.037	.318
	IC	-.032[b]	-.394	.695	-.038	.372
	CR	.103[b]	1.295	.198	.125	.388
	MBEA	.091[b]	1.027	.307	.099	.315
	MBEP	-.224[b]	-2.058	.042	-.196	.204
	LF	-.092[b]	-.580	.563	-.056	9.858E-02
3	IIA	.081[c]	.617	.538	.060	.136
	IS	.214[c]	1.943	.055	.186	.187
	IC	.112[c]	1.227	.223	.119	.277
	CR	.231[c]	2.823	.006	.266	.325
	MBEA	.132[c]	1.536	.128	.148	.308
	MBEP	-.167[c]	-1.548	.125	-.149	.195
	LF	.034[c]	-.222	.825	-.022	9.687E-02
4	IIA	-.084[d]	.663	.509	.065	.136
	IS	.018[d]	.125	.901	.012	.103
	IC	-.255[d]	-1.721	.088	-.166	9.733E-02
	MBEA	-.352[d]	-1.991	.049	-.192	6.741E-02
	MBEP	-.586[d]	-4.741	.000	-.422	.118
	LF	-.369[d]	-2.109	.037	-.203	6.883E-02
5	IIA	.002[e]	.015	.988	.002	.133
	IS	-.312[e]	-2.166	.033	-.209	8.388E-02
	IC	-.154[e]	-1.114	.268	-.109	9.474E-02
	MBEA	-.093[e]	.478	.634	.047	4.779E-02
	LF	-.069[e]	.354	.724	.035	4.851E-02
6	IIA	-.123[f]	-.977	.331	-.096	.110
	IC	-.001[f]	-.008	.994	-.001	6.915E-02
	MBEA	.280[f]	1.371	.173	.135	4.151E-02
	LF	.040[f]	.211	.833	.021	4.827E-02

a. Predictors in the model: (Constant) , EX
b. Predictors in the model: (Constant), EX, IIB
c. Predictors in the model: (Constant), EX, IIB, IM,
d. Predictors in the model: (Constant), EX, IIB, IM, CR,
e. Predictors in the model: (Constant), EX, IIB, IM, CR, MBEP,
f. Predictors in the model: (Constant), EX, IIB,IM, CR, MBEP, IS
g. Dependent Variable SAT

The dependent variable is EFF. The dependent variables are: EX, IIB, CR, MBEA, and IM.

The model is adequate with F ration equals to 83.235 and p-value of 0.000 which is significant at even alpha of 1%. The R square is 0.80 and the adjusted R square is .79.

The model is:

EFF = 0.231 = 0.844 EX = 0.297 CR – 0.733 MBEA – 0.259 IM

All the slopes are significant for the variables in the model at alpha 1% except IM which is significant at alpha 5%. The technique used in regression was stepwise.

Table 20: Displays Coefficients[a] – LEADER

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std Error	Beta	t	Sig
1	(Constant)	.506	.158		3.206	.002
	EX	.839	.055	.827	15.265	.000
2	(Constant)	.233	.159		1.463	.146
	EX	.707	.059	.696	11.878	.000
	IIB	.236	.055	.253	4.326	.000
3	(Constant)	.244	.157		1.553	.123
	EX	.885	.105	.872	8.8427	.000
	IIB	.237	.054	.254	4.401	.000
	LF	-.183	.089	-.203	-2.048	.043
4	(Constant)	.135	.160		.841	.402
	EX	.902	.103	.888	8.771	.000
	IIB	.180	.057	.193	3.140	.002
	LF	-.285	.096	-.316	-2.950	.004
	CR	.172	.070	.181	2.466	.015
5	(Constant)	.232	.148		1.565	.121
	EX	.886	.094	.872	9.390	.000
	IIB	.114	.054	.123	2.098	.038
	LF	-.127	.095	-.141	-1.339	.184
	CR	.640	.121	.675	5.306	.000
	MBEA	-.579	.126	-.614	-4.576	.000
6	(Constant)	.258	.147		1.754	.082
	EX	.793	.064	.781	12.384	.000
	IIB	.118	.055	.127	2.167	.033
	CR	.655	.120	.691	5.440	.000
	MBEA	-.640	.118	-.679	-5.411	.000
7	(Constant)	.231	.146		1.580	.117
	EX	.844	.068	.831	12.377	.000
	IIB	.297	.105	.319	2.836	.005
	CR	.780	.134	.822	5.808	.000
	MBEA	-.733	.126	-.777	-5.834	.000
	IM	-.259	.130	-.271	-1.990	.049

a. Dependent Variable: EFF

Table 21: Displays Excluded Variables [h] – LEADER

Model		Beta In	t	Sig	Partial Correlation	Collinearity Statistics Tolerance
1	IIA	.209[a]	3.131	.002	.290	.607
	IIB	.235[a]	4.326	.000	.386	.734
	IM	.260[a]	4.059	.000	.365	.624
	IS	.187[a]	3.067	.003	.284	.735
	IC	.193[a]	3.197	.002	.295	.739
	CR	.179[a]	2.656	.009	.249	.612
	MBEA	-.026[a]	-.356	.723	-.034	.561
	MBEP	-.105[a]	-1.220	.225	-.117	.395
	LF	-.201[a]	-1.869	.064	-.178	.249
2	IIA	.003[b]	-.031	.975	-.003	.261
	IM	.078[b]	.566	.573	.055	.134
	IS	-.007[b]	-0.79	.937	-.008	.323
	IC	-.059[b]	.781	.436	.076	.451
	CR	.088[b]	1.285	.202	.124	.529
	MBEA	-.081[b]	-1.186	.238	-.114	.543
	MBEP	-.138[b]	-1.742	.084	-.167	.392
	LF	-.203[b]	-2.048	.043	-.195	.249
3	IIA	.009[c]	.091	.927	.009	.260
	IM	.103[c]	.755	.452	.073	.133
	IS	.010[c]	.117	.907	.011	.320
	IC	.073[c]	.986	.326	.096	.447
	CR	.181[c]	2.466	.015	.234	.432
	MBEA	-.010[c]	-.129	.898	-.013	.388
	MBEP	-.040[c]	-.341	.734	-.033	.175
4	IIA	-.020[d]	-.212	.833	-.021	.256
	IM	.000[d]	.001	.999	.000	.120
	IS	-.250[d]	-2.174	.032	-.208	.171
	IC	-.168[d]	-1.465	.146	-.142	.175
	MBEA	-.614[d]	-4.576	.000	-.409	.109
	MBEP	-.278[d]	-2.053	.043	-.197	.123
5	IIA	-.117[e]	-1.306	.194	-.128	.243
	IM	-.257[e]	-1.882	.063	-.182	.103
	IS	-.231[e]	-2.197	.030	-.212	.171
	IC	-.059[e]	-.542	.589	-.053	.166
	MBEP	-.069[e]	-.123	.903	-.012	9.723E-02
6	IIA	-.126[f]	-1.413	.161	-.137	.244
	IM	-.271[f]	-1.990	.049	-.192	.104
	IS	.178[f]	-1.736	.086	-.168	.184
	IC	.008[f]	.077	.939	.008	.203
	MBEP	-.103[f]	-.915	.362	-.089	.156
	LF	-.141[f]	-1.339	.184	-.130	.176
7	IIA	-.148[g]	-1674	.097	-.163	.241
	IS	-.096[g]	-.790	.431	-.078	.130
	IC	.049[g]	.488	.627	.048	.194
	MBEP	.087[g]	-.784	.435	-.077	.155
	LF	-.124[g]	-1.184	.239	-.116	.175

a. Predictors in the model: (Constant), EX
b. Predictors in the model: (Constant), EX, IIB
e. Predictors in the model: (Constant), EX, IIB, LF, CR, MBEA
f. Predictors in the model: (Constant), EX, IIB, CR, MBEA

g. Predictors in the model: (Constant), EX, IIB, CR, MBEA, IM

h. Dependent variable: EFF

Table 22: Displays Regression Analysis- LEADER
Satisfaction
SAT = f (iia, iib, im, is, ic, cr, mbea, mbep, if, ex)

Variables Entered/Removed [a]

Model	Variables Entered	Variables Removed	Method
1	EX		Stepwise (Criteria: Probability-of-F-to-enter <=.050, Probability-of-F-to-remove>=.100)
2	LF		Stepwise (Criteria: Probability-of-F-to-enter <=.050, Probability-of-F-to-remove >= .100)
3	CR		Stepwise (Criteria: Probability-of-F-to-enter <=.050, Probability-of-F-to-remove >= .100)
4	MBEA		Stepwise (Criteria: Probability-of-F-to-enter <=.050, Probability-of-F-to-remove >= .100)

a. Dependent Variable: SAT

Table 23: Displays Model Summary – LEADER

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.742[a]	.551	.547	.34902
2	.773[b]	.598	.590	.33193
3	.807[c]	.651	.641	.31081
4	.828[d]	.686	.674	.29619

a Predictors: (Constant) , EX
b. Predictors: (Constant), EX, LF
c. Predictors: (Constant), EX, LF, CR
d. Predictors: (Constant), EX, LF, CR, MBEA

Table 24: Displays ANOVA[e]

Model		Sum of Squares	df	Mean Square	F	Sig
1	Regression	16.162	1	16.162	132.678	.000[a]
	Residual	13.156	108	.122		
	Total	29.318	109			
2	Regression	17.529	2	8.765	79.550	.000[b]
	Residual	11.789	107	.110		
	Total	29.318	109			
3	Regression	19.078	3	6.359	65.829	.000[c]
	Residual	10.240	106	9.660E-02		
	Total	29.318	109			
4	Regression	20.017	4	5.027	57.297	.000[d]
	Residual	9.212	105	8.773E-02		
	Total	29.318	109			

a. Predictors: (Constant) , EX
b. Predictors: (Constant), EX, LF
d. Predictors: (Constant), EX, LF, CR
e. Predictors: (Constant), EX, LF, CR, MBEA
e. Dependent Variable: SAT

The dependent variable is SAT. The dependent variables are: EX, LF, CR, and MBEA
The model is:
EFF = 0.545 + 1.093 EX – 0.425 LF + 0.711 CR – 0.529 MBEA
All the slopes are significant for the variables in the model at alpha 1%.
The technique used in regression was stepwise.

Table 25: Displays Coefficients[a] – LEADER

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig
		B	Std Error	Beta		
1	(Constant)	.788	.193		4.082	.000
	EX	.774	.067	.742	11.519	.000
2	(Constant)	.813	.184		4.427	.000
	EX	1.165	.128	1.118	9.092	.000
	LF	-.400	.114	-.433	-3.522	.001
3	(Constant)	.495	.189		2.615	.010
	EX	1.139	.120	1.093	9.477	.000
	LF	-.586	.116	-.634	-5.049	.000
	CR	.312	.078	.320	4.004	.000
4	(Constant)	.545	.181		3.008	.003
	EX	1.093	.115	1.049	9.482	.000
	LF	-.425	.120	-.460	-3.535	.001
	CR	.711	.138	.730	5.146	.000
	MBEA	-.529	.155	-.547	-3.424	.001

a. Dependent Variable: SAT

Table 26: Displays Excluded Variables [c] – LEADER

Model		Beta In	t	Sig	Partial Correlation	Collinearity Statistics Tolerance
1	IIA	.127[a]	1.551	.124	.148	.607
	IIB	.202[a]	2.773	.007	.259	.734
	IM	.200[a]	2.515	.013	.236	.624
	IS	.125[a]	1.677	.097	.160	.735
	IC	.188[a]	2.577	.011	.242	.739
	CR	.159[a]	1.954	.053	.186	.612
	MBEA	-.046[a]	-.528	.599	-.051	.561
	MBEP	-.264[a]	-2.645	.009	-.248	.395
	LF	-.433[a]	-3.522	.001	.322	.249
2	IIA	.140[b]	1.794	.076	.172	.606
	IIB	-.204[b]	2.949	.004	.275	.734
	IM	-.213[b]	2.831	.006	.265	.622
	IS	-.143[b]	2.021	.046	.193	.731
	IC	.208[b]	3.022	.003	.282	.734
	CR	.320[b]	4.004	.000	.362	.514
	MBEA	-.146[b]	1.530	.129	.147	.406
	MBEP	-.021[b]	-.145	.885	-.014	.178
3	IIA	.033[c]	.416	.679	.041	.520
	IS	.115[c]	1.580	.117	.152	.616
	IM	.093[c]	1.118	.266	.108	.474
	IS	-.100[c]	-1.044	.299	-.101	.359
	IC	-.024[c]	-.208	.835	-.020	.255
	MBEA	-.547[c]	-3.424	.001	-.317	.117
	MBEP	-.457[c]	-2.910	.004	-.273	.125
4	IIA	-.063[d]	-.775	.440	-.076	.459
	IIB	.056[d]	.770	.443	.075	.573
	IM	-.022[d]	-.255	.799	-.025	.394
	IS	-.156[d]	-1.699	.092	-.164	.349
	IC	-.010[d]	-.089	.930	-.009	.255
	MBEP	-.267[d]	-1.534	.128	-.149	9.724E-02

a. Predictors in the model: (Constant) , EX

b. Predictors in the model: (Constant), EX, LF

c. Predictors in the model: (Constant), EX, LF, CR

d. Predictors in the model: (Constant), EX, LF, CR,MBEA

d. Dependent Variable: SAT

Table 27: Illustrates Factor Analysis for LEADER

Discussion of Findings

The purpose of this study was to examine the relationship between transformational and transactional leadership and three outcome variables among trained Sigma trained professionals in the Aerospace Sector. First does Six Sigma Training Increase Leadership Skills? And second does Six Sigma Leaders after Training Influence Major Changes in the Organization and Achieve the Objectives of the Organization? The Multifactor Leadership Questionnaire (MLQ) was used to measure leadership behavior (transformational and transactional style) and three organizational outcomes extra effort on the job, perception of leaders' effectiveness, and subordinates' job satisfaction. The MLQ was very useful in providing meaningful and valid data to individuals and the organization overall that served to help this organization examine its practices and consider the steps they needed to take to remain competitive in a very difficult time for the aerospace industry. The population for this study consists of the Six Sigma trained professionals at three manufacturing sites. Responses were received from 110 of 150 surveys (73%) in this study.

Based on the statistical analysis, the results indicate that there is a positive linear relationship between transformational leadership and satisfaction (Hypothesis 1), and there is a positive linear relationship between transformational leadership and extra effort (Hypothesis 2). The results also indicated that there is a positive linear relationship between transformational leadership and effectiveness (Hypothesis 3) as also indicated, that there is a negative linear relationship between transactional leadership and satisfaction (Hypothesis 4). The results indicated that there is a negative linear relationship between transactional leadership and extra effort (Hypothesis 5). The results indicated that there is a negative linear relationship between transactional leadership and effectiveness (Hypothesis 6). The results indicated that there is a significant difference between the transformational and transactional leadership scores (Hypothesis 7).

The analysis showed the significant relationship on both transformational and transactional leadership styles and subordinates' job satisfaction, extra effort on the job and perception of leader effectiveness on individual and work group performance. Three outcome variables showed the significance for the transformational leadership factors. Idealized Influence explained most of the variance for subordinates' job satisfaction, extra effort on the job and perception of leader effectiveness. However, the Intellectual Stimulation provided the negative affect on the subordinates' job satisfaction model. On the other hand, there is both positive and negative relationship between transactional leadership and subordinates' job satisfaction, extra effort on the job and perceptions of leader effectiveness. The Contingent Reward showed the positive affect on three outcome variables as transformational factors. And the rest of the factors (Management-by-Exception (Active, Management-by-Exception (Passive), and Laissez-Faire) provided the negative relationship with all outcome variables as Bass's theory (1985).

Limitations and Future Research

In the transformational styles, leaders move the followers to transcend their own goal deployment initiatives for the good of the group, organization or business unit. The present findings should be viewed in the light of some limitations of the investigation that are suggestive of further study. Transformational leadership should be related to the different stages of mergers and acquisitions. The data analysis should also include both subordinates and their acquiring company representatives. In addition, the study has implications for understanding the development of leadership as an organizational capacity. It is extremely useful as a feedback tool for individuals and teams to see what behaviors they could do more of, and less of to improve outcomes. Second, research could examine additional word outcomes other than those investigated here. Extensive research attention has been devoted to such variables as work objective, additional components of motivation and components of job satisfaction that predict patterns for transformational and transactional leadership behaviors. Identifying other key variables related to desired outcomes can help organizations in employee Retaining, recruitment, placement and promotional policy. Third, an interesting issue would be to explore demographics and other variables that my influence leadership style such as implementing Six Sigma tools before mergers and acquisitions are transacted. Finally, the current study was a cross section. We examined a non-union environment with supporting business interest. Given the roadmap to business success, could a two tiered approach work (non-union to union and union to non-union) environment succeed?

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