

The Impact of Social/Cultural Factors on Tornado Warning Performance

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National Weather Service

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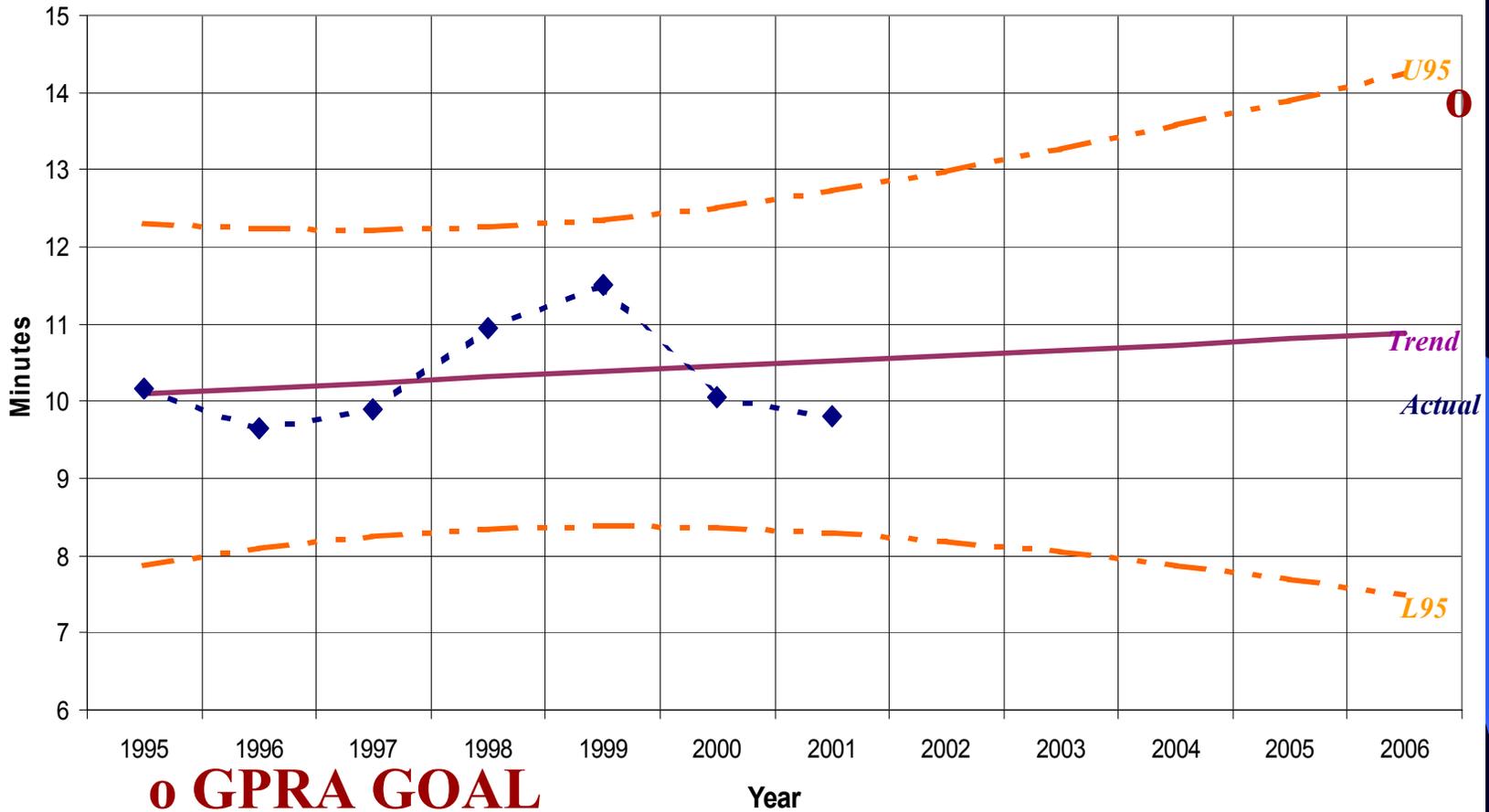
Sirota Corporation

**“Science does not float upon the winds,
but is inevitably grounded
in human relations.”**

Professor Gary Fine



Tornado Lead Times



Descriptive Statistics:

Constant = -131.1915

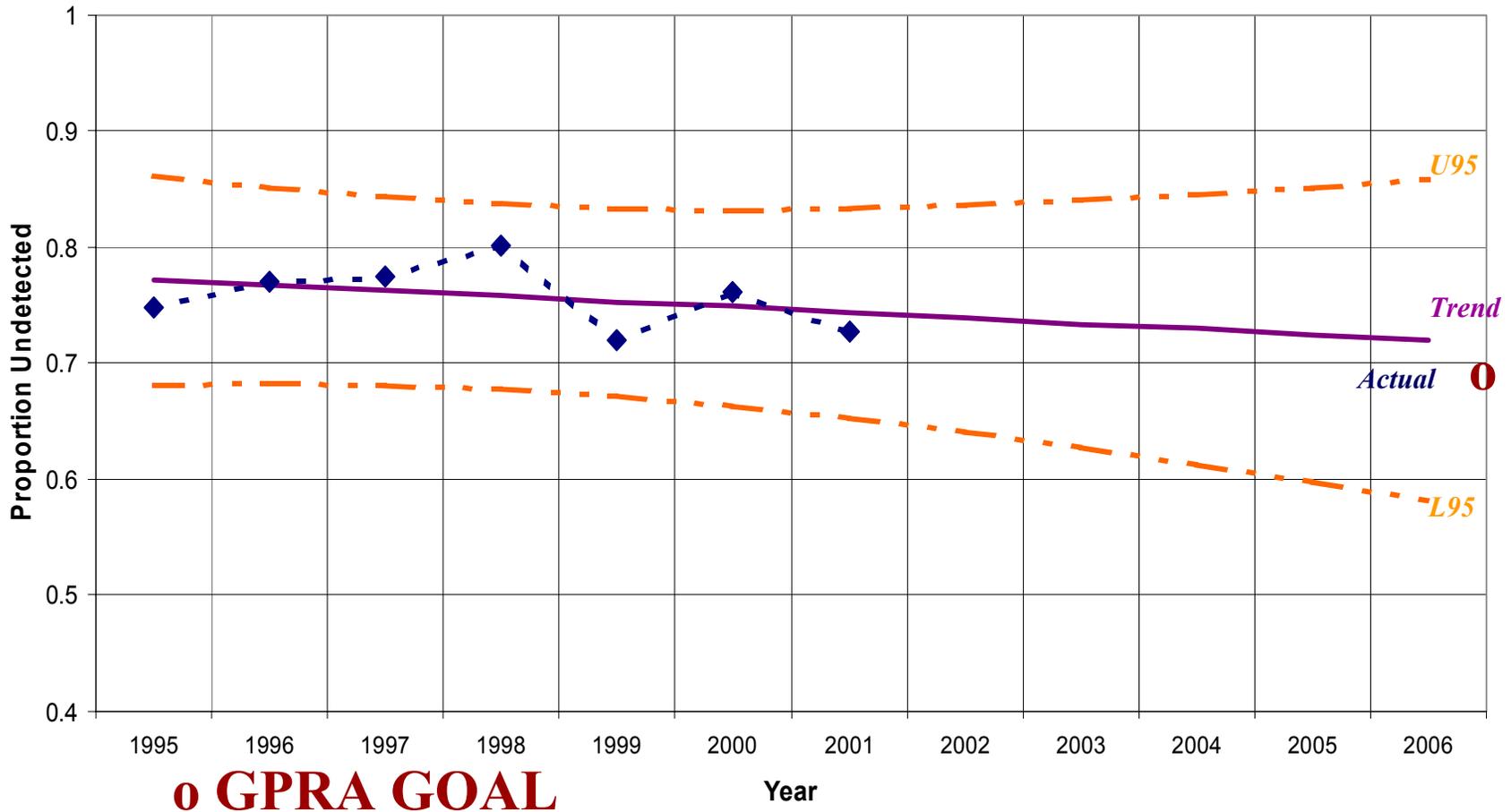
Coefficient = 0.0708

Rsqr = 0.053

T-value for slope = 0.53

2-tailed t-test 95% CI w/ 5 degrees of freedom = 2.57

Tornado False Alarm Rate



o GPR A GOAL

Descriptive Statistics:

Constant = 10.0956

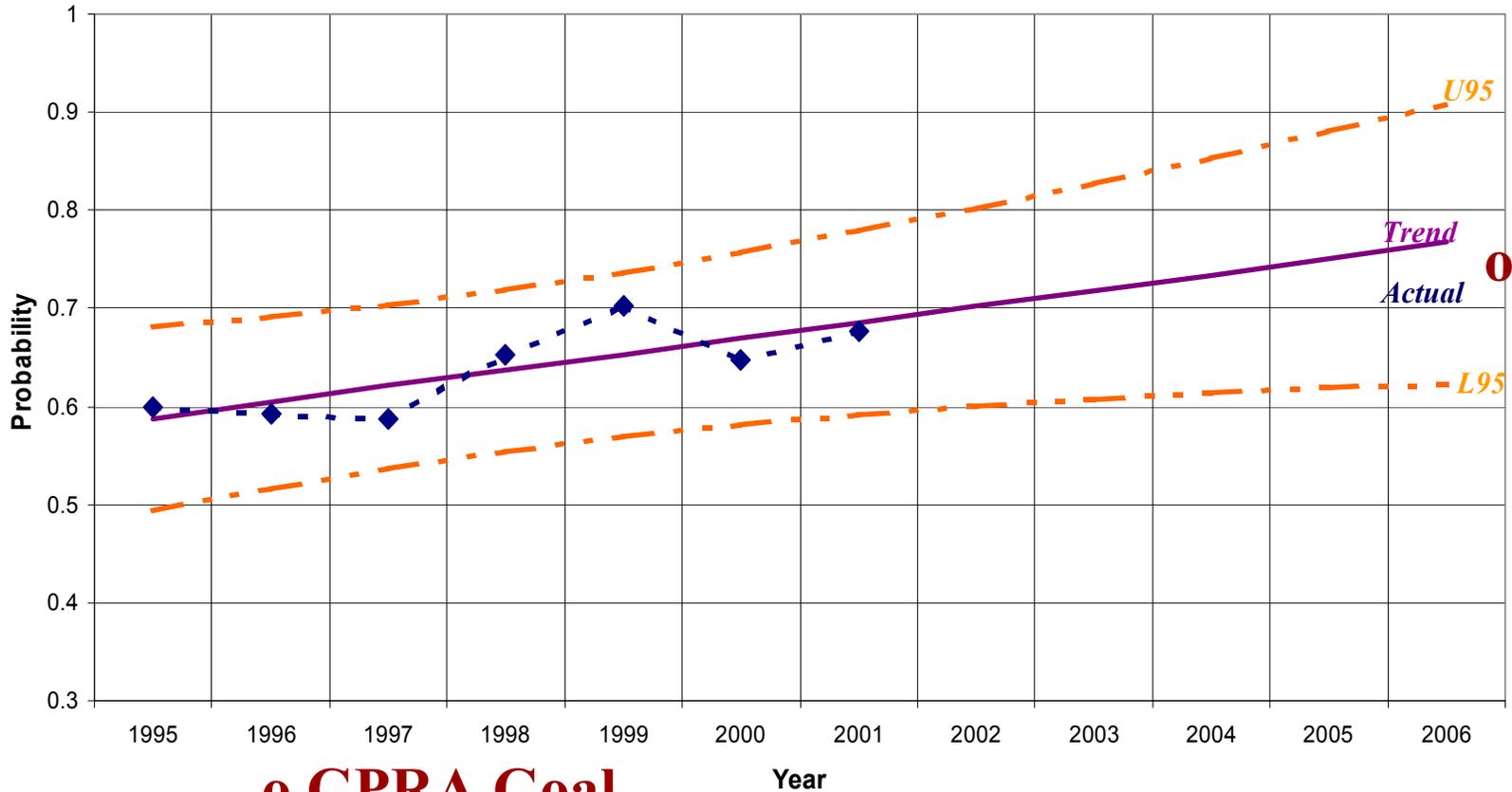
Coefficient = -0.0047

Rsq = 0.127

T-value for slope = -0.85

2-tailed t-test 95% CI w/ 5
degrees of freedom = 2.57

Tornado Probability of Detection



o GPRA Goal

Descriptive Statistics:

Constant = -31.8362

Coefficient = .0163

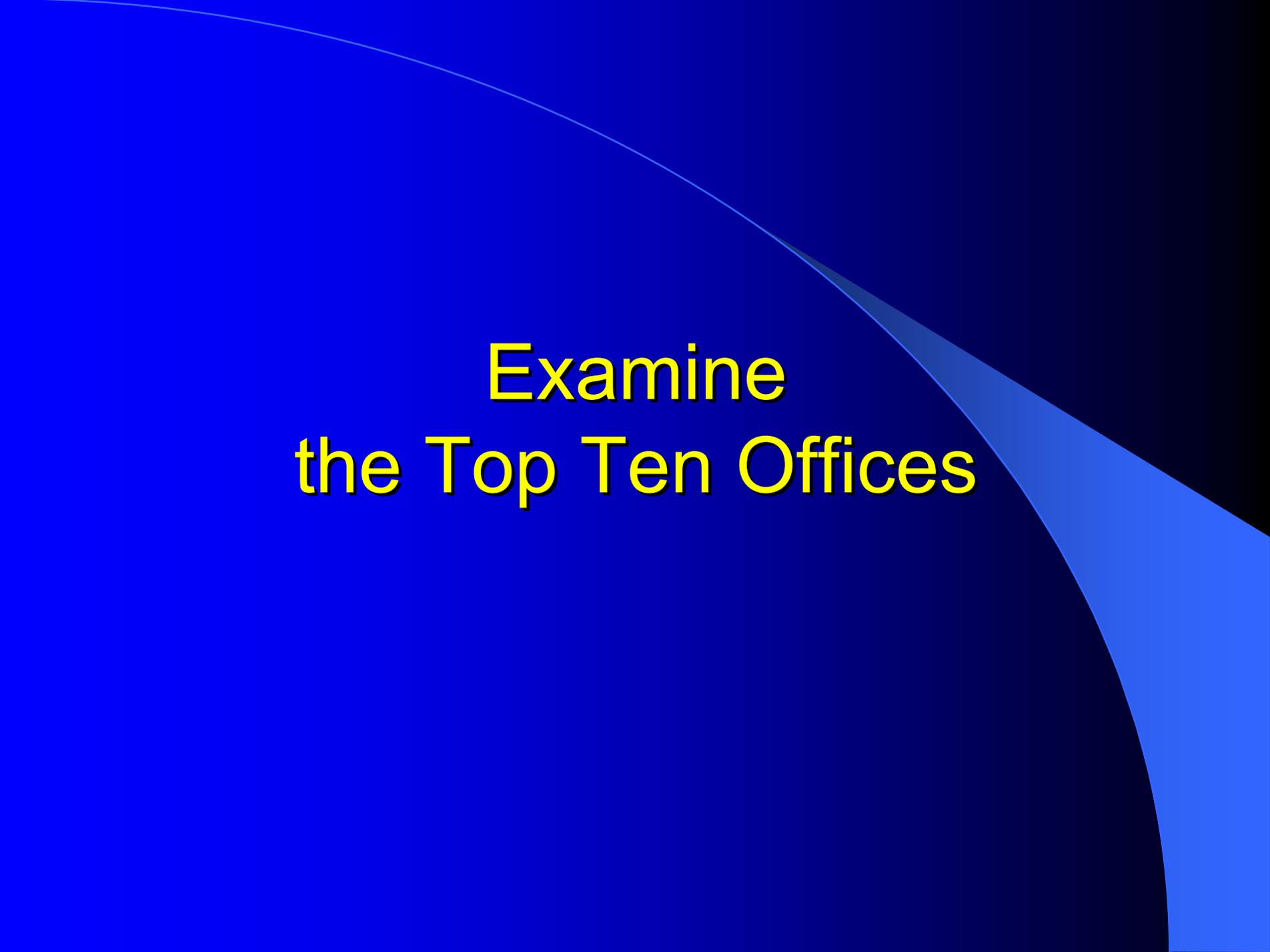
Rsqr = 0.623

T-value for slope = 2.87

2-tailed t-test 95% CI w/ 5 degrees of freedom = 2.57

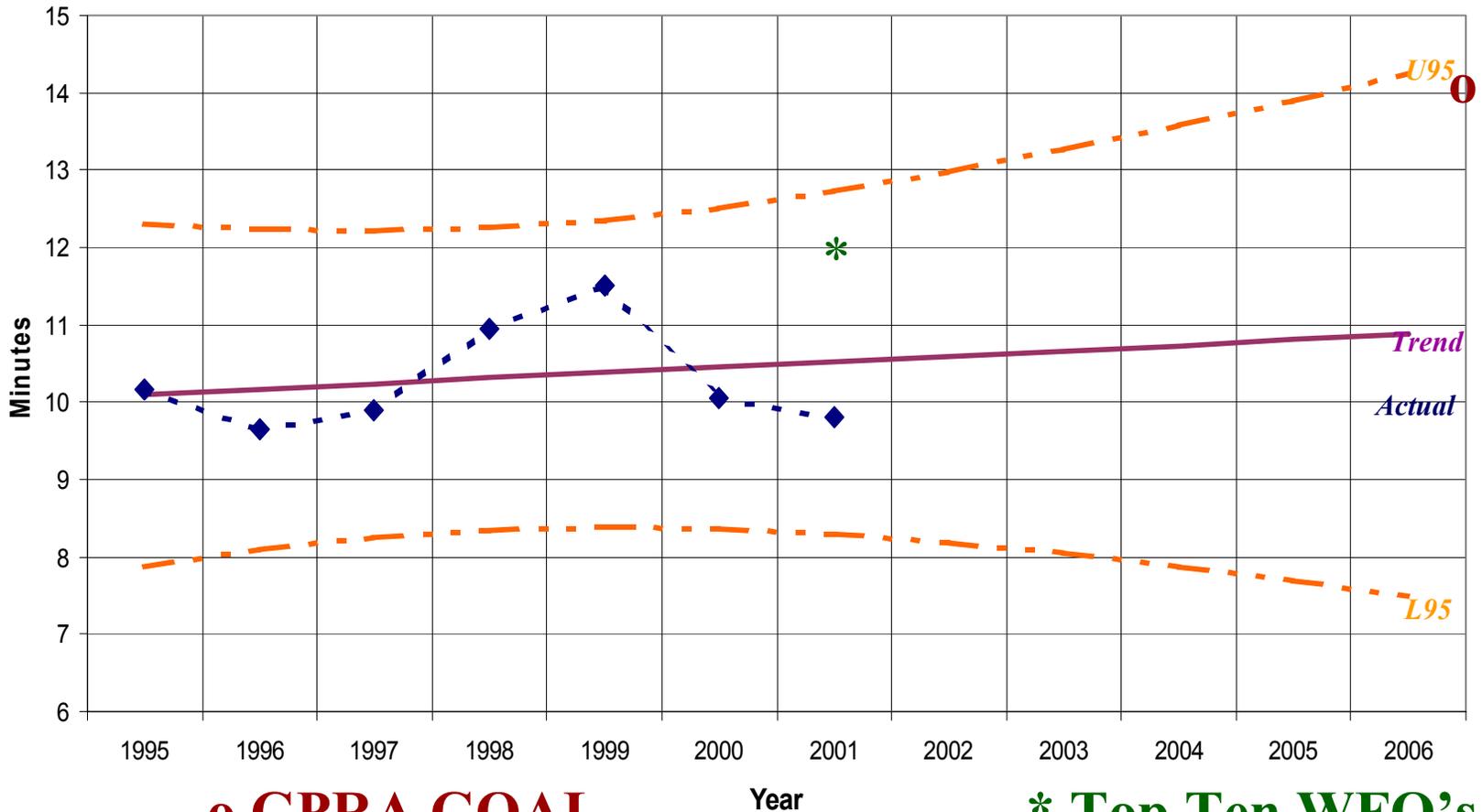
Questions asked by National Weather Service Management

- How do we improve our tornado warning verification statistics?
- How will we meet our GPRA goals for tornado warnings?
- What do we invest our resources in?



Examine the Top Ten Offices

Tornado Lead Times



o GPRA GOAL

*** Top Ten WFO's**

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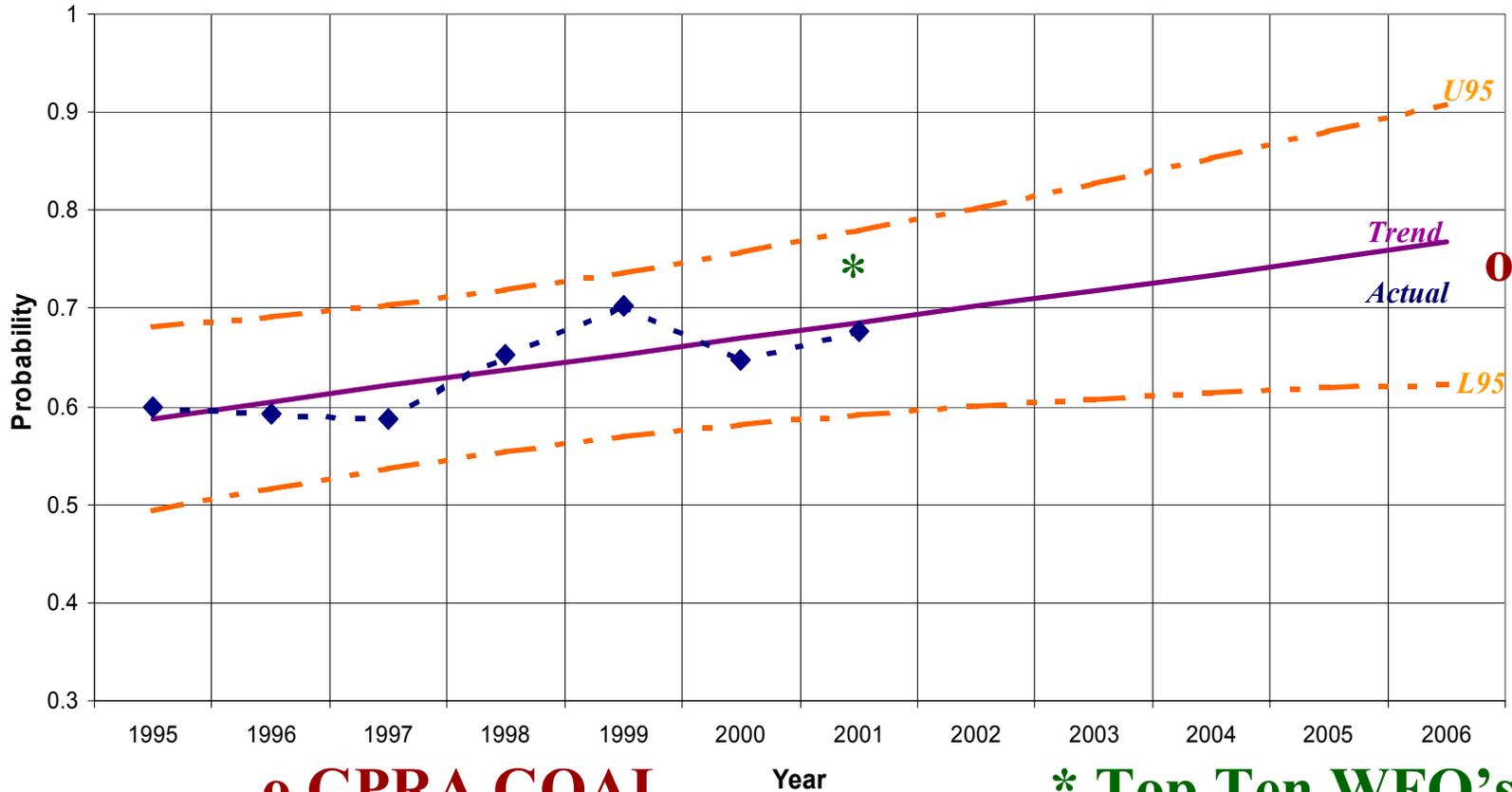
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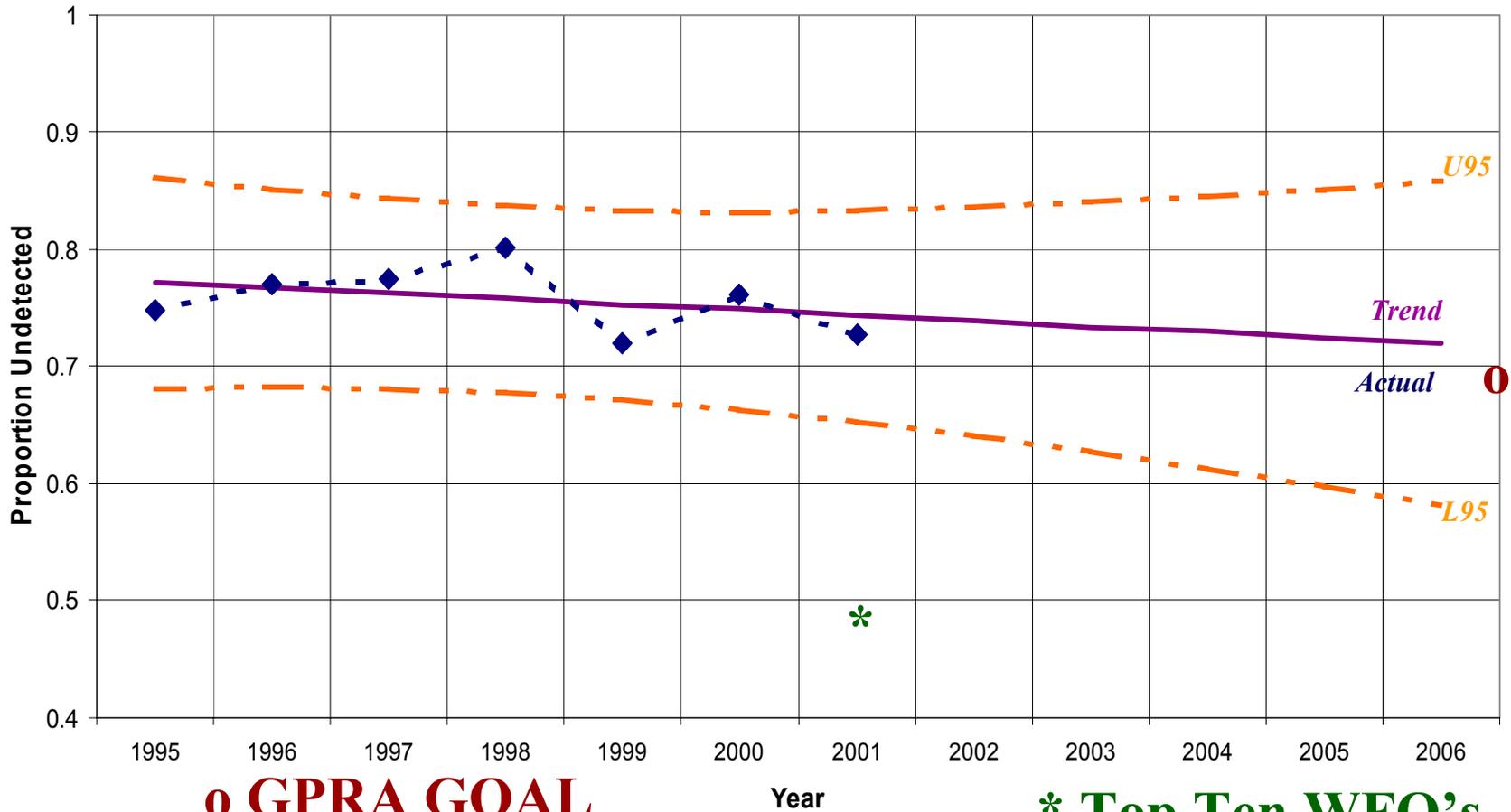
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Why are the Top Ten Offices doing so well?

- Better Science and Technology? No.
- Easier Verification? No.
- Easier Storms? No.
- More Practice? No.
- Better at Managing Diversity???

Hypothesis

A tornado warning is arguably the most challenging of all products issued by NWS forecasters. Sustained, high performance in tornado warnings, requires a highly-trained, dedicated staff who can work well as a team under very stressful conditions.

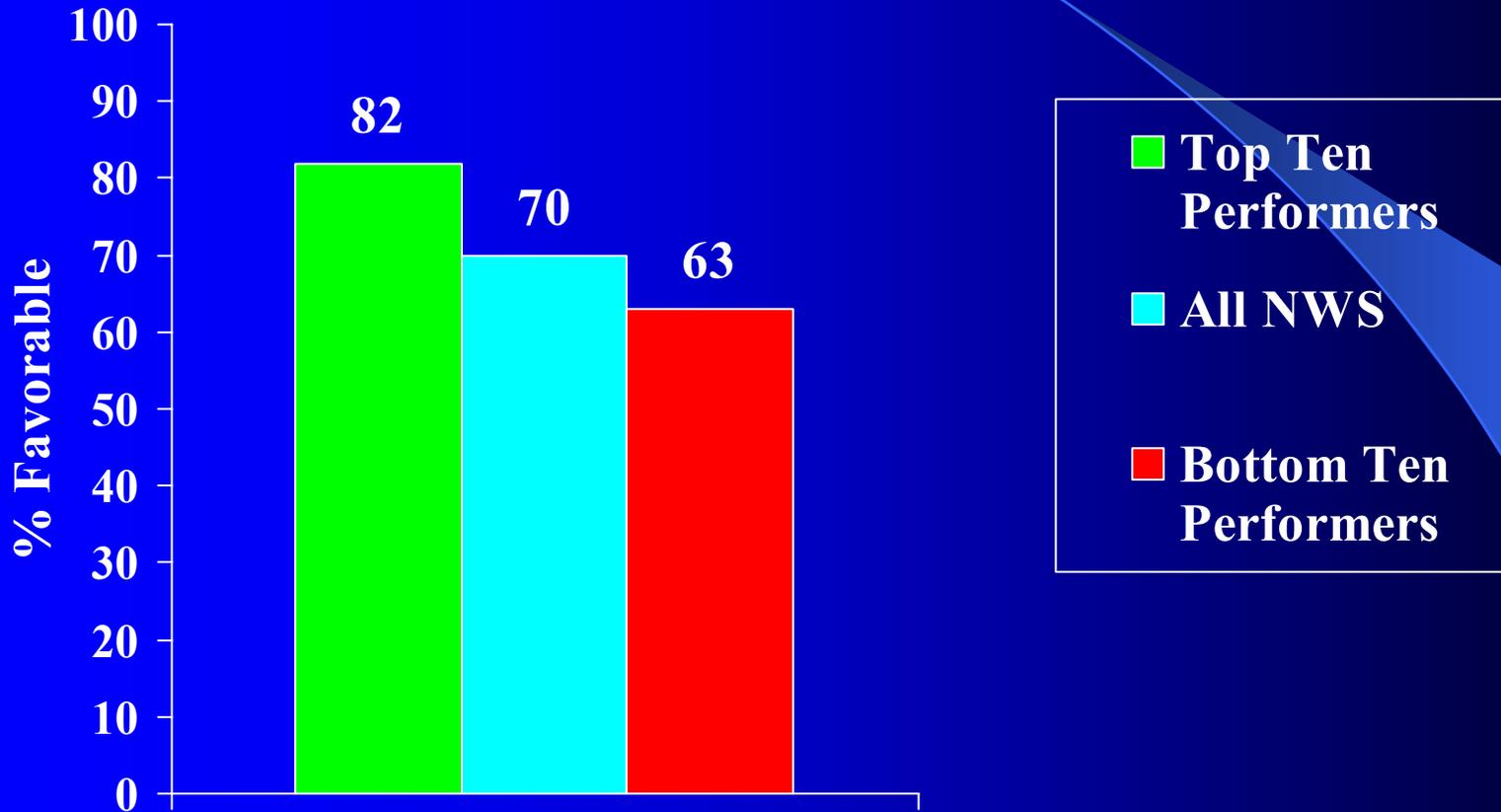
If the benefits of an inclusive, supportive, and flexible work environment, where managers foster personal development, teamwork and empowerment, among their employees, are to be seen, it would be in tornado warning verification statistics.

Offices that score high in tornado warning verification statistics will also score high in SFA results compared to offices with poor tornado verification statistics.

Methodology

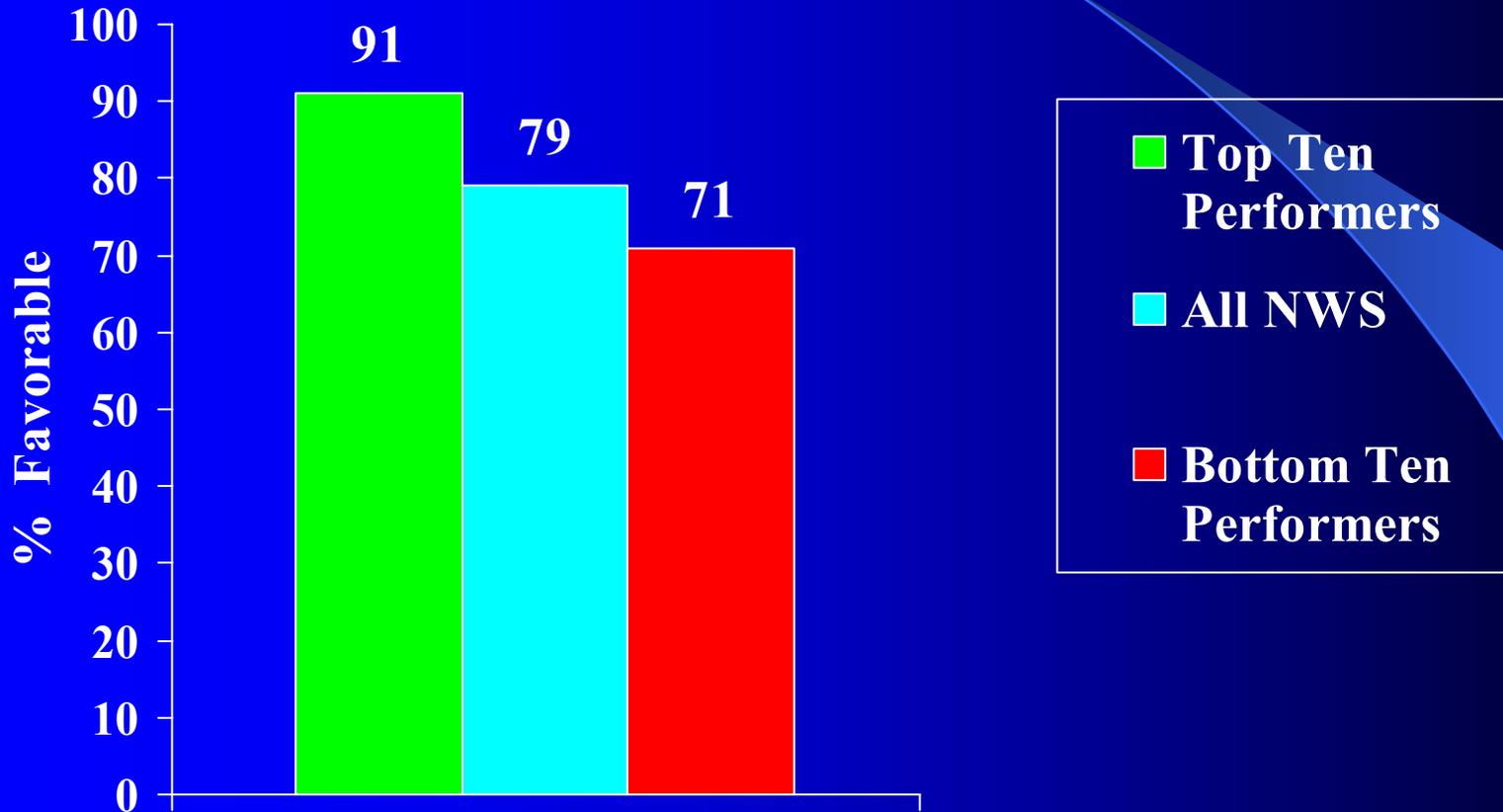
- Obtained 2000 & 2001 Tornado Warning Statistics for each NWS forecast office
- Ranked all forecast offices by skill
- Requested a special aggregate report of NOAA's all-employee survey (SFA) for the Top 10 and Bottom 10 forecast offices in skill
- Compared the two reports for significant differences

Supervision



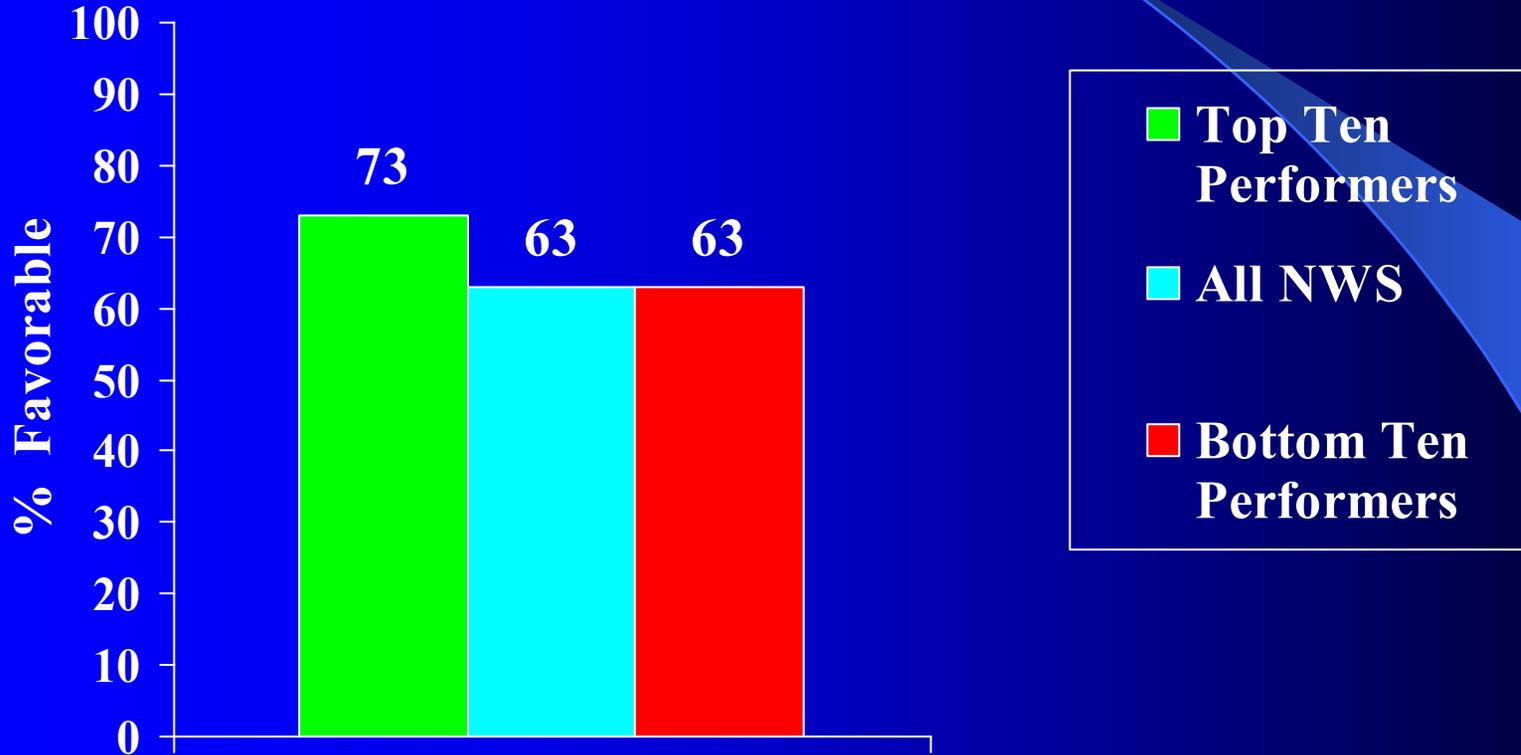
How would you rate the overall job done by your immediate supervisor?

Supervision



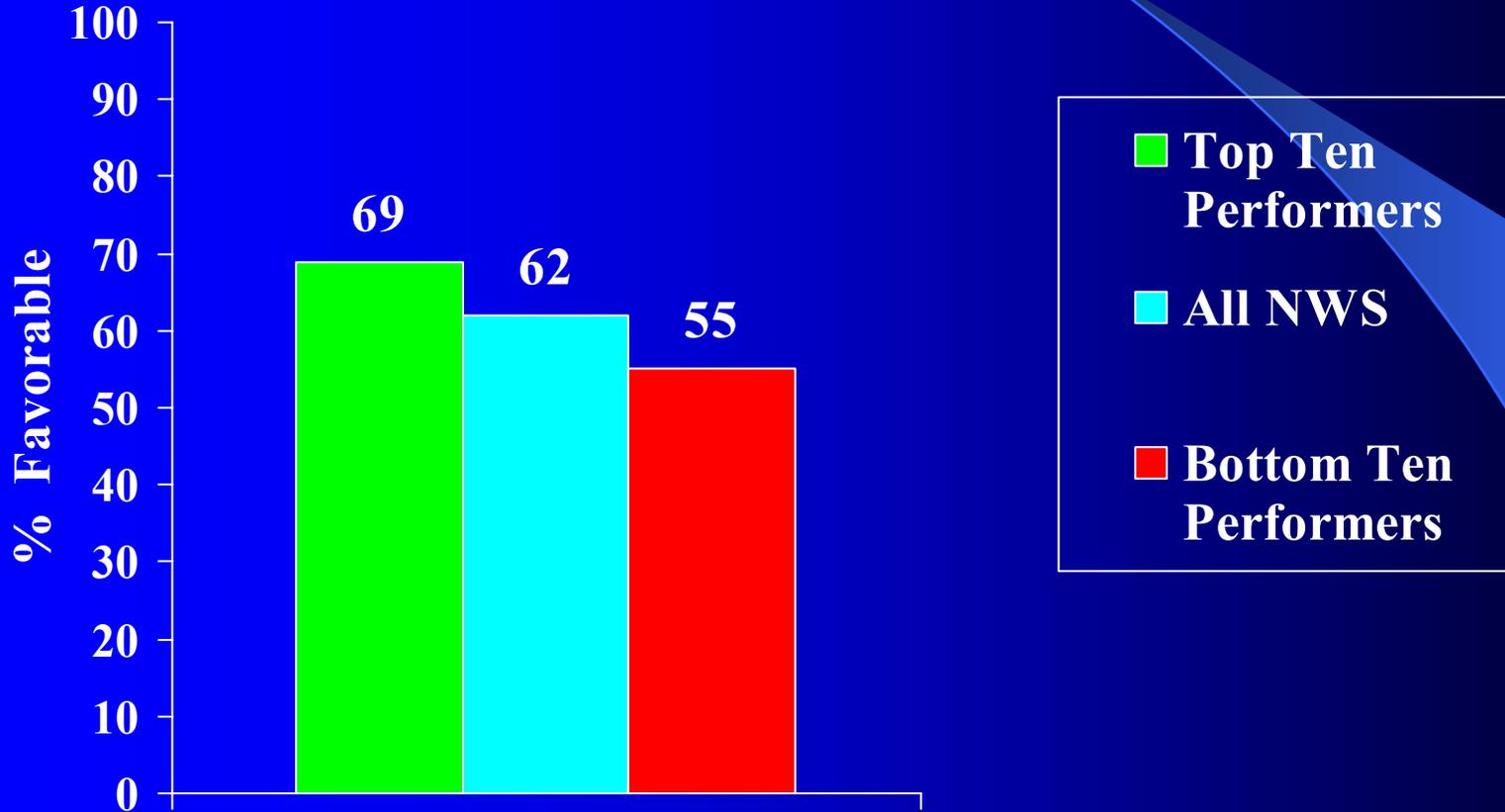
My immediate supervisor is a technically competent professional (knows the job)?

Supervision



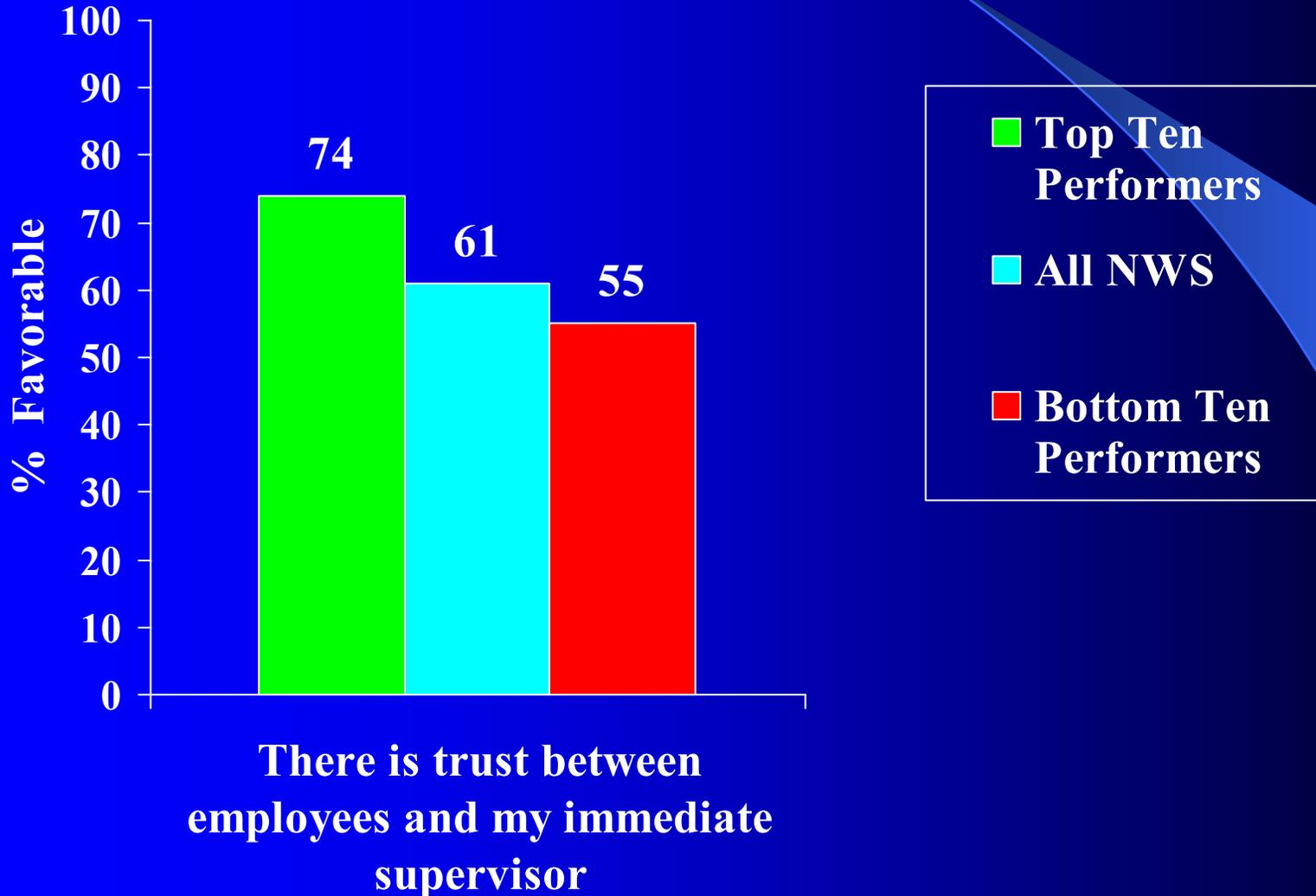
My immediate supervisor is competent in "human relations" (dealing with people who work for him/her)

Supervision

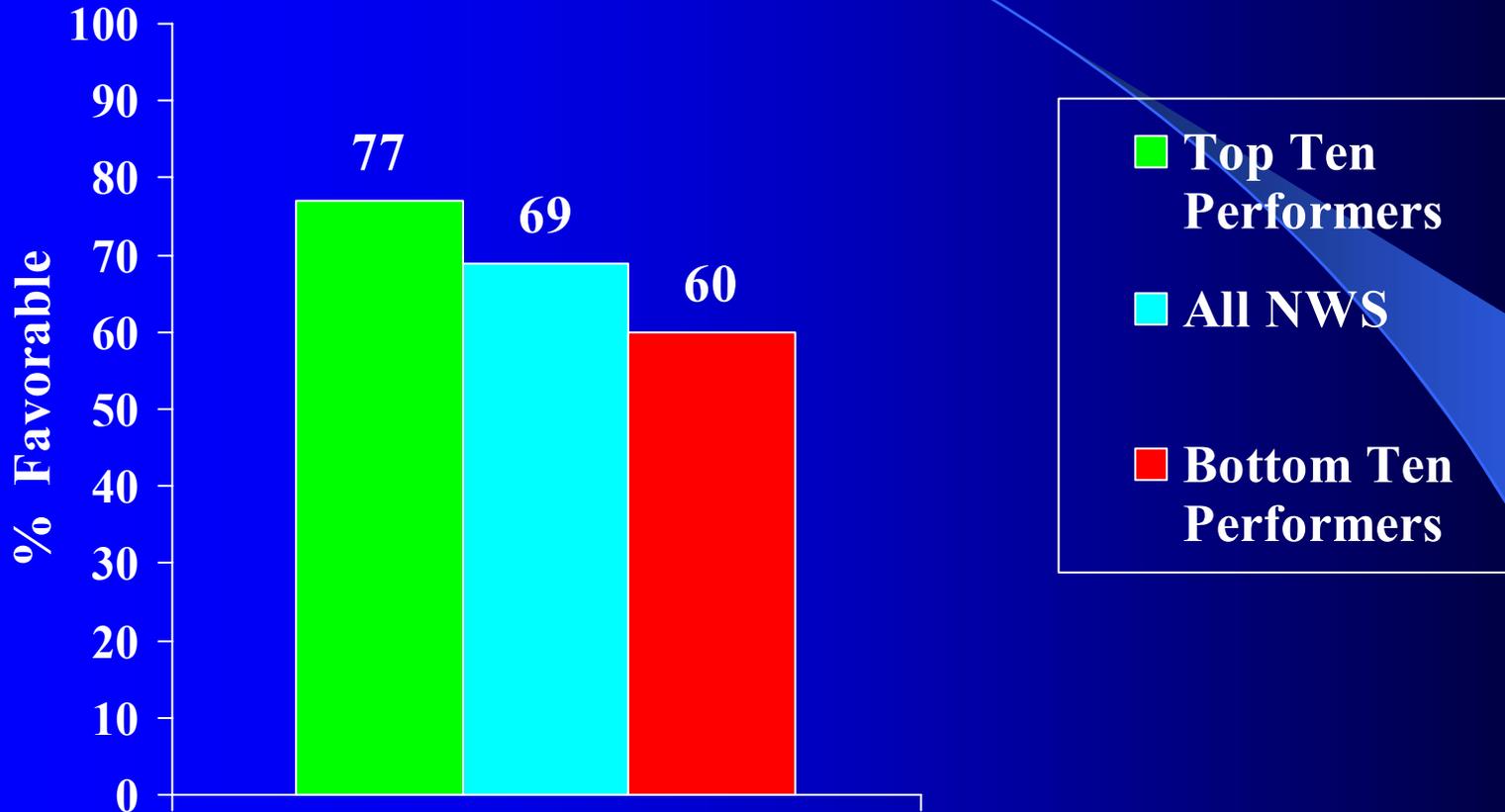


I can depend on my immediate supervisor to support me in the face of opposition

Fairness

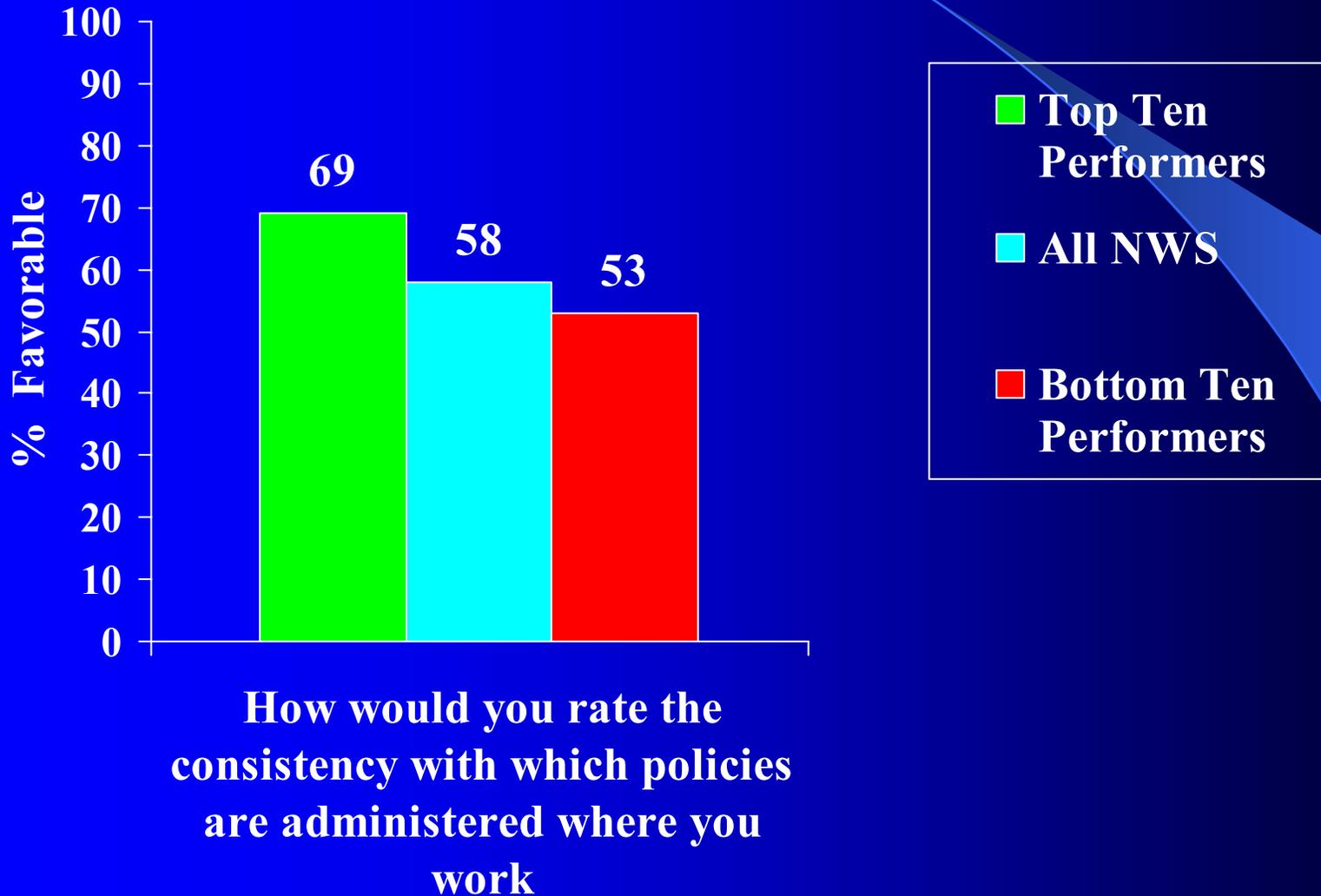


Fairness

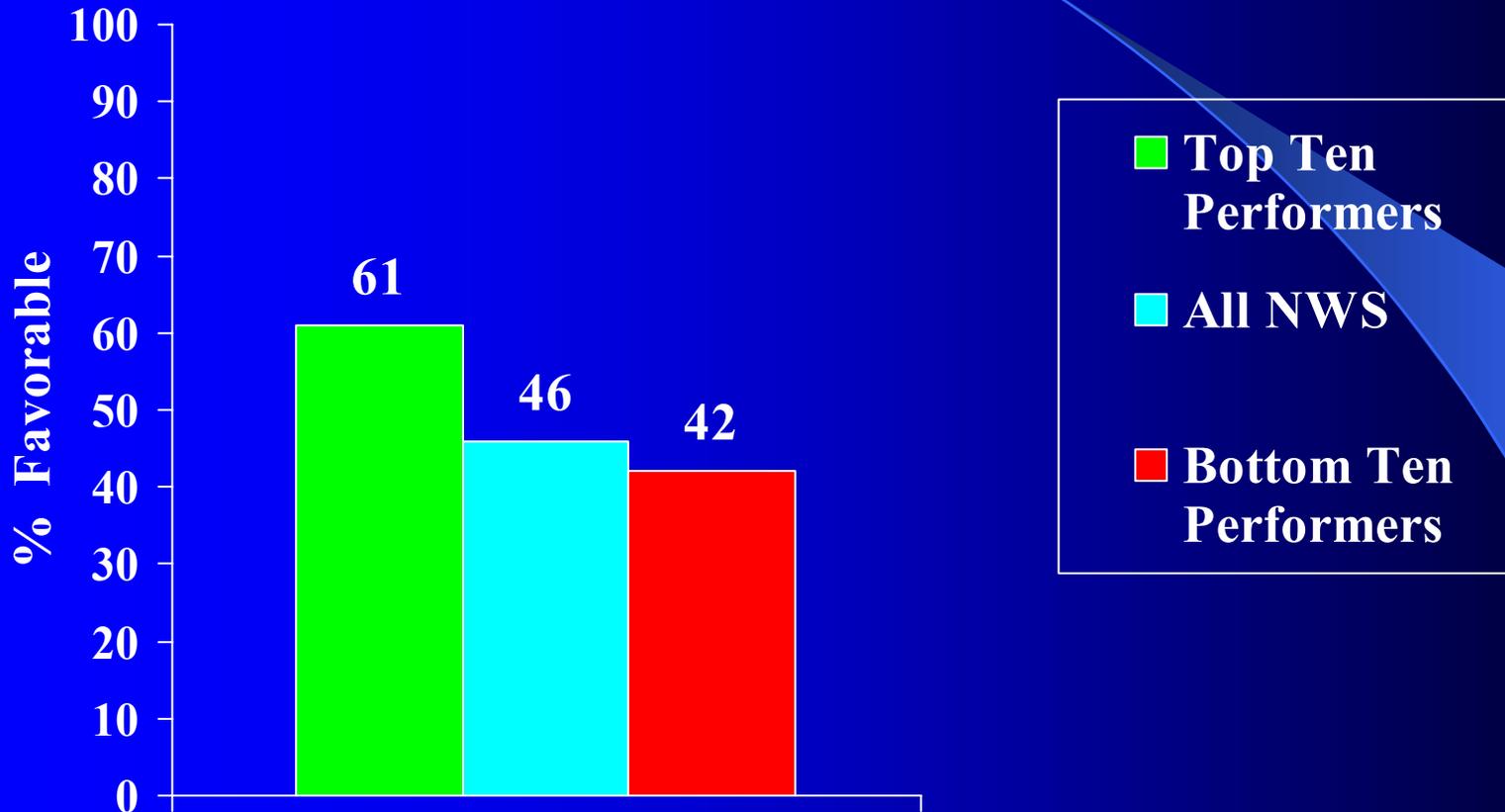


How would you rate the extent to which management treats you with respect and dignity

Fairness

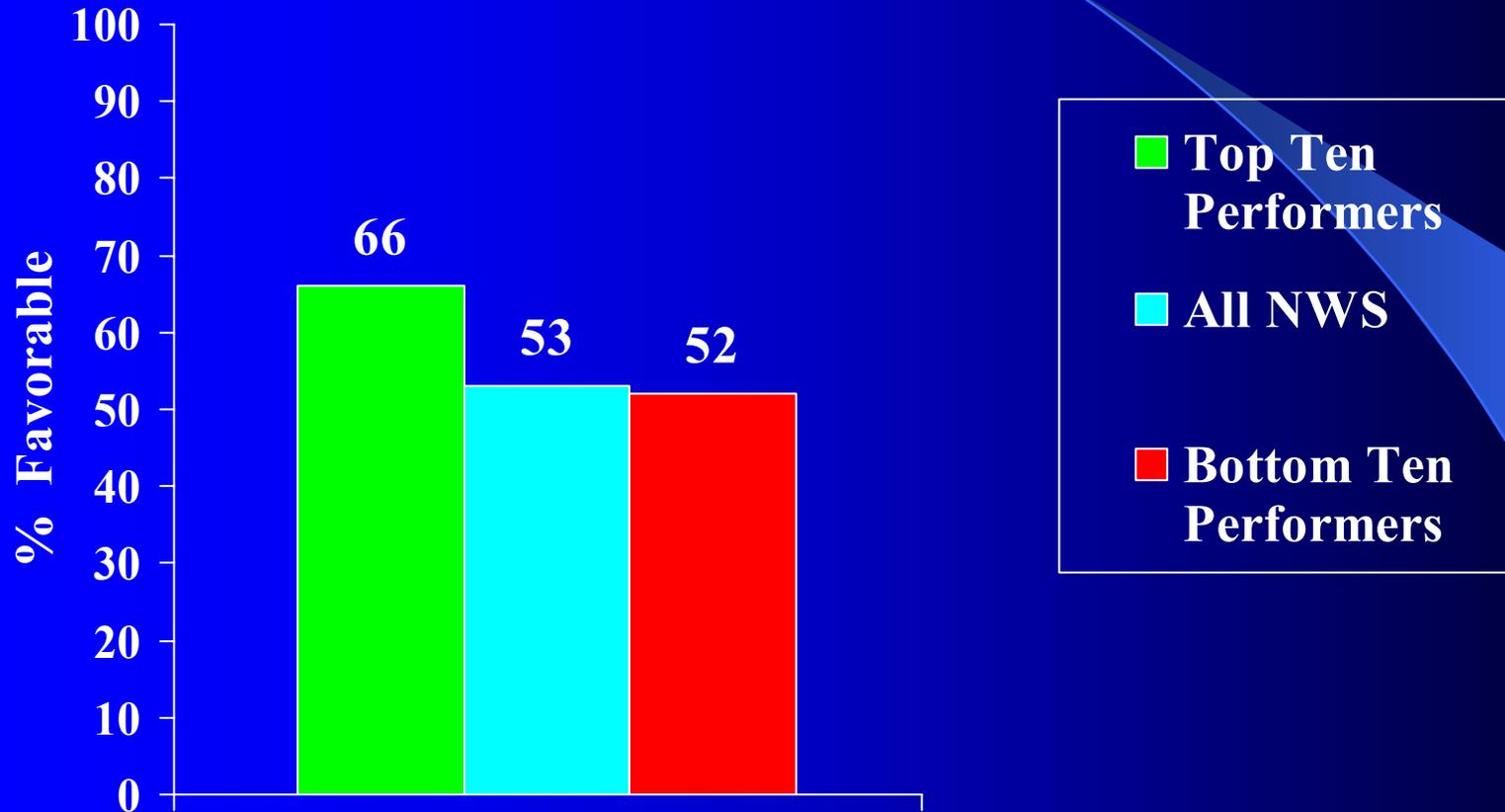


Fairness



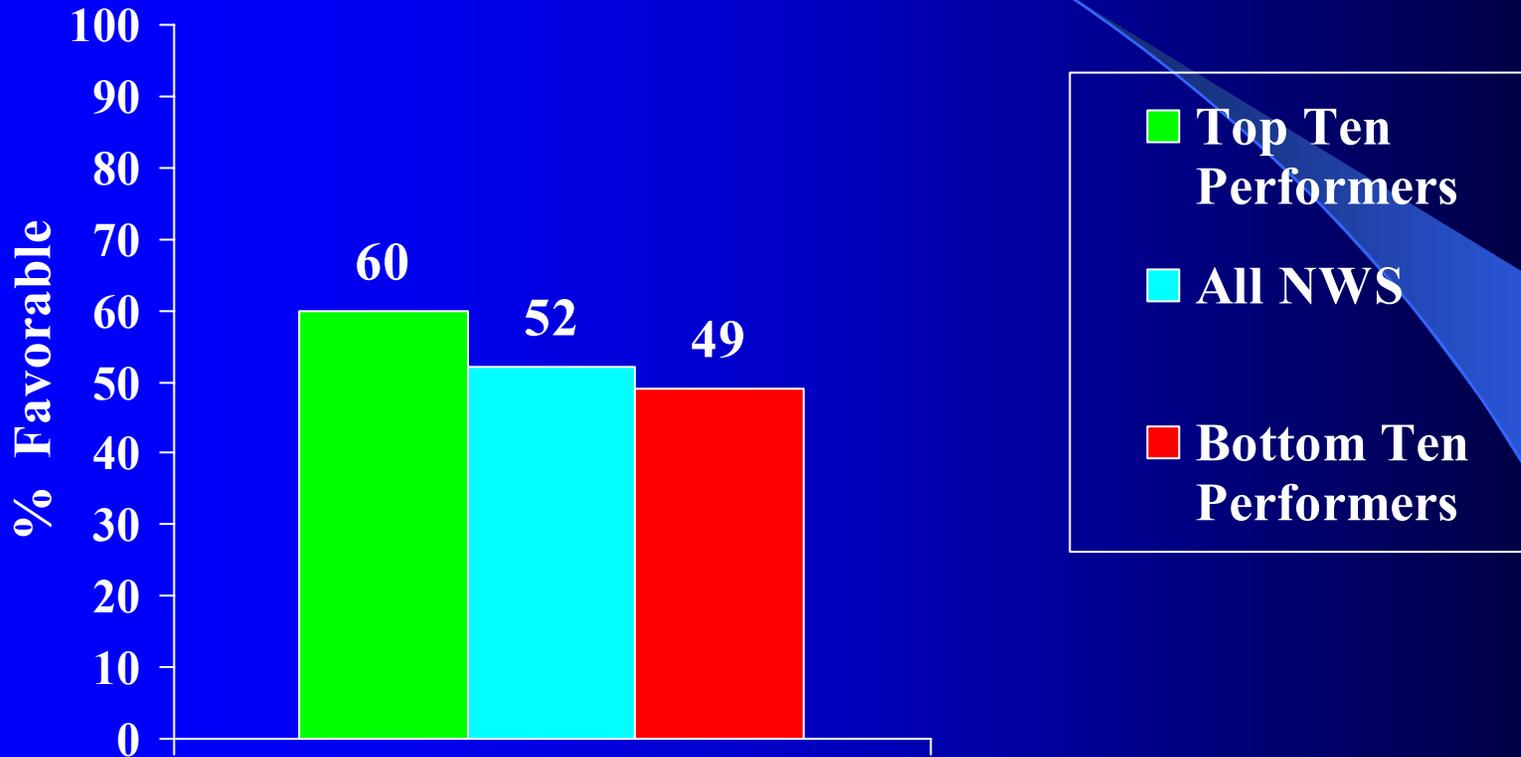
Where I work, there is trust
between management and
union representatives.

Communication



Management promotes effective communication among different workgroups

Innovation



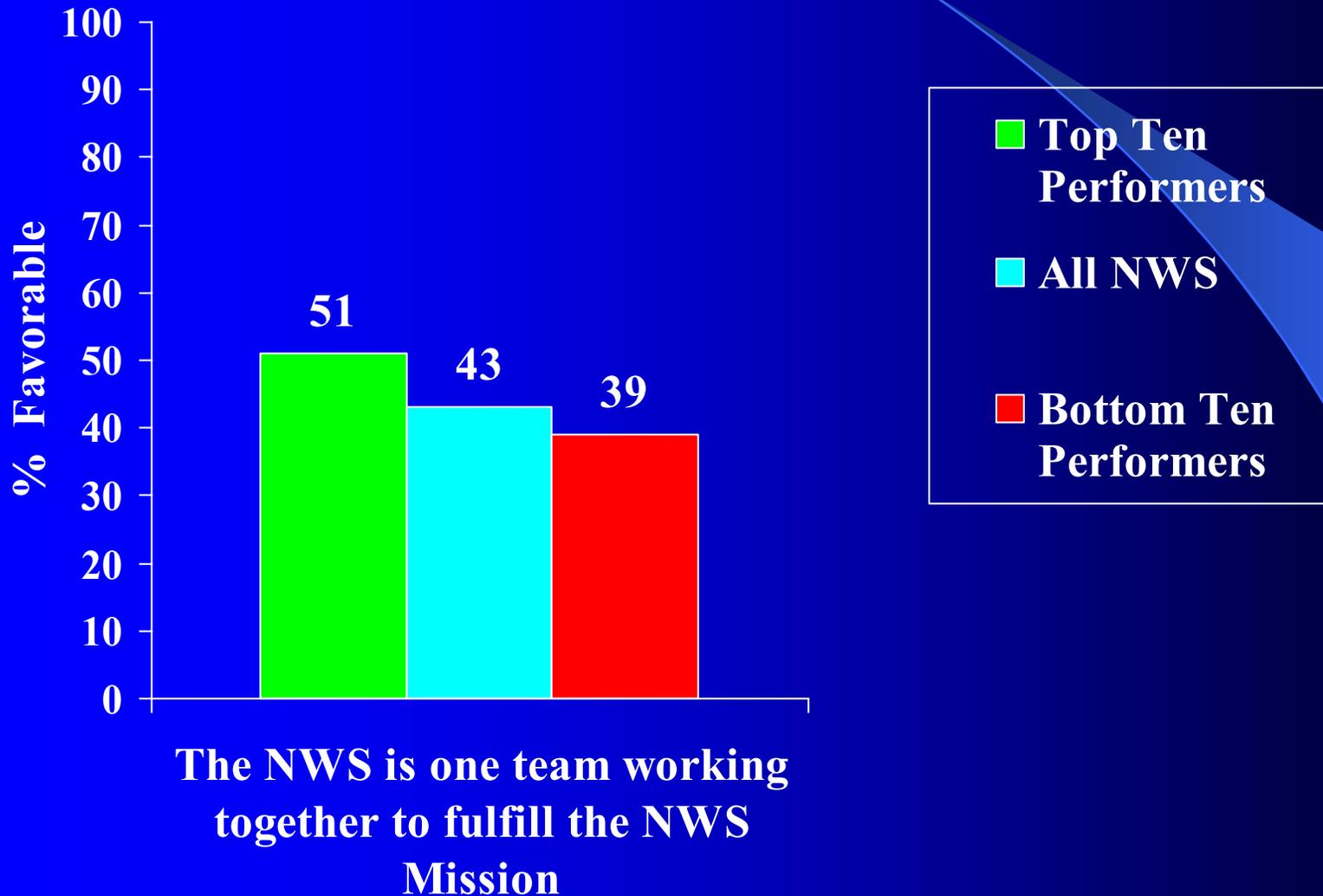
**In my NOAA Line Office,
management is receptive to
change that will improve the
working environment**

Supplemental Questions

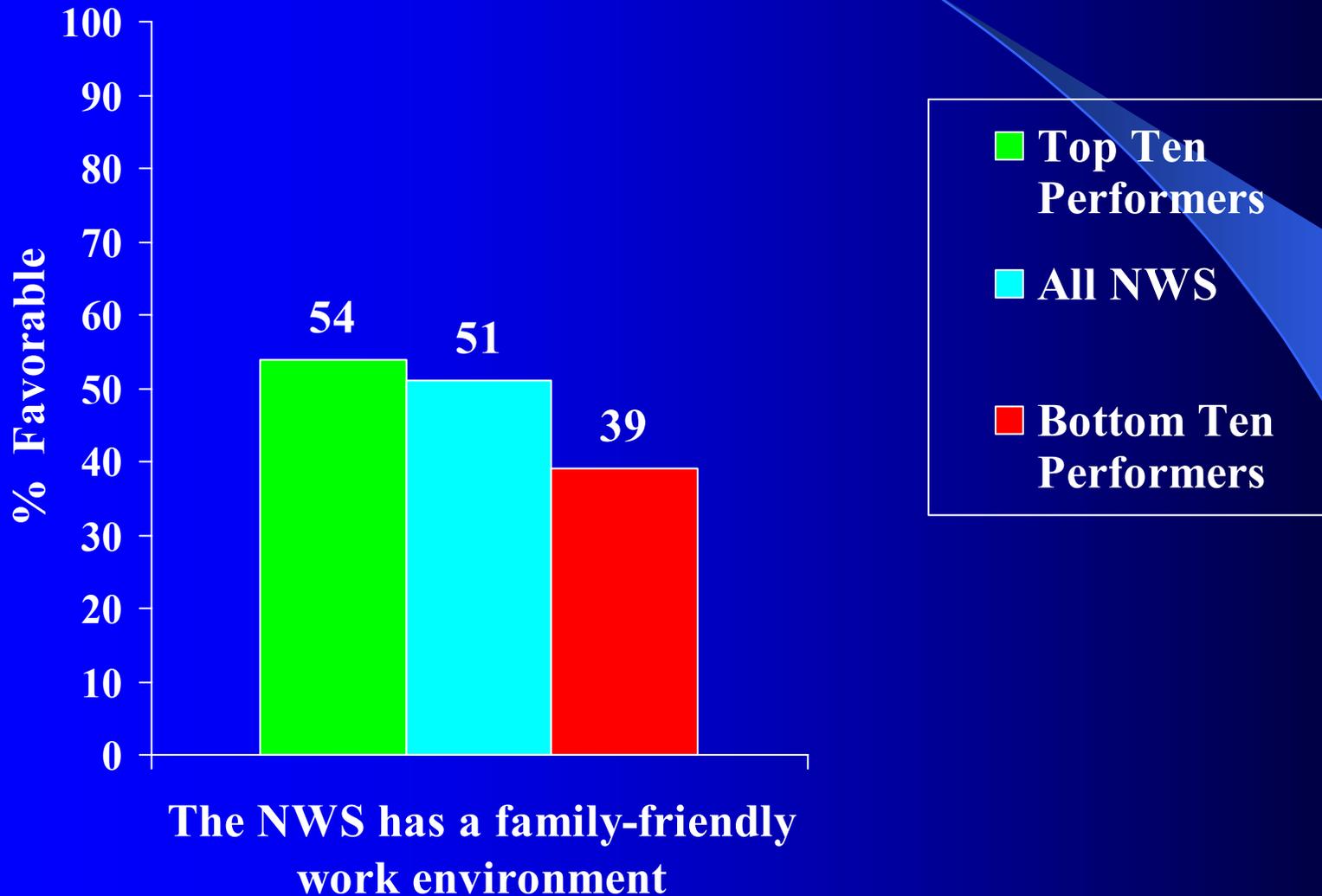


**Supervisors in the NWS take
the time needed to properly
manage their employees**

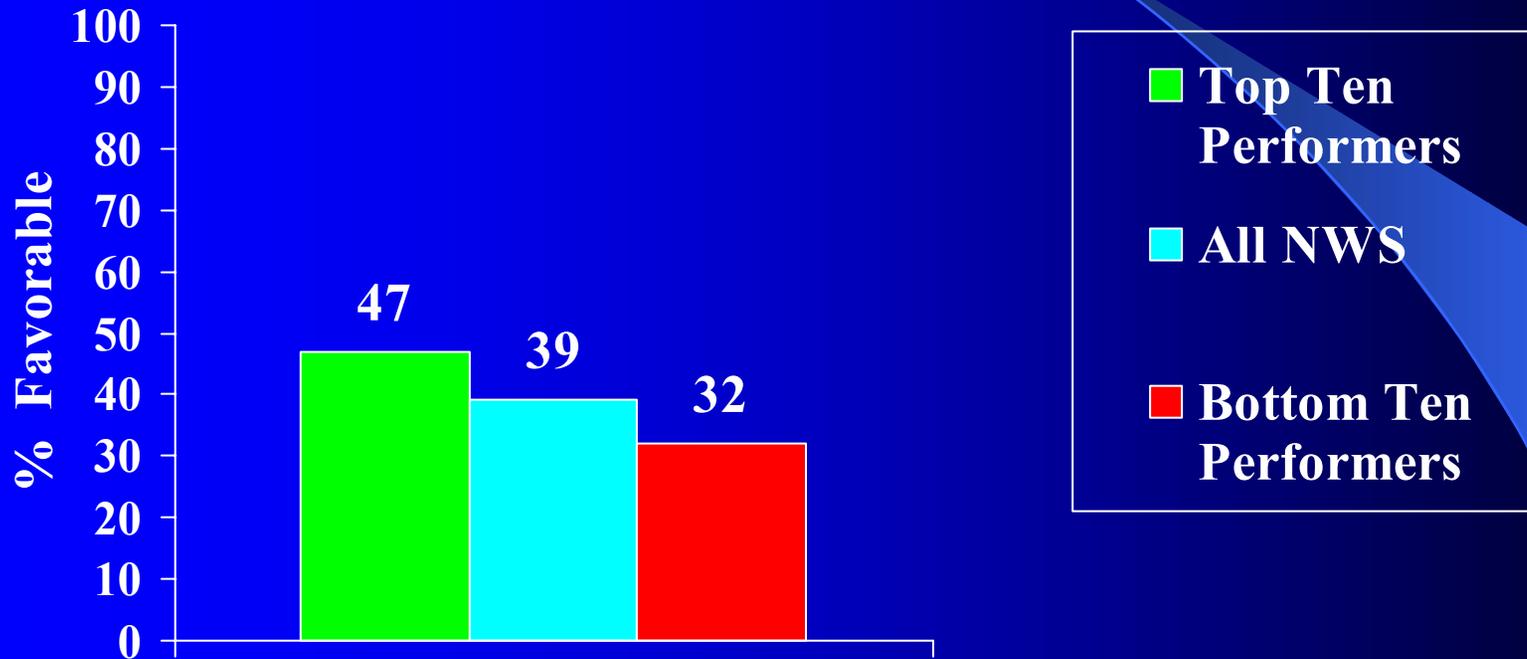
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Supplemental Questions

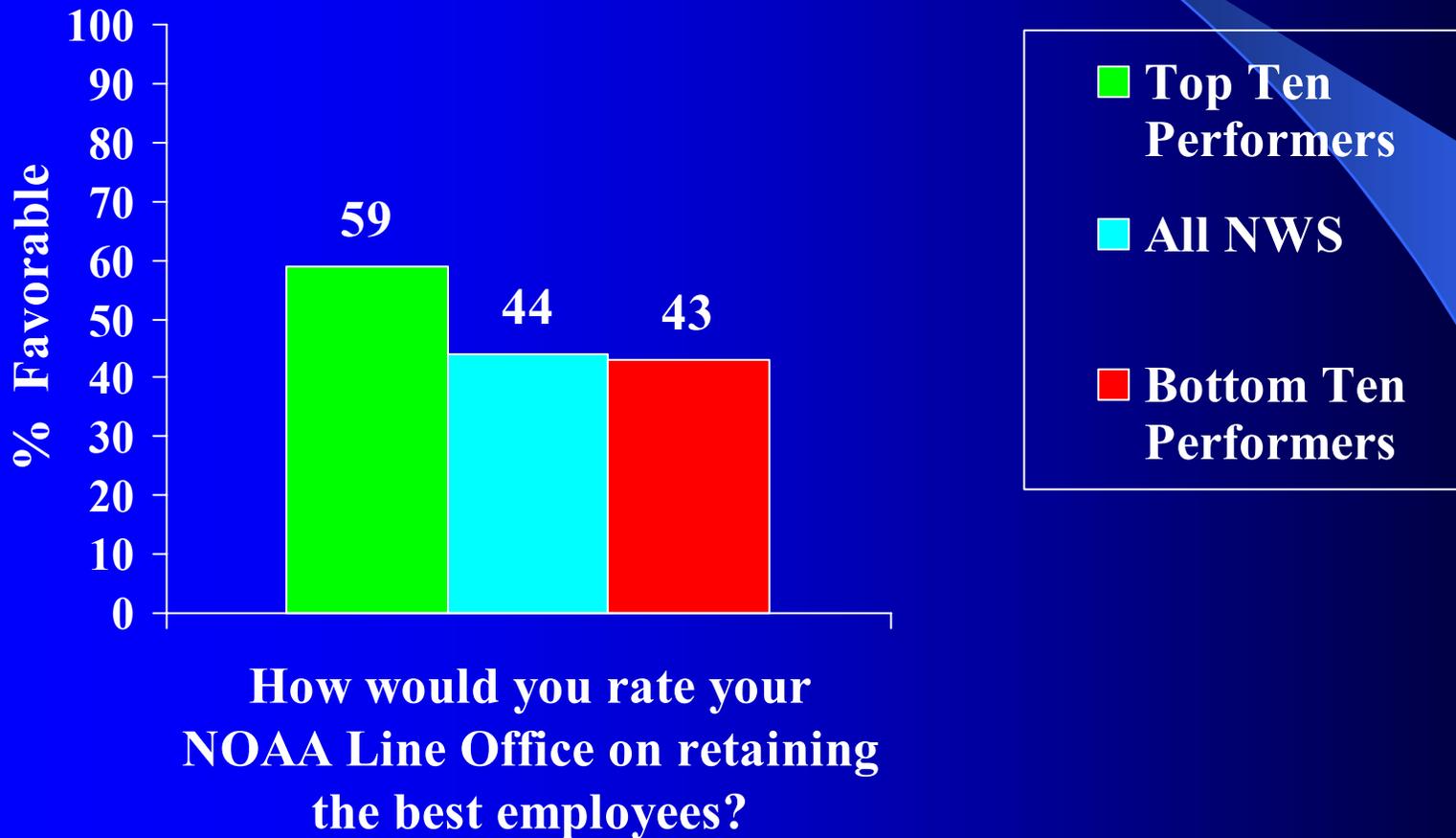


Leadership

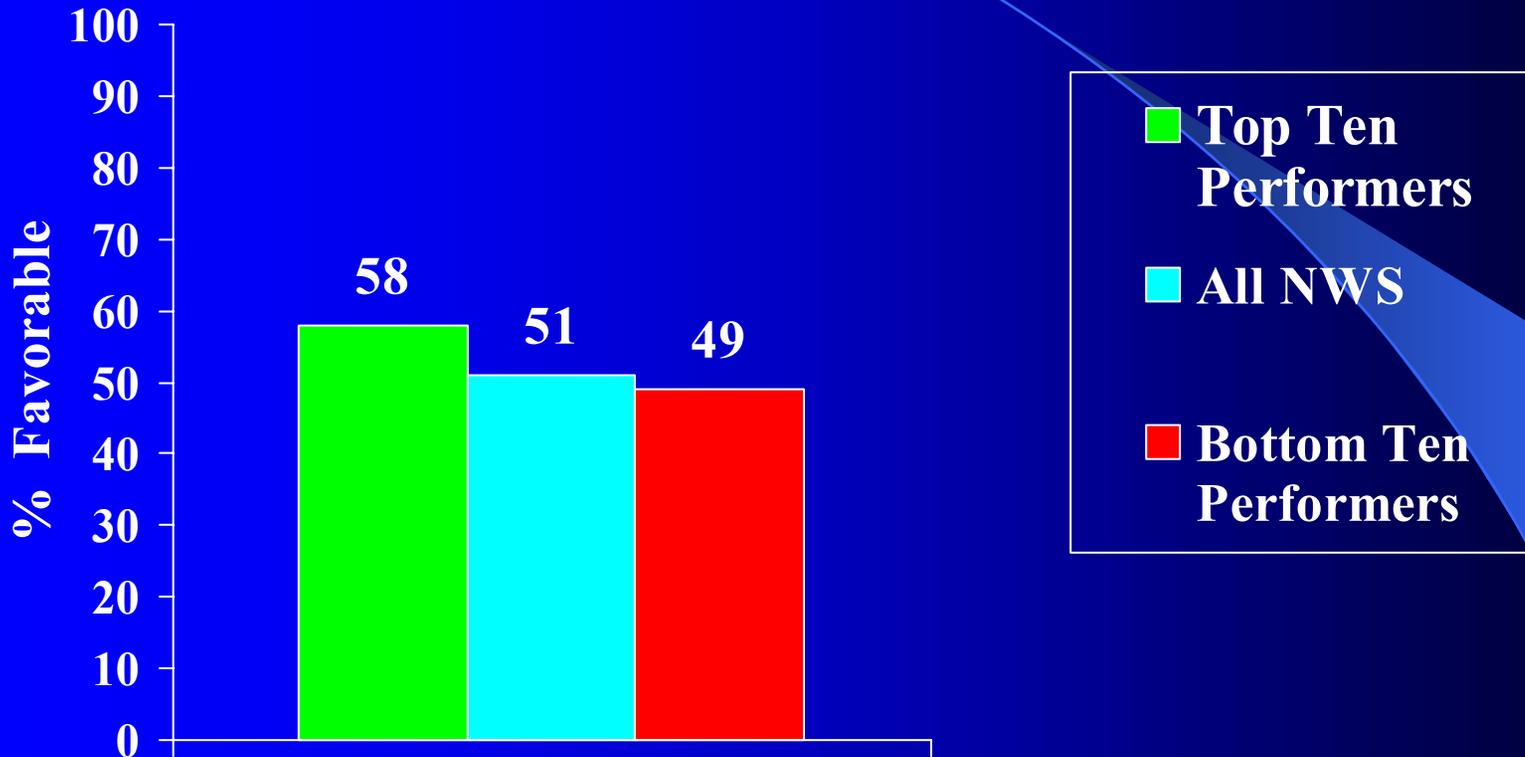


How would you rate the extent that management takes action on employee ideas and opinions

Leadership

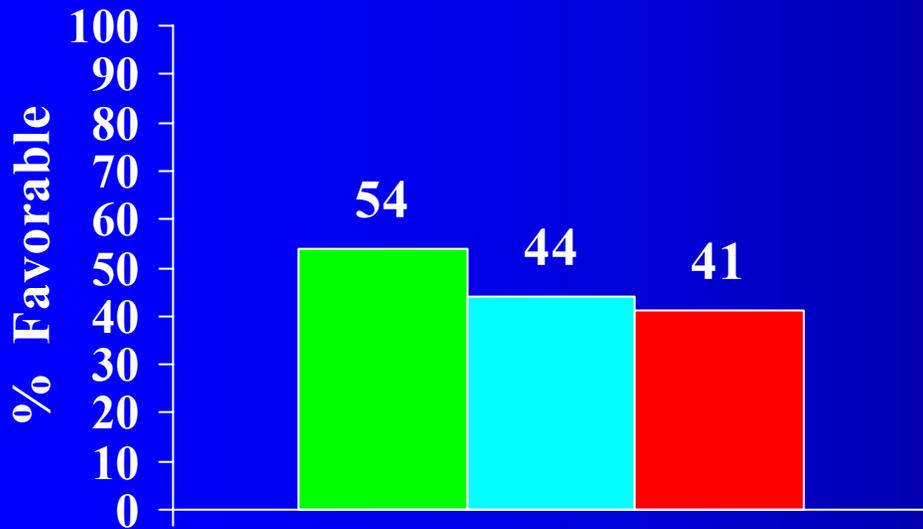


Employee Involvement



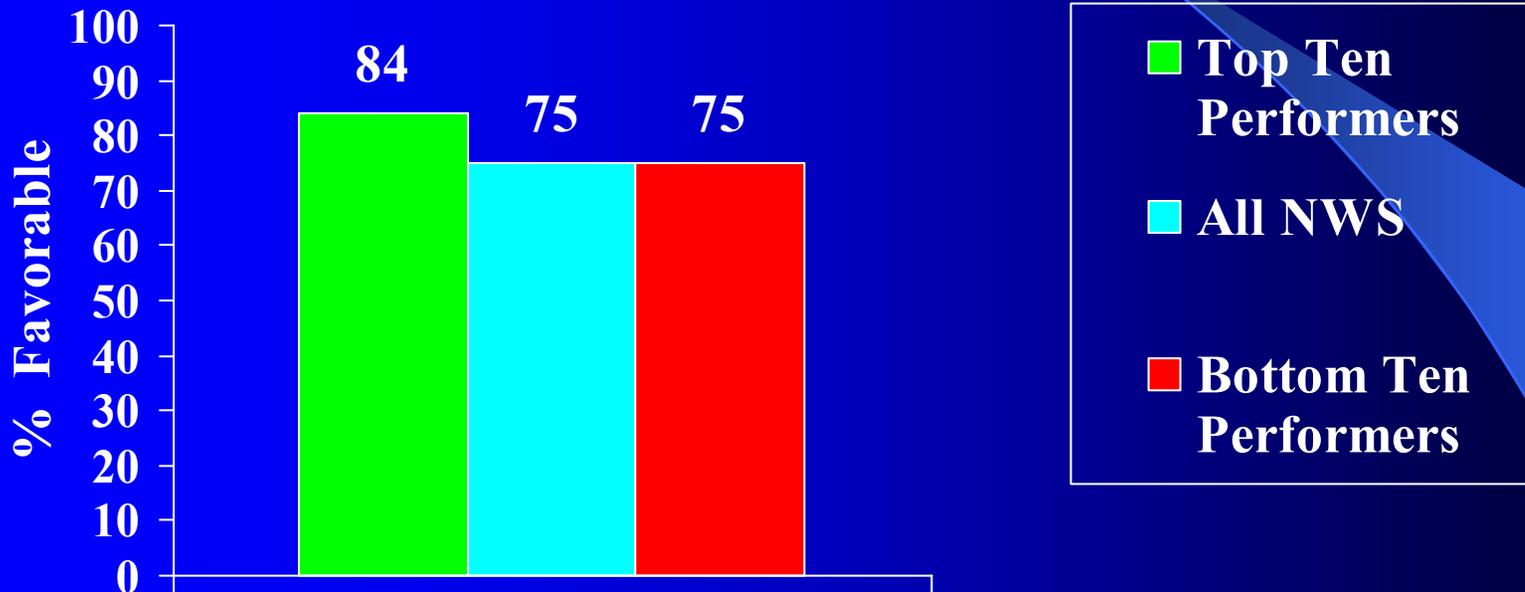
Management encourages employees to openly confront and solve problems rather than sweep them under the rug

Additional Experiences



I have confidence that my management will provide adequate support for the feedback and action portions of the SFA

EEO



**In my NOAA Line Office,
management works well with
employees of different
backgrounds.**

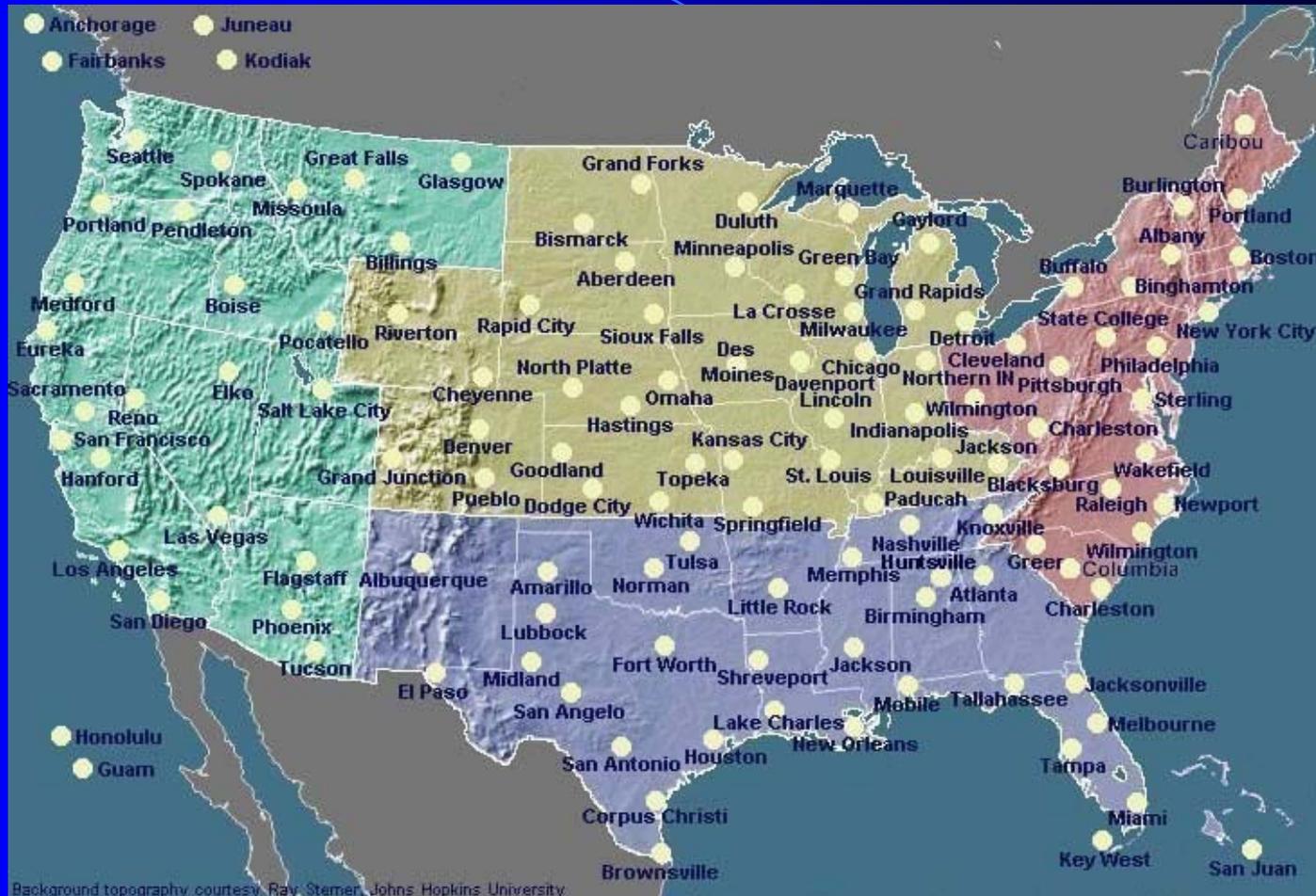
Findings from Phone Interviews of Top Ten Forecast Offices

- Manager leadership demonstrated through action (working shifts, severe weather) often in a subordinate role
- Managers do not micro-manage severe weather operations
- Some managers had anti-role models
- Managers back up their forecasters' decisions
- Managers foster open dialog
- Managers are careful in hiring people to enhance the existing team (consider both skills and personality)
- Office commitment to improvement

Findings from Phone Interviews of Top Ten Forecast Offices

- Managers work closely with the union representatives
- Managers support family/personal needs
- Offices seem to have low staff turnover
- Managers have strong focus on making the work satisfying and enjoyable for their employees
- Managers work to make sure that all employees are appreciated (both mets and non-mets)
- Managers reward quickly and often
- Management team support manager's goals

NWS Forecast Offices and Regions *



** Offices west of the Rockies were excluded from our analyses, as well as those reporting fewer than five tornado events in 2001/2002 and those with fewer than five employees completing the survey.*

Weather Forecast Office (WFO) Culture

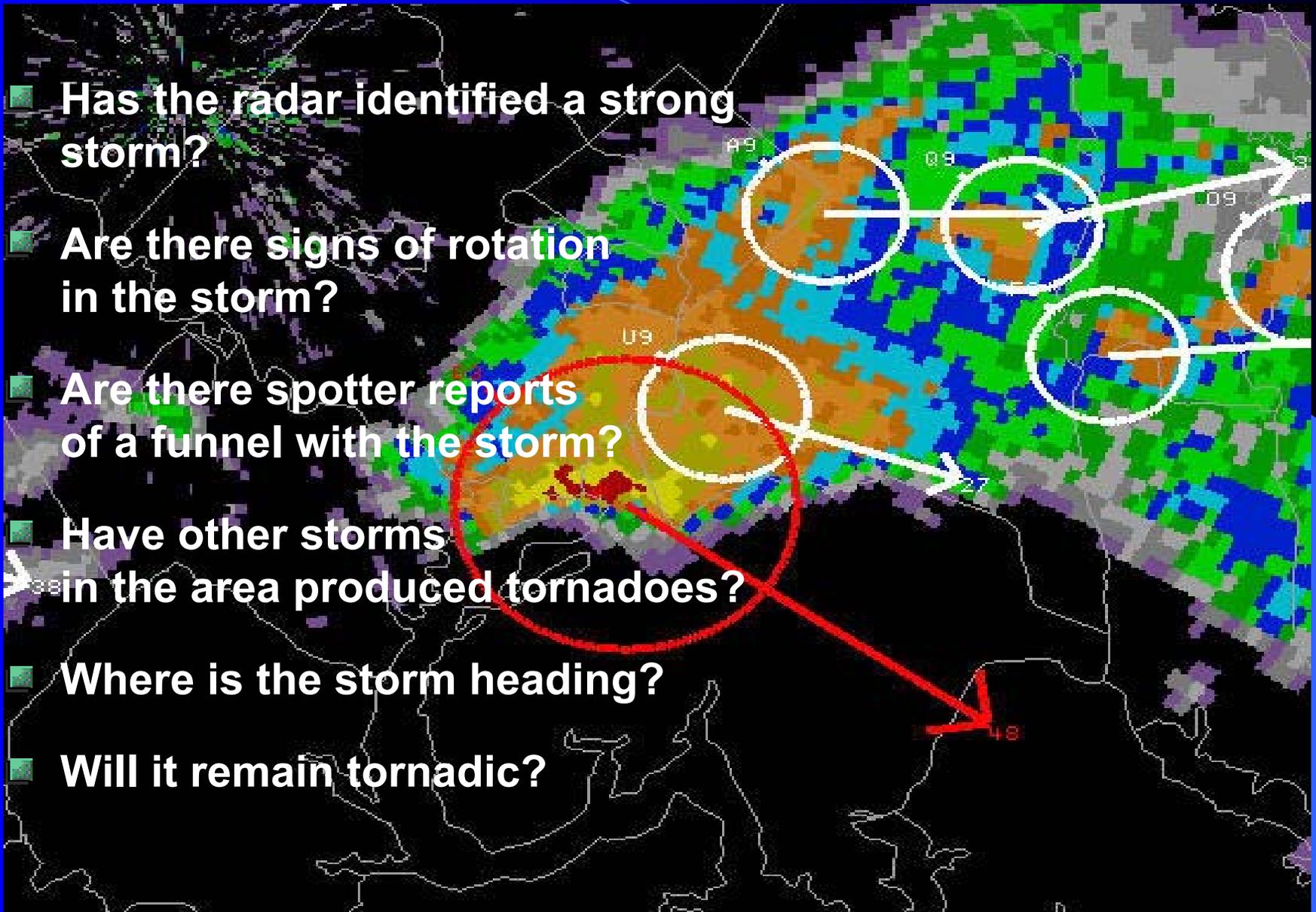


Characteristics

- “Family” unit of 20-30 people, isolated from other offices
- Relatively homogenous in gender, ethnicity, age
- Experienced (10-25 yrs)
- Unionized – can be contentious
- High value placed on Science and Technology and Dedication to Mission

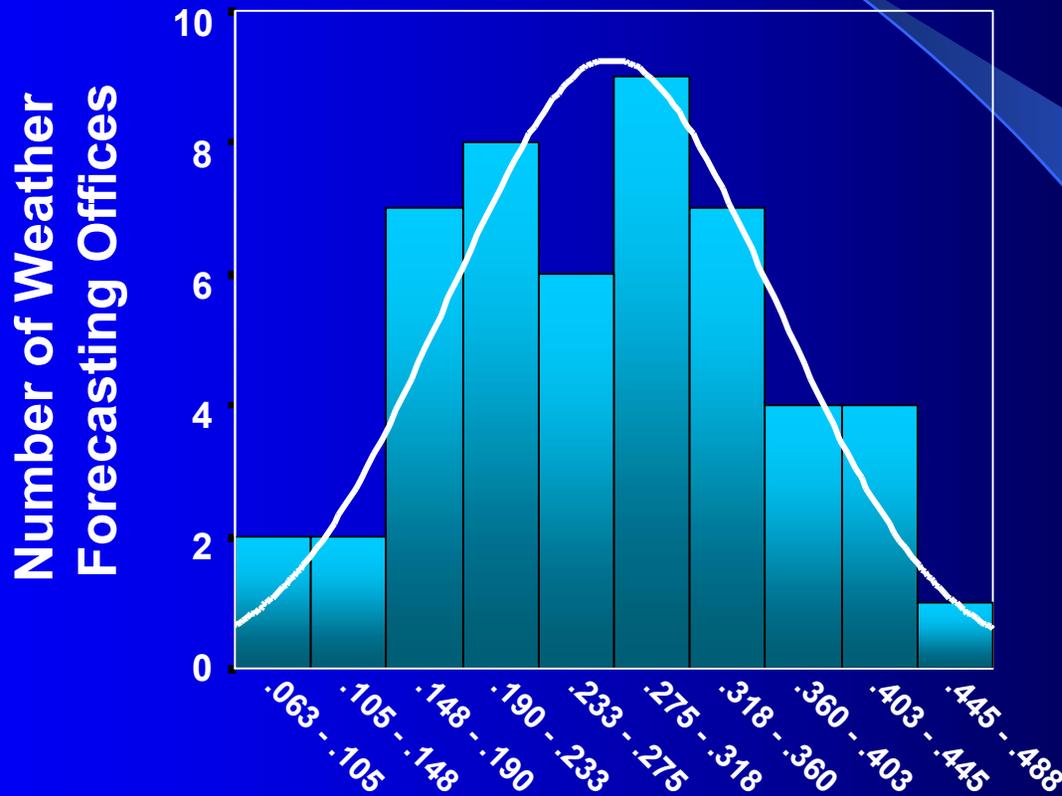
Which Storms are Tornadic?

- Has the radar identified a strong storm?
- Are there signs of rotation in the storm?
- Are there spotter reports of a funnel with the storm?
- Have other storms in the area produced tornadoes?
- Where is the storm heading?
- Will it remain tornadic?



Variation in Critical Success Index (CSI) Scores Across Offices

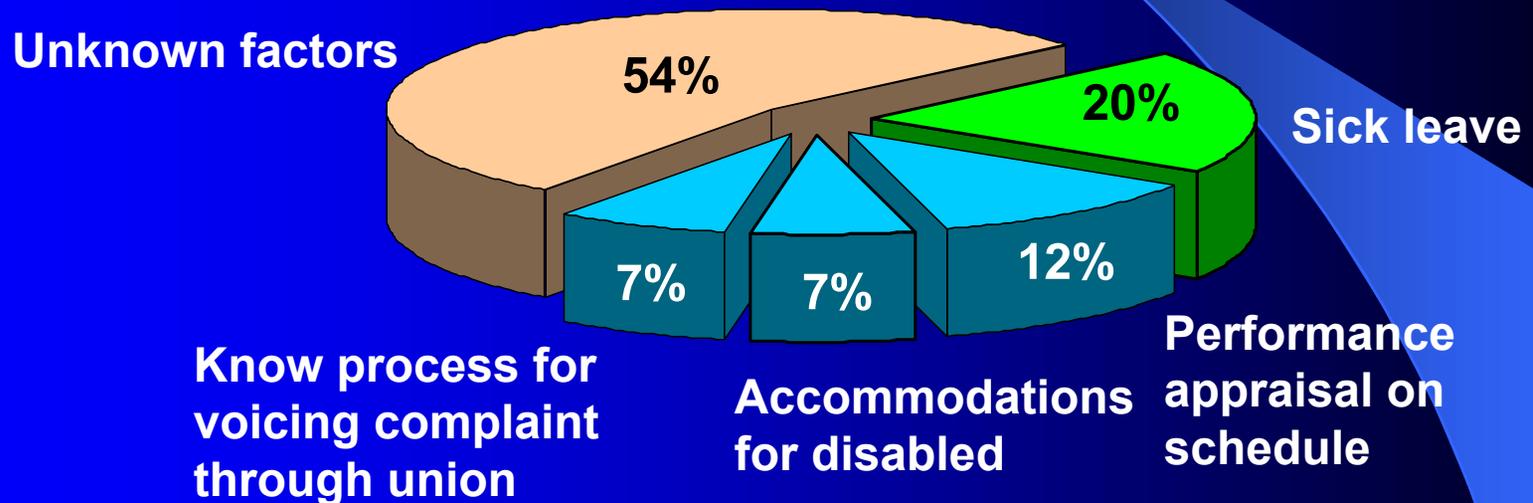
Research Question: How do we explain these CSI performance differences for tornado warnings across WFO's?



Poor Performance  Better Performance

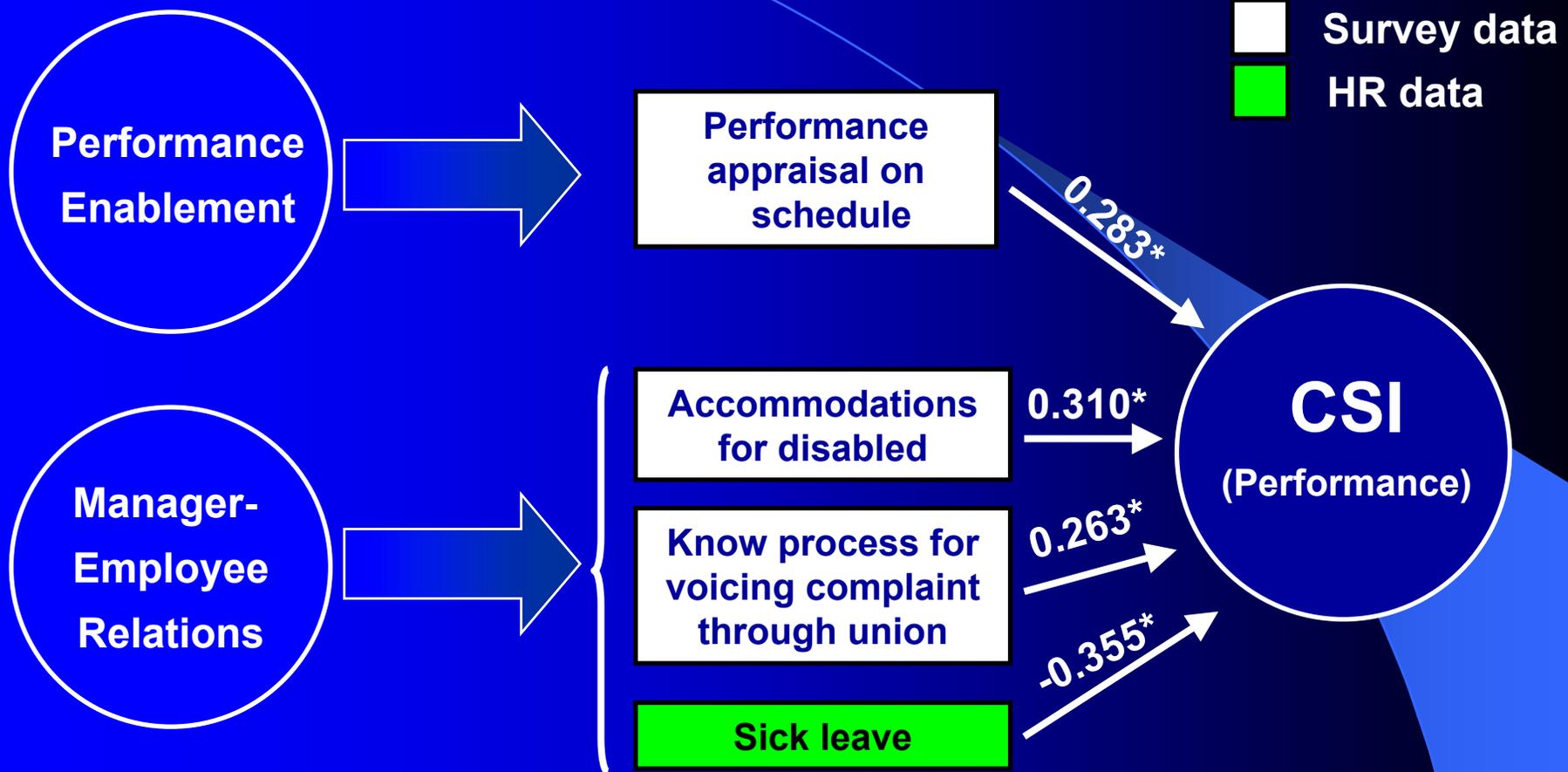
Regression Analysis

Nearly half of the differences in WFOs' performance are accounted for by four variables:



* Results based upon stepwise regression analysis

Conceptual Model



The most important factors in tornado warning performance reflect managerial effectiveness: Performance Orientation and Employee Relations

* Values are Standardized Beta coefficients

THE SICK LEAVE FACTOR

Highest SFA Correlates of Sick Leave
($R = -0.30$ to -0.45 ; Significance: 0.01)

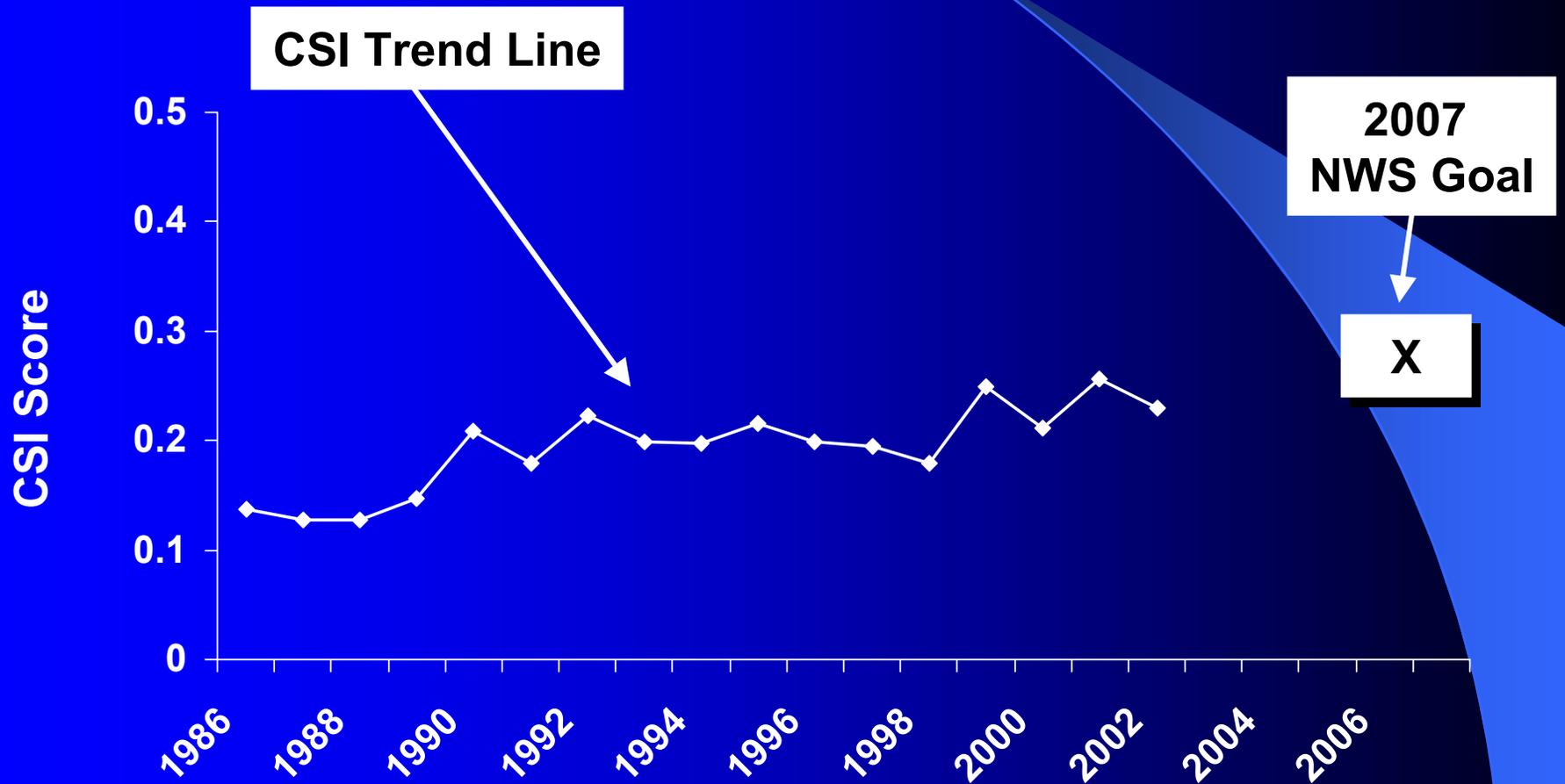
1. Supervisor behavior
2. Work group cooperation and teamwork
3. Emphasis on performance and diversity

THE SICK LEAVE FACTOR (cont.)

People can become ill for all sorts of reasons and one would expect to find *NO CORRELATION* between these factors and sick leave.

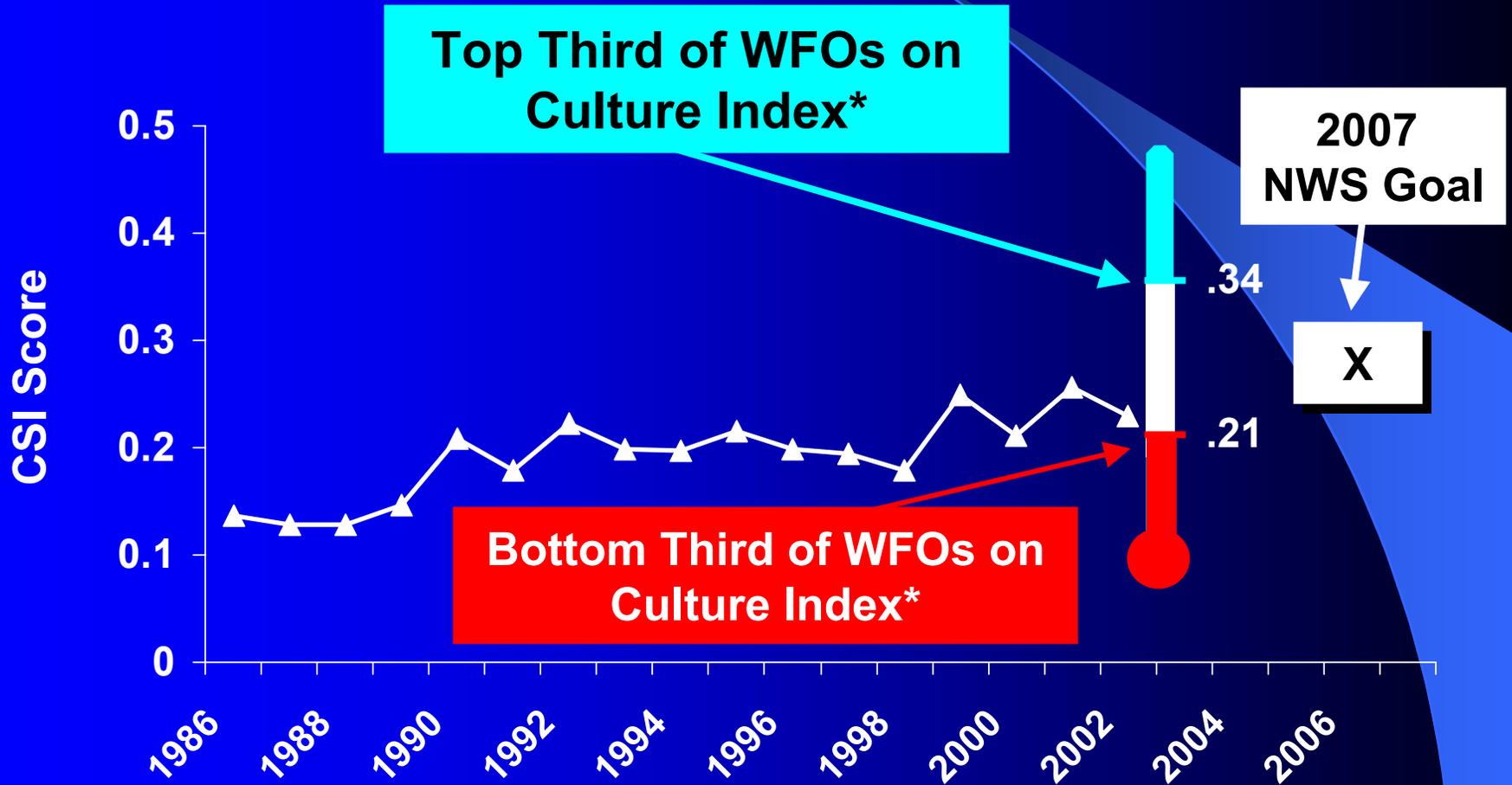
That fact that they are ***STRONGLY NEGATIVELY CORRELATED WITH SICK LEAVE*** suggests that in offices where employees are unhappy about their supervisor's behavior, the lack of cooperation/teamwork and the lack of emphasis on diversity and performance, employees are taking more ***false sick leave*** and/or ***getting sick because of their work environment***. This in turn adversely affects office tornado warning performance.

NWS Tornado Warning Performance



NWS Tornado Warning Performance

WFOs performing best on cultural variables have reached the NWS goal four years ahead of schedule:



*The Culture Index comprises the following items: Performance appraisal on schedule, Accomodations for disabled and Know process for voicing complaint through union

Conclusions

- Improvements in technology are extremely important to improve tornado warning performance. They promise to raise the performance of *all* offices.
- In addition, we have found that leadership in *individual* National Weather Service offices also has a demonstrable impact on performance.
- In fact, the quantitative goal of excellence the National Weather Service has set for itself could be achieved by attending to these cultural variables alone.

Conclusions (cont.)

- **Where diversity is managed better, a better job is done carrying out the National Weather Service mission!**
- **Where diversity is managed better, the cost of carrying out the National Weather Service mission is reduced!**
- **SFA 2002 results show that the National Weather Service should focus on aligning the management practices in the all our offices with the NOAA Diversity Vision. An improvement strategy based only on science and technology without an aggressive managing diversity component is likely to fall short of the mark.**
- **This is the Business Case for Managing Diversity for NOAA's National Weather Service**

High Performance Workgroup



Highly Accurate Warnings
Low Sick Leave

Low Performance Workgroup



Moderately Accurate Warnings
High Sick Leave

Bottom Line:

The key to NOAA success lies with you,
its middle managers.

You are on the front lines leading NOAA employees.

You can tap into NOAA's unrealized potential.

You can make the NOAA Diversity Vision a reality.

NOAA's Managers can make a BIG DIFFERENCE!

And the PAYOFF IS GREAT!

Question

Knowing that Diversity Issues have a significant impact on our ability to perform NOAA's Mission and we are being held accountable to meeting our GPRA performance measures...

What are we going to do about it?

What are **YOU** going to do about it?