Using Quantitative and Qualitative Data to Revise Program Theory: Description of Process

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Session 229

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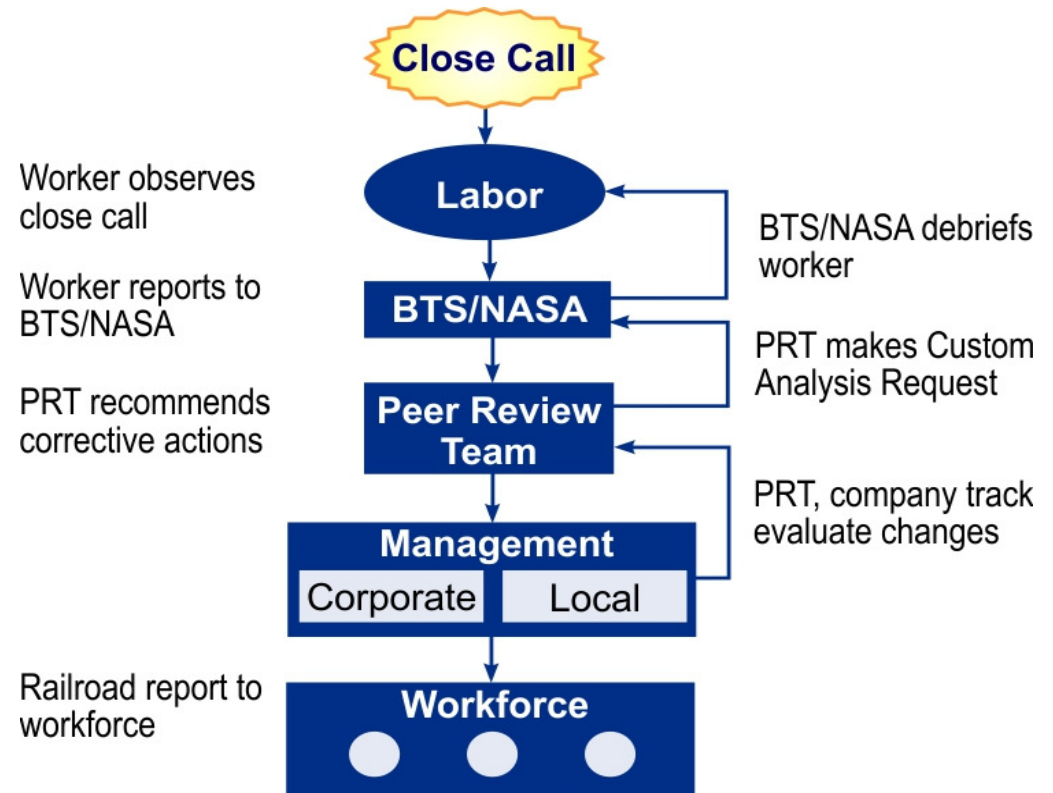Volpe National Transportation Systems Center

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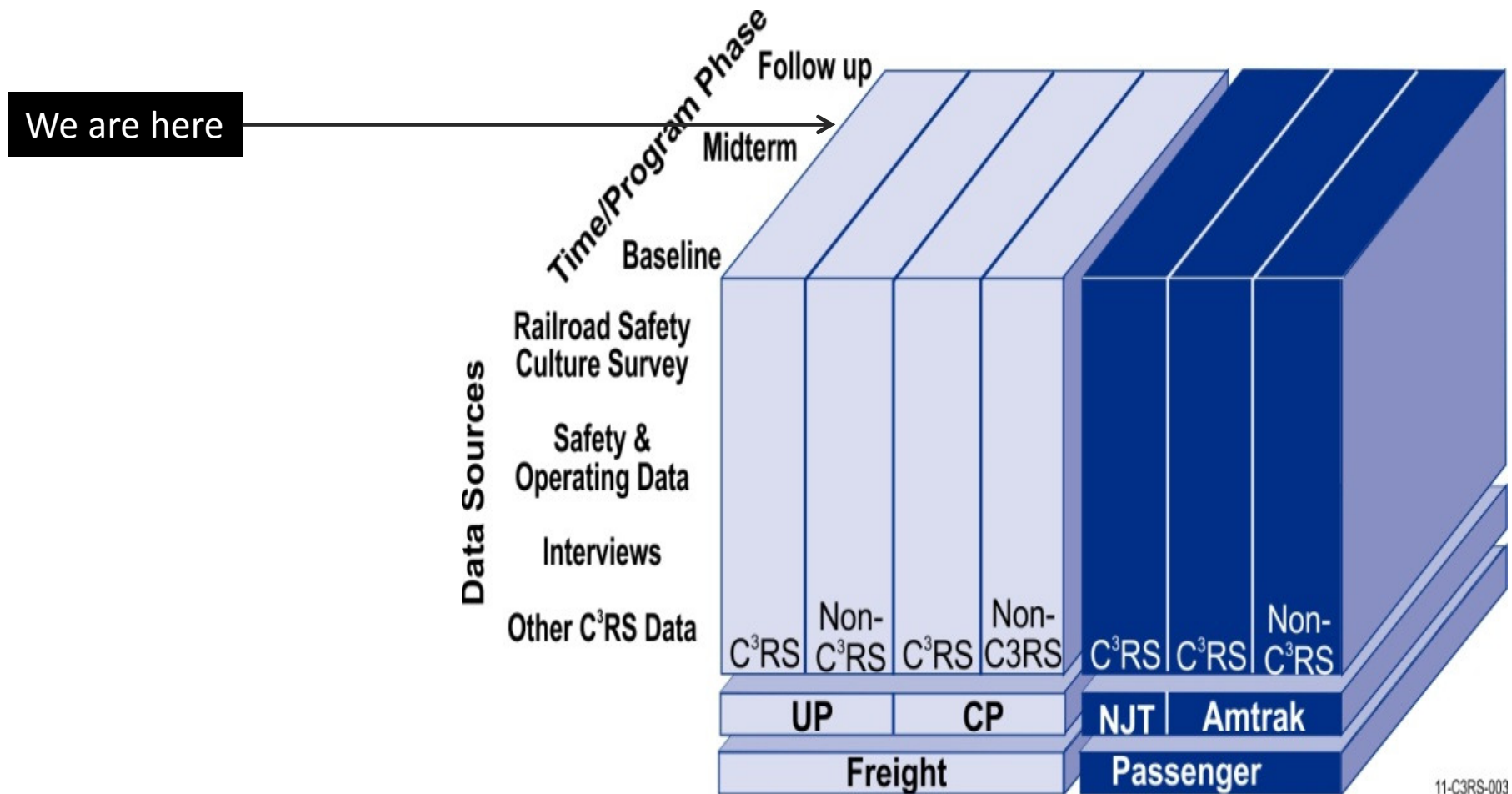
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The Confidential Close Call Reporting System

Why is it being tested?

- ❑ Programs like this have worked in other industries, but were never tested in railroad settings.
- ❑ FRA established 4 pilot projects to test close call feasibility.

Close Call

Worker observes close call — **Labor** — BTS/NASA debriefs worker

Worker reports to BTS/NASA — **BTS/NASA** — PRT makes Custom Analysis Request

PRT recommends corrective actions — **Peer Review Team** — PRT, company track evaluate changes

Management — Corporate | Local

Railroad report to workforce — **Workforce**

Evaluation Design: Comparative Case Study Using Quantitative and Qualitative Data

Evaluation Questions

❑ What are the characteristics of a successful C^{3}RS implementation?

❑ What is the impact of C^{3}RS on safety and safety culture?

❑ What are the conditions needed to make C^{3}RS sustainable?

Use Mixed Methods Data to Construct Models That Explain Decisions to Continue or Not Continue With C³RS

What observation do we need to explain?

❑ Three companies made a rational decision to continue/expand C³RS

❑ One company made a rational decision not to continue

To understand the pattern we used the data to construct "post-hoc" logic models

❑ Specific model with the particulars of the disengagement case

❑ Projection of the post-hoc model onto the original model

❑ General post-hoc model to compare cases of engagement and disengagement
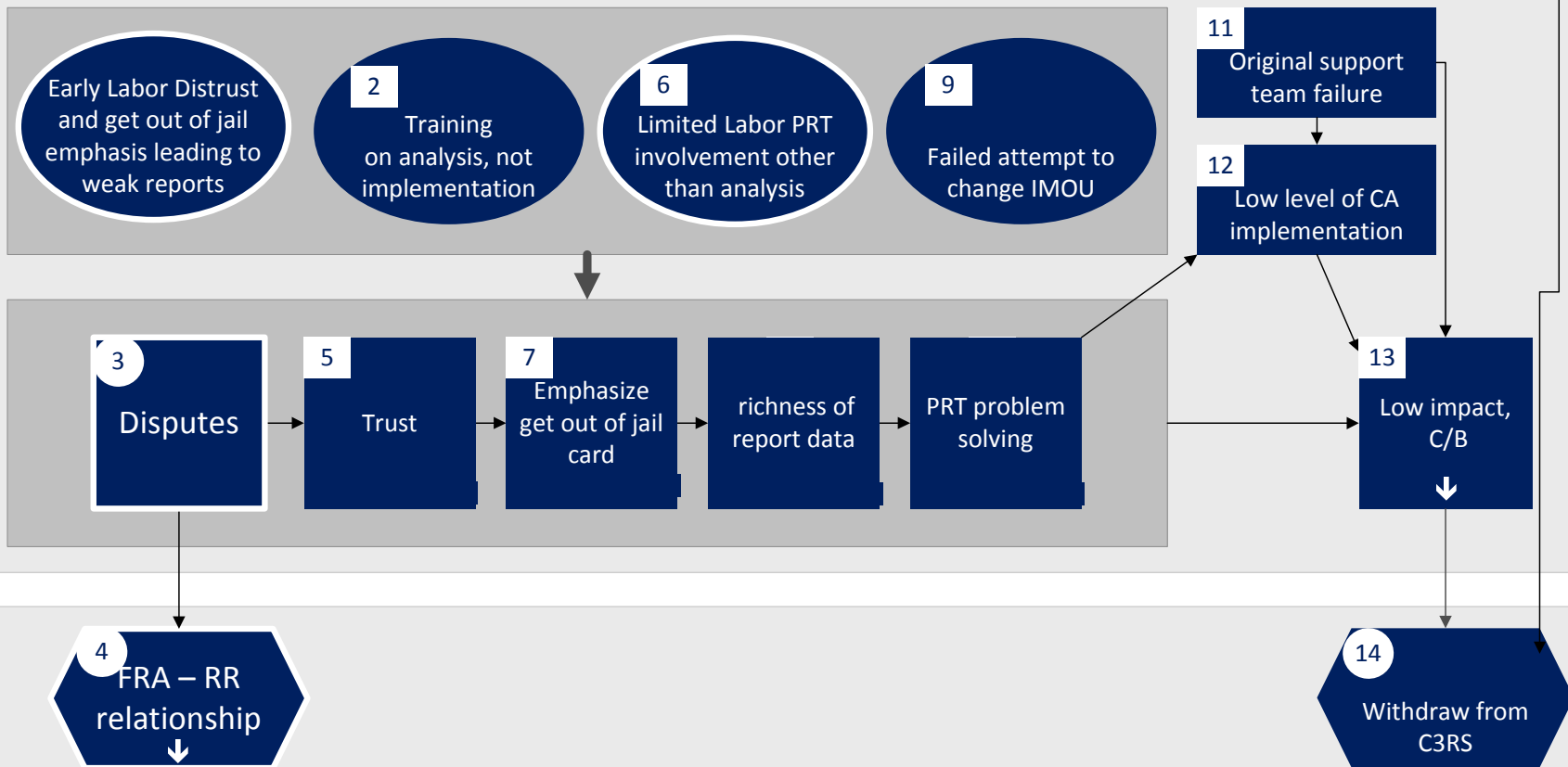
Model Specific to the Disengagement Case

1

Railroad environmental factors that combine to affect C3RS operations and effectiveness
- **Inconsistency due to senior management transitions**
- Inter-union issues
- Business conditions
- labor/management issues
- Collaboration vs. discipline balance
- Others

C3RS within the Railroad

Early Labor Distrust and get out of jail emphasis leading to weak reports

2 Training on analysis, not implementation

6 Limited Labor PRT involvement other than analysis

9 Failed attempt to change IMOU

11 Original support team failure

12 Low level of CA implementation

3 Disputes

5 Trust

7 Emphasize get out of jail card

richness of report data

PRT problem solving

13 Low impact, C/B

4 FRA – RR relationship

14 Withdraw from C3RS

Consequences outside of Railroad corporate boundaries

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Mapping of Post-hoc Model Onto Original (Stakeholder based) Model

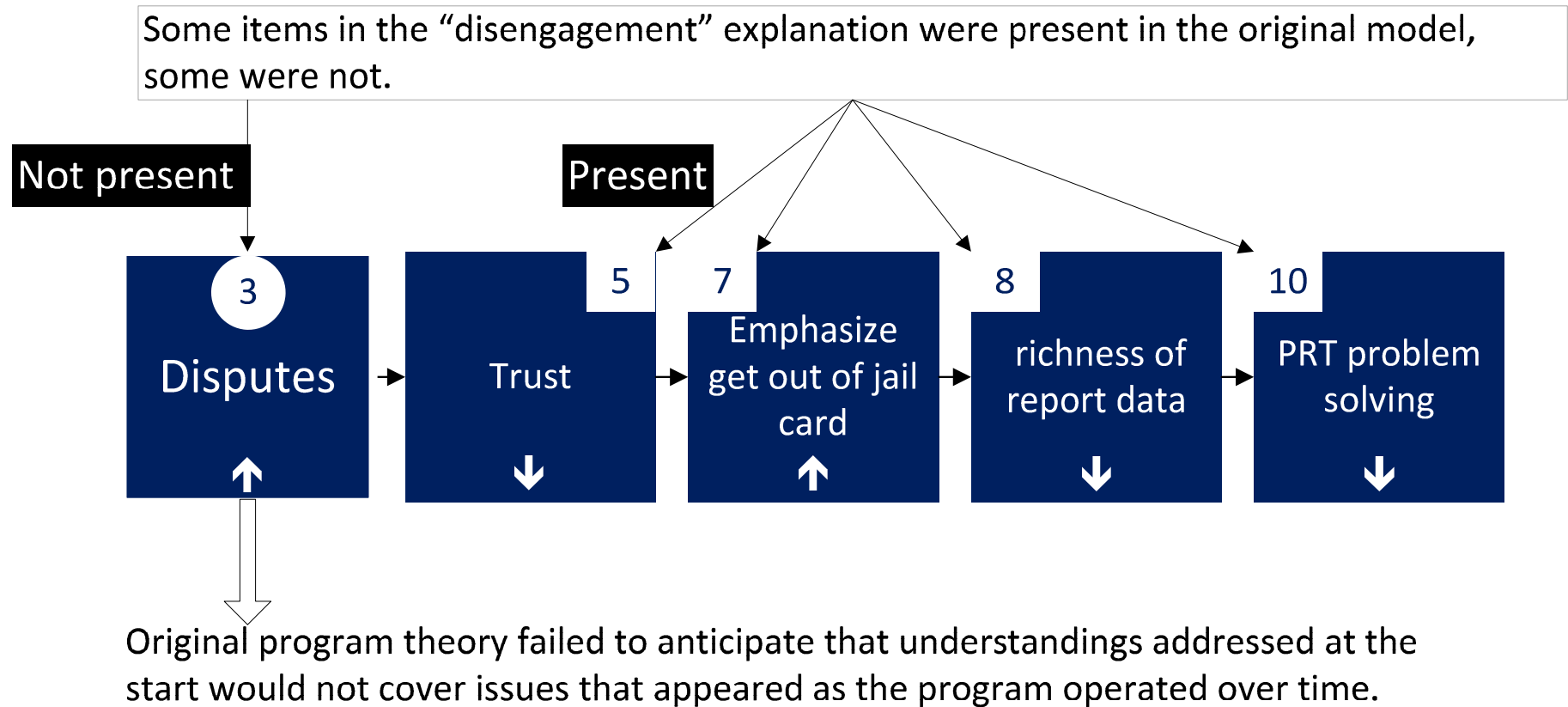## Logic Model: How C³RS Works

	Implementation		First Order	Second Order	Third Order
FRA/Volpe	• Leadership • Resource planning • Training **2**	Monitoring and improving		Data analysis	Policy decision-making
BTS or NASA	• Leadership • Resource planning • Training **2**	Systems operation	• Communication • Processing of even more reports • Resource planning	Sampling reports	
Support Team	• Leadership • Resource planning **11**	Corrective action review **11**	• Safety-enabling behaviors • Alignment with other safety programs • Communication: quality, amount, consistency • Corrective action implementation and monitoring **12**	• Rigorous continuous improvement in company • Trend analysis • Safety policy	
PRT	• Leadership • Resource planning • Launch **12**	• Report analysis • Corrective action identification **6** • Effectiveness of corrective action • NASA communications	• Analysis of even more reports • Resource planning **8** **9**		
C³RS-Targeted Employees		Employee submission of reports to NASA	• Employee involvement in C³RS • Safety practices • Awareness **7** **8**		Employee morale
Multiple Stakeholders	• IMOU • Start safety culture change **1** **5** **9**	Implementation of corrective actions **6** **12**		• Safety culture **13** • Incidents - Injuries - Derailments, collisions - Mechanical defects - Decertifications, FTX - Operating costs	• Liability • Safety costs • Production • Profitability
Railroad Industry				Industry-wide reporting system	• Safety culture • Best safety practices

Feedback — Feedback — Feedback — Feedback

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Example #1 of Knowledge from Mapping "Disengagement" Model Onto Original Program Theory

Some items in the "disengagement" explanation were present in the original model, some were not.

Not present

Present

3	5	7	8	10
Disputes ⬆	Trust ⬇	Emphasize get out of jail card ⬆	richness of report data ⬇	PRT problem solving ⬇

Original program theory failed to anticipate that understandings addressed at the start would not cover issues that appeared as the program operated over time.

Example #2 of knowledge from mapping "disengagement" model onto original program theory

Logic Model: How C³RS Works

Implementation → First Order → Second Order → Third Order

Support Team
- Leadership
- Resource planning

Corrective action review

- Safety-enabling behaviors
- Alignment with other safety programs
- Communication: quality, amount, consistency
- Corrective action implementation and monitoring **12**

- Rigorous continuous improvement in company
- Trend analysis
- Safety policy

Impact finding has roots in two different
- stakeholder groups, and
- stages of the program life cycle

Early Labor Distrust and get out of jail emphasis leading to weak reports

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12 Low level of CA implementation

Low impact, C/B

PRT
- Leadership
- Resource planning
- Launch **12**

- Report analysis
- Corrective action identification
- Effectiveness of corrective action
- NASA communications

- Analysis of even more reports
- Resource planning

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Model Characteristics for Comparing Sites

To compare across sites we need a generic model with parts that can be "turned on" and "turned off" for different settings

Required characteristics for the model

❑ Be in a visual form many audiences will be comfortable with

❑ Allow easy visual comparison across sites

❑ Based on our qualitative and quantitative data

❑ Reflect our knowledge of system context

We Considered Three Candidate Models for Cross-site Comparisons

❑ Too unique and specific to the "disengagement" case.

❑ Probably the most "correct" but very difficult to work with and explain

❑ Difficult visual comparison across versions

❑ Very familiar to anyone with exposure to Lean -6 Sigma

❑ Easy visual comparison across cases
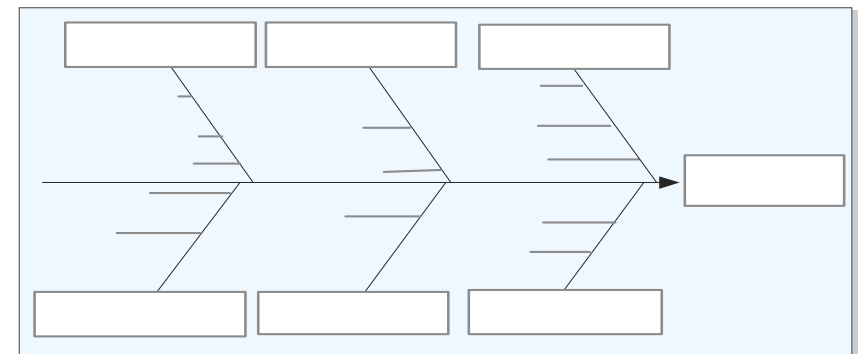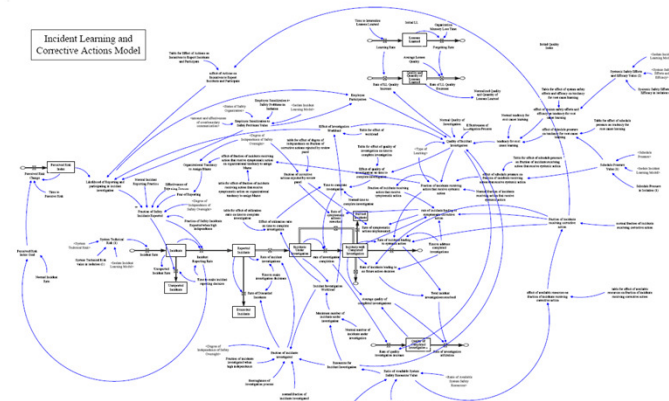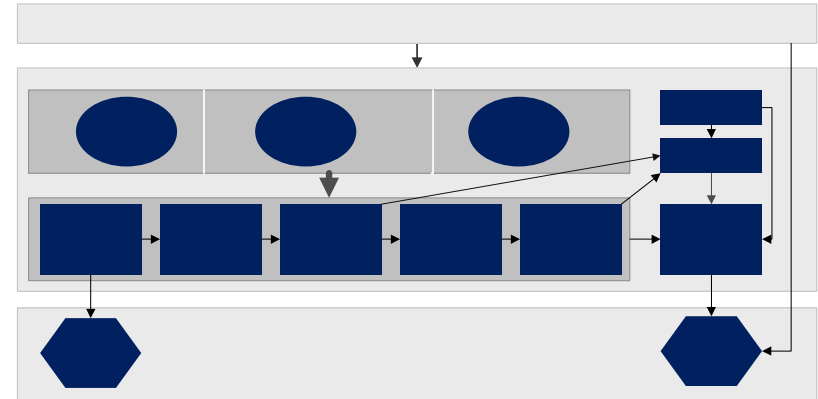
C³RS Cross-Site Success Factors
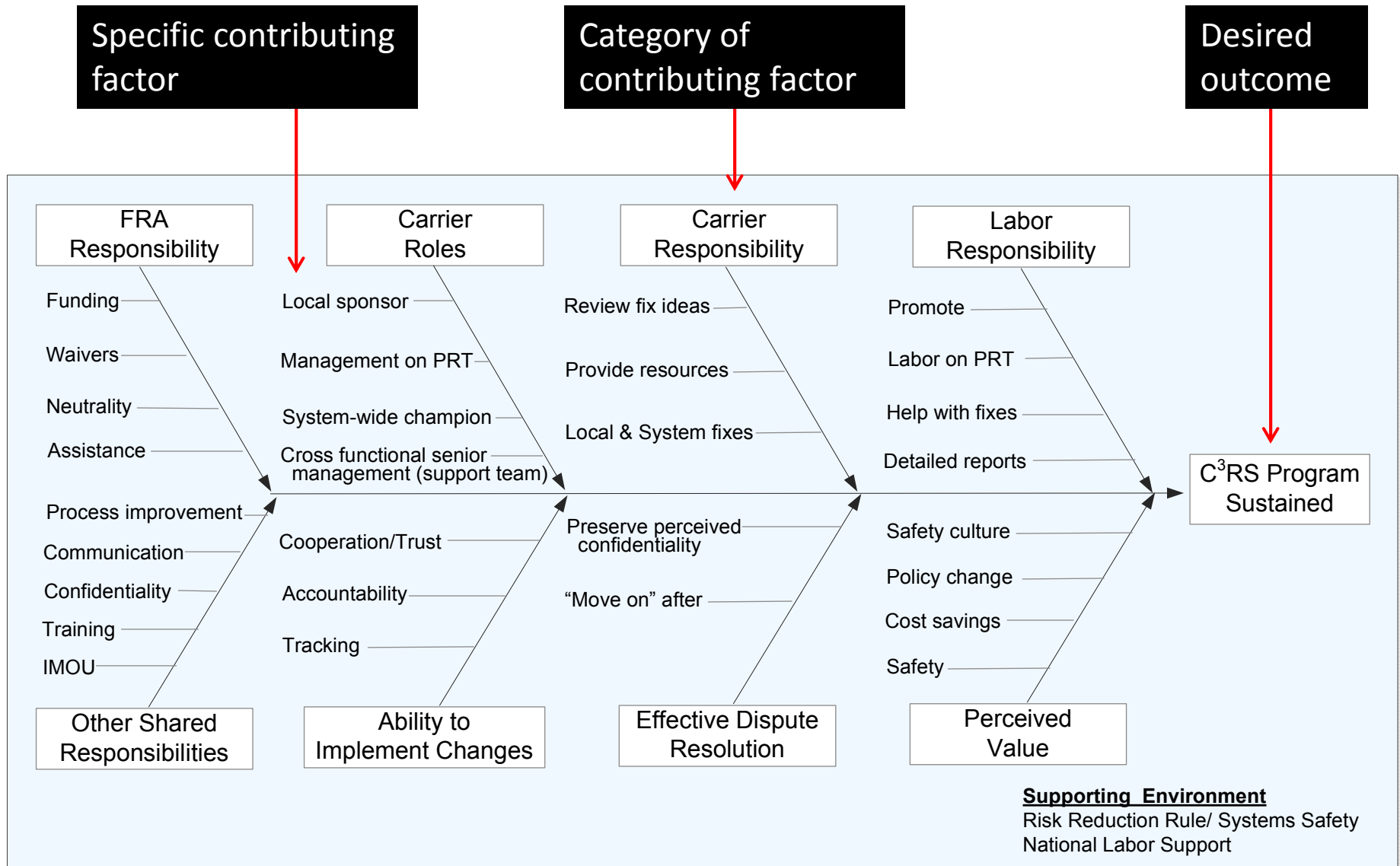
What Did it Take to Construct This Model?

❑ A lot of data to address specific topics, (e.g. did the safety culture change?)

❑ "Craft knowledge" about the stronger and weaker aspects of the data (e.g. how believable were a particular set of interviews?)

❑ Understanding

▪ the companies involved (e.g. beyond specific action, how enthusiastic was the champion?)

▪ context (e.g. what was the FRA doing to promote C^{3}RS in the industry?)

▪ the innovation (e.g. How do these kinds of programs work in other industries

It was the ability to interpret the data that allowed us to construct the model.
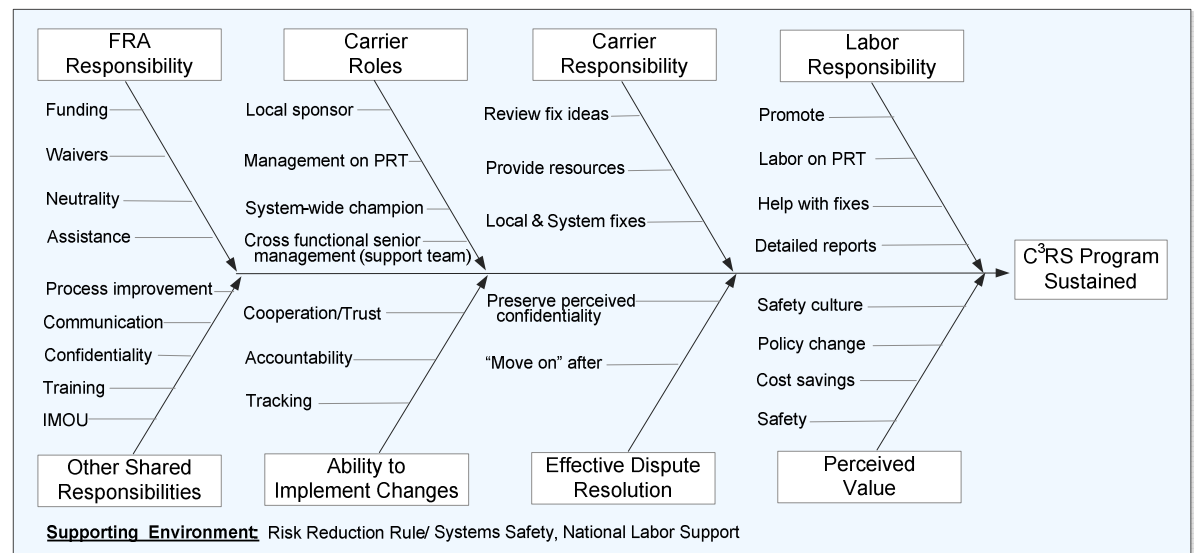
Using Quantitative and Qualitative Data to Revise Program Theory: Examples of How the Data Were Used

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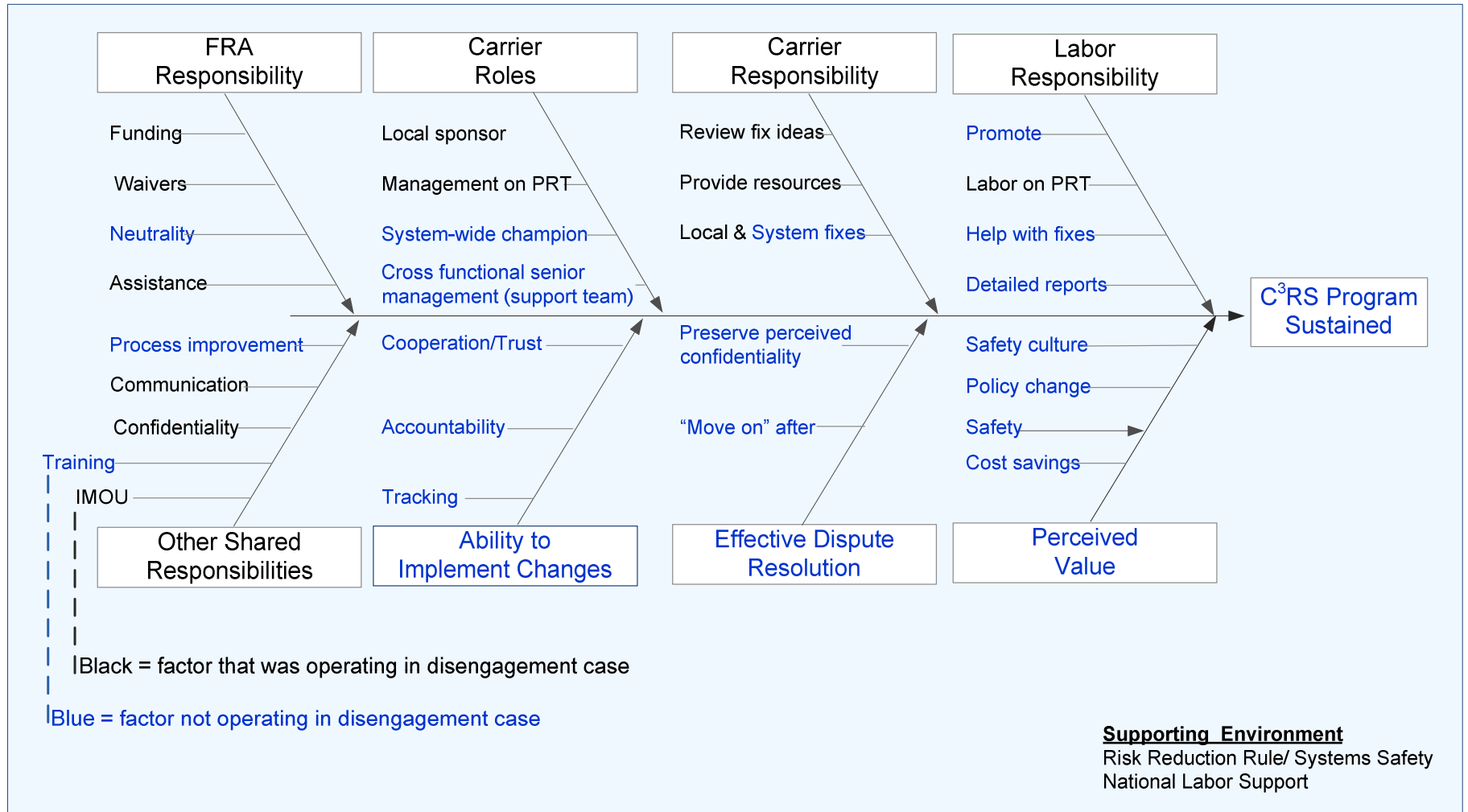*Advancing transportation innovation for the public good*

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Six of Eight Major Findings Relied on Combining Quantitative and Qualitative Data

	Interviews and field notes	Safety data	Safety Culture Survey	Corrective Action Data
C^3RS produced some small benefits				
Some improvements in supervisor – employee relationships			x	
PRT consistently worked on analyzing cases and recommending corrective actions	x			x
PRT implemented some local corrective actions involving education/awareness	x			x
New Support Team was more effective. Implemented many corrective actions related to Excess Speed	x			x
Many factors led to decision to disengage from C^3RS				
Decisions made very early in the planning process by all stakeholders affected CP's decision 5 years later to withdraw	x			
The outcomes of the dispute resolutions decreased trust in C^3RS and kicked off a downward spiral	x			x
The manner in which the disputes were resolved soured relationships	x		x	
Decision to withdraw had other specific and diffuse reasons	x	x	x	x

To Explain Disengagement, Map Findings onto Model

FRA Responsibility
- Funding
- Waivers
- Neutrality
- Assistance

Carrier Roles
- Local sponsor
- Management on PRT
- System-wide champion
- Cross functional senior management (support team)

Carrier Responsibility
- Review fix ideas
- Provide resources
- Local & System fixes

Labor Responsibility
- Promote
- Labor on PRT
- Help with fixes
- Detailed reports

C³RS Program Sustained

Other Shared Responsibilities
- Process improvement
- Communication
- Confidentiality
- Training
- IMOU

Ability to Implement Changes
- Cooperation/Trust
- Accountability
- Tracking

Effective Dispute Resolution
- Preserve perceived confidentiality
- "Move on" after

Perceived Value
- Safety culture
- Policy change
- Safety
- Cost savings

Black = factor that was operating in disengagement case

Blue = factor not operating in disengagement case

Supporting Environment
Risk Reduction Rule/ Systems Safety
National Labor Support

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Quantitative Safety Findings

❑ Railroad Safety Culture Survey showed initial improvements, then decreased back to baseline values

  ▪ Organizational Concern for Employees
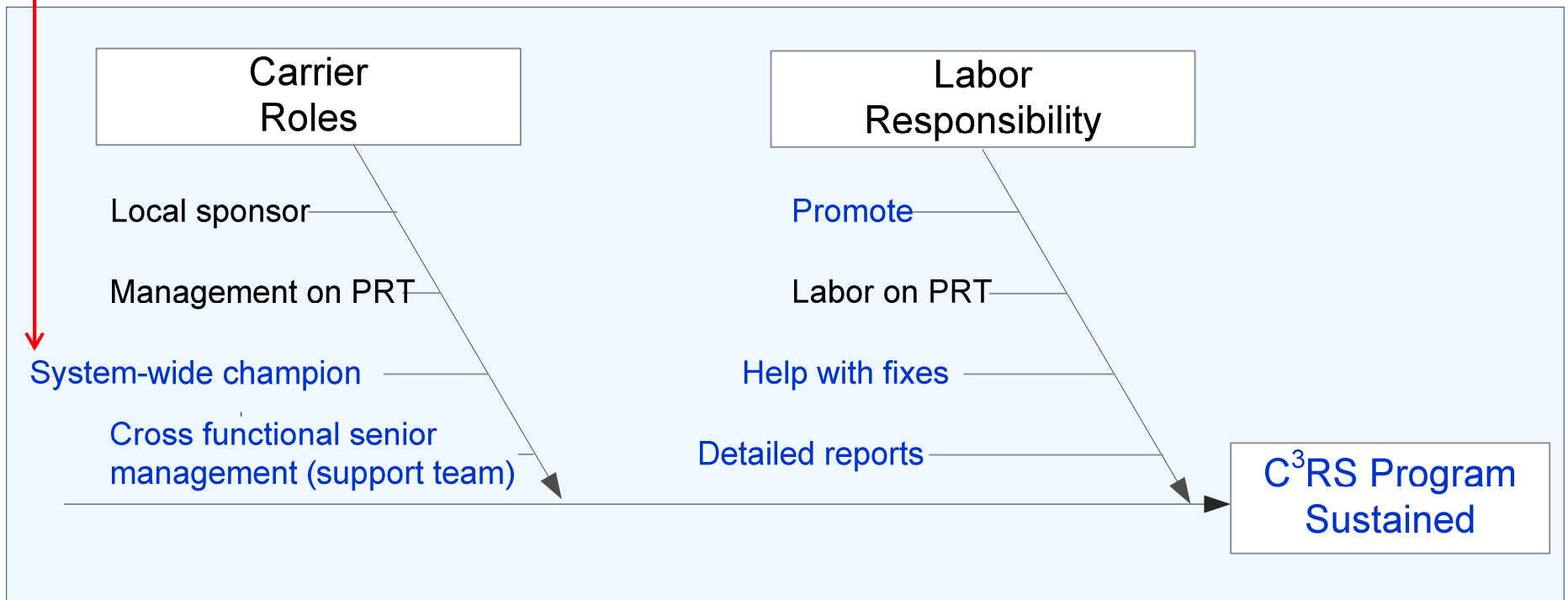
  ▪ Labor-Management Relations

Labor Responsibility

Promote

Labor on PRT

Help with fixes

Detailed reports

Safety culture

Policy change

Cost savings

Safety

Perceived Value

C^3RS Program Sustained
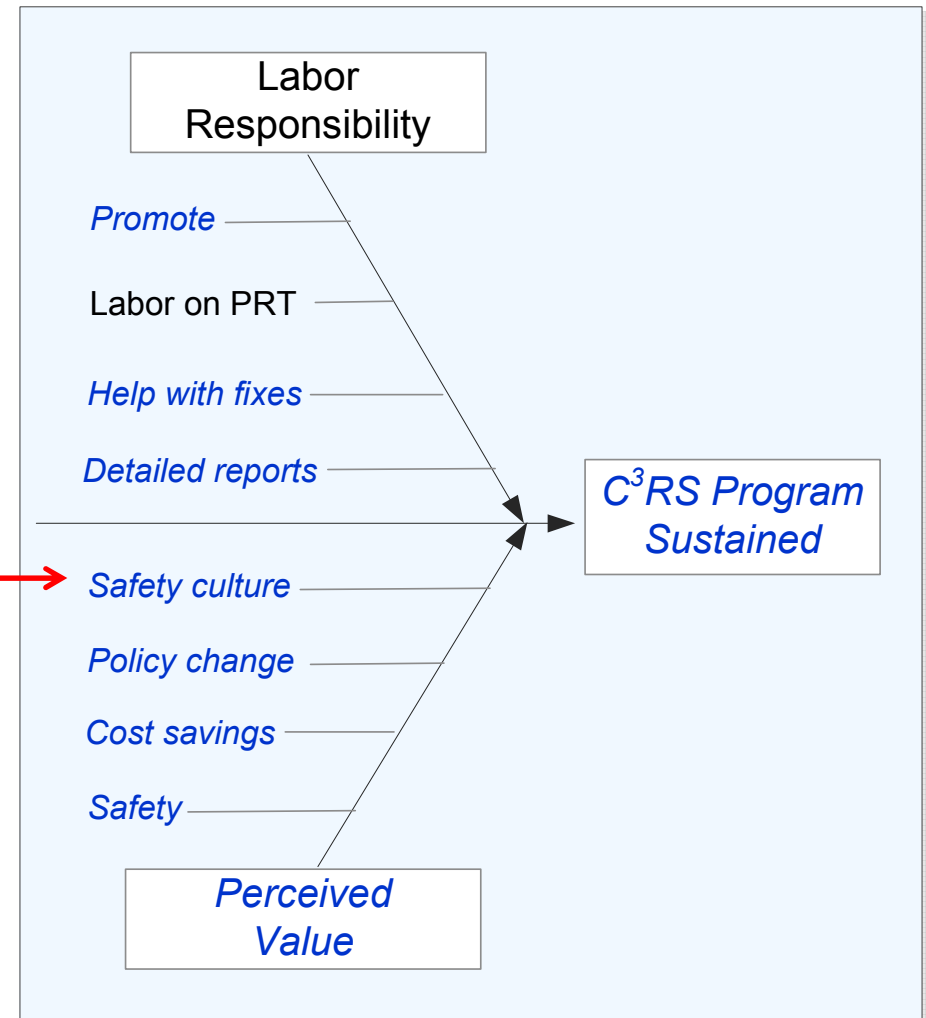
Quantitative Safety Findings

❑ Safety data did not show an impact
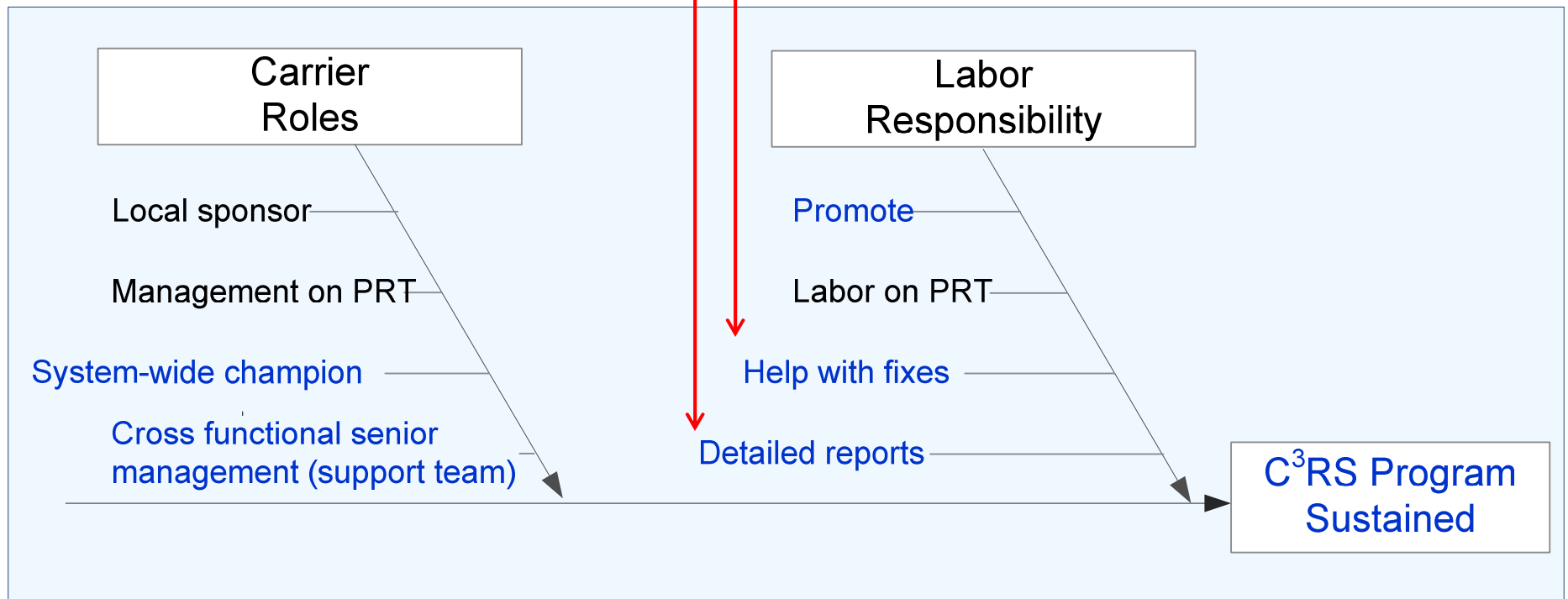
    ▪ Human Factors incidents

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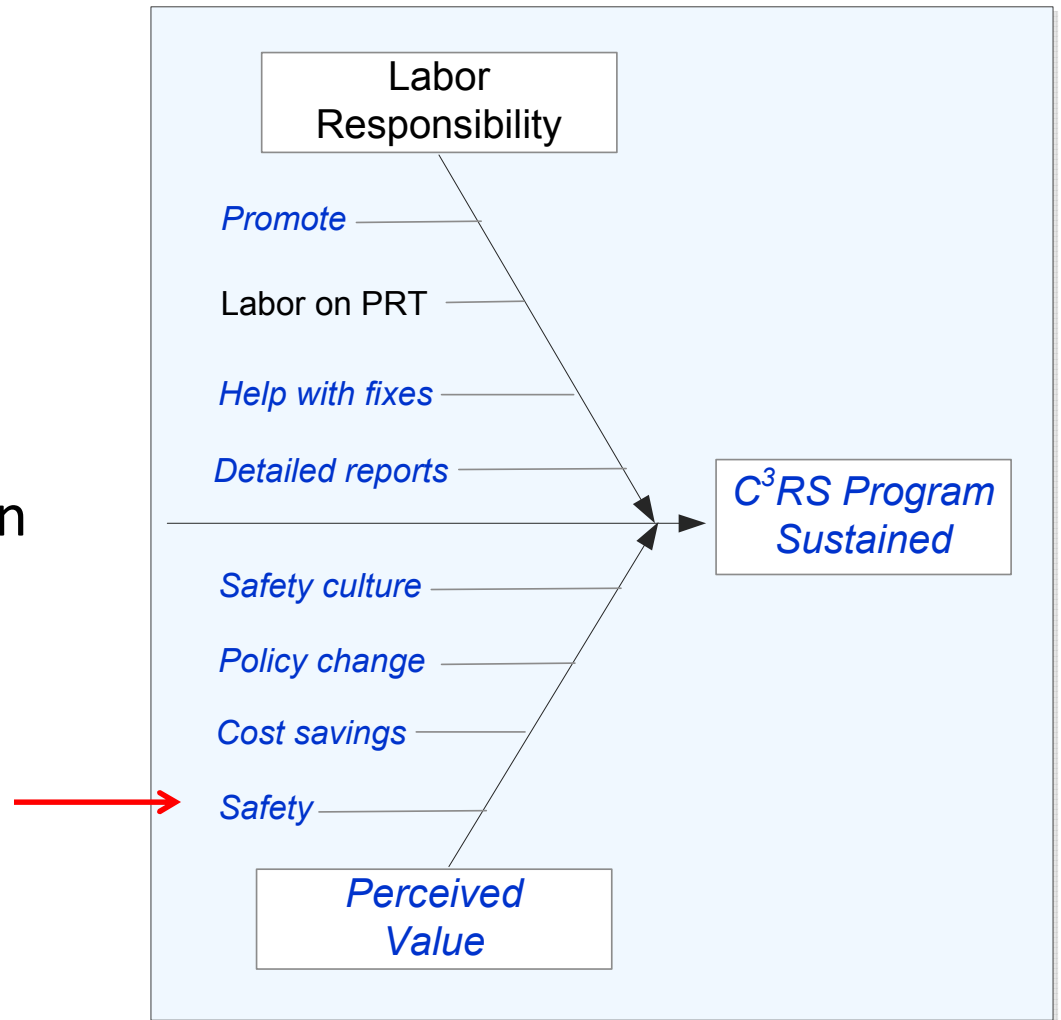
Qualitative Interview findings

❑ Senior sponsorship issues

■ Senior sponsorship was lost and replacement delayed

■ Initial Support Team not adequately responsive to C^{3}RS

Carrier Roles	Labor Responsibility

Local sponsor

Promote

Management on PRT

Labor on PRT

System-wide champion

Help with fixes

Cross functional senior management (support team)

Detailed reports

C^{3}RS Program Sustained

Qualitative Interview findings

Pre-existing safety culture, labor distrust & disputes led to less detail in incident reports

Labor not involved in implementing corrective actions

Carrier Roles		Labor Responsibility
Local sponsor		Promote
Management on PRT		Labor on PRT
System-wide champion		Help with fixes
Cross functional senior management (support team)	Detailed reports	C^{3}RS Program Sustained

For More Information

U.S. DOT Federal Railroad Administration, Research Results RR08-33, Confidential Close Call Reporting System: Preliminary Evaluation Findings, December 2008

U.S. DOT Federal Railroad Administration, Research Results RR12-04, Derailments Decrease at a C^{3}RS Site at Midterm, April 2012

U.S. DOT Federal Railroad Administration, Research Results RR12-09, Senior Cross-functional Support—Essential for Implementing Corrective Actions at C^{3}RS Sites, August 2012

U.S. DOT Federal Railroad Administration, Research Results RR13-49, Another C3RS Site Improves Safety at Midterm, December 2013

U.S. DOT Federal Railroad Administration, Research Results RR14-18, Update from C3RS Lessons Learned Team: Safety Culture and Trend Analysis, July 2014

U.S. DOT Federal Railroad Administration, Research Results RR 14-17, Update from C3RS Lessons Learned Team: Four Demonstration Pilots, July 2014

How Might You Use Our Approach to Revise Program Theory?

Can you give any examples from your own work where data were used to revise program theory?