JalViGo

User Manual

Explore connections. Interpret performance.

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NAVIGATION

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Case page ranges include the application network and four centrality network figures.

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1.1 GETTING STARTED

Using this manual

JalViGo helps users examine directed networks, compare disruption scenarios and interpret sector-specific performance. This manual explains how to prepare a network, use the four workspaces, evaluate results and retain an auditable analysis record. It is intended for analysts, educators, researchers and domain managers.

The examples cover manufacturing, organizational behaviour and human resources, corporate communication, supply chain coordination, project delivery, social media and port logistics. All bundled cases are illustrative. Employee observations in the two organizational cases are synthetic; they are not findings about an actual workforce.

Edition and scope

Item	Coverage
Manual edition	1.0
Software basis	Local JalViGo source snapshot inspected
Core workspaces	Explore; Paths; What-if & resilience; Report
Specialist functions	Serial manufacturing schedules, integer product mix and separate employee outcome measures
Method evidence	Implementation definitions, reproducible examples and cited primary references

This edition describes the inspected implementation. It does not imply external certification, clinical validation, or endorsement by the organizations cited. The reference section distinguishes methodological sources from the software conventions used here.

The meaning of JALVIGO

The name **JALVIGO** carries a special meaning:

JAL – Derived from the Sanskrit word *Jāla*, meaning a web or network of connections.
VI – Represents Vijay.
GO – Represents Goran.

Thus, **JALVIGO** symbolizes the integration of network science, academic collaboration, and our shared commitment to advancing scientific research.

1.2 QUICK START

Your first analysis

Start with a bundled case to learn the controls before importing operational data. The following sequence produces a baseline, one disruption scenario and a saved record.

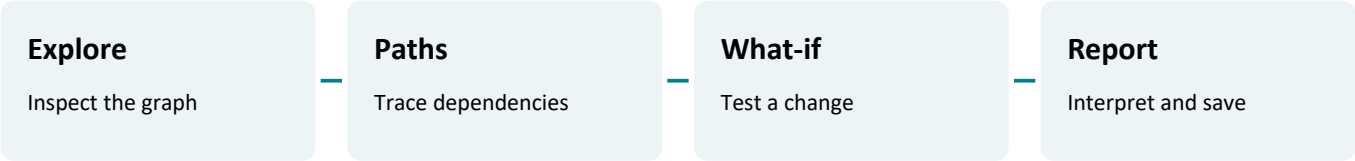


Figure 1. The four workspaces and a repeatable analysis sequence. This is a schematic, not a screenshot.

1. In **Explore**, open **Cases & templates**. Alternatively, use **New / import** and select its **Cases & templates** tab. Choose **Corporate Communication**.

2. Inspect the network and case brief. Confirm what an arrow means. For this exercise, treat source-to-target ties as directed communication links.

3. Select **Betweenness** and inspect the ranking. Record the highest-ranked actor as a candidate dependency. A structural ranking is a prompt for investigation, not a personnel evaluation.

4. Open **What-if & resilience**. Remove that specific actor, keeping other removal and addition controls at zero. Compare the baseline with the scenario.

5. Record the baseline/scenario comparison in What-if. Open **Report** for the current baseline summary and expand the relevant **Click to show** indicators.

6. Use **Export** to save a session JSON and the required results. Record the selected case, removed actor, seed and assumptions with the files. Reset the scenario to return to the original comparison.

Understand the two states

Baseline is the current loaded network. **Scenario** is the transformed network produced by the what-if controls. Applying a scenario to the network makes it the new baseline. Export the original session first if you need a lasting comparison.

Moving nodes or changing the layout changes the drawing, not the graph calculations. Removing a node or arc changes the network and can alter results.

1.3 DATA

Prepare and import data

Define the actor population, time period, relationship type and arrow direction before creating the file. Mixing reporting lines, material flows and advice-seeking ties in one binary network can make a result difficult to interpret.

Input	Use and important convention
Edge list	CSV, TSV, semicolon or whitespace-separated source and target pairs. Map columns in the import dialog.
Adjacency matrix	Rows are sources and columns are targets. Preserve isolated actors with an explicit matrix or session.
Network files	GraphML, GEXF and Pajek network files are supported. Inspect the import preview and warnings.
Excel	Workbook import loads an external spreadsheet-reading library when needed.
Session JSON	Preferred for restoring network state together with specialist inputs and scenario settings.

Minimal directed edge list

source,target
CUT,CNC
CNC,DEBURR

Each row creates a directed tie. A reciprocal relationship requires both directions. Use stable, unique identifiers, and keep descriptive names separate from identifiers. Quote CSV values that contain commas. For the example above, one reversed row would break the forward manufacturing route.

Import procedure

1. Choose **New / import**, then upload a file, paste a table or use the matrix editor. Select the relevant columns and direction settings.

2. Review repaired rows and warnings. Self-loops are removed, duplicate ties are merged, nonzero weights become binary ties and zero-weight ties are skipped. Invalid numeric weights require correction.

3. Check actor count, tie count, isolated actors and several known arrows against the source. Save a session after acceptance.

Ordinary node-attribute import preserves supported fields such as ID, name and group; it does not automatically map arbitrary manufacturing or employee columns. Enter those specialist inputs in their panels or restore them from a compatible session JSON. The interactive matrix editor is intended for networks of up to 20 actors.

2.1 EXPLORE

Explore network structure

Explore combines the drawing, actor details, case explanation and centrality rankings. Select a measure first, then investigate the actors that stand out. The meaning of importance depends on the relationship represented by the arrows.

Measure	Interpretation	Useful question
In-degree	Number of incoming ties	Who receives connections from many actors?
Out-degree	Number of outgoing ties	Who directly reaches many actors?
Betweenness	Share of shortest routes through an actor	Which actor may act as a broker?
Closeness	Outward distance-based accessibility	Who can reach others in relatively few steps?
Eigenvector	Incoming connections weighted by source importance	Who is connected to influential sources?

Read the ranking in context

High betweenness may identify a useful coordinator or a dependency that needs backup. High in-degree may indicate visibility, demand for help or a formal reporting role. Neither proves performance, wellbeing or authority. Check the case definition and the underlying data before assigning a business meaning.

Closeness uses outward directed distances with a correction for disconnected networks. Eigenvector scores use an incoming formulation with an identity shift and maximum normalization. Exact numerical comparisons with other packages require matching these conventions. See the methods reference.

Arrange a readable view

1. Choose a layout appropriate to the story: hierarchical for directional progression, or a force layout for clusters and cross-links.

2. Pan and zoom to inspect the drawing. Move actors to clarify dense areas and adjust labels or arc shapes when preparing a figure.

3. Use groups and consistent colors for teams, tiers or roles. Keep the same encoding across baseline and scenario images.

4. Export a vector figure when labels must remain sharp at publication size. Retain a separate session containing the analysis state.

Layouts alter coordinates only. They do not create shortcuts, remove ties or improve resilience. For large graphs, use the actor table and targeted comparisons rather than treating a dense picture as sufficient evidence.

2.2 PATHS

Trace paths and dependencies

Paths answers a directional question: can the selected source reach the selected destination, and by which route? A route from A to B does not establish that B can reach A. Use meaningful endpoint choices for the domain.

1. Select the source and destination in **Paths**. Inspect the highlighted route, hop count and available path information.

2. Check each arrow against the intended flow. A short path measures network steps; it is not elapsed time or cost in this binary network.

3. Try a second destination or reverse the endpoints. Record unreachable pairs explicitly rather than assigning them a finite travel time.

4. Paths queries the current baseline. To inspect a disrupted route, save the baseline, create the scenario and choose **Apply to network**. Query Paths, then reload the saved baseline before the next experiment. Use this procedure in the sector walkthroughs below.

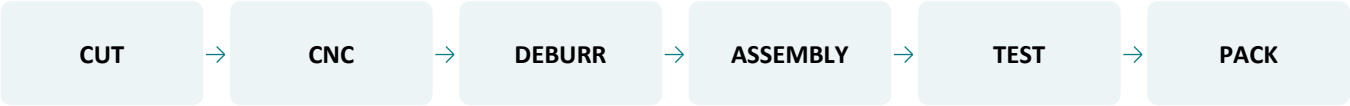


Figure 2. A required directed process route. Removing CNC to Deburring breaks this serial process.

Manufacturing controls are here

The manufacturing inputs, process plan, Gantt chart and processing/waiting pie chart are contained in **Paths**. There is no separate Manufacturing workspace. Load the pump assembly case to populate the route, processing times and product-mix example.

A manufacturing route is an explicitly entered sequence of stations. Its consecutive directed ties must exist. Generic shortest-path results do not automatically select a production route, change the route or reschedule work around a missing station.

Avoid confusing routes and schedules

A network path describes which connections are available. A schedule additionally requires unit quantities, release intervals and processing times. Two routes with the same hop count may have very different production times. Conversely, a structurally connected network can still be unsuitable for a requested fixed manufacturing route.

Path counting is bounded to keep the interface responsive. The resilience path calculation uses simple paths without repeated actors, even where the interface uses the word walks. Report a displayed cap rather than claiming exhaustive counts beyond it.

2.3 WHAT IF

Build disruption scenarios

What-if controls allow repeatable structural experiments. Change one factor at a time first; combine controls only after understanding their individual effects. Baseline and scenario values should always refer to the same starting session.

Control	How to use it
Remove actors	Use the slider or type a count or percentage. Automatic removal rounds to whole actors and retains at least two actors.
Remove ties	Use the slider or type a percentage from 0 to 80. Decimal percentages are accepted.
Specific actor	Select the particular actor to remove; manual selections can be combined with automatic removals.
Specific arc	Select source and target. Removing A to B does not remove B to A unless selected separately.
Add ties	Set the addition percentage and strategy, such as backup suppliers, bridges, reciprocity or random links.
Seed	Keep a fixed seed when comparing repeatable random experiments.

Order of operations matters

The engine removes explicitly selected actors, then any additional automatic actor selections and their incident ties. It removes selected arcs, applies percentage tie removal to the surviving ties, and then adds ties. Consequently, a percentage is not always a percentage of the original tie count. Read the resulting counts rather than adding percentages arithmetically.

The tie-addition step does not restore arcs explicitly selected for removal. Two-way additions create paired directed ties. Proposed new links must still be checked for contractual, technical or organizational feasibility outside the software.

A controlled comparison

1. Save the baseline. Set additions and automatic removals to zero. Remove one specific actor or arc.

2. Record changes in reachability, efficiency and connected structure. For manufacturing, also check whether the required route remains available.

3. Reset, then test a different intervention with the same baseline. Use a fixed seed for random selections.

4. Choose **Apply to network** only when the modified network should become the baseline. Undo can recover recent network snapshots, but is not a substitute for exported sessions.

2.4 RESILIENCE

Interpret structural resilience

The resilience analysis asks whether selected source and sink endpoints remain connected under modeled component failures. The endpoints and failure mode define the experiment. Record them with every reported score.

1. Choose the source and sink actors relevant to the service or flow. Verify that the baseline has the intended directed connection.

2. Select the failure mode: single failures or combinations of failures. Endpoint actors are excluded from node-failure selections.

3. Run the analysis and read the method indication. For up to 20 combined node and arc failure elements, combination analysis can enumerate exactly; larger cases use seeded Monte Carlo sampling.

4. Record the seed and the reported uncertainty interval for a sampled result. Compare scenarios under the same endpoints and method.

What the score means

Combination mode treats the modeled nonempty failure combinations equally. It measures survivability under that experiment, not the probability that a business will operate next month. Real failure rates, correlated hazards, repair durations and exposure are not calibrated by this structural calculation. The source framework is a network structural perspective [2].

A Monte Carlo interval describes sampling uncertainty for the defined experiment; it does not include uncertainty in the network data or the failure assumptions. Changing the experiment changes the interpretation even if the displayed percentage looks similar.

Investigate vulnerable connections

Use the single-point-of-failure information and endpoint paths to identify candidates for redundancy. Test an explicit alternative tie or backup strategy and compare the resulting connectivity. Check whether the proposed link is operationally feasible and whether it preserves the correct direction of flow.

Do not interpret this score as recovery speed, recovery cost or inventory coverage. Time-to-survive and time-to-recover controls are not exposed in the current interface, even though older engine components may exist in the source.

Reporting item	Example form
Experiment	Single failures, or all nonempty combinations
Endpoints	Source ID and sink ID
Computation	Exact, or sampled with seed and interval
Conclusion	Connectivity retained under the stated experiment

2.5 REPORT

Read the performance report

Report summarizes the current baseline and applicable domain outcomes. Structural baseline/scenario comparisons are in What-if; the manufacturing panel also compares both states. Click **Click to show** to reveal an indicator and its explanation, or click again to hide it. Employee productivity and employee wellbeing use this same interaction.

Measure family	Interpretation and reading rule
Size and density	Actor and directed tie counts describe the population; density is ties divided by n(n - 1).
Reciprocity	Fraction of directed ties whose reverse tie also exists.
Global efficiency	Mean reciprocal directed distance over all distinct ordered pairs; unreachable pairs contribute zero.
Average finite distance	Average only over reachable pairs. A reduction after disconnection is not automatically an improvement.
Z1 to Z5	Structural indicators with specific projection and normalization conventions; see page 65.
Manufacturing	Baseline, scenario and changes for makespan, throughput, cycle and waiting measures when inputs are valid.
Employee outcomes	Separate productivity and wellbeing values with criteria, coverage and observation-based analysis.

Use multiple measures together

A disrupted network may have fewer reachable pairs but shorter distances among the remaining pairs. Report efficiency and reachability alongside average distance. A high density also does not establish that the connections are affordable, useful or correctly directed.

Handle unavailable values

Treat N/A, an unavailable outcome, and zero as different states. A missing manufacturing route produces blocked results rather than a faster completion time. Employee measures need valid observations; they are not inferred from centrality. A zero valid output observation is meaningful, whereas missing output is excluded.

Prepare a result statement

State the case, observation period, baseline definition, intervention, metric units, method and interpretation. For example: “Removing the specified route arc blocks the fixed pump process; manufacturing completion measures are unavailable under that route assumption.” Avoid interpreting a structural experiment as an observed causal effect.

3.1 MANUFACTURING

Case: Manufacturing Case and Inputs

Choose **Manufacturing - Precision Pump Assembly** in Cases & templates and open **Paths**. This case demonstrates a deterministic serial line with one machine per station and a shared ordered route.

Order	Station ID	Operation	Minutes per unit
1	CUT	Cutting	3
2	CNC	CNC machining	8
3	DEBURR	Deburring	2
4	ASSEMBLY	Assembly	5
5	TEST	Quality testing	4
6	PACK	Packing	2

Enter a single product batch

1. Set the route in the order shown. Verify all five consecutive directed arcs exist.

2. Set processing times in minutes per unit. Set **quantity to 20** and **release interval to 0 minutes**; use single-product mode for this example.

3. Inspect the process plan and charts in Paths. Open Report for the numerical baseline/scenario table.

4. Save the input session and export manufacturing results. Record the units and any assumptions about release time.

All 20 units are released at time zero. Stations process one unit at a time in first-in, first-out order. The next operation begins only after that unit has finished the previous station and the next station is available. Buffers are unlimited. Setup, travel, breakdowns, rework and parallel machines are not modeled.

Use the case to study a bottleneck

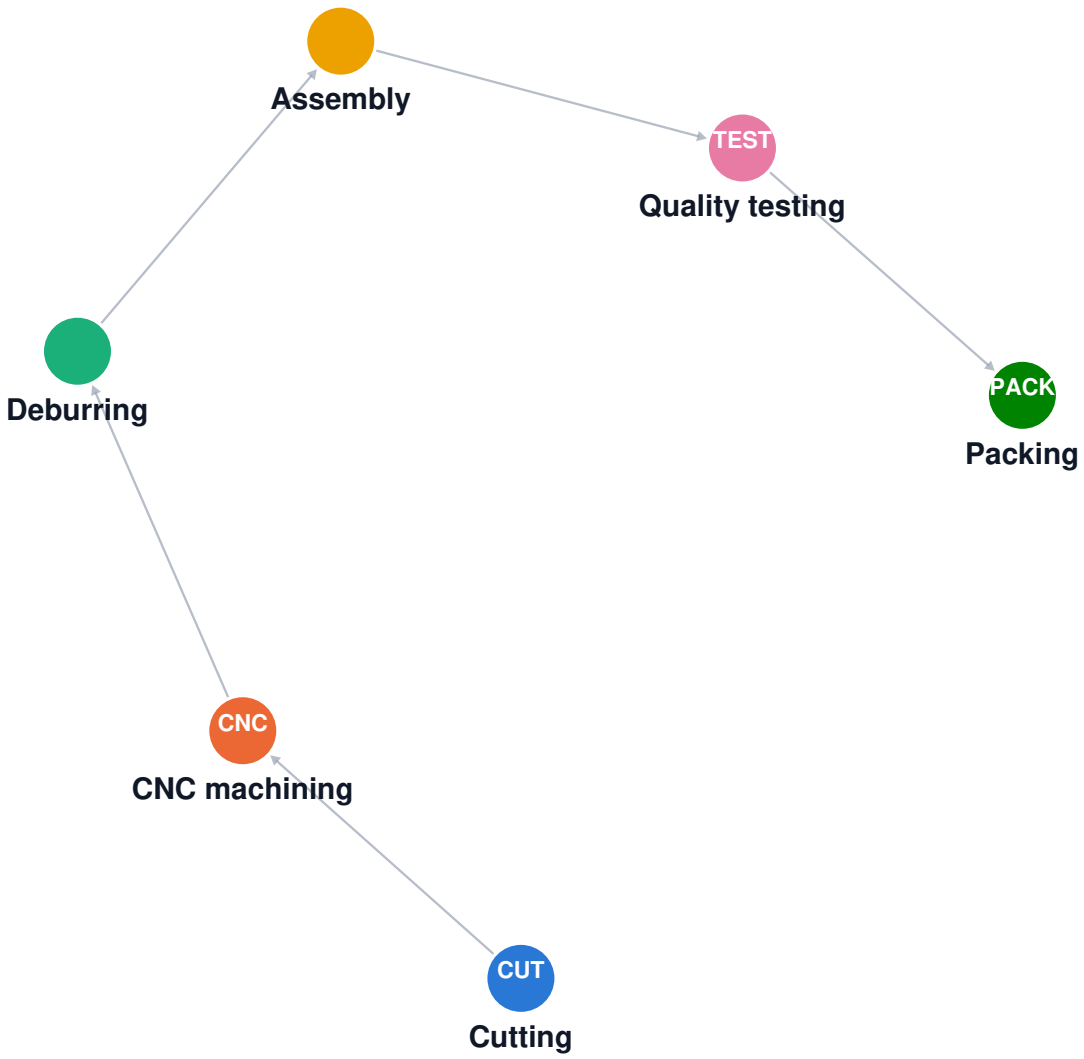
CNC requires eight minutes per unit, the longest station processing time. With simultaneous releases, the first unit completes after 24 minutes and later completions are eight minutes apart. Twenty units therefore finish at 24 + 19 × 8 = **176 minutes**.

Remove CNC or the CNC-to-DEBURR arc in What-if to test route failure. The schedule becomes blocked. The model does not bypass a station merely because another network path exists. Restore the component before testing processing-time changes.

3.1 APPLICATION NETWORK

Precision pump assembly

JalViGo bundled case: 6 actors and 5 directed ties. Generated with the uploaded application's layout, scene model and native figure exporter.



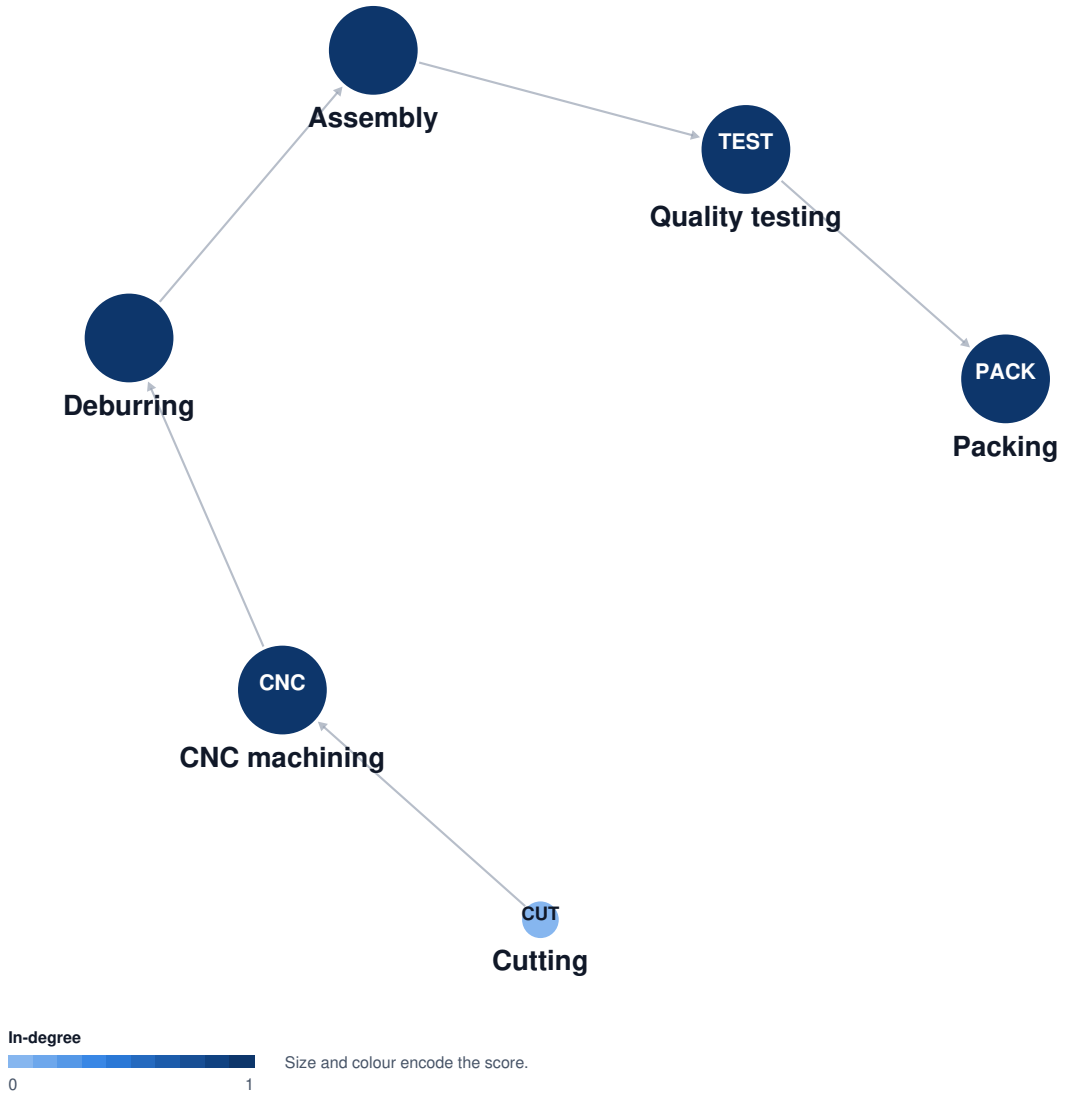
The actual six-station process route is shown. Removing a required station or transfer tie interrupts this configured serial route.

Colours identify teams where defined; the smaller ungrouped cases use JalViGo's categorical colours. Coordinates affect the drawing, not the network measures.

3.1 APPLICATION CENTRALITY NETWORK

In-degree centrality

Precision pump assembly | 6 actors | 5 directed ties. Node size and colour encode the application's calculated score.



HIGHEST VALUES IN THE APPLICATION

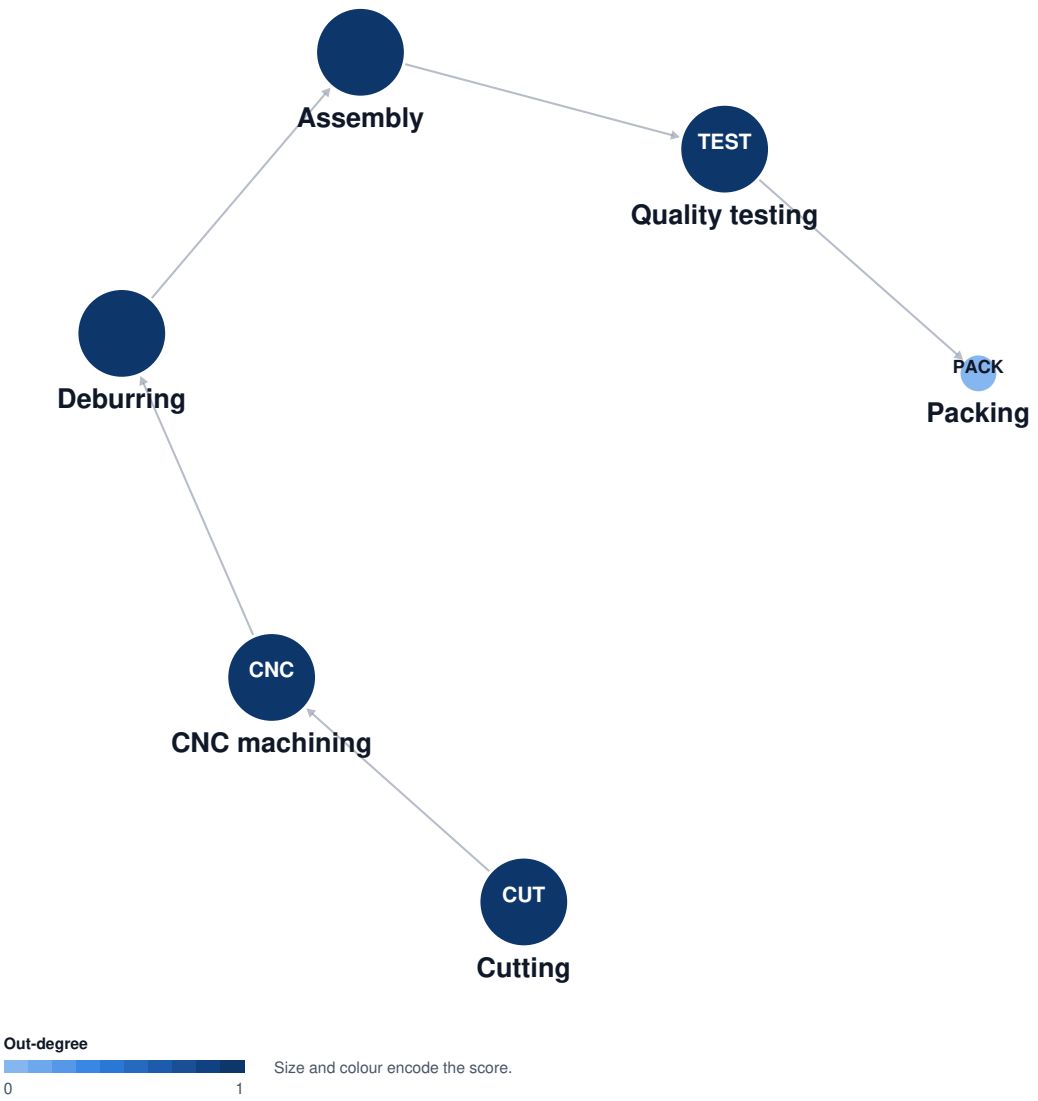
CNC: 1; DEBURR: 1; ASSEMBLY: 1; TEST: 1; PACK: 1

Incoming ties received by each actor. The node identities and topology match the preceding case network.

3.1 APPLICATION CENTRALITY NETWORK

Out-degree centrality

Precision pump assembly | 6 actors | 5 directed ties. Node size and colour encode the application's calculated score.



HIGHEST VALUES IN THE APPLICATION

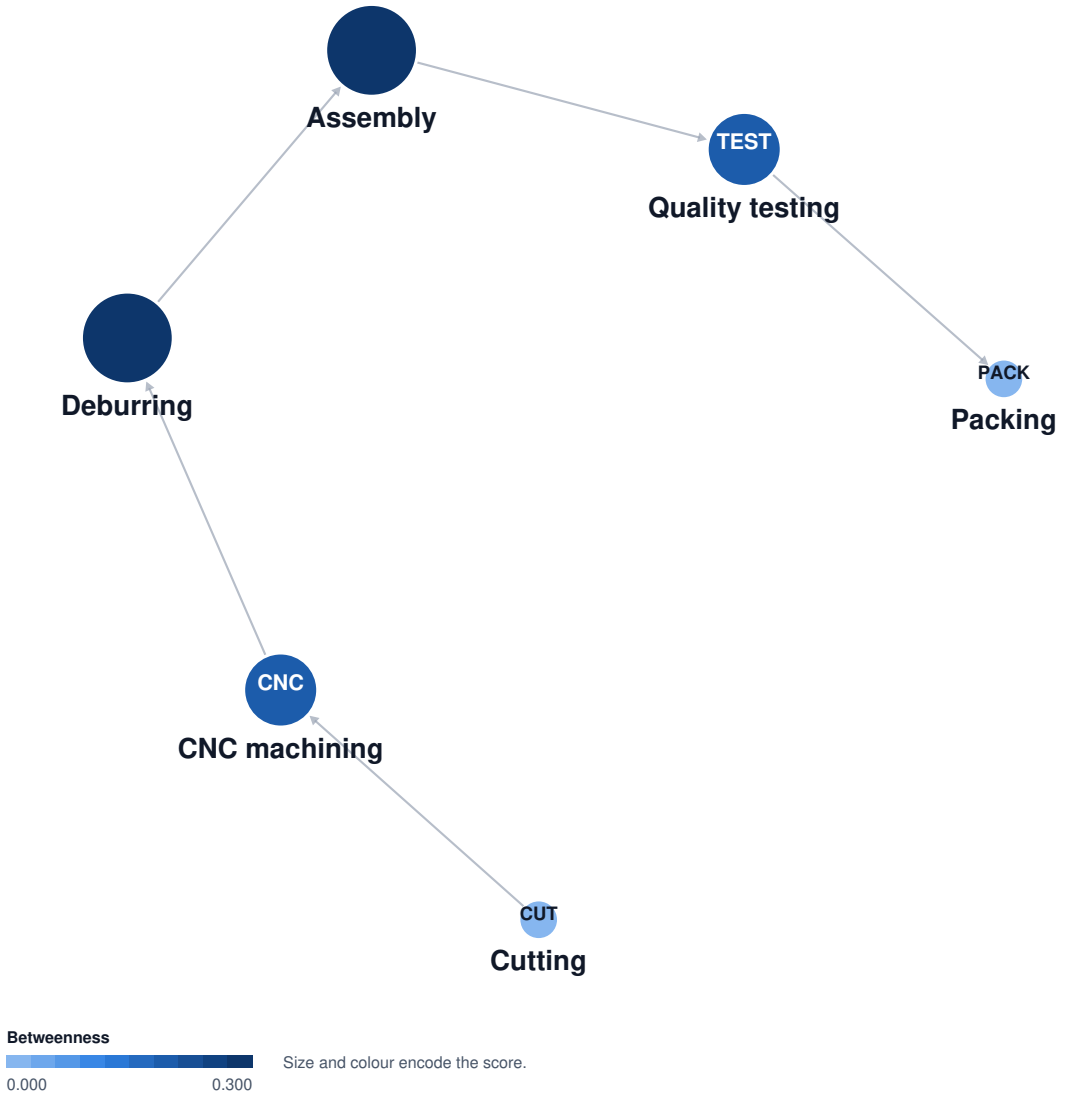
CUT: 1; CNC: 1; DEBURR: 1; ASSEMBLY: 1; TEST: 1

Outgoing ties sent by each actor. The node identities and topology match the preceding case network.

3.1 APPLICATION CENTRALITY NETWORK

Betweenness centrality

Precision pump assembly | 6 actors | 5 directed ties. Node size and colour encode the application's calculated score.



HIGHEST VALUES IN THE APPLICATION

DEBURR: 0.300; ASSEMBLY: 0.300; CNC: 0.200; TEST: 0.200; CUT: 0.000

Brokerage on shortest directed paths, using JalViGo's normalization. The node identities and topology match the preceding case network.

3.1 APPLICATION CENTRALITY NETWORK

Closeness centrality

Precision pump assembly | 6 actors | 5 directed ties. Node size and colour encode the application's calculated score.

HIGHEST VALUES IN THE APPLICATION

CUT: 0.333; CNC: 0.320; DEBURR: 0.300; ASSEMBLY: 0.267; TEST: 0.200

Outward directed closeness, using JalViGo's reachability correction. The node identities and topology match the preceding case network.

3.2 MANUFACTURING RESULTS

Manufacturing measures and charts

Measure	20 units released at time zero
Makespan	176.000 min
Mean throughput time	100.000 min
Mean output cycle time	8.000 min/unit
Batch throughput	0.113636 units/min
Mean waiting time	76.000 min
Bottleneck processing cycle	8.000 min/unit

Makespan spans the batch from the first release to the final completion. Throughput time is each unit's completion minus its release, averaged across units. Output cycle time is the mean spacing between consecutive completions; it is unavailable for a single completed unit. Batch throughput is completed units divided by makespan.

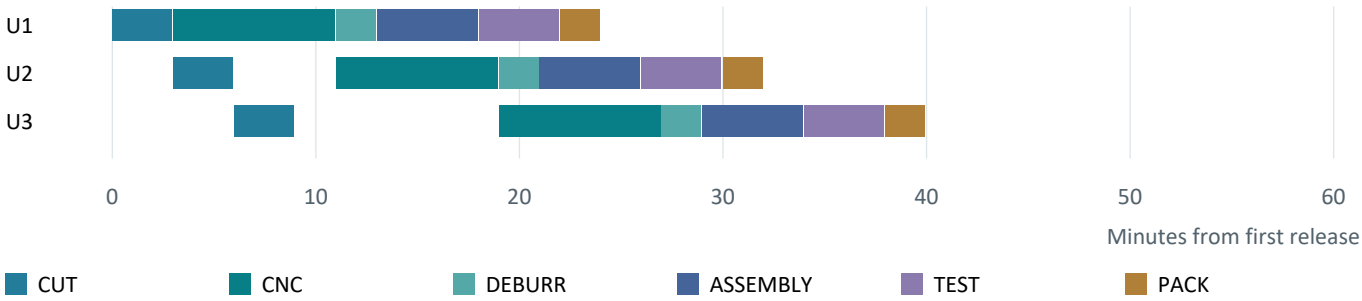


Figure 3. First three units of the baseline pump schedule. Bars show processing; gaps between a unit's operations represent waiting.

The **Process plan** appears above the Gantt chart and shows the operation order and durations. The interactive **Gantt chart** organizes operations by station; inspect a bar for unit and timing information. The preview is limited to the first 50 units and first 30 stations, while the calculation uses the full permitted batch.

The **pie chart** separates average processing time (24 minutes, 24%) from average waiting time (76 minutes, 76%) for the baseline. These are shares of mean throughput time, not machine utilization. Switch the chart between baseline and scenario when comparing results.

Paced release experiment

Change the release interval to eight minutes. Makespan remains 176 minutes, but mean throughput time falls to 24 minutes and modeled waiting becomes zero. This demonstrates that releasing work later can reduce in-system waiting without increasing completed output in this example. Cycle-time terminology varies; the labels above specify the software definitions [5].

3.3 PRODUCT MIX

Product mix optimization and scheduling

Product mix combines an integer quantity decision with a subsequent schedule. In Paths, enter products, demand bounds, price, variable cost, station processing times and available station minutes. Keep all capacities on a common planning-period basis.

Input	Standard pump	Premium pump
Initial planned quantity	10	10
Minimum / maximum demand	0 / 40	0 / 30
Selling price / variable cost	300 / 180	450 / 250
Contribution per unit	120	200
CUT / CNC / DEBURR minutes	3 / 8 / 2	4 / 12 / 3
ASSEMBLY / TEST / PACK minutes	5 / 4 / 2	7 / 6 / 3

1. Load the pump case and open the product-mix inputs. Set available productive time to **480 minutes at each station**. Use a consistent currency unit for both prices and costs.

2. Check minimum and maximum demand, nonnegative times and the planned quantities. A zero station time means no processing at that station for that product.

3. Select **Optimize & schedule mix**. Read the optimizer status before using the result. It applies the selected quantities and enables product-mix scheduling.

4. Set the product sequence using the earlier/later controls. The product list determines the release and production order. Reinspect the schedule after changing that order.

Verified optimum for the case

The optimal whole-unit quantities are **15 Standard pumps and 30 Premium pumps**. Revenue is 18,000, variable cost is 10,200 and contribution is **7,800 currency units**. CNC uses all 480 available minutes. With Standard first, Premium second and zero release interval, the schedule makespan is **502 minutes**.

Station workload feasibility does not guarantee completion within a 480-minute elapsed shift: downstream operations finish after CNC. The optimizer maximizes contribution under capacity and demand bounds; it does not minimize makespan or optimize sequence. A generic production-planning formulation is described in [4]; JalViGo uses its own integer search.

3.4 PRODUCT MIX INTERPRETATION

Control product mix assumptions

The objective is the sum of quantity multiplied by selling price minus variable cost for each product. Each station limits the sum of product quantities multiplied by their station times. Product quantities are whole numbers bounded by their entered minimum and maximum demand.

Station	Used minutes at the optimum	Available minutes
Cutting	165	480
CNC machining	480	480
Deburring	120	480
Assembly	285	480
Quality testing	240	480
Packing	120	480

Read the solver status

Optimal means the search proves the best whole-unit contribution under the entered linear constraints. **Feasible** after the search limit means the best mix found is usable under those constraints, but optimality has not been proved. Invalid or infeasible input requires correction before a result can be used.

The implementation supports up to 12 products and a search limit of 100,000 branch-and-bound visits. Quantities are bounded by the input rules; large demand ranges can make proving optimality more difficult. Retain the status with the exported result rather than reporting every feasible result as optimal.

What to verify before operational use

1. Confirm that demand bounds refer to the same planning period as capacity, and that costs include the intended variable components.

2. Check the shared route and every required directed arc. Zero processing at a station does not remove the requirement for a valid transfer chain.

3. Review machine assumptions, buffer space, materials, labor, changeovers and due dates separately. These constraints are not all represented in this model.

4. Compare the Gantt completion time with the intended dispatch deadline. Revise quantities or assumptions if the capacity-feasible mix finishes too late.

The model is a deterministic serial scheduling aid, not a general job-shop optimizer. A change in prices can alter the chosen quantities without changing any network tie. Conversely, a removed route arc can block scheduling even when aggregate capacity arithmetic is feasible.

4.1 ORGANIZATIONAL OUTCOMES

Case: Employee Productivity and Wellbeing

Load **Organizational Behaviour - Productivity & Wellbeing**. This 12-employee, three-team case opens Report and provides two distinct outcome measures. Their values come from employee observations, not from the collaboration network.

Input	Meaning and accepted value
Employee ID and team	Identify the observation and its organizational context.
Output	Accepted, complexity-adjusted work units; a nonnegative number. Define the unit consistently.
Hours	Observed working hours; must be greater than zero for productivity.
Wellbeing raw score	An integer from 0 to 25 representing an existing WHO-5 total.
Period and targets	Use comparable periods and explicitly document the evaluation criteria.

Two separate calculations

Employee productivity is total valid output divided by total valid hours. It is a pooled rate, not an unweighted mean of individual rates. **Employee wellbeing** converts each valid WHO-5 raw total to a 0-to-100 score by multiplying by four, then takes an unweighted mean across valid respondents [6].

The supplied observations total **1,060 work units and 960 hours**. Productivity is therefore **1.104167 work units/hour**. Mean wellbeing is **70.000 out of 100**. These are separate outcomes; the software does not combine them into one employee score.

Edit observations and inspect coverage

1. Open Report and expand both measures under Performance indicators using **Click to show**. Also inspect the Employee performance measures panel.

2. Review the observation table. Edit output, hours or raw wellbeing totals and commit the change with Enter or by leaving the field.

3. Check the number of valid productivity and wellbeing observations separately. Invalid or missing values are excluded only from the affected measure.

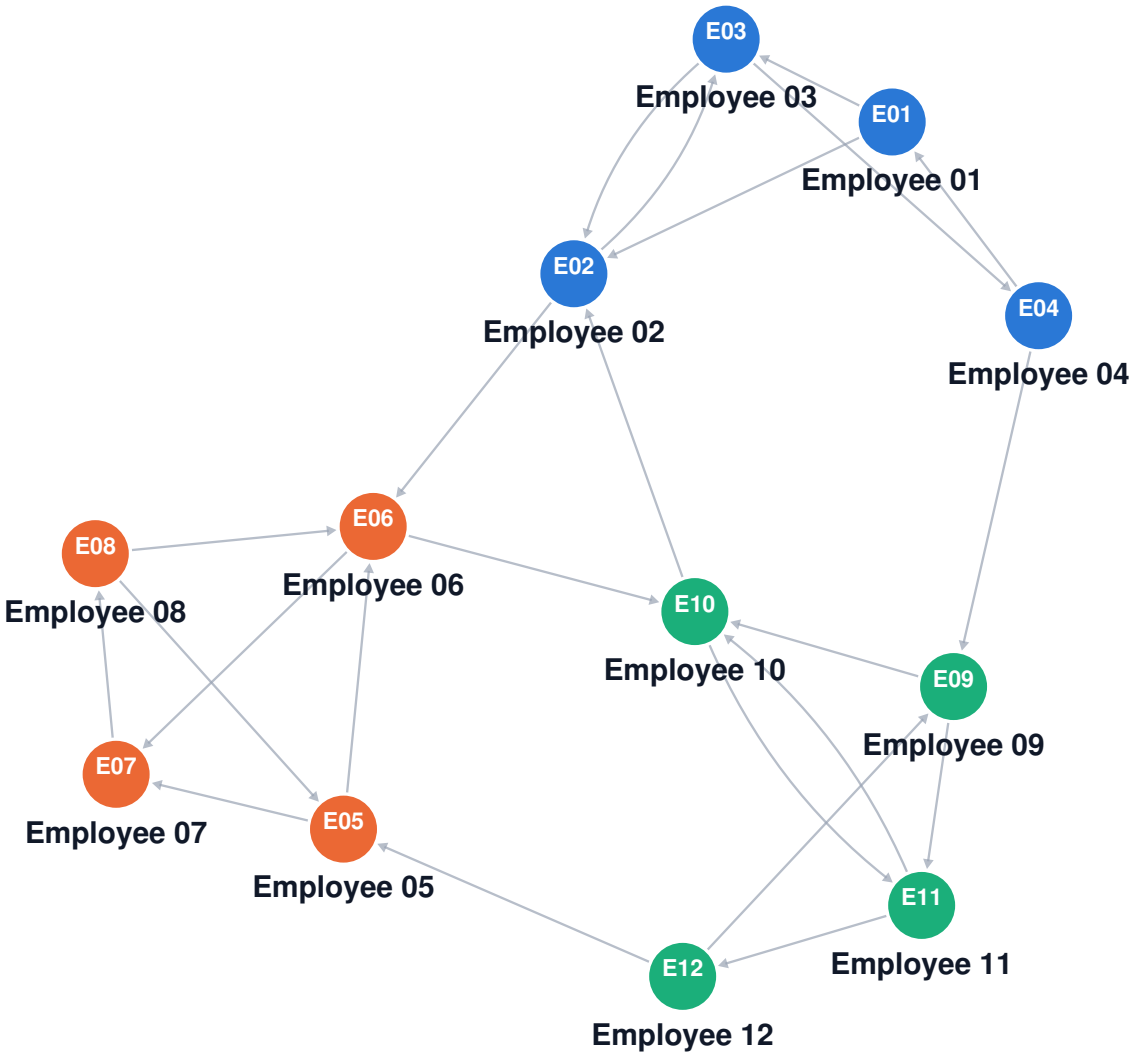
4. Export employee results and the session to retain observations and criteria.

Valid zero output and a valid zero wellbeing total are retained. Zero hours is invalid for productivity. The interface accepts an already calculated WHO-5 total; it does not administer or reproduce the questionnaire. Consult the official instrument for administration [6].

4.1 APPLICATION NETWORK

Employee productivity and wellbeing

JalViGo bundled case: 12 actors and 23 directed ties. Generated with the uploaded application's layout, scene model and native figure exporter.



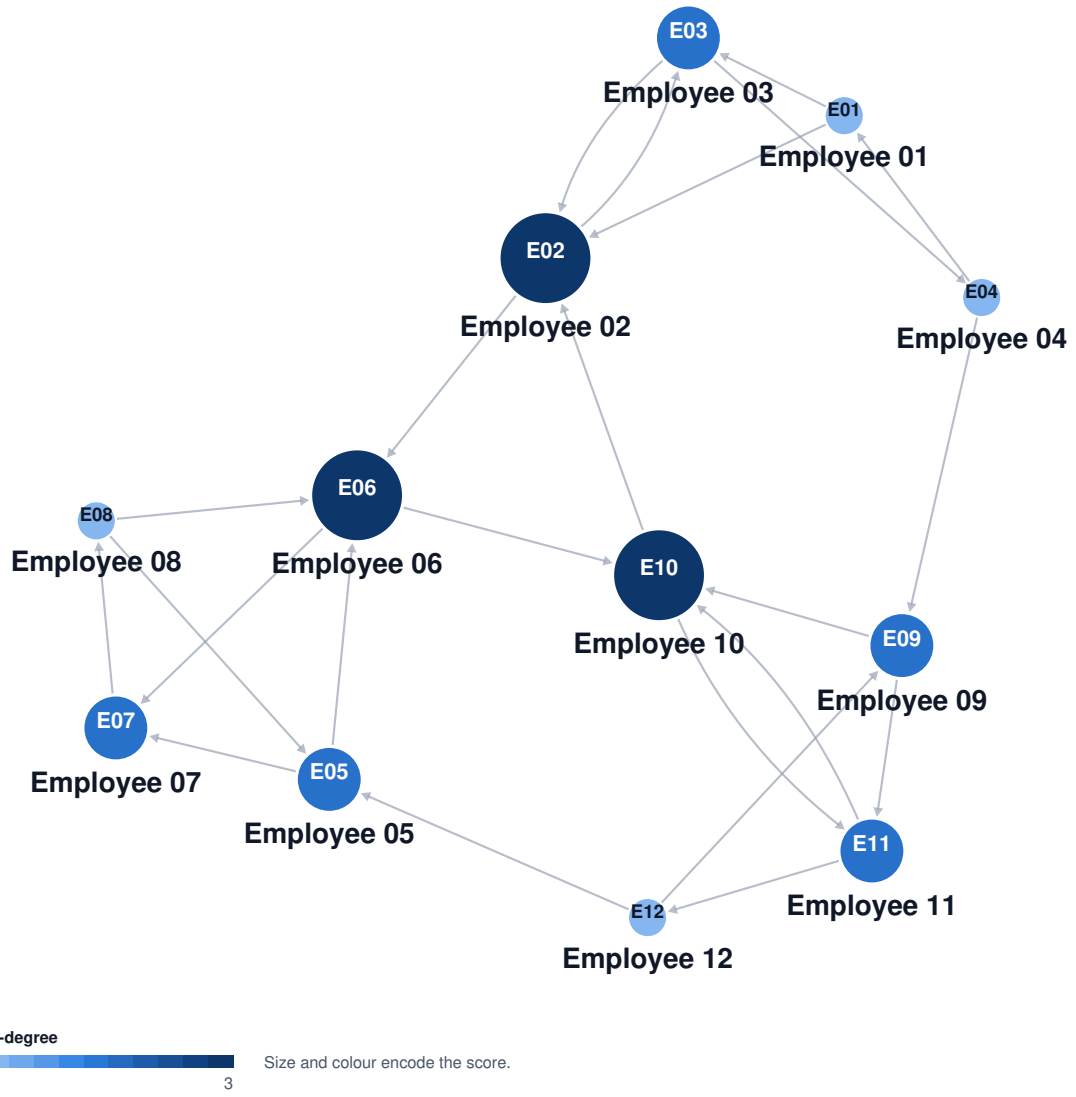
All 12 employees and 23 collaboration ties are retained. Employee output and wellbeing remain separate recorded outcomes.

Colours identify teams where defined; the smaller ungrouped cases use JalViGo's categorical colours. Coordinates affect the drawing, not the network measures.

4.1 APPLICATION CENTRALITY NETWORK

In-degree centrality

Employee productivity and wellbeing | 12 actors | 23 directed ties. Node size and colour encode the application's calculated score.



HIGHEST VALUES IN THE APPLICATION

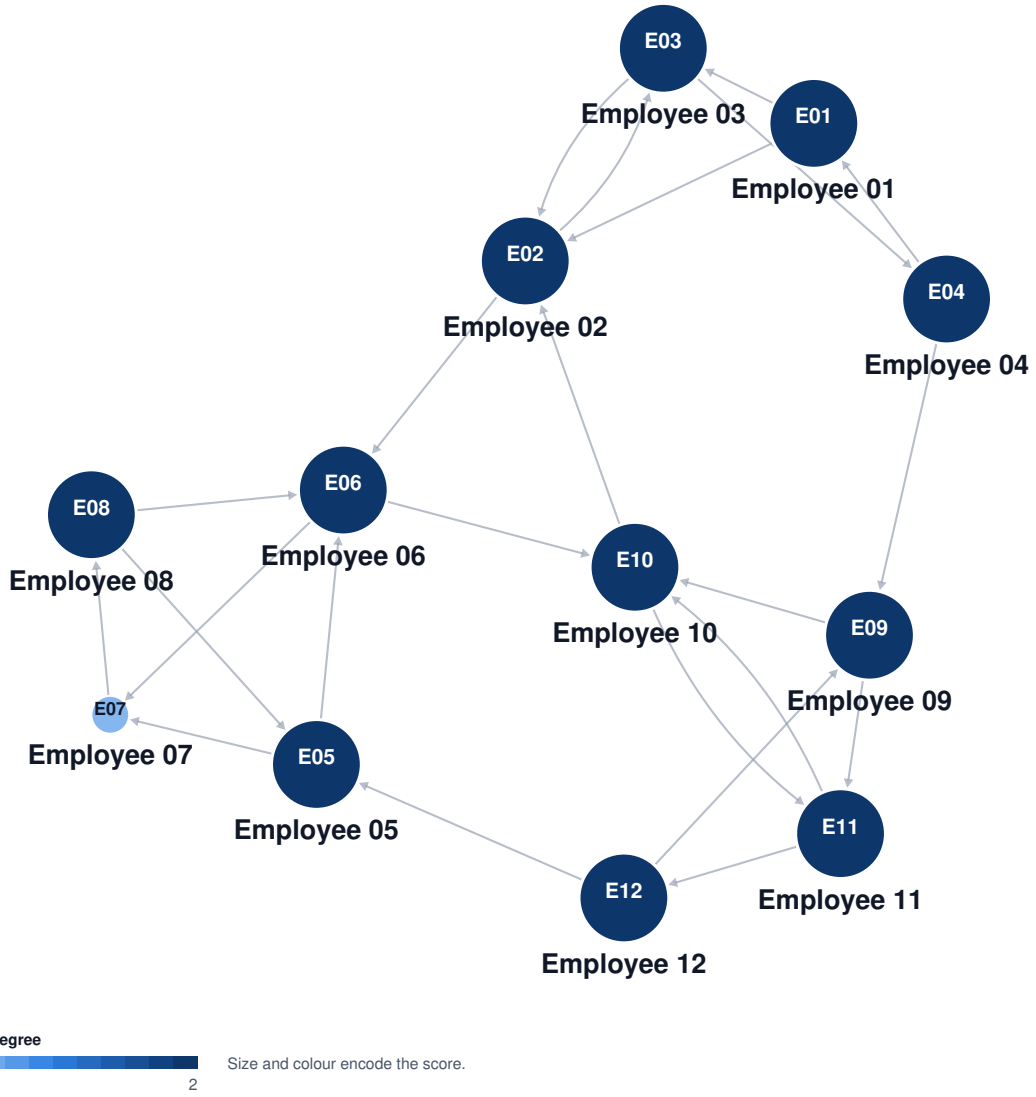
E02: 3; E06: 3; E10: 3; E03: 2; E05: 2

Incoming ties received by each actor. The node identities and topology match the preceding case network.

4.1 APPLICATION CENTRALITY NETWORK

Out-degree centrality

Employee productivity and wellbeing | 12 actors | 23 directed ties. Node size and colour encode the application's calculated score.



HIGHEST VALUES IN THE APPLICATION

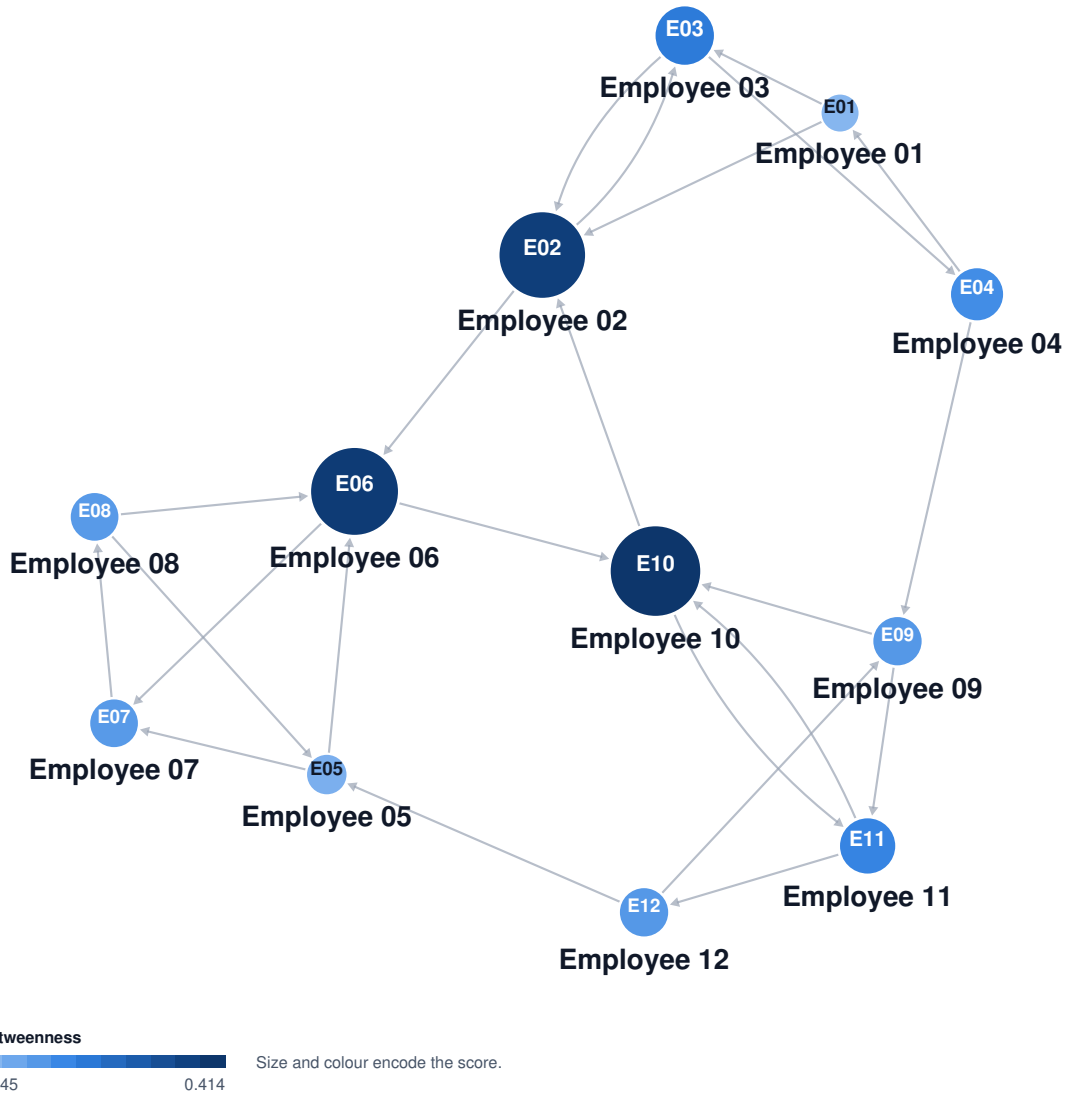
E01: 2; E02: 2; E03: 2; E04: 2; E05: 2

Outgoing ties sent by each actor. The node identities and topology match the preceding case network.

4.1 APPLICATION CENTRALITY NETWORK

Betweenness centrality

Employee productivity and wellbeing | 12 actors | 23 directed ties. Node size and colour encode the application's calculated score.



HIGHEST VALUES IN THE APPLICATION

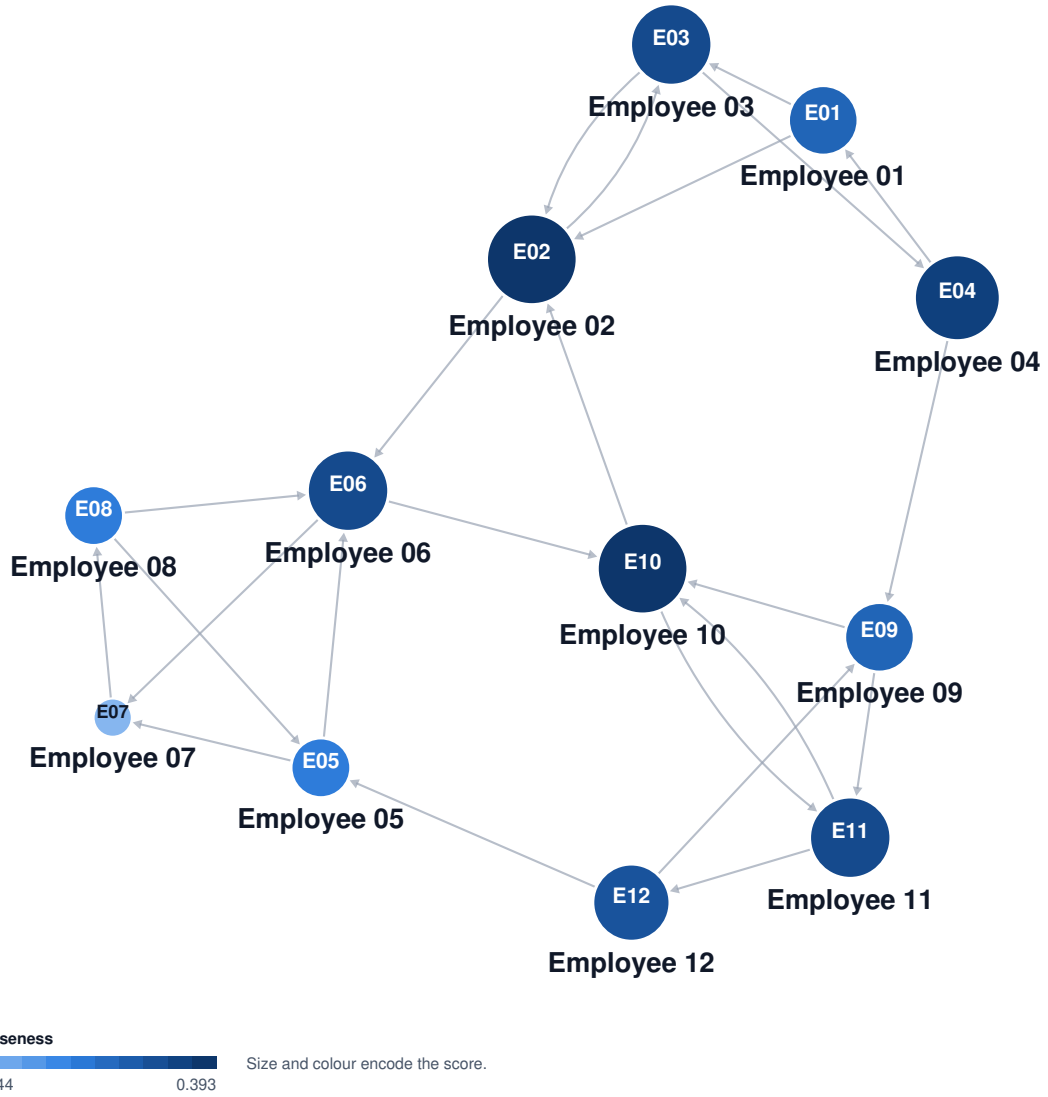
E10: 0.414; E06: 0.395; E02: 0.386; E03: 0.200; E11: 0.177

Brokerage on shortest directed paths, using JalViGo's normalization. The node identities and topology match the preceding case network.

4.1 APPLICATION CENTRALITY NETWORK

Closeness centrality

Employee productivity and wellbeing | 12 actors | 23 directed ties. Node size and colour encode the application's calculated score.



HIGHEST VALUES IN THE APPLICATION

E02: 0.393; E10: 0.393; E04: 0.379; E03: 0.367; E06: 0.367

Outward directed closeness, using JalViGo's reachability correction. The node identities and topology match the preceding case network.

4.2 EVALUATION CRITERIA

Evaluate employee outcomes

In Report, set a positive productivity target and a wellbeing target between 0 and 100. The illustrative defaults are **1 work unit/hour** and **70 out of 100**. These are editable case criteria, not universal performance standards or clinical cutoffs.

Derived team comparison	Productivity	Mean wellbeing
Service Alpha	1.025	81
Service Beta	1.3125	55
Service Gamma	0.975	74

The table above is calculated from the supplied 12 observations for this manual. It illustrates why the measures should remain separate: Service Beta has the highest output rate and the lowest mean wellbeing in the synthetic data. This pattern does not establish a causal relationship.

Read target attainment

Productivity attainment divides the pooled rate by the selected target. Wellbeing gap subtracts its target from the mean score. The analysis also counts individuals meeting each target among valid observations. A group mean meeting a target does not mean that every employee meets it.

1. Document the rationale for the targets and the meaning of one output unit. Make team comparisons only where work content and measurement periods are reasonably comparable.

2. Change a target and observe that the evaluation changes while the underlying measured outcomes remain the same.

3. Inspect valid-observation coverage. Investigate missingness before treating a group comparison as representative.

4. Keep employee results separate from network centrality. Use a network scenario to explore collaboration structure, not to manufacture predicted changes in wellbeing.

Preserve the observation cohort

Removing an actor from a what-if network does not automatically remove that person’s observation from the employee dataset. The retained observation cohort avoids presenting unchanged measurements as a predicted post-intervention result. To analyze a different population or period, prepare and document that dataset explicitly.

Use appropriately restricted, pseudonymized records for workforce analysis. The tool provides decision support, not a diagnosis or an automated employment recommendation. WHO-5 questionnaire wording is not reproduced in this manual; the official source is linked in the references.

5.1 SECTOR WALKTHROUGH

Case: Corporate Communication

Case: Corporate Communication. Ten actors represent executive and functional roles, including CEO, Operations, Supply Chain, Finance, Human Resources, Marketing, IT, Project Office, Regional Head and Sales.

Decision question

Which roles connect otherwise separated functions, and how might communication continuity change if one coordinating role is temporarily unavailable? Treat each directed tie as a documented communication relationship over a specified period.

1. Load the case and use Explore to compare in-degree, out-degree and betweenness. Note whether the same role leads all three rankings.

2. In Paths, examine the direction from CEO to IT. One available three-step route is CEO to Operations to Supply Chain to IT; another passes through Project Office.

3. In What-if, remove **OPS** explicitly with other controls at zero. Compare structural results there. To inspect a route, apply the scenario using the save/apply/restore procedure on page 7.

4. Restore the baseline, then test removal of one specific communication arc. Compare its effect with actor removal, which also removes all incident ties.

5. Export the baseline and each scenario with a short explanation of the role or relationship represented.

Record	Why it matters
Centrality ranking	Identifies structural roles for discussion
Reachability and efficiency	Shows whether alternative communication remains
Specific removed ID or arc	Makes the scenario reproducible
Proposed backup link	Needs business validation before implementation

Domain interpretation

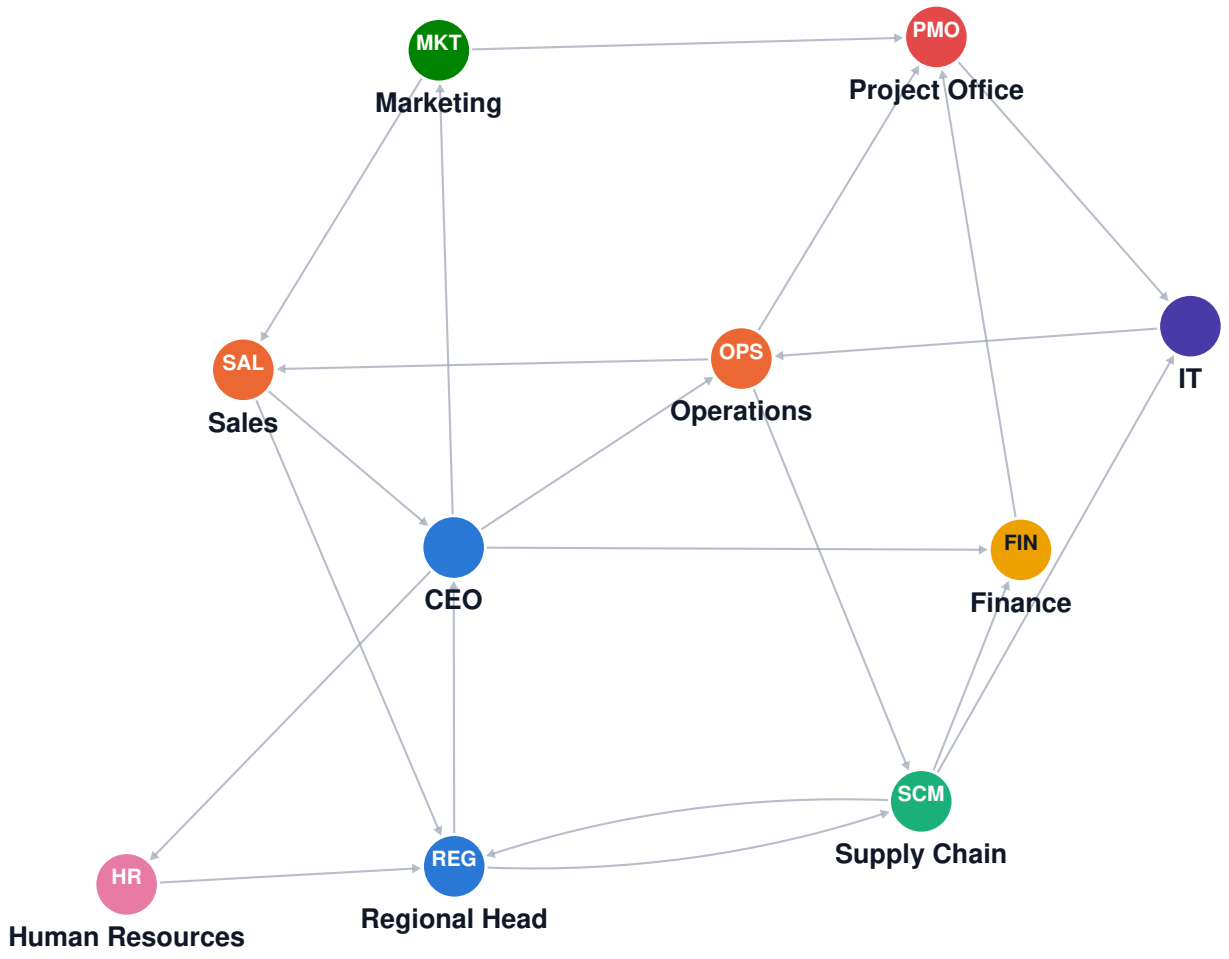
A coordinator can be both valuable and a continuity dependency. Consider a designated deputy or an agreed escalation channel as a business hypothesis, then represent the corresponding tie and inspect the structural effect. Do not assume that adding a line in the graph establishes actual communication behavior.

The case does not contain measured employee performance. Productivity and wellbeing are not derived from communication frequency or centrality. Use one of the organizational outcome cases, with appropriate observations, when those outcomes are required.

5.1 APPLICATION NETWORK

Corporate communication

JalViGo bundled case: 10 actors and 20 directed ties. Generated with the uploaded application's layout, scene model and native figure exporter.



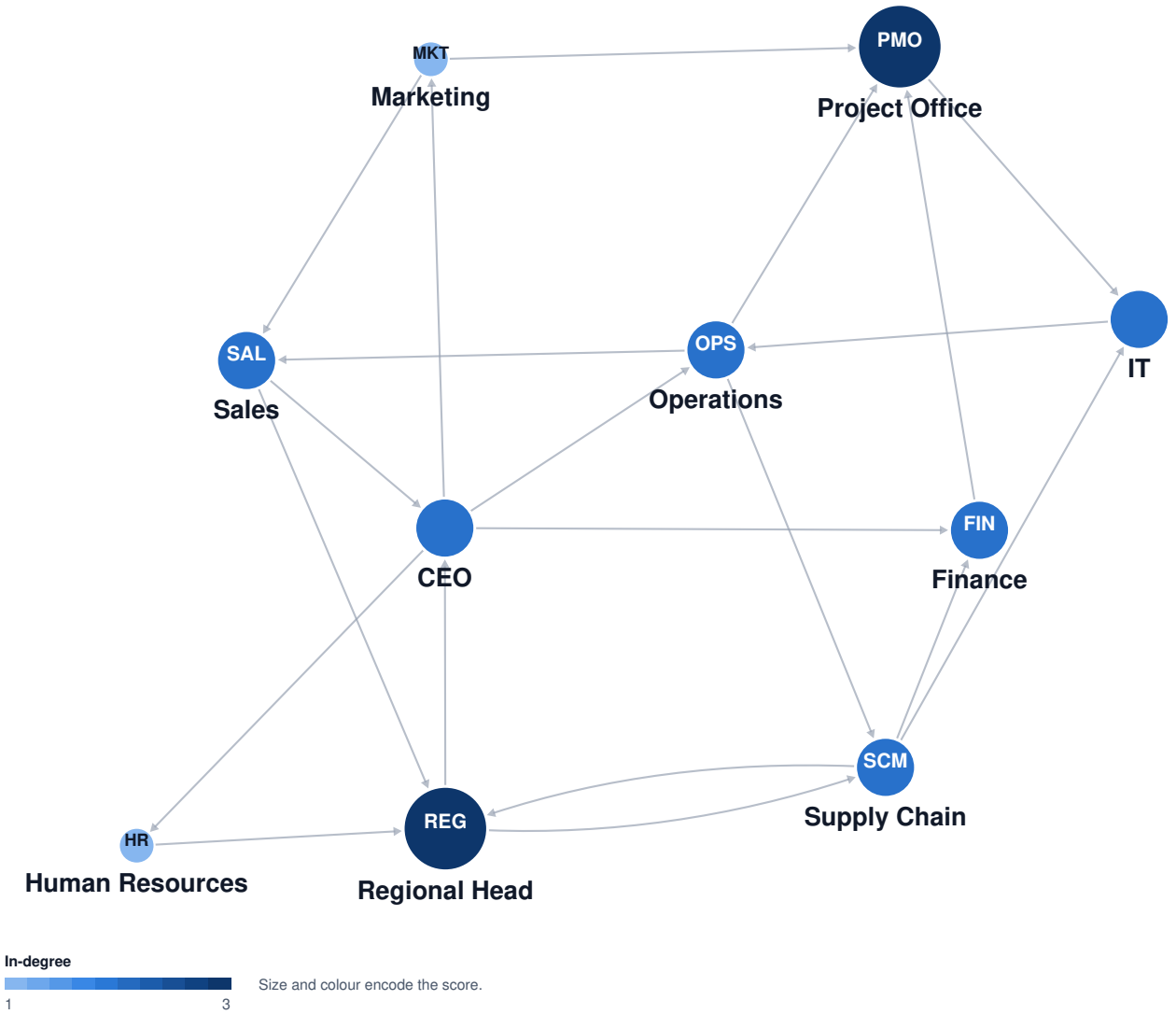
All 10 functional actors and 20 directed communication ties are shown, including reciprocal and feedback relationships.

Colours identify teams where defined; the smaller ungrouped cases use JalViGo's categorical colours. Coordinates affect the drawing, not the network measures.

5.1 APPLICATION CENTRALITY NETWORK

In-degree centrality

Corporate communication | 10 actors | 20 directed ties. Node size and colour encode the application's calculated score.



HIGHEST VALUES IN THE APPLICATION

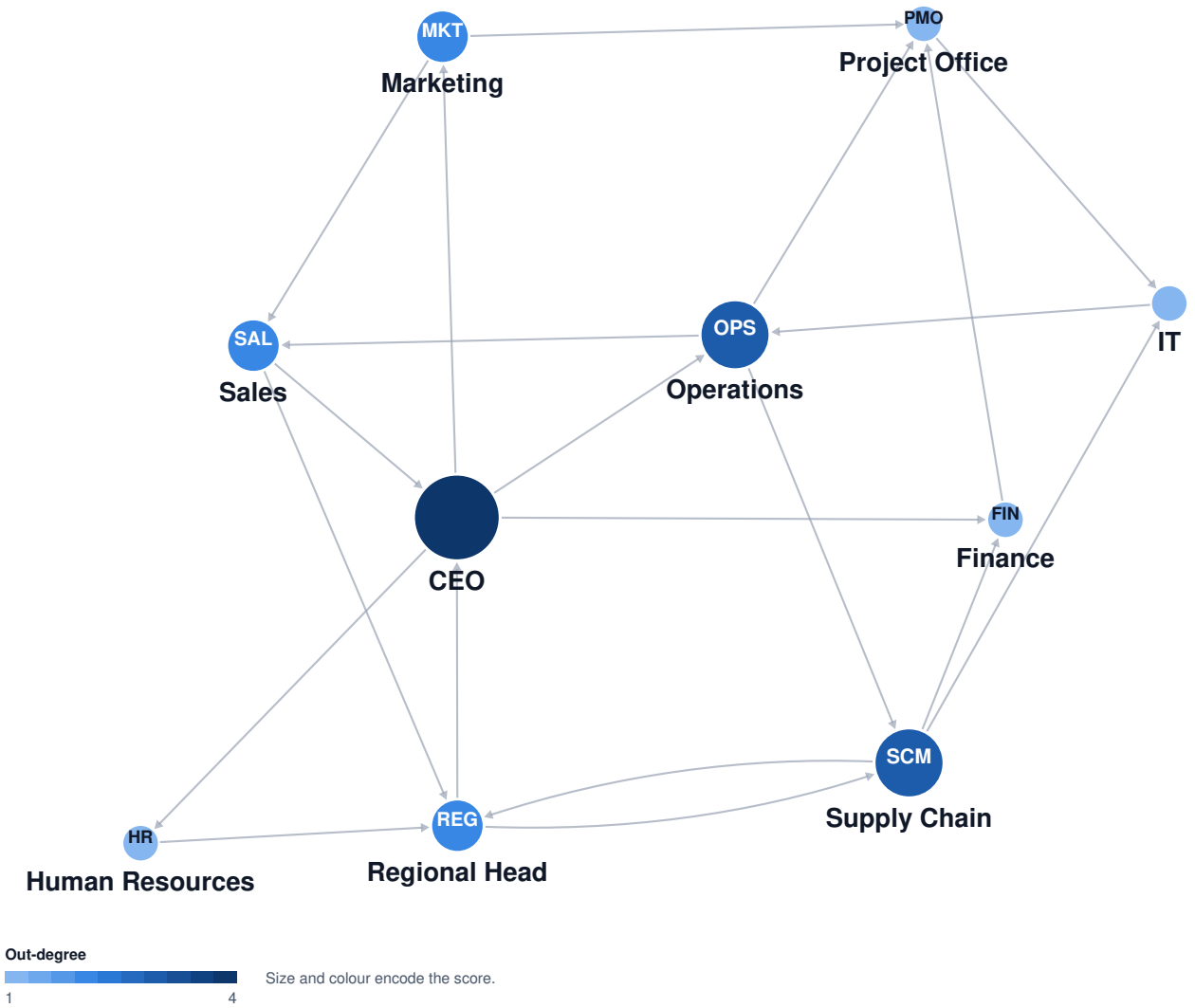
PMO: 3; REG: 3; CEO: 2; OPS: 2; SCM: 2

Incoming ties received by each actor. The node identities and topology match the preceding case network.

5.1 APPLICATION CENTRALITY NETWORK

Out-degree centrality

Corporate communication | 10 actors | 20 directed ties. Node size and colour encode the application's calculated score.



HIGHEST VALUES IN THE APPLICATION

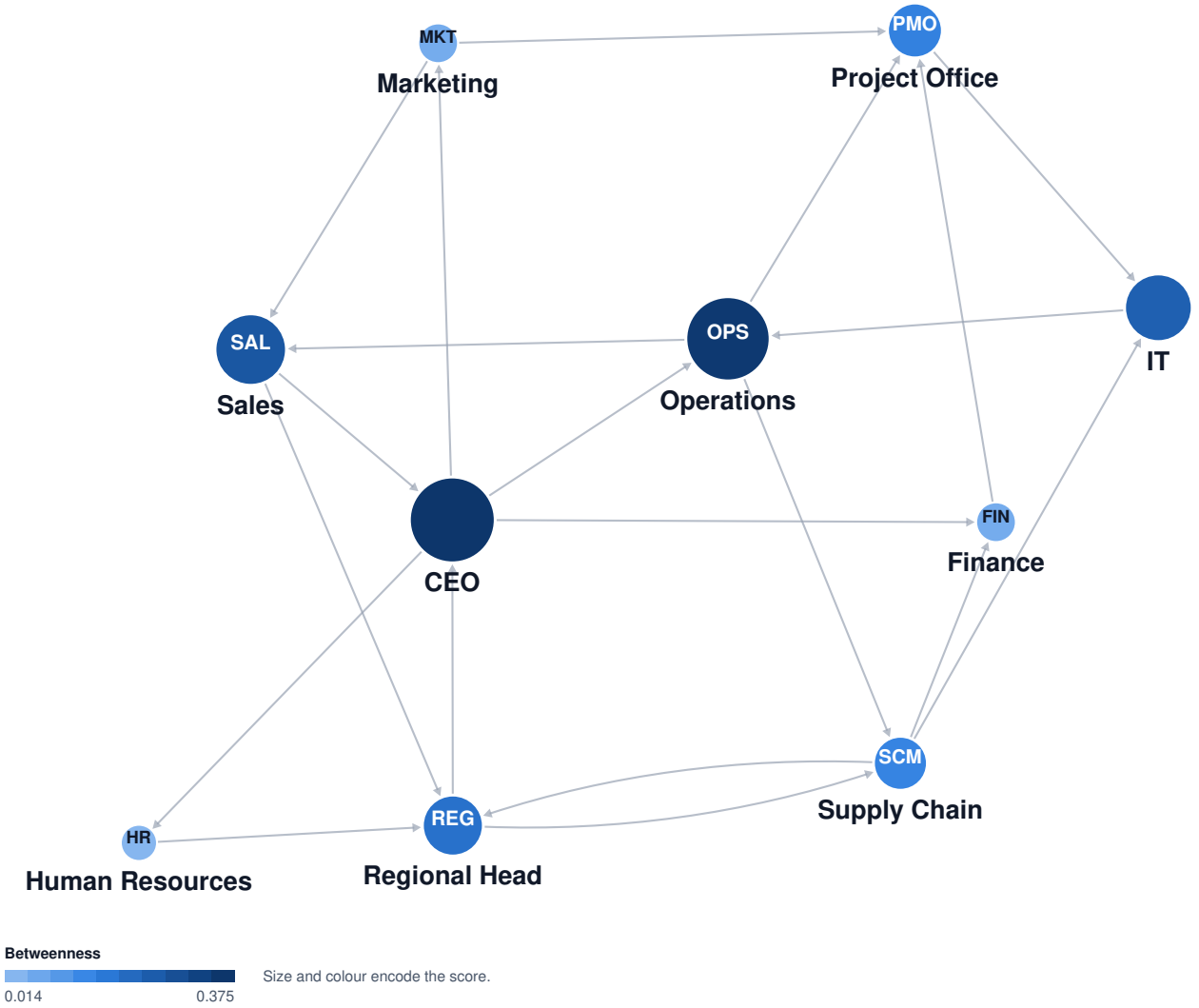
CEO: 4; OPS: 3; SCM: 3; MKT: 2; REG: 2

Outgoing ties sent by each actor. The node identities and topology match the preceding case network.

5.1 APPLICATION CENTRALITY NETWORK

Betweenness centrality

Corporate communication | 10 actors | 20 directed ties. Node size and colour encode the application's calculated score.



HIGHEST VALUES IN THE APPLICATION

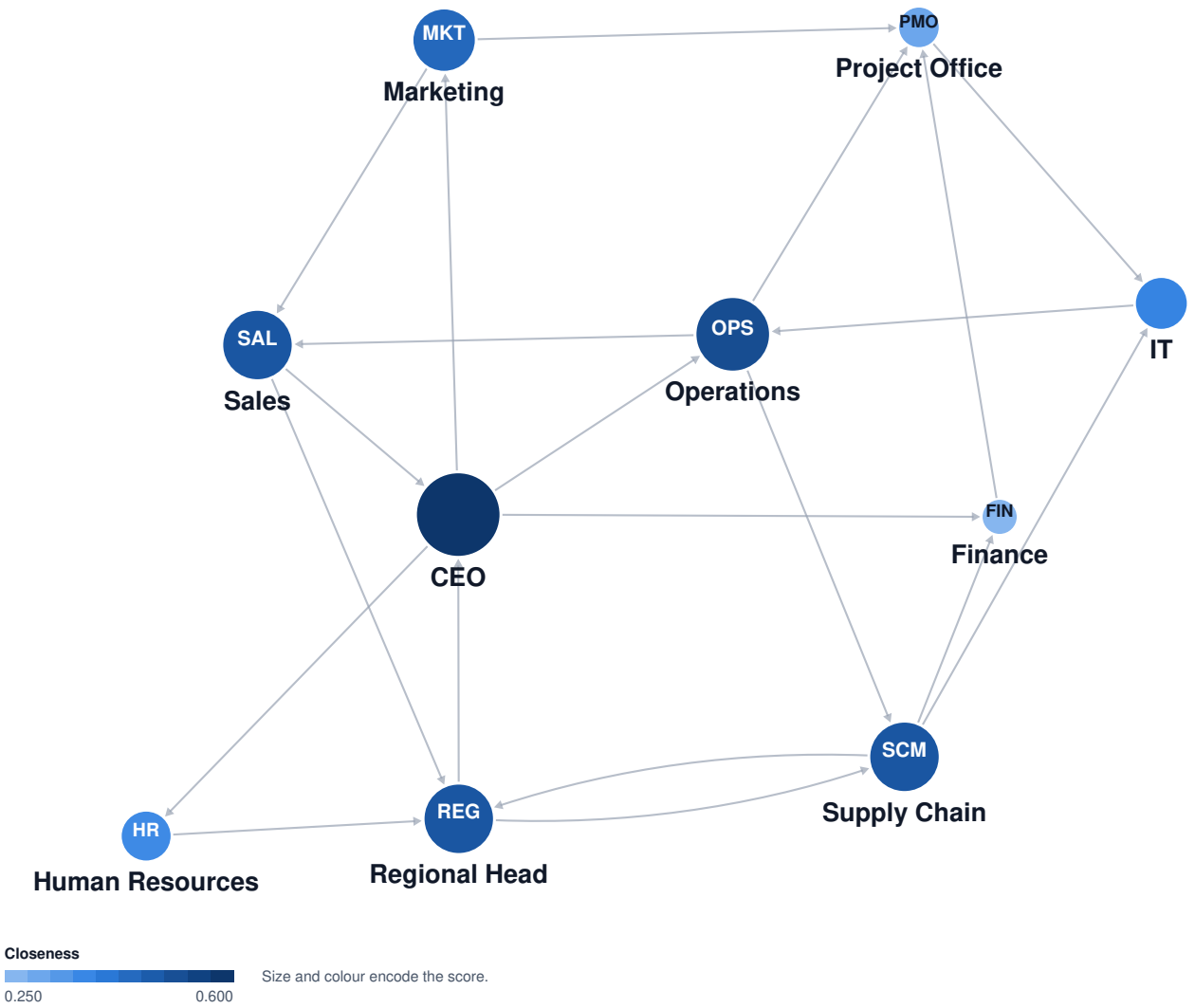
CEO: 0.375; OPS: 0.363; SAL: 0.271; IT: 0.243; REG: 0.194

Brokerage on shortest directed paths, using JalViGo's normalization. The node identities and topology match the preceding case network.

5.1 APPLICATION CENTRALITY NETWORK

Closeness centrality

Corporate communication | 10 actors | 20 directed ties. Node size and colour encode the application's calculated score.



HIGHEST VALUES IN THE APPLICATION

CEO: 0.600; OPS: 0.529; SCM: 0.500; REG: 0.500; SAL: 0.500

Outward directed closeness, using JalViGo's reachability correction. The node identities and topology match the preceding case network.

5.2 SECTOR WALKTHROUGH

Case: Supply Chain Coordination

Case: Supply Chain Coordination. Ten actors include two suppliers, two plants, a warehouse, two distribution centres, two retailers and a logistics partner. Interpret the ties consistently as coordination links; they do not carry measured shipment volumes or capacities.

Decision question

Which intermediate facility or connection supports source-to-retailer continuity, and can a feasible backup connection reduce structural dependence? The network perspective complements operational capacity analysis [2].

1. Load the case. In Paths, choose **S1** as source and **R1** as destination. Inspect the route S1 to M1 to WH to DC1 to R1 and any alternatives.

2. Save the baseline and remove **WH** in What-if. S1 can no longer reach R1. Apply the scenario to verify this in Paths, then restore the saved baseline.

3. Remove only **M1 to WH**. The route through M2 remains available. Use the save/apply/restore procedure on page 7 to inspect it in Paths.

4. Choose the same endpoints in resilience analysis. Record whether the calculation is exact or sampled, along with the seed and failure mode.

5. Test a backup strategy or explicit new connection. Validate physical transport, contracts and capacity before treating it as an implementable alternative.

Network evidence	Operational follow-up
Loss of source-to-retailer reachability	Identify a real alternate service or transport arrangement
Remaining directed route	Check capacity, lead time and product compatibility
Higher structural resilience	Assess investment and operating costs separately
Z1 to Z5 changes	Report the calculation conventions and graph projection

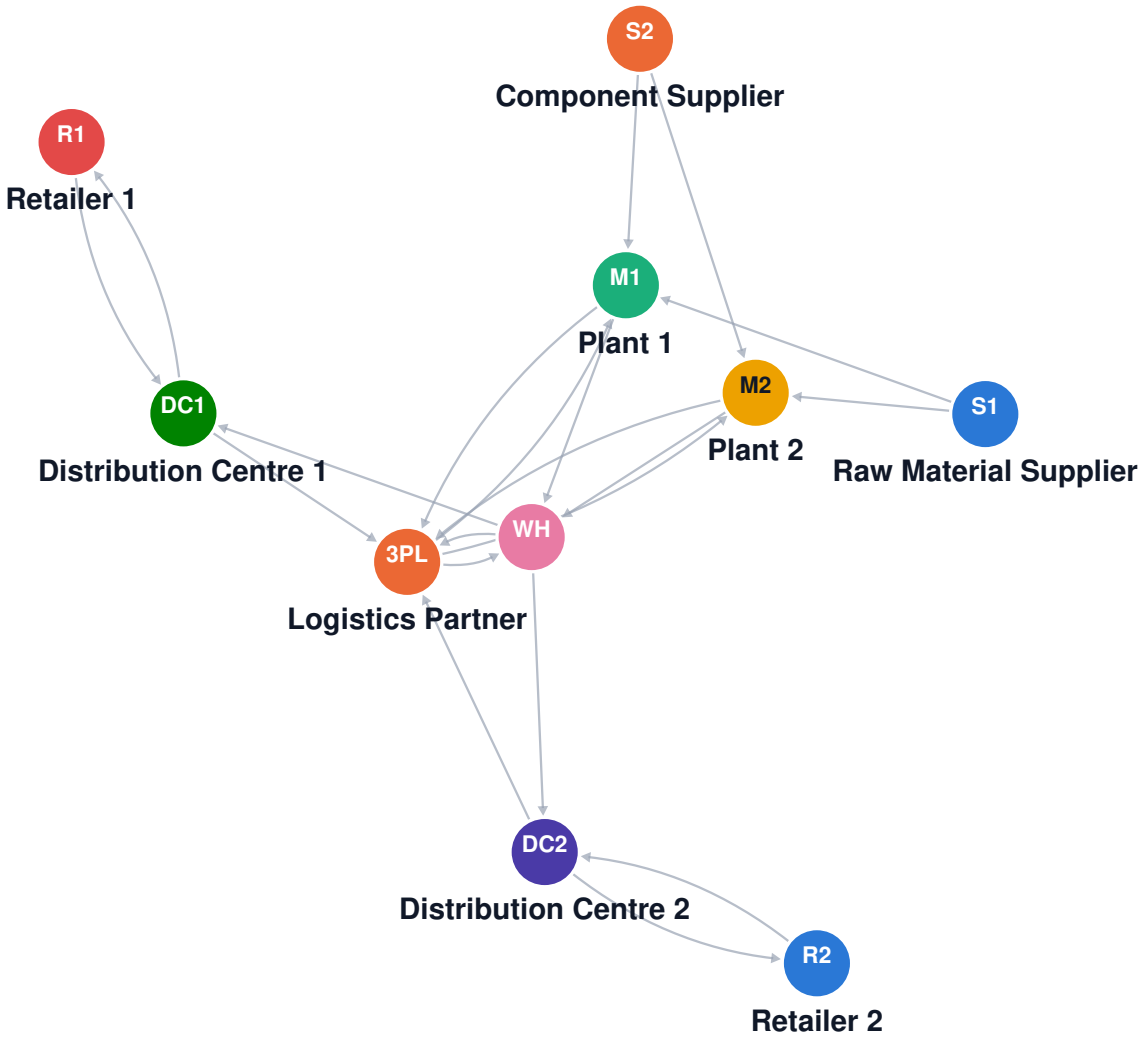
Boundary of the case

A surviving path is not a guarantee that demand can be fulfilled. Binary ties omit throughput capacity, inventory, product spoilage, shipment timing and contracts. The cited perishable-food study [3] motivates structural indicators, but loading this case does not execute that publication’s full optimization model.

5.2 APPLICATION NETWORK

Supply chain coordination

JalViGo bundled case: 10 actors and 20 directed ties. Generated with the uploaded application's layout, scene model and native figure exporter.



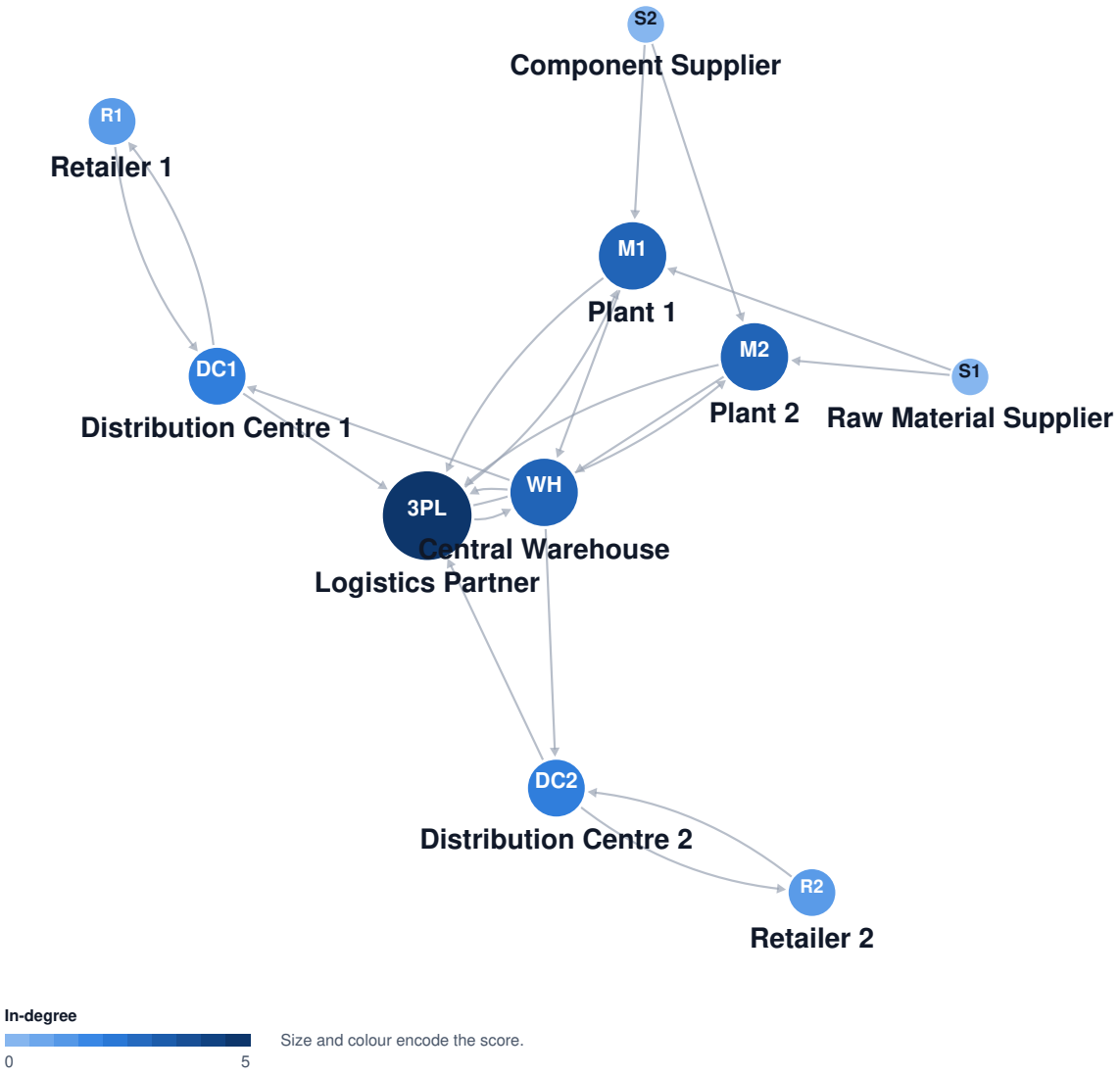
The full case includes the logistics partner (3PL), retailer feedback and two-way warehouse coordination. Every displayed tie comes from the bundled network.

Colours identify teams where defined; the smaller ungrouped cases use JalViGo's categorical colours. Coordinates affect the drawing, not the network measures.

5.2 APPLICATION CENTRALITY NETWORK

In-degree centrality

Supply chain coordination | 10 actors | 20 directed ties. Node size and colour encode the application's calculated score.



HIGHEST VALUES IN THE APPLICATION

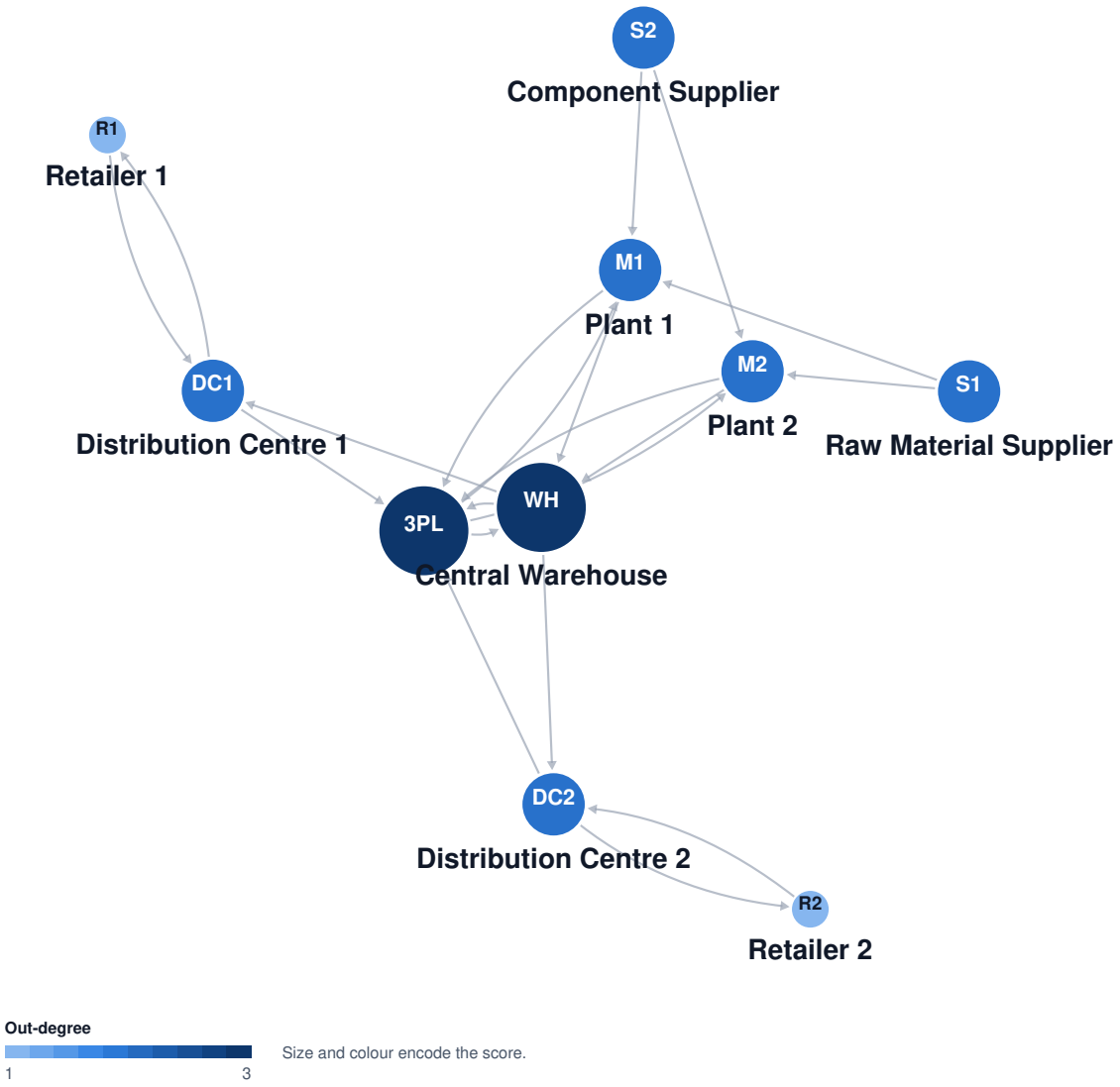
3PL: 5; M1: 3; M2: 3; WH: 3; DC1: 2

Incoming ties received by each actor. The node identities and topology match the preceding case network.

5.2 APPLICATION CENTRALITY NETWORK

Out-degree centrality

Supply chain coordination | 10 actors | 20 directed ties. Node size and colour encode the application's calculated score.



HIGHEST VALUES IN THE APPLICATION

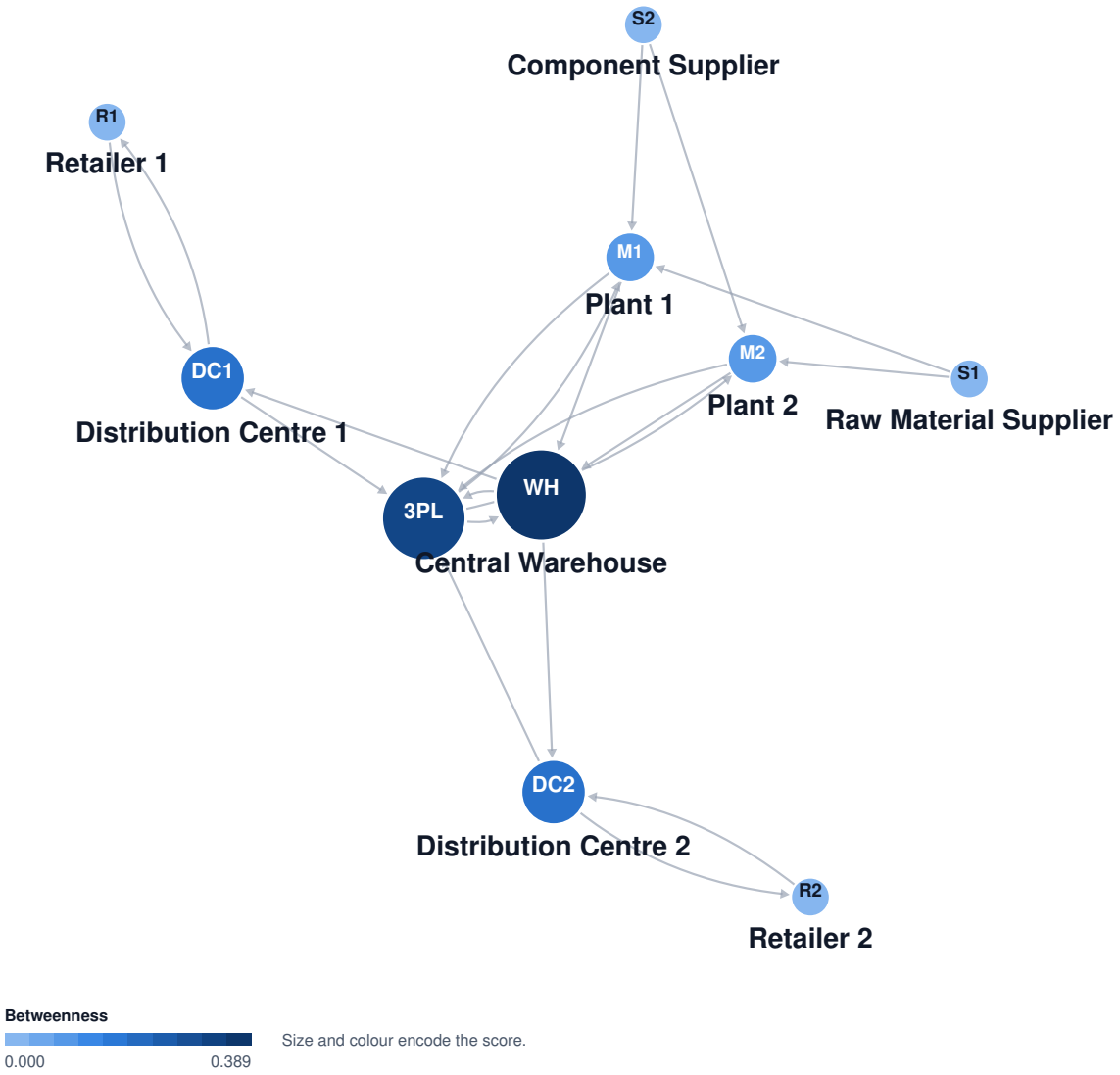
WH: 3; 3PL: 3; S1: 2; S2: 2; M1: 2

Outgoing ties sent by each actor. The node identities and topology match the preceding case network.

5.2 APPLICATION CENTRALITY NETWORK

Betweenness centrality

Supply chain coordination | 10 actors | 20 directed ties. Node size and colour encode the application's calculated score.



HIGHEST VALUES IN THE APPLICATION

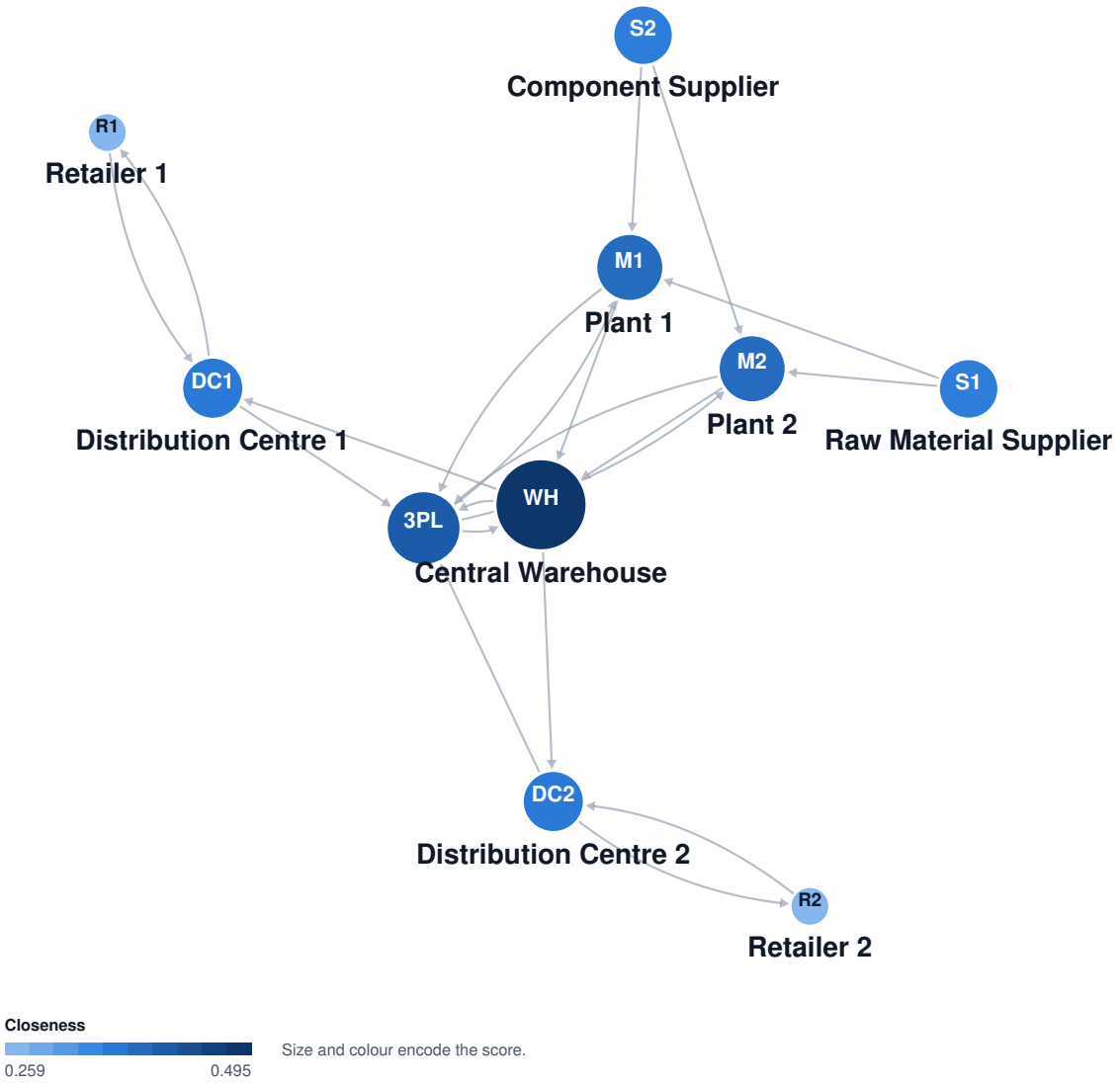
WH: 0.389; 3PL: 0.333; DC1: 0.194; DC2: 0.194; M1: 0.083

Brokerage on shortest directed paths, using JalViGo's normalization. The node identities and topology match the preceding case network.

5.2 APPLICATION CENTRALITY NETWORK

Closeness centrality

Supply chain coordination | 10 actors | 20 directed ties. Node size and colour encode the application's calculated score.



HIGHEST VALUES IN THE APPLICATION

WH: 0.495; 3PL: 0.419; M1: 0.389; M2: 0.389; DC1: 0.363

Outward directed closeness, using JalViGo's reachability correction. The node identities and topology match the preceding case network.

5.3 SECTOR WALKTHROUGH

Case: Project Collaboration

Case: Project Collaboration. Ten roles represent Sponsor, Project Manager, Design, Engineering, Data Team, Quality, Procurement, Vendor, Operations and Customer. The ties illustrate directed coordination dependencies.

Decision question

Is coordination overly dependent on the project manager, and can technical teams still reach the operational handover roles if one communication route is lost?

1. Load the case. Compare the Project Manager and Engineering in the centrality ranking. Record the selected measure rather than using the general word importance.

2. In Paths, examine **DES to OPS**. The supplied graph includes Design to Data Team to Operations, as well as Design to Engineering to Quality to Operations.

3. Remove **DATA to OPS** in What-if. Use the save/apply/restore procedure on page 7 to verify the alternative through Engineering and Quality in Paths.

4. Restore the baseline and remove **PM**. Compare sponsor/customer coordination with technical handover routes. Actor removal and arc removal answer different questions.

5. Document any proposed backup liaison role as a new relationship, then compare the baseline and scenario in What-if.

Output to retain	Interpretation
Selected actor ranking	Potential coordination and brokerage roles
Endpoint path before and after	Availability of directed handover routes
Efficiency and disconnected pairs	Overall structural effect of the intervention
Annotated network figure	A communication aid for the project team

Apply the result in the domain

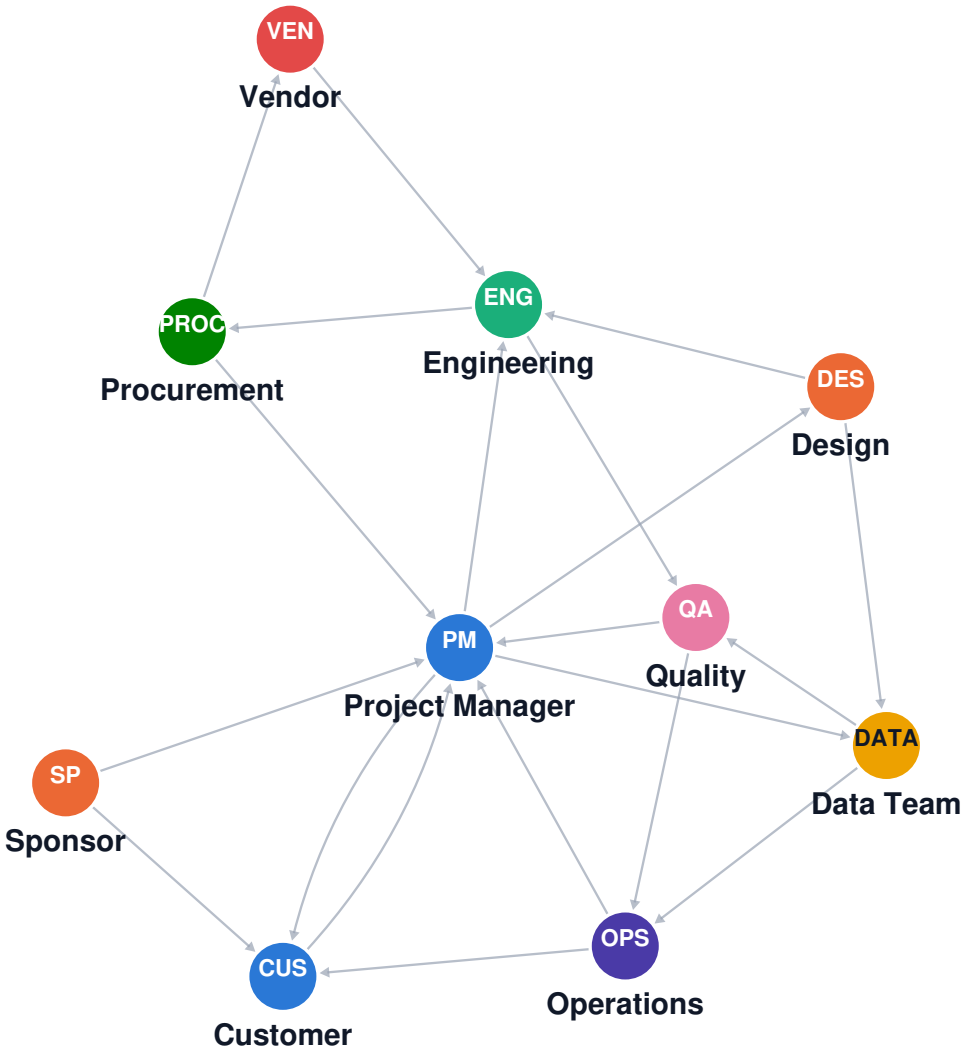
Discuss whether the paths reflect how information actually moves, whether escalation rules permit the proposed alternate route and whether a named deputy can cover the missing coordination role. Refresh the network when project responsibilities change.

This is a role-collaboration network, not a critical-path project schedule. Arcs have no activity durations, precedence slack or resource calendars in this case. A shortest route in the collaboration graph is not the project completion time. Use the manufacturing scheduler only for processes that match its stated serial assumptions.

5.3 APPLICATION NETWORK

Project collaboration

JalViGo bundled case: 10 actors and 20 directed ties. Generated with the uploaded application's layout, scene model and native figure exporter.



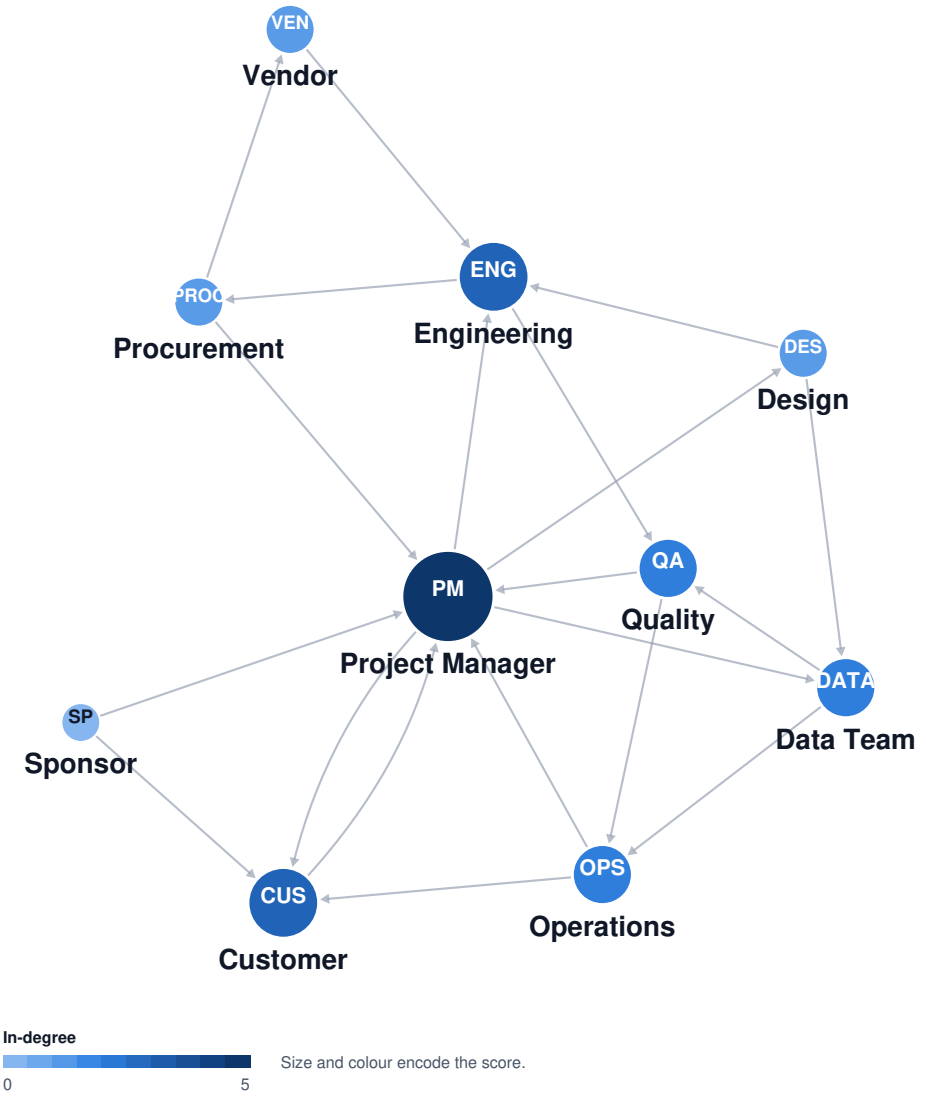
The full role network includes sponsor and customer links, technical handovers and feedback to the project manager.

Colours identify teams where defined; the smaller ungrouped cases use JalViGo's categorical colours. Coordinates affect the drawing, not the network measures.

5.3 APPLICATION CENTRALITY NETWORK

In-degree centrality

Project collaboration | 10 actors | 20 directed ties. Node size and colour encode the application's calculated score.



HIGHEST VALUES IN THE APPLICATION

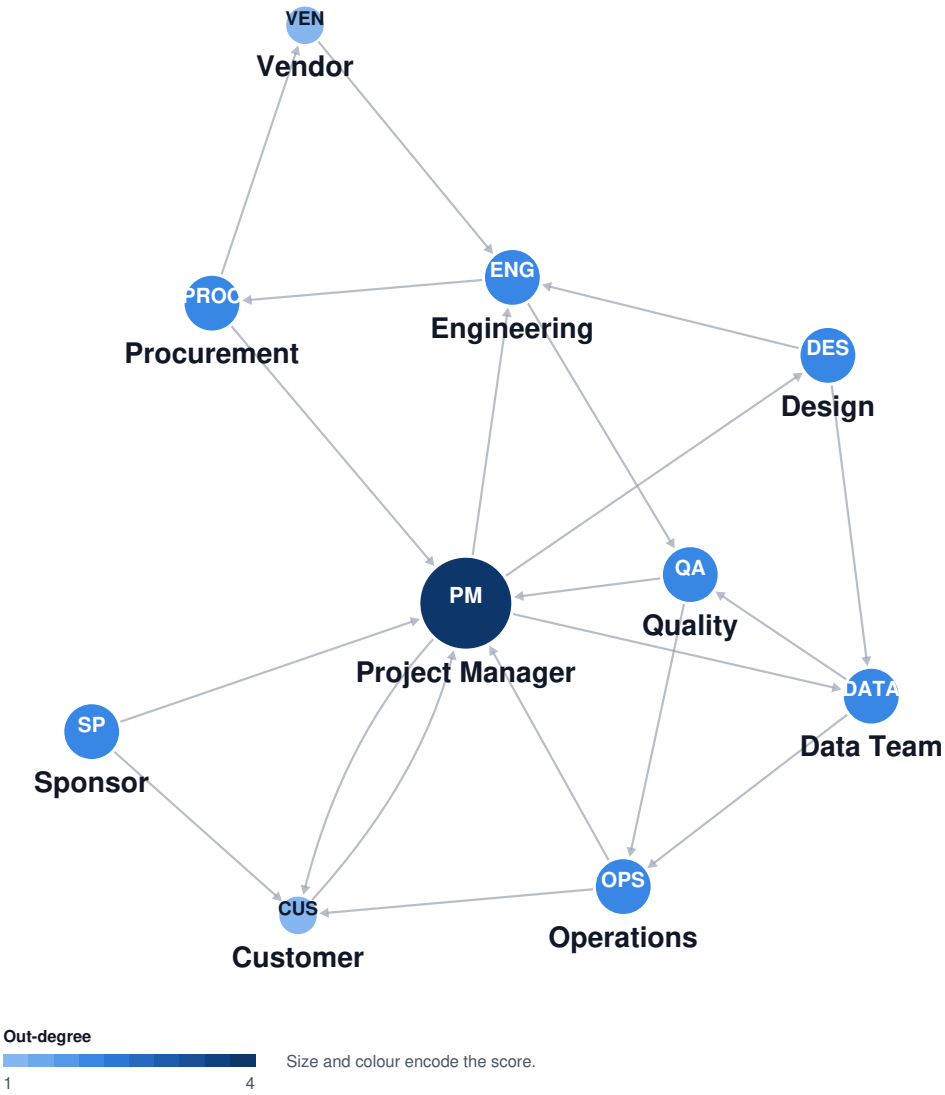
PM: 5; ENG: 3; CUS: 3; DATA: 2; QA: 2

Incoming ties received by each actor. The node identities and topology match the preceding case network.

5.3 APPLICATION CENTRALITY NETWORK

Out-degree centrality

Project collaboration | 10 actors | 20 directed ties. Node size and colour encode the application's calculated score.



HIGHEST VALUES IN THE APPLICATION

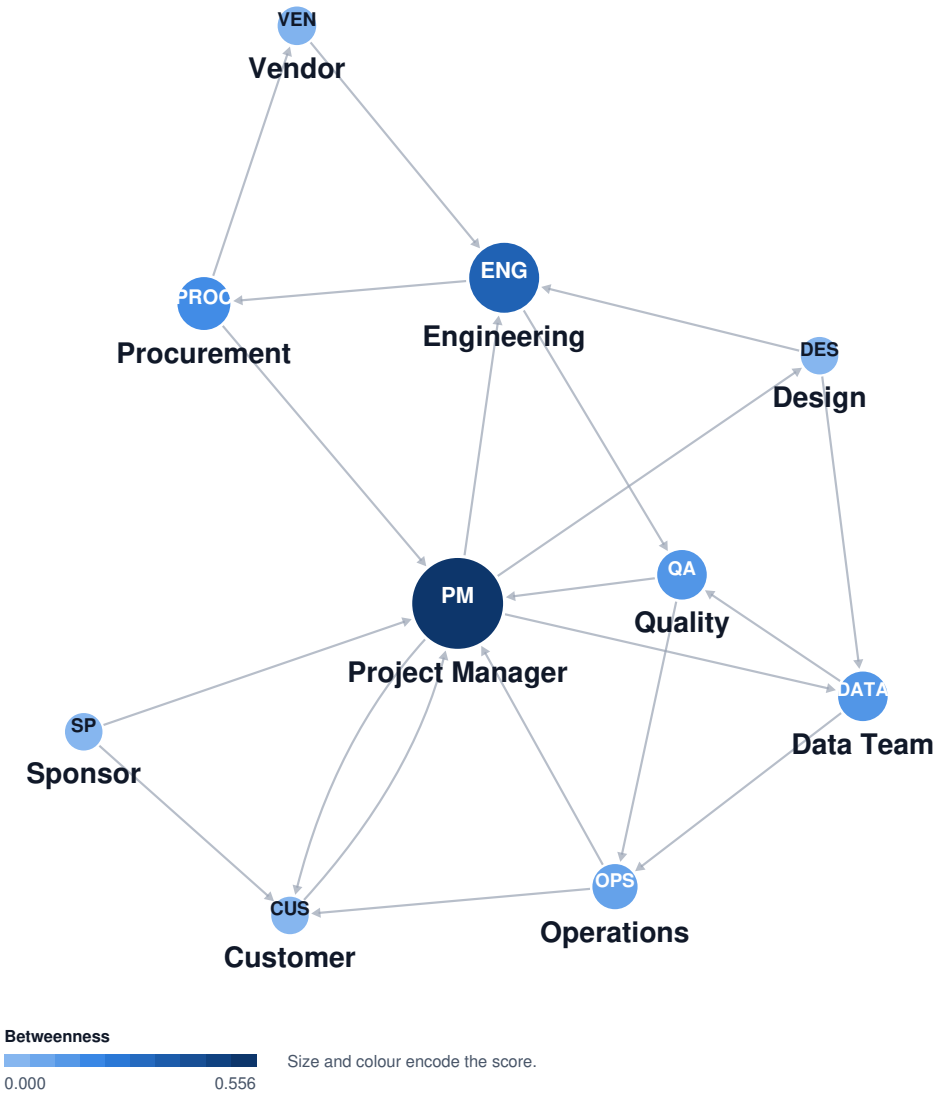
PM: 4; DES: 2; ENG: 2; DATA: 2; QA: 2

Outgoing ties sent by each actor. The node identities and topology match the preceding case network.

5.3 APPLICATION CENTRALITY NETWORK

Betweenness centrality

Project collaboration | 10 actors | 20 directed ties. Node size and colour encode the application's calculated score.



HIGHEST VALUES IN THE APPLICATION

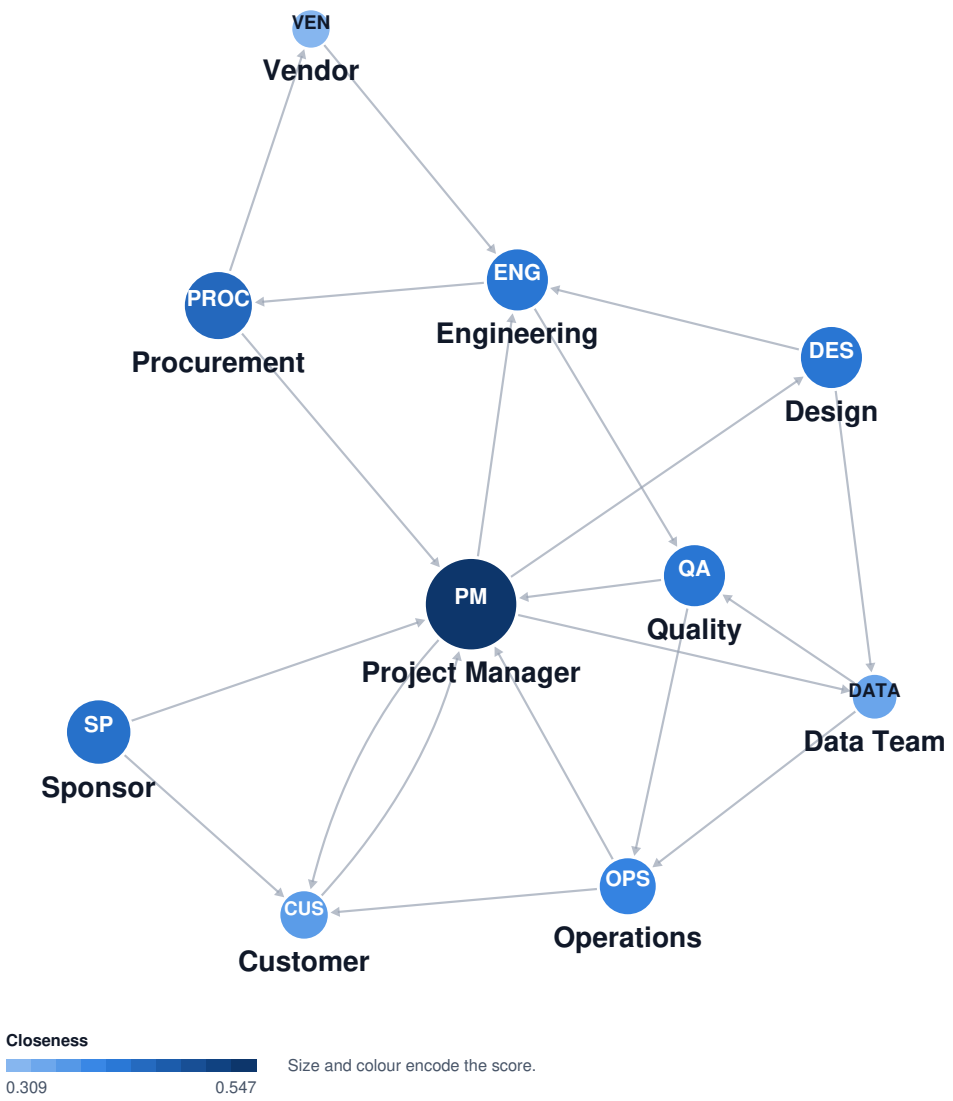
PM: 0.556; ENG: 0.343; PROC: 0.166; DATA: 0.130; QA: 0.130

Brokerage on shortest directed paths, using JalViGo's normalization. The node identities and topology match the preceding case network.

5.3 APPLICATION CENTRALITY NETWORK

Closeness centrality

Project collaboration | 10 actors | 20 directed ties. Node size and colour encode the application's calculated score.



HIGHEST VALUES IN THE APPLICATION

PM: 0.547; PROC: 0.444; SP: 0.429; DES: 0.418; ENG: 0.418

Outward directed closeness, using JalViGo's reachability correction. The node identities and topology match the preceding case network.

5.4 SECTOR WALKTHROUGH

Case: Social Media Influence

Case: Social Media Influence. Ten actors represent a brand, media, two influencers, three communities and three audience groups. Each tie is a directed influence or information relationship in an illustrative campaign network.

Decision question

Which intermediaries connect the brand to audience groups, and how much structural reach remains if a channel is unavailable? Specify whether a tie means following, sharing or an observed communication link before applying the workflow to real data.

1. Load the case and inspect out-degree, betweenness and eigenvector rankings. Compare the meaning of an actor with many outgoing links against one with influential incoming links.

2. In Paths, inspect **BRD to A3**. A direct three-step chain is Brand to Influencer B to Community 3 to Audience 3.

3. Save the baseline and remove **INF2**. This eliminates the inbound route to Community 3, so the brand no longer reaches A3. Apply the scenario to verify the endpoint result in Paths.

4. Restore the baseline and test an individual tie removal instead. Record the exact direction removed and whether another directed route remains.

5. Export a figure with readable community labels and a results file that identifies the intervention.

Structural finding	What it does not establish
Reachable audience group	Observed impressions or conversions
High eigenvector score	Commercial effectiveness or credibility
Alternative path	A guaranteed diffusion or exposure event
Lost path after removal	The size of a real campaign revenue loss

Use the result responsibly

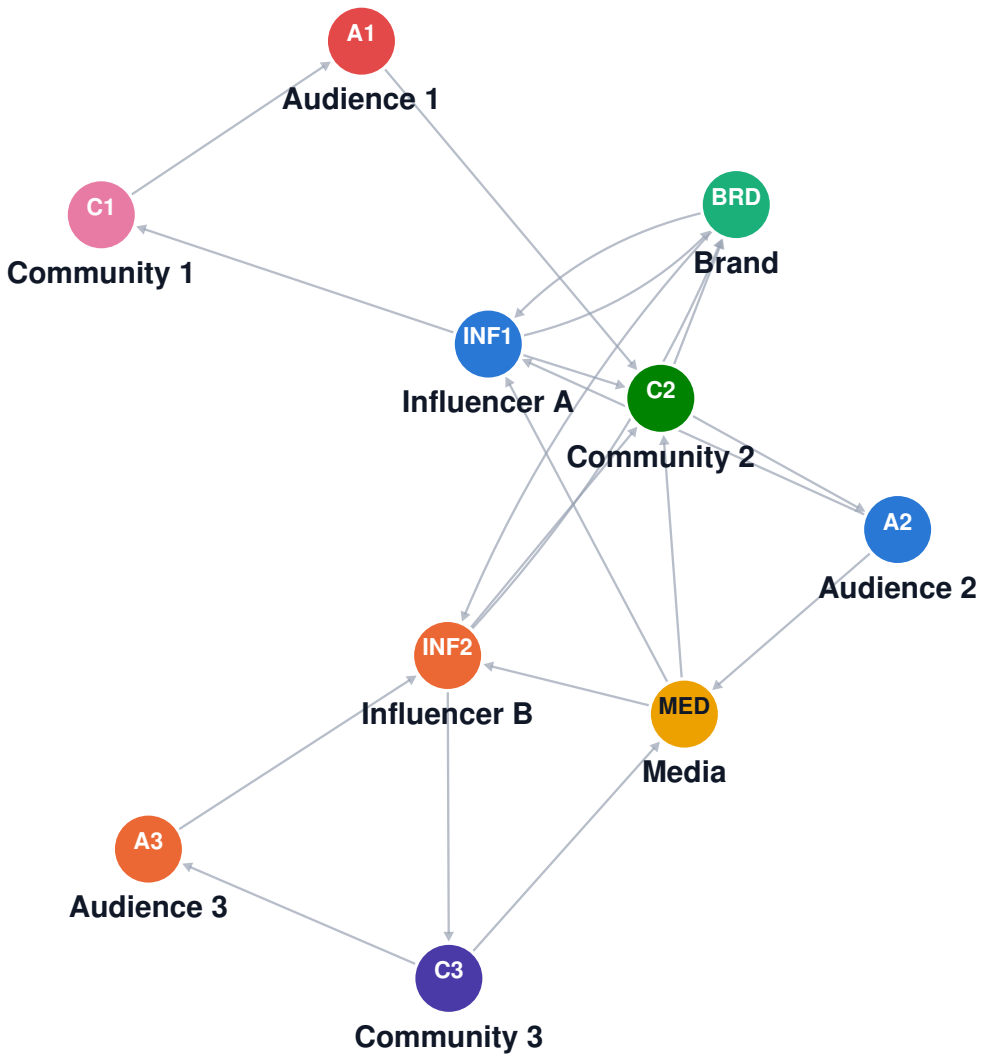
Use the analysis to prioritize questions about channel diversity and intermediary dependence. Validate those questions against campaign analytics, content differences and time-specific observations. Changing platform behavior and audience overlap are not simulated by the binary graph.

The case does not connect to social-media accounts or scrape live engagement data. Import a properly prepared network for an actual study, document the collection window and retain a copy of the input alongside the exported analysis.

5.4 APPLICATION NETWORK

Social media influence

JalViGo bundled case: 10 actors and 20 directed ties. Generated with the uploaded application's layout, scene model and native figure exporter.



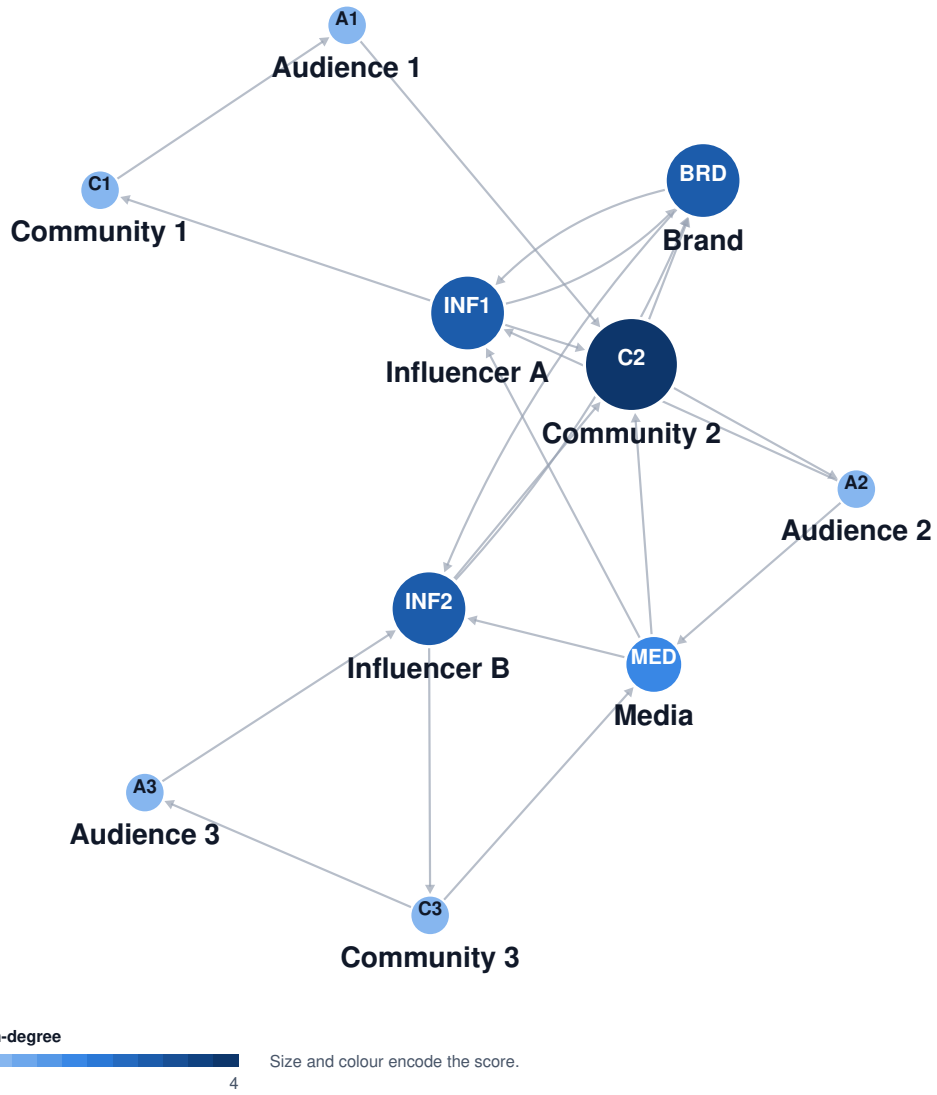
The full influence network includes feedback from communities and audiences. Direction matters when tracing potential reach.

Colours identify teams where defined; the smaller ungrouped cases use JalViGo's categorical colours. Coordinates affect the drawing, not the network measures.

5.4 APPLICATION CENTRALITY NETWORK

In-degree centrality

Social media influence | 10 actors | 20 directed ties. Node size and colour encode the application's calculated score.



HIGHEST VALUES IN THE APPLICATION

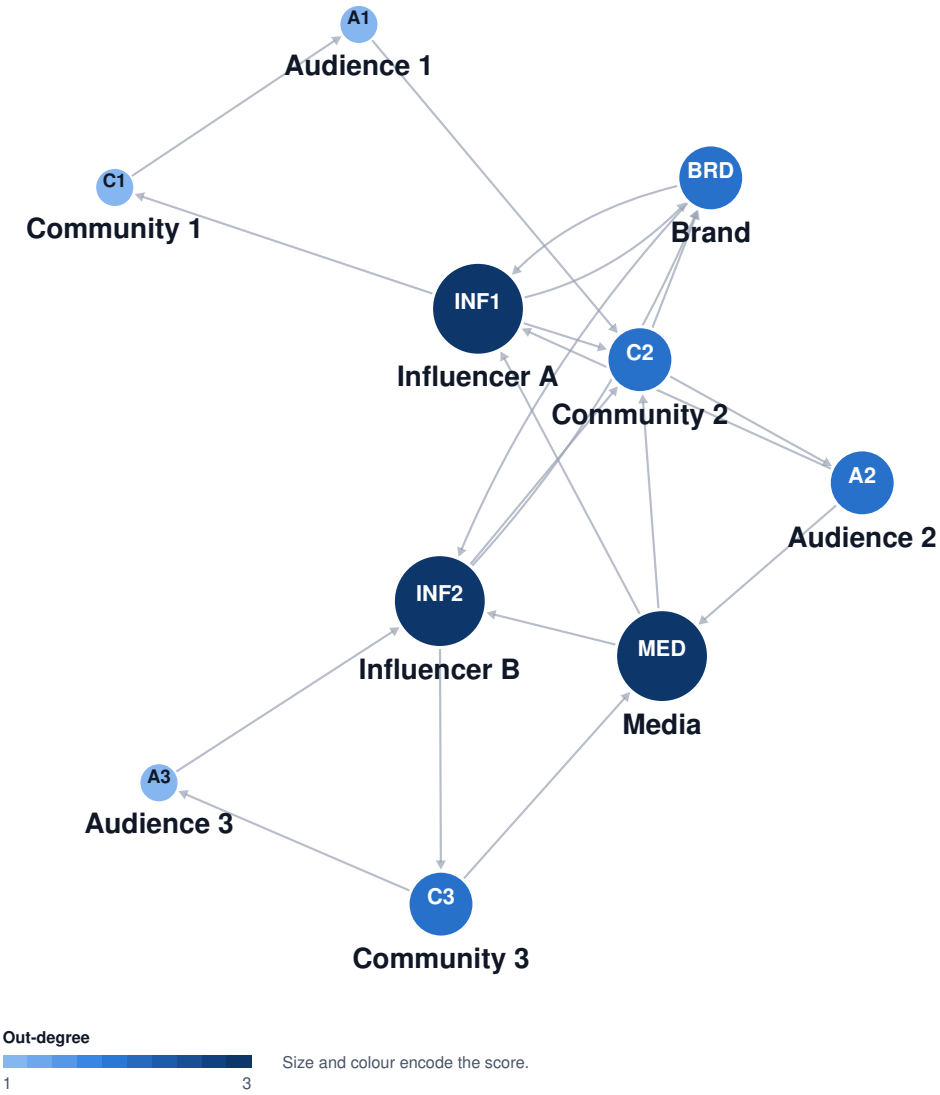
C2: 4; INF1: 3; INF2: 3; BRD: 3; MED: 2

Incoming ties received by each actor. The node identities and topology match the preceding case network.

5.4 APPLICATION CENTRALITY NETWORK

Out-degree centrality

Social media influence | 10 actors | 20 directed ties. Node size and colour encode the application's calculated score.



HIGHEST VALUES IN THE APPLICATION

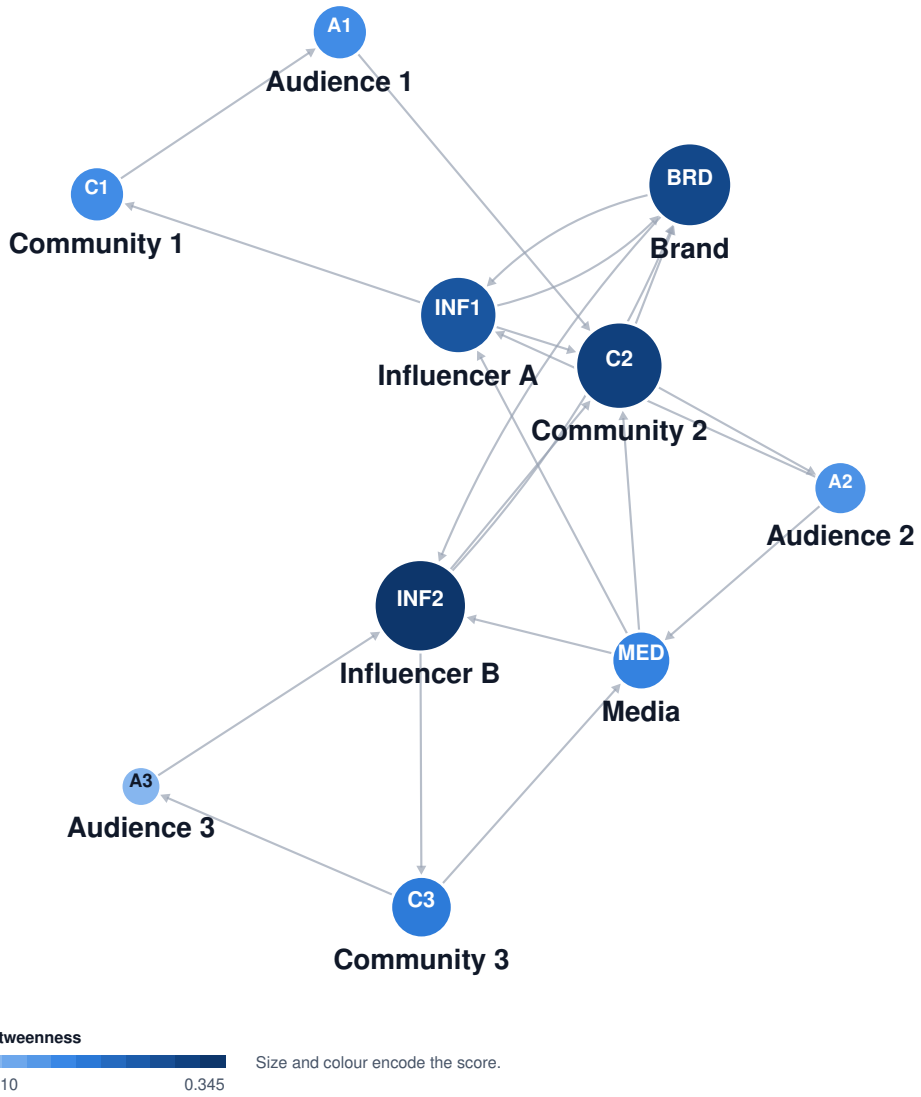
INF1: 3; INF2: 3; MED: 3; BRD: 2; C2: 2

Outgoing ties sent by each actor. The node identities and topology match the preceding case network.

5.4 APPLICATION CENTRALITY NETWORK

Betweenness centrality

Social media influence | 10 actors | 20 directed ties. Node size and colour encode the application's calculated score.



HIGHEST VALUES IN THE APPLICATION

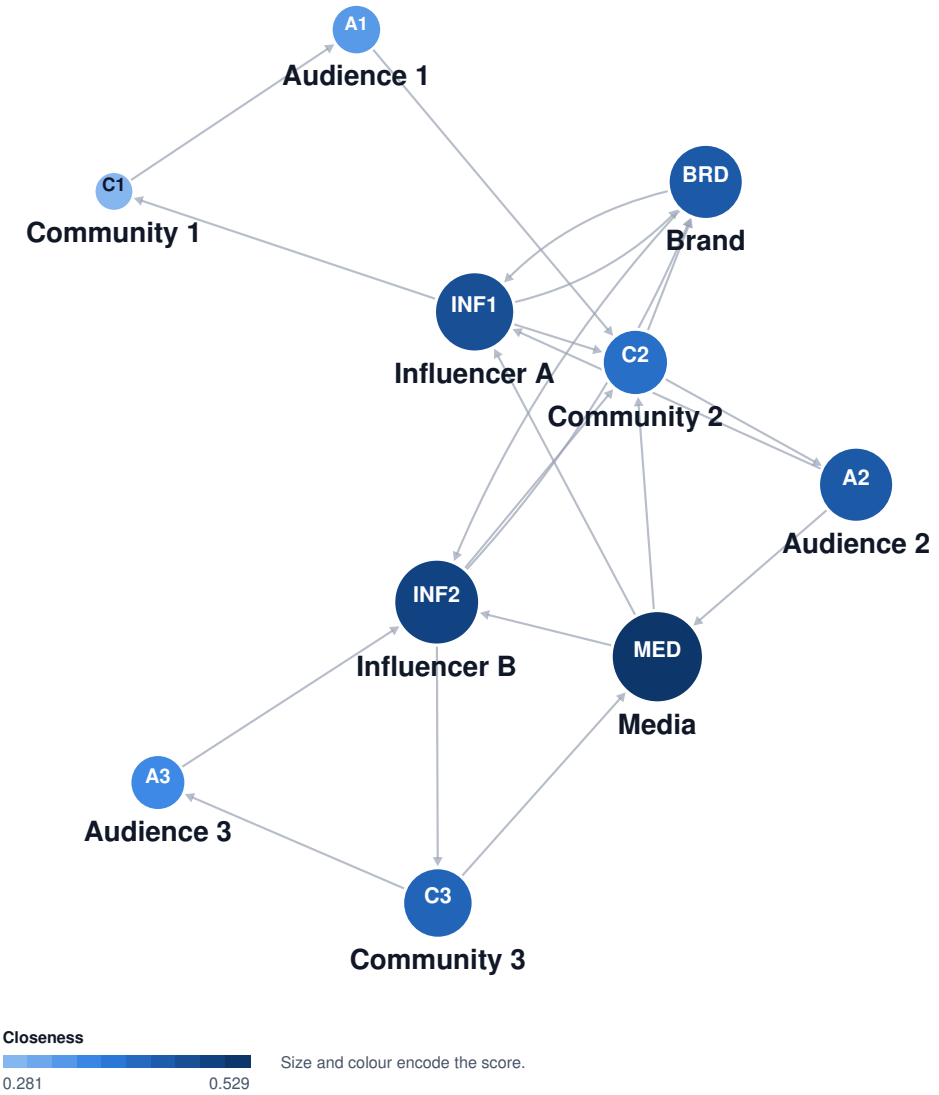
INF2: 0.345; C2: 0.314; BRD: 0.292; INF1: 0.251; C3: 0.153

Brokerage on shortest directed paths, using JalViGo's normalization. The node identities and topology match the preceding case network.

5.4 APPLICATION CENTRALITY NETWORK

Closeness centrality

Social media influence | 10 actors | 20 directed ties. Node size and colour encode the application's calculated score.



HIGHEST VALUES IN THE APPLICATION

MED: 0.529; INF2: 0.500; INF1: 0.474; BRD: 0.450; A2: 0.450

Outward directed closeness, using JalViGo's reachability correction. The node identities and topology match the preceding case network.

5.5 SECTOR WALKTHROUGH

Case: Port and Logistics

Case: Port & Logistics Network. The bundled ten-actor case represents stakeholders in port and logistics coordination. Use the actor names and case brief to identify the operational meaning of each relationship before running a disruption.

Decision question

Which coordination handoffs are vulnerable, and can the selected origin still reach the intended downstream stakeholder after a disruption? A stakeholder network supports a different decision from a physical vehicle-routing or berth-scheduling model.

1. Load the case and inspect actor labels. Identify a source and downstream destination relevant to the service being discussed; record their exact IDs.

2. Use Paths to establish a baseline route. Review each direction with a domain expert, distinguishing information exchange from physical movement.

3. Rank betweenness in Explore, then remove the highest-ranked intermediary in What-if. Use the save/apply/restore procedure on page 7 to query the disrupted endpoint path.

4. Restore the baseline and remove one arc on its path. Compare with whole-actor removal to distinguish a failed handoff from an unavailable stakeholder.

5. Evaluate a plausible alternative coordination link. Use identical endpoints and failure assumptions when comparing resilience scores.

Evidence to present	Operational interpretation
Actor and arc definitions	Explains what a disruption represents
Endpoint path comparison	Shows whether a coordination route remains
Exact or sampled resilience	Describes the modeled failure experiment
Feasibility notes on new ties	Separates a graph suggestion from an agreed procedure

Limits of inference

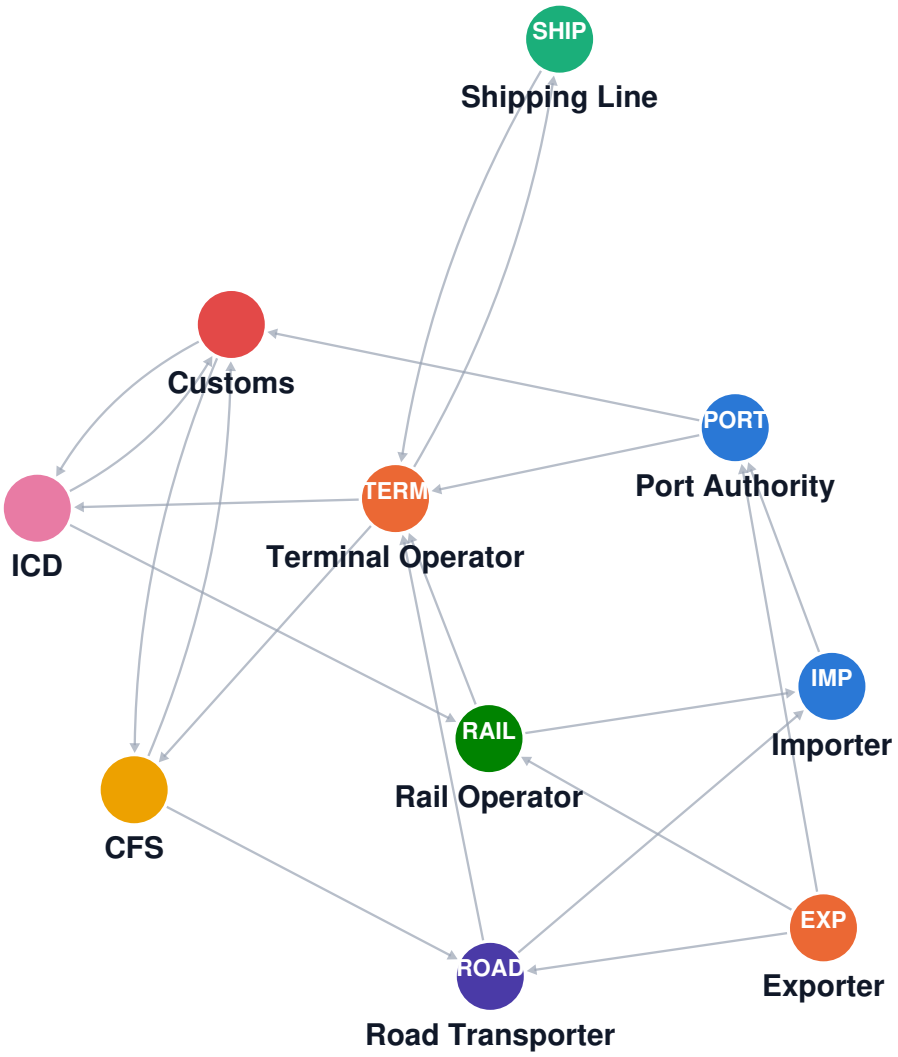
A connected stakeholder network does not prove sufficient berth capacity, crane availability, vessel turnaround performance or customs clearance speed. These require operational data and separate models. Do not relabel graph hop counts as transit time.

For an actual port study, retain the observation period, relationship definition and accountable data owner. When the network changes, use a new baseline session so that the original disruption comparison remains reproducible.

5.5 APPLICATION NETWORK

Port and logistics

JalViGo bundled case: 10 actors and 20 directed ties. Generated with the uploaded application's layout, scene model and native figure exporter.



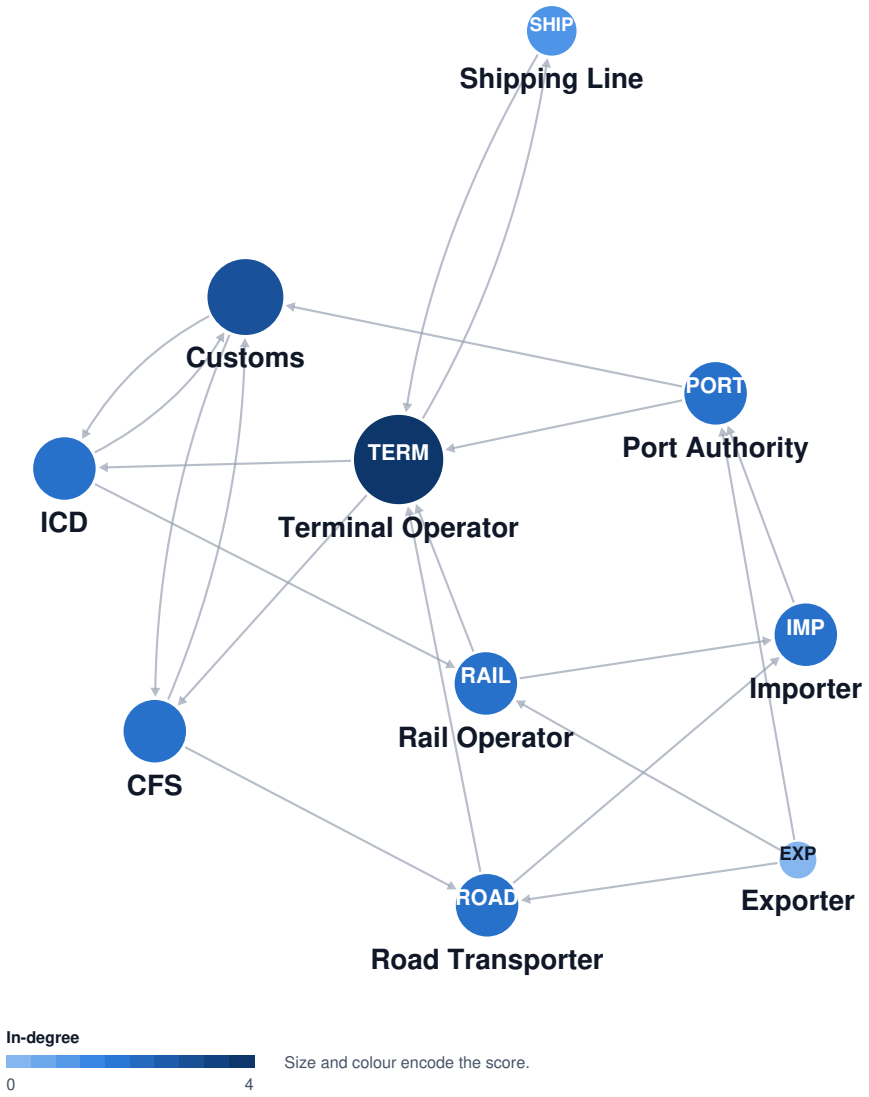
The actual stakeholder IDs include PORT, TERM, SHIP, CFS, ICD, RAIL, ROAD, CUSTOM, IMP and EXP.

Colours identify teams where defined; the smaller ungrouped cases use JalViGo's categorical colours. Coordinates affect the drawing, not the network measures.

5.5 APPLICATION CENTRALITY NETWORK

In-degree centrality

Port and logistics | 10 actors | 20 directed ties. Node size and colour encode the application's calculated score.



HIGHEST VALUES IN THE APPLICATION

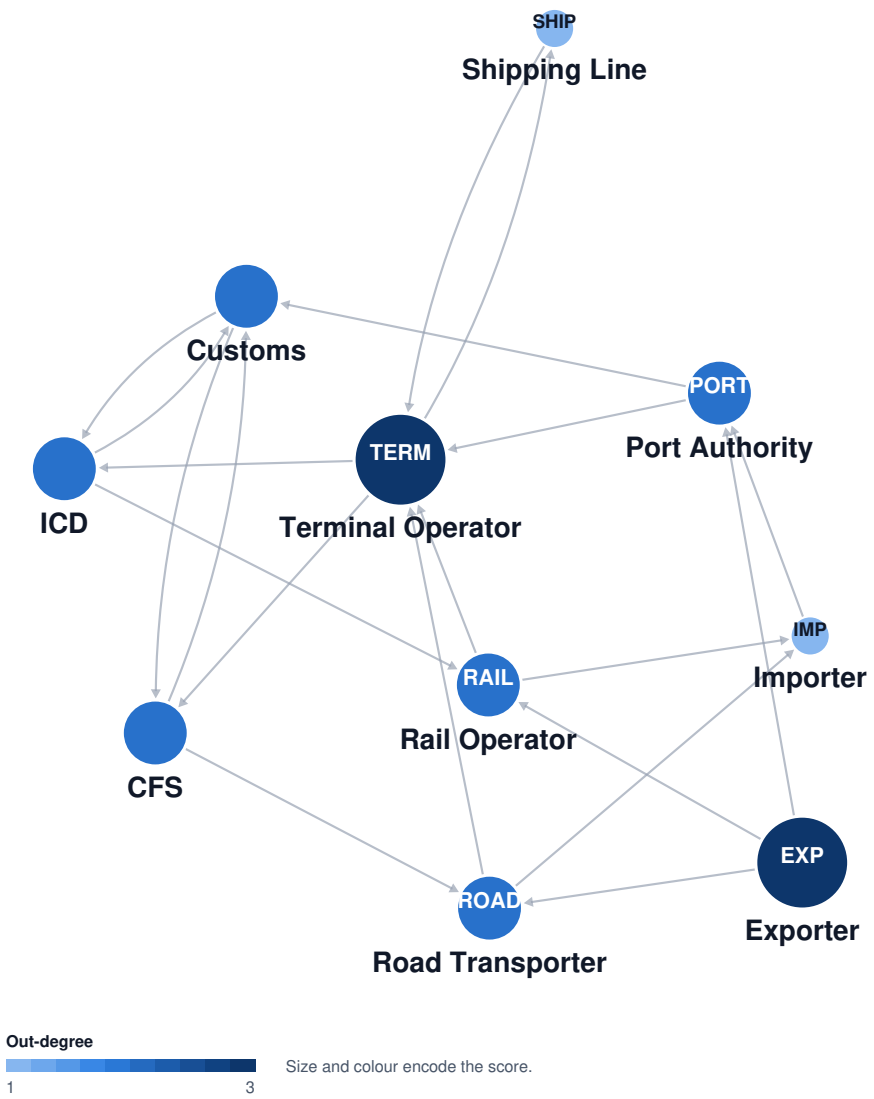
TERM: 4; CUSTOM: 3; PORT: 2; CFS: 2; ICD: 2

Incoming ties received by each actor. The node identities and topology match the preceding case network.

5.5 APPLICATION CENTRALITY NETWORK

Out-degree centrality

Port and logistics | 10 actors | 20 directed ties. Node size and colour encode the application's calculated score.



HIGHEST VALUES IN THE APPLICATION

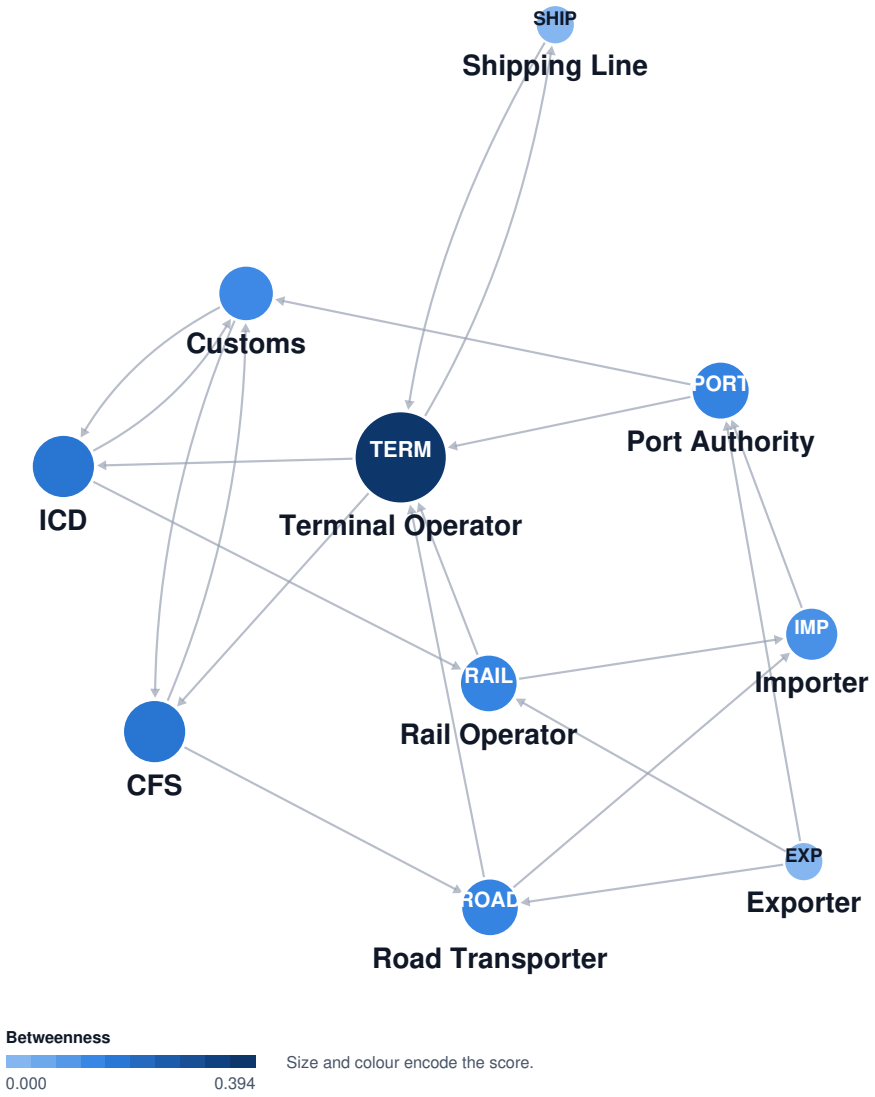
TERM: 3; EXP: 3; PORT: 2; CFS: 2; ICD: 2

Outgoing ties sent by each actor. The node identities and topology match the preceding case network.

5.5 APPLICATION CENTRALITY NETWORK

Betweenness centrality

Port and logistics | 10 actors | 20 directed ties. Node size and colour encode the application's calculated score.



HIGHEST VALUES IN THE APPLICATION

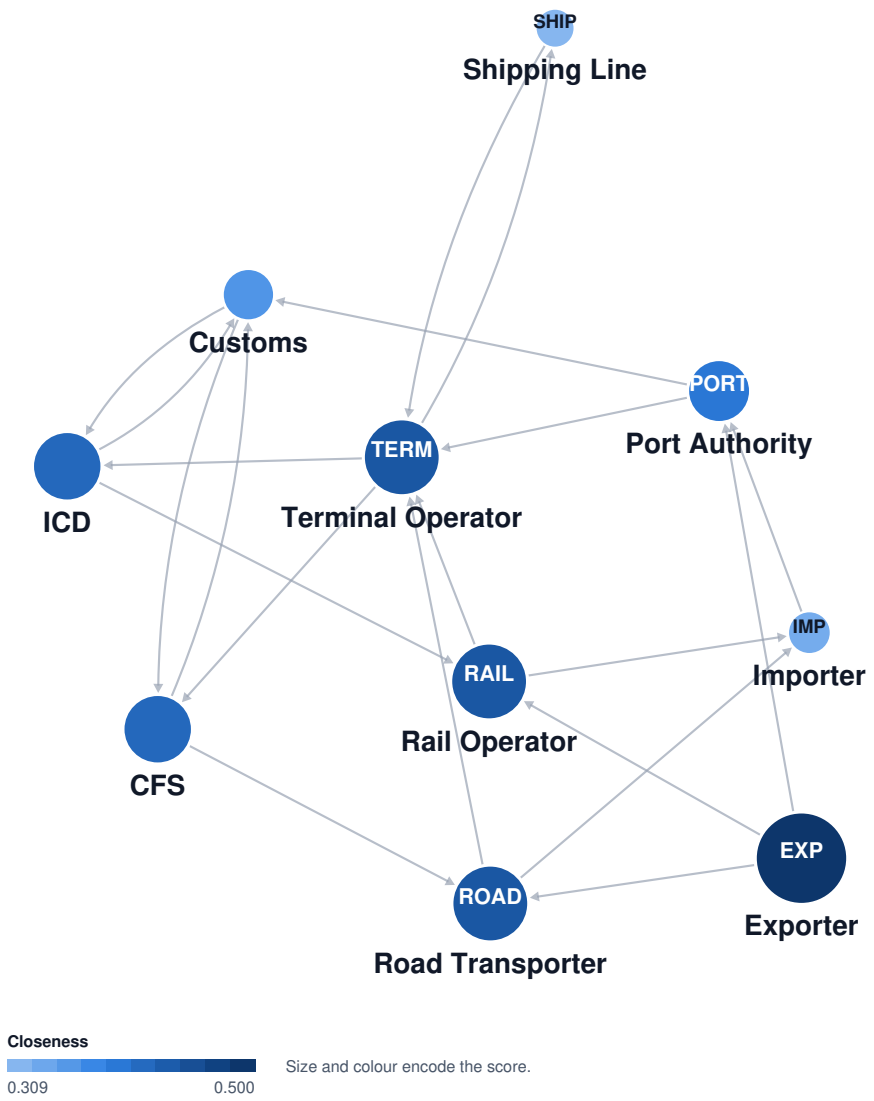
TERM: 0.394; CFS: 0.183; ICD: 0.183; PORT: 0.144; RAIL: 0.141

Brokerage on shortest directed paths, using JalViGo's normalization. The node identities and topology match the preceding case network.

5.5 APPLICATION CENTRALITY NETWORK

Closeness centrality

Port and logistics | 10 actors | 20 directed ties. Node size and colour encode the application's calculated score.



HIGHEST VALUES IN THE APPLICATION

EXP: 0.500; TERM: 0.444; RAIL: 0.444; ROAD: 0.444; CFS: 0.418

Outward directed closeness, using JalViGo's reachability correction. The node identities and topology match the preceding case network.

5.6 SECTOR WALKTHROUGH

Case: Organizational Behaviour and HR

Case: Organizational Behavior & Collaboration. This larger case has 120 employees in ten departments and includes synthetic productivity and wellbeing observations. It supports organization-level network exploration alongside separate outcome evaluation.

Decision question

Where are collaboration dependencies located, and how do observed employee outcomes compare with explicit criteria? Keep these as two related analytical questions rather than assuming that centrality explains the outcomes.

1. Choose the case in Cases & templates. Report opens with the employee measures available. Reveal **Employee productivity** and **Employee wellbeing** under Performance indicators.

2. Review the Employee performance measures panel, criteria and observation coverage. At the defaults, the productivity target is 1 and the wellbeing target is 70.

3. Confirm totals of **10,789 output units** and **9,120 hours**. The pooled productivity is **1.183005 units/hour**, and mean wellbeing is **69.733333 out of 100**.

4. Check target counts: **88 of 120** employees meet the productivity target, and **59 of 120** meet the wellbeing target in the synthetic dataset.

5. Use Explore to examine collaboration brokers and departments, then conduct a network scenario. Observe that structural removal does not predict or automatically change the recorded employee outcomes.

Choose the right organizational case

Case	Best learning use
12 employee Productivity & Wellbeing	Trace the calculations and inspect three team patterns
120 employee Behavior & Collaboration	Practice larger organizational network and outcome analysis

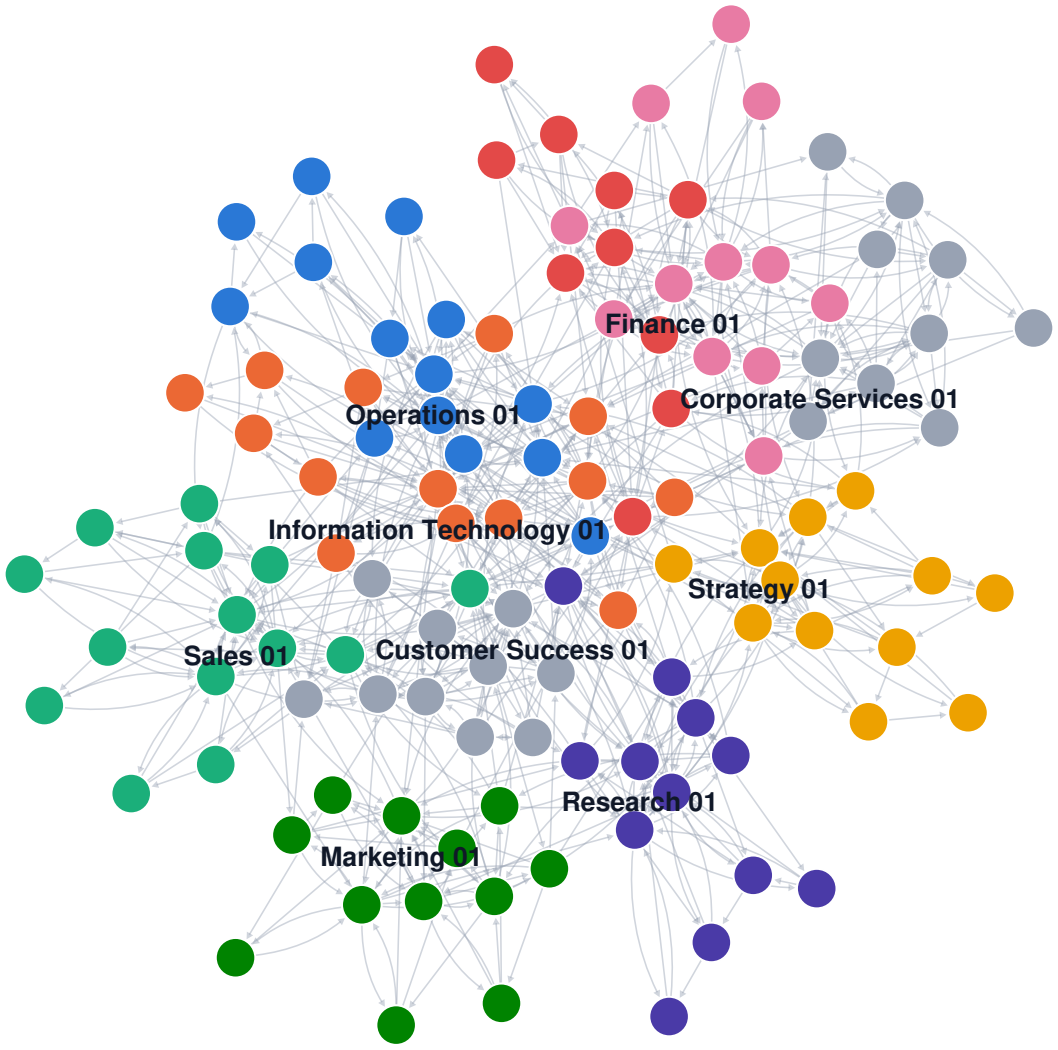
If an OB case appears to lack outcomes, reload the case and inspect the observation panel rather than only the network picture. A generic imported edge list will not create employee records. For a real study, replace the illustrative observations with governed data and document the work-unit definition, hours, survey administration and criteria.

The manual’s benchmark values are calculation checks, not reference norms for an actual organization. Do not compare unrelated occupations using raw output units without an agreed adjustment method.

5.6 APPLICATION NETWORK

Organizational behaviour and collaboration

JalViGo bundled case: 120 actors and 673 directed ties. Generated with the uploaded application's layout, scene model and native figure exporter.



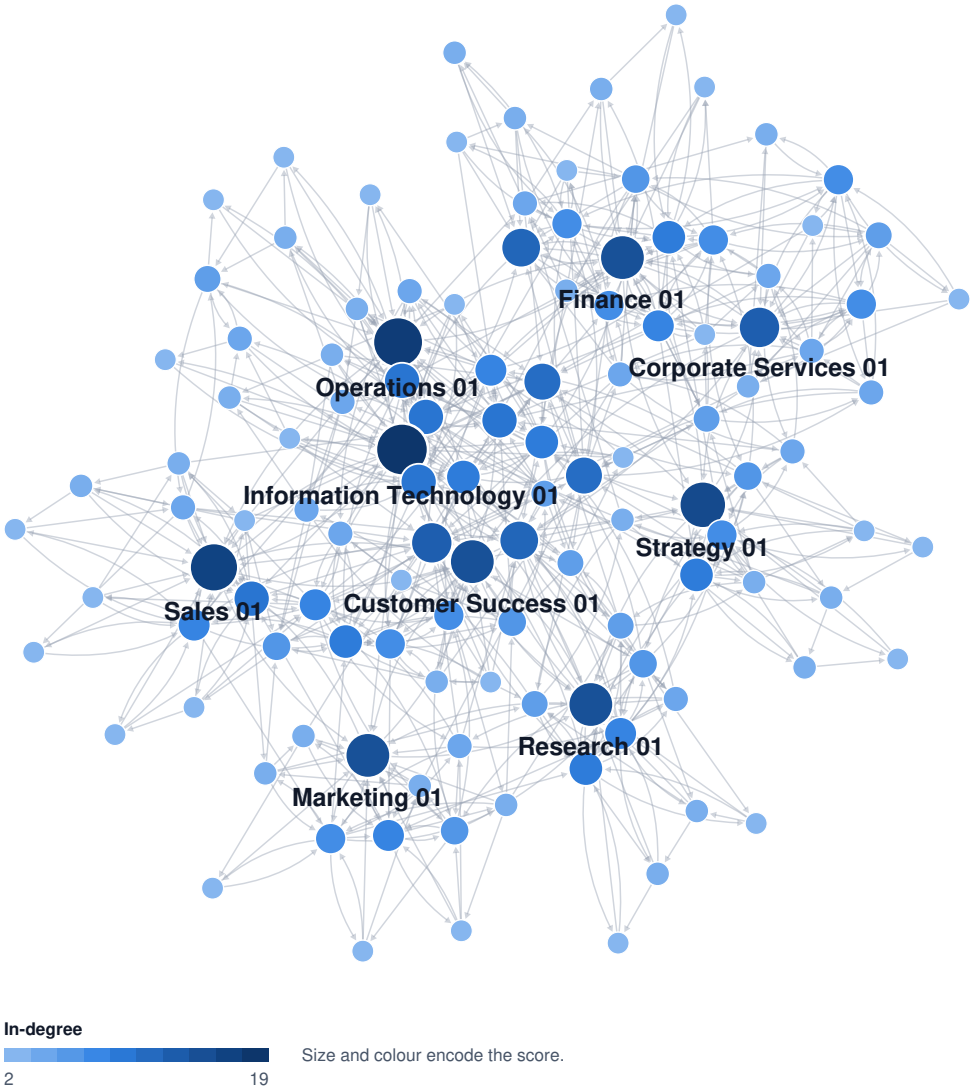
All 120 employee nodes and 673 directed ties are retained. Labels follow JalViGo's automatic policy so selected central actors remain readable.

Colours identify teams where defined; the smaller ungrouped cases use JalViGo's categorical colours. Coordinates affect the drawing, not the network measures.

5.6 APPLICATION CENTRALITY NETWORK

In-degree centrality

Organizational behaviour and collaboration | 120 actors | 673 directed ties. Node size and colour encode the application's calculated score.



HIGHEST VALUES IN THE APPLICATION

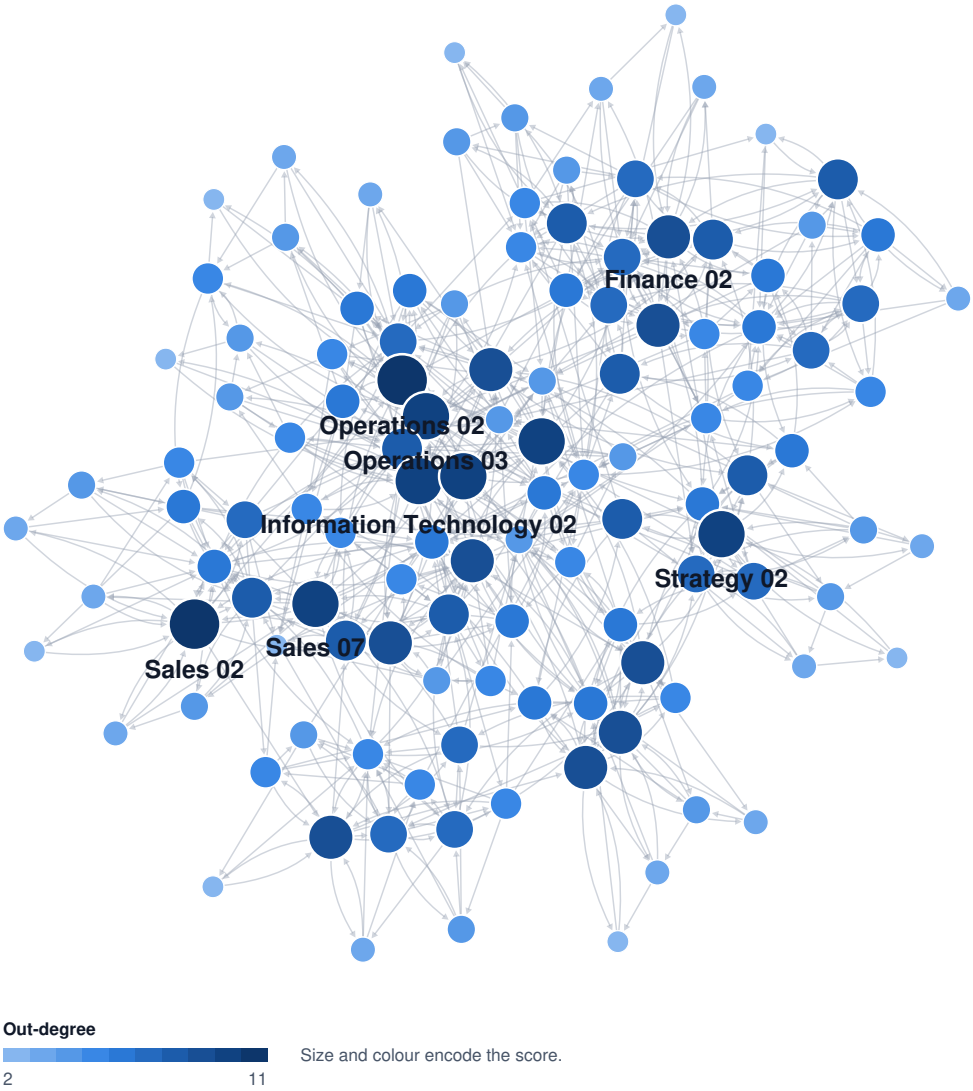
E049: 19; E013: 18; E063: 17; E001: 16; E027: 15

Incoming ties received by each actor. The node identities and topology match the preceding case network.

5.6 APPLICATION CENTRALITY NETWORK

Out-degree centrality

Organizational behaviour and collaboration | 120 actors | 673 directed ties. Node size and colour encode the application's calculated score.



HIGHEST VALUES IN THE APPLICATION

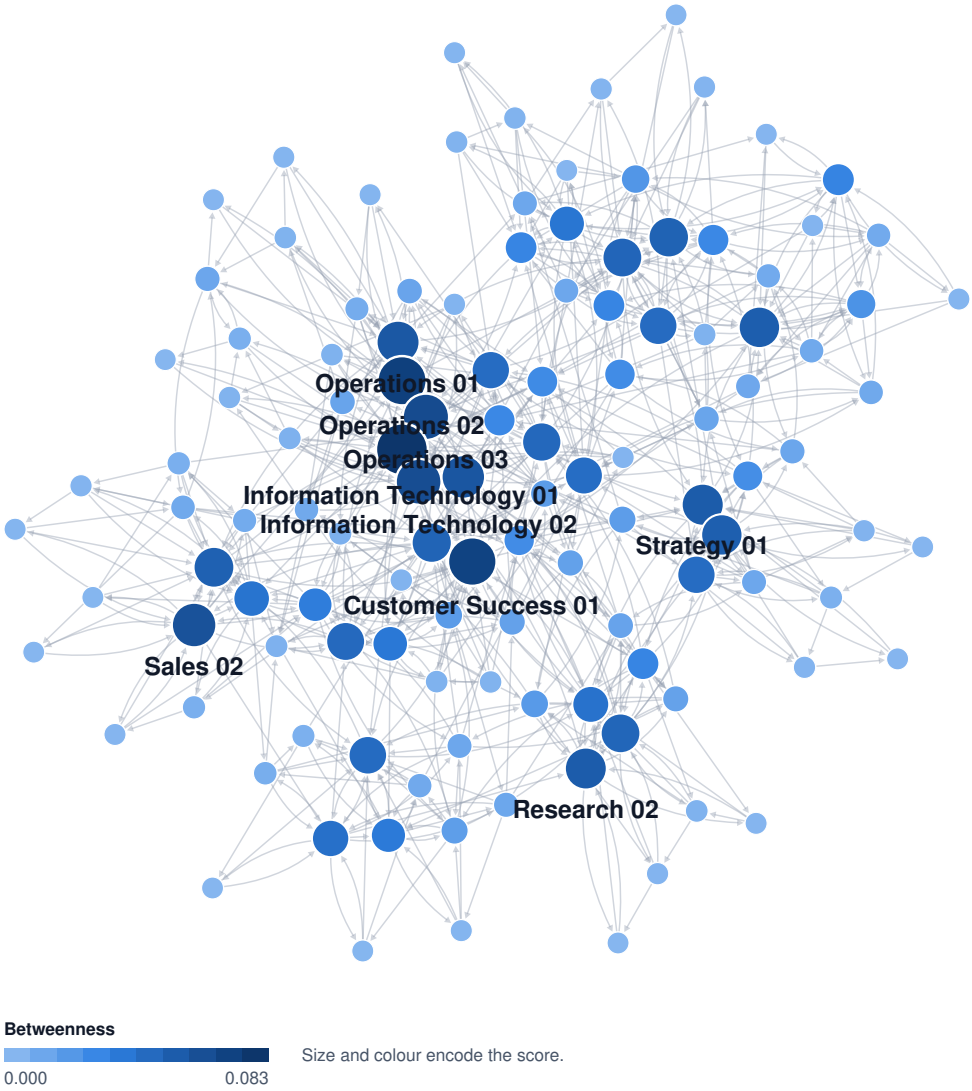
E014: 11; E064: 11; E002: 10; E015: 10; E050: 10

Outgoing ties sent by each actor. The node identities and topology match the preceding case network.

5.6 APPLICATION CENTRALITY NETWORK

Betweenness centrality

Organizational behaviour and collaboration | 120 actors | 673 directed ties. Node size and colour encode the application's calculated score.



HIGHEST VALUES IN THE APPLICATION

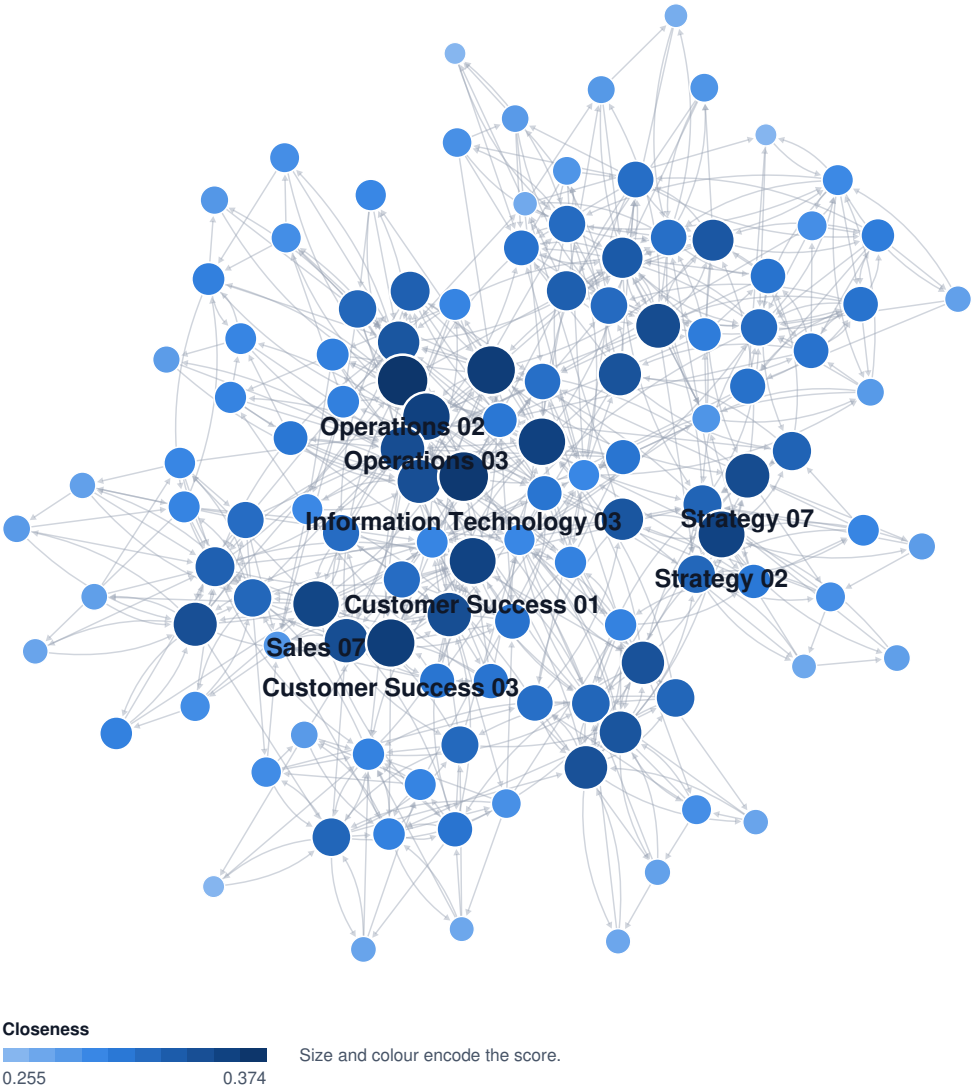
E049: 0.083; E014: 0.075; E101: 0.073; E015: 0.067; E050: 0.066

Brokerage on shortest directed paths, using JalViGo's normalization. The node identities and topology match the preceding case network.

5.6 APPLICATION CENTRALITY NETWORK

Closeness centrality

Organizational behaviour and collaboration | 120 actors | 673 directed ties. Node size and colour encode the application's calculated score.



HIGHEST VALUES IN THE APPLICATION

E014: 0.374; E051: 0.371; E019: 0.366; E103: 0.365; E015: 0.362

Outward directed closeness, using JalViGo's reachability correction. The node identities and topology match the preceding case network.

6.1 OUTPUTS

Save export and share

Retain inputs and settings as well as the final figure. A published image alone cannot reproduce the scenario, manufacturing assumptions or employee evaluation criteria.

Output	Use
Session JSON	Portable restoration of network and analysis inputs; preferred analysis backup.
Browser save	Convenient localStorage save in the current browser; restore through Export.
Edge list or adjacency matrix	Transfer the graph to other tools; specialist observations are not represented by ordinary graph formats.
Actor and distance CSV	Analyze rankings or pairwise distances using the exported conventions.
Manufacturing or employee CSV	Retain the specialist measures and their relevant inputs.
Full results JSON	Machine-readable results for traceability and further inspection.
SVG or PNG figure	Network illustration for reports, presentations and publication.

Prepare a publication figure

Choose SVG for scalable lines and labels, or PNG at the required output size and resolution. The figure dialog offers widths of 3.5, 7 or 10 inches and PNG resolutions of 300, 600 or 1200 DPI. Review font size, label visibility, legend, grayscale and background settings at the final printed size. The figure exporter captures the network; do not assume it exports the manufacturing charts.

Protect and reproduce the analysis

Browser saves are tied to the browser and can be lost when its storage is cleared. Export session JSON before switching devices. Undo retains up to 25 network snapshots, but not every parameter-edit history.

A share link contains encoded session data, including any embedded employee observations. Anyone receiving the link can access that content. Share only an appropriately prepared dataset; long sessions may exceed the approximately 60,000-character limit.

Calculations in the documented workflows run in the browser. External fonts and the optional Excel reader can still generate network requests. A local launch is not an assurance of fully offline operation. The inspected application does not provide user accounts or role-based access controls.

6.2 SUPPORT

Troubleshooting and practical limits

Symptom	Check and corrective action
Page does not open locally	Keep the local server running and verify the port. If 8766 is occupied, use an available port and the matching URL.
Import has fewer ties	Inspect warnings for duplicate pairs, self-loops and zero weights. Confirm source/target mapping and direction.
No path exists	Check arrow direction and disconnected actors. Reverse reachability is a separate question.
Manufacturing is blocked	Restore required route stations and consecutive arcs. Check times, quantities and release settings.
Mix is infeasible	Check minimum demand against station capacities, and planned quantities against demand bounds.
Mix is feasible but not optimal	The search limit was reached. Preserve that status; a feasible result is not a proof of optimality.
Employee outcome unavailable	Load an OB outcome case or supply observations; check positive hours and raw wellbeing totals from 0 to 25.
Outcome stays unchanged after removal	Recorded employee observations are retained independently of network scenarios. This is not a forecast of intervention effects.
Share or export is too large	Use a session file rather than a share link and respect matrix and distance-export limits.

Limits to record in an analysis

Network import supports up to **5,000 actors and 150,000 ties**. Matrix export is bounded at 3,000 actors and distance export at 2,000. Report displays the first 500 actor rows. Betweenness uses sampled sources above 2,000 actors. Manufacturing accepts quantities up to 10,000 subject to an operation limit of two million; chart previews are smaller than full calculations.

If a result seems implausible, save the session and reproduce it on a small network with known expected results. Record the browser, case, exact input, action sequence and displayed error when requesting support through your software provider. No dedicated support address is specified in this edition.

6.3 METHODS

Calculation reference

Definitions below describe the inspected code. For n actors, m is the number of directed ties, d(i,j) is the shortest directed distance, and unreachable pairs are excluded only where explicitly stated.

Indicator	Implementation convention
Density	m / [n(n - 1)] for distinct actor pairs.
Global efficiency	Sum of 1/d(i,j) over reachable distinct ordered pairs, divided by n(n - 1); unreachable pairs contribute zero.
Z1 Robustness	Number of unique undirected links divided by n - 1. Reciprocal arcs collapse to one link for this projection.
Z2 Resilience	Minimum degree in the undirected projection; distinct from the failure-combination resilience analysis.
Z3 Flexibility	(Reachable distinct ordered pairs + n) / n^2. The diagonal is included.
Z4 Efficiency	Sum of finite directed distances divided by n(n - 1). Unreachable pairs contribute no distance; this is not global efficiency.
Z5 Centralization	Let v(i) = 2 × undirected degree and vmax be its maximum. Sum [vmax - v(i)] divided by 2(n - 1)(n - 2).

Small or degenerate graphs require the implementation’s edge-case handling. Do not extrapolate formulas through a zero denominator. The Z indicators draw on [3], but matching a published table requires matching direction, projection and normalization. This edition does not claim replication of every numerical example in that study.

6.4 AUTHORS

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Prof. Manupati Vijay Kumar is an Associate Professor in Operations and Supply Chain Management at the Indian Institute of Management Mumbai. He earned his PhD in Industrial and Systems Engineering from IIT Kharagpur. His research examines supply chain resilience, viability and reconfigurability, multimodal logistics, reverse logistics and distributed manufacturing. His work also covers integrated process planning and scheduling, and healthcare supply chains. His teaching interests include AI, machine learning, generative AI and agentic AI in supply chain management.

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Prof. Goran Putnik is a production and systems engineering scholar associated with the University of Minho, Portugal, and Centro ALGORITMI. He joined the University of Minho in 1993 and has served as a full professor in its Department of Production and Systems, School of Engineering. He received his DrSci (PhD) in mechanical engineering from the University of Belgrade in 1993. His research and teaching interests include production systems, automata and formal theory. His published work explores virtual, cloud and ubiquitous manufacturing, advanced manufacturing architectures and enterprise integration. His academic career includes coordination of international projects and contributions to scholarly books and journals.

6.5 REFERENCE

References

The references support method interpretation. They do not imply that their authors or publishers endorse JalViGo. The network figures use the bundled case data and JalViGo's native figure renderer from the uploaded application.

[1] Brandes, U. (2001). A faster algorithm for betweenness centrality. Journal of Mathematical Sociology, 25(2), 163-177. Read source.

[2] Kim, Y., Chen, Y.-S., and Linderman, K. (2015). Supply network disruption and resilience: A network structural perspective. Journal of Operations Management, 33-34, 43-59. Read source.

[3] Karanam, M., Krishnanand, L., and Manupati, V. K. (2025). Quantifying performance indicators in perishable food supply chain networks: Assessing dynamic performance under ripple effects. Computers & Industrial Engineering, 201, 110873. Read source.

[4] AMPL. Production model. An example of contribution maximization with capacity and demand constraints. Read source.

[5] Lean Enterprise Institute. Cycle Time. Lean Lexicon. Read source.

[6] World Health Organization (2024). The World Health Organization-Five Well-Being Index (WHO-5). Official instrument and scoring source. Read source.