SUPPLEMENTAL MATERIAL 2: PRACTICAL IMPLEMENTATION GUIDANCE FOR CONVERGE-DIVERGE-RECONVERGE SURVEY ARCHITECTURE

Purpose

This supplementary material provides practical guidance for researchers seeking to implement the converge-diverge-reconverge survey framework in their own multi-role organisational contexts. The guidance synthesises lessons learned from developing and deploying the engineering workplace survey documented in the main manuscript.

1. WHEN TO USE THIS APPROACH

Appropriate Contexts

Use converge-diverge-reconverge architecture when:

- Your research question requires BOTH cross-role comparison AND role-specific depth
- Roles in your organisational context experience shared phenomena differently
- You want to capture functional diversity without fragmenting your dataset
- You need to avoid overwhelming respondents with irrelevant questions
- Sample size permits meaningful subgroup analysis by role (n greater than or equal to 30 per role as general guidance)
- Your survey platform supports branching logic (most modern platforms do)

Inappropriate Contexts

Do NOT use this approach when:

- Roles are too heterogeneous within categories to create meaningful shared modules
- Sample size is insufficient for role-stratified analysis (n less than 30 per role)
- Your research focus is purely on universal constructs with role as a simple control variable
- Resources do not permit complex survey design, testing, and validation
- Your survey platform lacks branching capabilities
- Time constraints prevent proper pilot testing of all pathways

2. KEY DESIGN DECISIONS

2.1 Determining Universal vs. Role-Specific Content

Universal modules should include:
- Constructs expected to exist across all roles (e.g., job satisfaction, organisational commitment, well-being)
- Demographic and work context variables for cross-role comparison
- Organisational-level perceptions (culture, leadership, values)
- Outcome variables you want to compare across roles

Role-specific modules should include:

- Observable practices, behaviours, or decisions unique to a function
- Pressure manifestations that differ substantively across roles
- Technical or functional knowledge that only specific roles would possess
- Context-specific challenges that would not be meaningful to other roles

Test question for classification:
"Would this question be meaningful and interpretable to someone OUTSIDE this role?"
- If YES: Consider for universal modules
- If NO: Belongs in role-specific module

2.2 Selecting Role Categories

Guiding principles:

1. Align with organizational structure: Use functional divisions recognized in your target context
2. Ensure within-role homogeneity: People within each role category should experience similar phenomena
3. Balance granularity: Too broad = lose functional depth; too narrow = insufficient sample sizes
4. Consider analytical needs: Each role needs sufficient n for meaningful analysis (aim for n greater than or equal to 30)

Pilot testing recommendation: Test role self-identification with 10-15 people from target population. Ask: "Which category best describes your primary role?" Revise if people struggle to classify themselves.

2.3 Balancing Module Length

The challenge: Role-specific modules may require varying numbers of items to capture relevant phenomena adequately. How do you balance depth against completion time parity?

Solution: Use completion time rather than item count as your equality metric.

Our approach: We accepted minor variation (10-12 minutes across all pathways) rather than strict equality, prioritising role-specific depth over perfect time matching.

2.4 Sequencing Universal and Role-Specific Content

Two main options:

Option A: Universal, then Role-Specific, then Universal (Our Approach)
Sequence:
1. Demographics/universal foundation first
2. Role-specific modules second
3. Final universal modules third (reconverge)

Advantages:
- Universal items benefit from contextual priming (respondents reflect on role-specific experiences before answering abstract organisational questions)
- Role-specific content is fresh in mind when completing final universal items
- Creates narrative flow: context, then specific, then general

Disadvantages:
- Potential priming effects (role-specific content may influence universal responses)
- More complex to explain to reviewers unfamiliar with this approach

Option B: Universal, then Role-Specific, then Minimal Reconverge
Sequence:
1. All universal modules first
2. Role-specific modules second
3. Brief demographic/verification items only at the end

Advantages:
- Minimises priming of universal constructs by role-specific content
- More conventional sequence
- Easier to explain and defend

Disadvantages:
- Universal items may feel abstract without a role-specific context
- Loses the benefit of contextual activation

Our recommendation: Option A (our approach) if you can justify the sequencing rationale.
Option B: if you want to minimise reviewer concerns about priming.

2.5 Handling Roles Without Dedicated Modules

Not every role needs a role-specific module. Reasons to skip role-specific content:

1. Heterogeneity: Role category is too diverse internally
2. Research focus: Your primary questions do not center on this role
3. Sample size: Expected n is too small for meaningful role-specific analysis
4. Resource constraints: Limited time/resources for module development

When skipping role-specific modules:
- Route these respondents directly to universal reconverge section
- Explain this design decision in your methods section
- Note in limitations that these roles lack functional depth measurement
- Consider whether to still collect these responses for cross-role comparison

3. IMPLEMENTATION STEPS

Step 1: Define Your Research Questions (2-4 weeks)

- What universal phenomena do you want to compare across roles?

- What role-specific mechanisms or manifestations do you want to understand?
- How will roles differ in their experiences?
- What sample size do you need per role?

Step 2: Select Role Categories (1-2 weeks)

- Review organisational structures in your context
- Consult with practitioners or stakeholders
- Pilot test role self-identification with a small sample
- Finalise 4-8 role categories (more than eight becomes unwieldy)

Step 3: Develop Item Pools (4-6 weeks)

Universal modules:
- Review existing validated scales
- Develop custom items if needed
- Ensure items are interpretable across all roles

Role-specific modules:
- Interview or consult with representatives from each role
- Review role-specific literature
- Develop items reflecting actual practices/experiences in each role
- Use concrete, observable language

Step 4: Design Branching Architecture (1 week)

- Determine sequencing (universal first vs. role-specific first)
- Plan routing logic (usually single routing variable = primary role)
- Calculate completion time for each pathway
- Adjust module lengths if needed for parity

Step 5: Build Survey in Platform (1-2 weeks)

Platform considerations:
- Google Forms: Free, supports branching, adequate for most needs
- Qualtrics: Professional features, advanced branching, institutional support common
- SurveyMonkey: Mid-range option, supports branching
- REDCap: Good for medical/health contexts, secure, free via institutions
- LimeSurvey: Open source, full control, requires server

Build process:
1. Create all sections first (do not add questions yet)
2. Add universal modules
3. Add role selection question
4. Create separate sections for each role-specific module
5. Configure branching logic
6. Add final reconverge sections
7. Test EVERY pathway

Step 6: Pilot Test (2-3 weeks)

Critical: Test all pathways with actual users from target population

Pilot testing protocol:
1. Recruit 2-3 people per role category (10-20 people total minimum)
2. Ask them to complete the survey
3. Time each pathway
4. Debrief: What was confusing? What felt irrelevant? Any technical issues?
5. Check that the branching logic worked correctly
6. Verify data export structure supports your analysis plan

Common issues found in pilot testing:
- Role categories unclear or overlapping
- Some role-specific items relevant to multiple roles (consider moving to universal)
- Branching logic errors (wrong routes, dead ends)
- Completion time variation too large
- Technical issues on mobile devices

Step 7: Revise and Finalize (1-2 weeks)

- Address pilot testing feedback
- Adjust module lengths if completion time varies too much
- Clarify role category descriptions
- Fix any technical issues
- Delete all pilot test data before ethics submission

Step 8: Ethics Approval (4-8 weeks)

Documentation to prepare:
- Full survey instrument (all pathways)
- Participant information sheet
- Consent process description
- Branching logic diagram
- Data handling and storage procedures
- Anonymity protections

Address in ethics application:
- Why some roles get more questions (completion time parity)
- How branching works (automated, not manual)
- Whether pilot data will be used (answer: NO - delete before approval)

Step 9: Deploy and Monitor (Ongoing)

- Launch survey
- Monitor response rates by role
- Check for differential attrition by pathway
- Verify branching is working correctly
- Monitor completion times by role

4. COMMON PITFALLS AND HOW TO AVOID THEM

Pitfall 1: Role Modules Vary Too Much in Length

Problem: Commissioning gets 25 questions, operations gets 5, leading to 15-minute vs. 5-minute completion times.

Solution:
- Use completion time, not item count, as your metric
- Consider adding optional extended sections for shorter pathways
- Accept minor variation (plus or minus 2-3 minutes) rather than forcing artificial equality
- Pilot test to verify actual completion times match estimates

Pitfall 2: Role Categories Overlap or Are Unclear

Problem: Respondents do not know which role to select; "project engineer" could be design, commissioning, or project management.

Solution:
- Provide clear definitions for each role category
- Include examples in the role selection question
- Pilot test role self-identification
- Add "primary role" qualifier to question wording
- Provide "Other" option with text entry for edge cases

Pitfall 3: Universal Constructs Scattered Throughout Survey

Problem: Mixing universal items into role-specific sections, making cross-role comparison difficult.

Solution:
- Maintain a clear converge-reconverge structure
- All universal items in either front-loaded or reconverge sections
- No universal constructs embedded in role-specific modules
- Makes analysis cleaner and more defensible

Pitfall 4: Forgetting to Test ALL Pathways

Problem: Commissioning pathway tested thoroughly; operations pathway has broken branching logic that routes to the wrong section.

Solution:
- Test every single role pathway before launch
- Use checklist: "I have personally completed the survey as [Role X]"
- Check data export for each pathway
- Verify routing works correctly in preview AND live modes

Pitfall 5: Using Role as Both Routing Variable AND Measured Construct

Problem: Asking role-specific questions about role perceptions creates circular logic.

Solution:
- Keep role selection simple: "What is your primary role?" [Select one]
- Do not ask role-specific questions about role identity or role perceptions
- Role is a moderator (affects survey pathway), not an outcome variable

Pitfall 6: Not Documenting Sequencing Rationale

Problem: Reviewers question why universal items come after role-specific or why specific modules are longer.

Solution:
- Document ALL design decisions explicitly in the methods section
- Explain sequencing choice with justification
- Address completion time parity as a design constraint
- Pre-empt reviewer concerns by addressing them proactively

5. ANALYSIS CONSIDERATIONS

Data Structure

Your data will have:
- Universal variables: Present for all respondents (no missing data)
- Role-specific variables: Present only for respondents who completed that module (structured missingness by design)

Analysis implications:
- Cross-role comparison uses universal variables only
- Role-specific analysis uses a subset of data (filter by role)
- Cannot compare role-specific responses across roles (they answered different questions)

Sample Size Requirements

Minimum per role: n greater than or equal to 30 for basic descriptive statistics
Preferred per role: n greater than or equal to 50 for regression/correlational analysis
Ideal per role: n greater than or equal to 100 for complex modeling

If n is insufficient in some roles:
- Consider combining similar roles
- Report descriptive statistics only for small-n roles
- Focus comparative analysis on roles with adequate n

Handling Missing Data

Role-specific modules: Missing data is by design (people did not see those questions). Code as "Not applicable" or use role-specific subsets.

Universal modules: Missing data is problematic (should be minimal). Investigate:
- Did respondents drop out at certain points?
- Are specific items being skipped?
- Is one pathway experiencing higher attrition?

6. REPORTING YOUR SURVEY

Methods Section Should Include:

1. Architecture description: Converge-diverge-reconverge with branching logic
2. Routing logic: How respondents are assigned to role-specific modules
3. Module structure: Number of items per module, content focus
4. Sequencing rationale: Why universal items positioned where they are
5. Completion time: Target time and how parity was achieved across pathways
6. Pilot testing: How survey was validated before deployment

Results Section Should Include:

1. Response rates by role: How many respondents per pathway
2. Completion times by role: Verify parity was achieved
3. Attrition analysis: Did any pathways have higher dropout rates?

Limitations Section Should Address:

1. Priming effects: If universal items come after role-specific
2. Role self-selection: Potential for misclassification
3. Generalizability: Sample representativeness per role
4. Module depth: Trade-offs in balancing depth across roles

7. ADAPTATION TO OTHER CONTEXTS

This framework is transferable to any multi-role organisational setting where:
- Roles are functionally distinct but organizationally interdependent
- Shared organisational conditions manifest differently across roles
- Research aims to understand both system-level phenomena and role-specific mechanisms

8. TROUBLESHOOTING COMMON ISSUES

Issue: Response Rate Varies Dramatically by Role

Symptoms: 200 responses from operations, 12 from HSE
Causes:
- Population size differs by role
- Some roles are less engaged with the survey topic
- Recruitment strategy not reaching all roles equally

Solutions:
- Targeted recruitment for under-represented roles
- Extend data collection period
- Offer incentives for hard-to-reach roles
- Accept unequal numbers but weight analysis accordingly

Issue: Respondents Confused About Role Selection

Symptoms: Many "Other" selections, debrief reveals role categories unclear
Causes:
- Role categories do not match actual job titles
- Overlapping categories
- Missing relevant categories

Solutions:
- Add examples to the role selection question
- Refine categories based on pilot feedback
- Add "primary role" qualifier

Issue: Completion Time Varies More Than Expected

Symptoms: Some pathways take 20 minutes, others 8 minutes
Causes:
- Role-specific modules have different item types (some require more thought)
- Some respondents were more engaged with the topic
- Open-ended questions in some modules but not others

Solutions:
- Adjust module lengths based on actual pilot data, not estimates
- Standardise question types across modules
- Accept some variation (plus or minus 3-5 minutes) as acceptable

9. CHECKLIST FOR IMPLEMENTATION

Design Phase
- Research questions clearly define universal vs. role-specific content
- Role categories aligned with organisational structure
- Within-role homogeneity verified through stakeholder consultation
- Sample size targets set for each role (n greater than or equal to 30 minimum)
- Sequencing decision made and justified
- Completion time parity strategy determined

Development Phase
- Universal modules developed and validated
- Role-specific modules developed for each target role
- Branching logic designed (usually one routing variable)
- Survey built in a platform with correct routing
- All pathways tested by the research team
- Mobile compatibility verified

Pilot Testing Phase
- Recruited 2-3 testers per role (10-20 total minimum)
- ALL pathways tested by actual users
- Completion times recorded for each pathway
- Branching logic verified for each pathway
- Data export structure tested
- Feedback collected and addressed
- Pilot data deleted before ethics submission

Ethics Phase
- Full survey instrument documented (all pathways)
- Branching logic diagram created
- Completion time parity demonstrated
- Role module length variation justified
- Data handling procedures specified
- Anonymity protections detailed
- Ethics approval obtained

Deployment Phase
- Survey launched with correct routing
- Initial responses checked (all pathways working?)
- Response rates monitored by role
- Completion times monitored by pathway
- Technical issues addressed promptly

Reporting Phase
- Architecture is clearly described in the methods
- Routing logic explained
- Sequencing rationale provided
- Module length variation justified
- Completion time parity demonstrated
- Response distribution by role reported
- Design trade-offs acknowledged in limitations

CONCLUSION

The converge-diverge-reconverge framework provides a principled approach to multi-role survey design that balances depth and comparability. Success requires careful attention to role categorisation, module design, completion time parity, and thorough pilot testing.

The investment in design complexity is repaid through richer, more nuanced data that capture both shared organisational dynamics and role-specific manifestations. When implemented thoughtfully, this approach enables research that honours functional diversity while maintaining analytical coherence.

Estimated implementation time using this guidance: 12-16 weeks from initial planning to roll out