Before the Department of Commerce
National Telecommunications and Information Administration
Washington, D.C.

In the Matter of	)	
	)	
Request for Comments on	)	Docket No. 200521-0144
The National Strategy to Secure 5G	)	RIN 0660-XC047
Implementation Plan	)	
	)	

COMMENTS OF GSMA

David Walsh
General Counsel

GSMA
The Walbrook Building, 25 Walbrook
London, EC4N 8AF, UK
Tel: +44 (0)207 356 0600
Fax: +44 (0)207 356 0601

June 25, 2020

Submitted electronically via secure5G@ntia.gov

Re: Comments of the GSMA Association on NTIA's Request for Public Comments on *The National Strategy to Secure 5G Implementation Plan*, Docket No. 200521-0144, RIN 0660-XC047

Introduction and Executive Summary:

GSM Association (GSMA) appreciates the opportunity to comment on the Department of Commerce's National Telecommunications and Information Administration's (NTIA) Implementation Plan for the Administration's "National Strategy to Secure 5G" (Strategy)[1] released in accordance with the "Secure 5G and Beyond Act of 2020" (Act) by President Trump on March 23, 2020. GSMA represents the interests of the worldwide mobile ecosystem uniting more than 750 operators with almost 400 companies in the mobile ecosystem, including handset and device makers, software companies, equipment providers and internet companies, and organizations in adjacent sectors. GSMA promotes regulatory frameworks that support competition, innovation, investment, and the long-term growth of the sector, with the goal of creating benefits for consumers and communities.

GSMA has been pleased to engage with the Department of Commerce's NTIA and Bureau of Industry and Security (BIS) to advance secure, interoperable wireless communications systems and infrastructure around the world including fifth generation wireless technologies (5G)[2]. GSMA and its members appreciate the Administration's commitment to ensure the security and reliability of wireless infrastructure while maintaining the United States' position of

[1] U.S. Department of Commerce, National Telecommunications and Information Administration, *Request for Public Comments on The National Telecommunications and Information Administration*, Notice, request for public comments, 85 Fed. Reg. 32016 (May. 28, 2020).

[2] *See* Letter from J. Shane and M. Brown, Counsel to GSMA, to K. Nies-Vogel, BIS, re: *Request for Extension of Temporary General License to Permit Transactions with Huawei that Are Necessary for the Operation of Telecommunications Networks and Provision of Critical Updates and Repairs for Consumers* (Aug. 6, 2019).

leadership in commercial development and deployment of advanced wireless services. In these comments we provide our perspectives to the questions in the NPRM and highlight areas for consideration.

We appreciate the balancing act that the administration and U.S. companies must do to address the security concerns today while looking to correct market inefficiencies in the long term. Short-term fixes should keep security and global interoperability top of mind, allowing for sufficient stakeholder review and study to determine technical challenges and potential fixes. In the long term, a global effort to diversify the supply chain will require time and capital.

As we highlighted in our January 2020 filings to the Department of Commerce[3], the global information and communications technology and services (ICTS) market relies on interoperability not just to support customers internationally but also U.S. companies participating in the global economy. International peering arrangements, roaming, backhaul, and interconnection underpin global communications and business. Clarity around the rules will allow operators to plan and predict their business cycles better and further innovation.

As stated in our March 2020 comments to BIS[4], the U.S. Government's actions to date have shifted the market for equipment and managed services, but have not yet led to the creation of a new viable competitive vendor. As U.S. operators continue to deploy their 5G networks, vendor diversity remains a priority. As we note below, open networking and virtualization represents a critical path forward, recognizing that it may not produce short-term solutions on its own.

[3] *See* GSMA Comments to the U.S. Department of Commerce, *re: In the Matter of Securing the Information and Communications Technology and Services Supply Chain*, Docket No. *191119-0084, RIN 0605-AA51, (January 10, 2020).*

[4] *See* Comments from the GSM Association, BIS, re: *Request for Comments on Future Extensions of Temporary General License (TGL),* Notification of Inquiry, Docket No. BIS 2020-0001, RIN 0694-ZA02, (March 25, 2020).

We experience wireless services as connecting us instantaneously, but they depend upon networks deployed through a dynamic and meticulous process of planning, development and sourcing. In an ecosystem that hinges on interoperability, a lack of clarity may thwart major investments and basic operations, from security patches to interconnection to cloud-based innovation. Steps made today will have a tremendous effect on global operations for years to come.

What areas of research and development should the U.S. Government prioritize to achieve and maintain U.S. leadership in 5G? How can the US Government create an environment that encourages private sector investment in 5G technologies and beyond?

In September 2019, the GSMA conducted a survey focused on understanding the decisions and strategies global mobile operators are considering for network transformation and next generation wireless services. The anonymized survey features 100 operators from around the world, comprised of 25 operators in the Americas, 39 in Asia Pacific, 18 in Europe and 18 in the Middle East and Africa. This group of operators represents 72% of global mobile connections as well as 84% of global mobile CapEx[5].

Overall, operators are aligning their network transformation strategies against the backdrop of the evolving mobile ecosystem dynamics. 26% of operators ranked infrastructure costs as their number one barrier to increased 5G spend, more than any other barrier. Operators indicated network security upgrades as a top area of investment for operator 5G core and service networks, followed by Virtualization and Service-Based Architecture. Linked to network security are operator concerns around supply-chain diversity with 51% saying it is important to bring new vendors into their network.

[5] *See* P. Jarich, GSMA Intelligence, *Network Transformation 2020: How Operators are Planning for the Network of Tomorrow*, (November 2019), available at https://data.gsmaintelligence.com/research/research/research-2019/network-transformation-2020

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Intelligence

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Operator Insights

Network Transformation 2020

How operators are planning for the network of tomorrow

DATE

November 2019

Peter Jarich. Head of GSMA Intelligence
Jason Reed, Lead Analyst

GSMA Intelligence

The GSMA represents the interests of mobile operators worldwide, uniting more than 750 operators with nearly 400 companies in the broader mobile ecosystem, including handset and device makers, software companies, equipment providers and internet companies, as well as organisations in adjacent industry sectors. The GSMA also produces the industry-leading MWC events held annually in Barcelona, Los Angeles and Shanghai, as well as the Mobile 360 Series of regional conferences.

For more information, please visit the GSMA corporate website at www.gsma.com

Follow the GSMA on Twitter: @GSMA

GSMA Intelligence

GSMA Intelligence is the definitive source of global mobile operator data, analysis and forecasts, and publisher of authoritative industry reports and research. Our data covers every operator group, network and MVNO in every country worldwide – from Afghanistan to Zimbabwe. It is the most accurate and complete set of industry metrics available, comprising tens of millions of individual data points, updated daily.

GSMA Intelligence is relied on by leading operators, vendors, regulators, financial institutions and third-party industry players, to support strategic decision-making and long-term investment planning. The data is used as an industry reference point and is frequently cited by the media and by the industry itself.

Our team of analysts and experts produce regular thought-leading research reports across a range of industry topics.

www.gsmaintelligence.com

info@gsmaintelligence.com

GSMA Intelligence

Contents

GSMA Intelligence

Answering the key questions on mobile networks

With 5G networks and services going live and mobile broadband usage skyrocketing, two key questions surround operator network transformation strategies: how will operator spending evolve and what will drive that spending?

92%	64%	61%
The vast majority of operators expect network investment spend to remain the same or grow over the next 12 months. Some 40% expect spend to be up to 10% higher.	New revenue generation (direct or otherwise) is the primary goal of network transformation for two thirds of operators, helping justify additional network investment spend.	61% of operators are investing in private wireless networks, indicating enterprise as a target for new revenues. This is supported by 70% planning standalone 5G deployment within three years.

GSMA Intelligence

How operator networks are evolving to meet future opportunities

Whether or not operators are investing in their networks is an important question. But just as important is how they will be investing: where they will be putting their investment funds and what strategies will be guiding their decisions.

78%	25%	26%
The overriding theme for network transformation is use of IT technologies. The top-ranked priority (nearly 80% deemed it important). It was also top among opex saving technologies; 55% ranked it in the top three.	Only a quarter of operators claim to be commercially deploying open networking technologies, held back by internal expertise gaps. However, very few (18%) think that doing so is unimportant going forward.	IT transformation allows operators to host assets on the public cloud – and cloud players to compete with them. Few operators (26%), however, see defending against public cloud providers as a top priority.

GSMA Intelligence

Today’s news is reflected in operator network strategies

In the midst of planning for 5G launches, new IoT business models, and the integration of foundational technologies such as AI and blockchain, operators must align their network transformation strategies with ever-evolving mobile ecosystem dynamics.

47%	89%	51%
As the critical nature of mobile networks escalates, operators and regulators have highlighted network vulnerabilities, with around half of operators seeing security as an “extremely important” priority.	Whether or not operators see the public cloud as a competitive threat, they do see it as a tool to leverage; 20% claim to be deploying network functions on it, while 89% plan OSS/BSS deployments on it.	Linked to network security concerns are supply-chain diversity worries – reliance on too few suppliers. Around half of operators think it is important to bring new vendors into their network.

GSMA Intelligence

Crossing the 5G horizon

5G represents the greatest network transformation opportunity (and challenge) for operators in the last decade. Beyond the new services it will enable, there will be implications in terms of vendors engaged and technology priorities.

85%	41%	68%
While likely optimistic, an overwhelming majority of operators plan to have non-standalone 5G launched within three years, with standalone close behind. Both, however, will co-exist.	If 5G is a tool for enabling new enterprise services, new coverage models will be required; in-building 5G is the most important 5G RAN investment area, highlighted by more than 40% of operators.	Spectrum is the lifeblood of mobile services; almost 70% of operators see limited spectrum access as a barrier to greater 5G investment.

Survey details

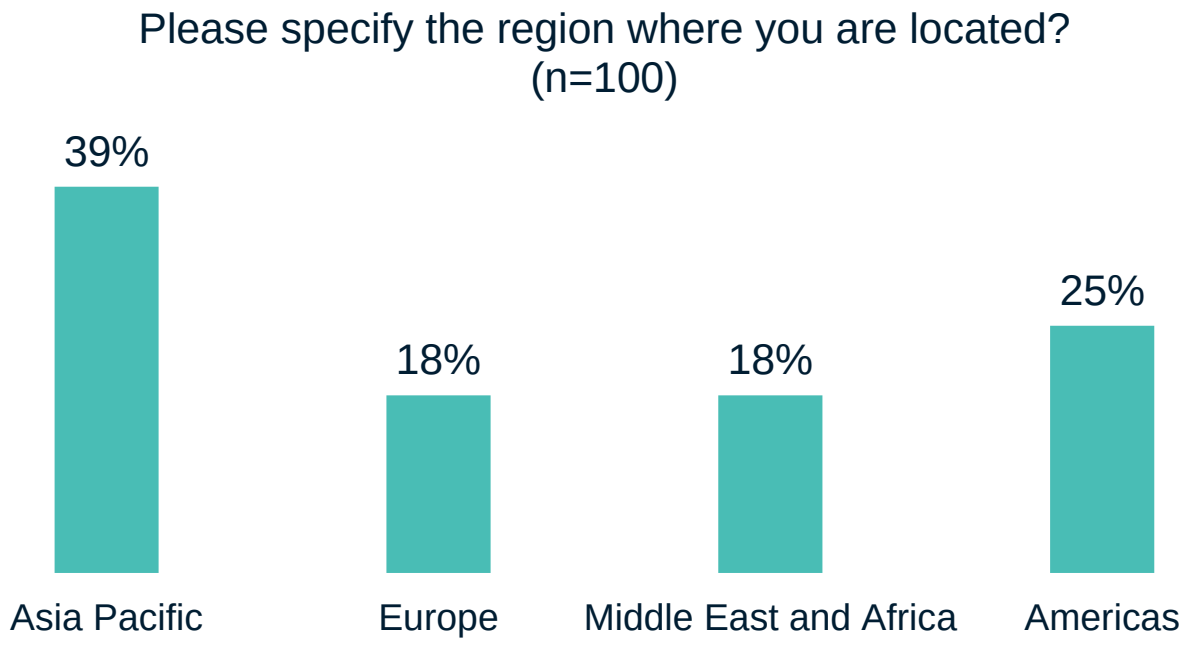
Distribution and timing

In September 2019, GSMA Intelligence surveyed 100 network infrastructure decision makers from operators around the world to understand their network transformation strategies, priorities and obstacles. All responses were confidential and only reported on in the aggregate.

72% of global mobile connections represented by operators surveyed.

84% of global mobile capex represented by operators surveyed.

88% share of converged (offering fixed and mobile) operators surveyed.



Survey details

Sample sizes

Segment	Sample size
Total	100
Region	
Asia Pacific	39
Europe	18
Middle East and Africa	18
Americas	25
Organisation size (by connections)	
Fewer than 10 million	18
10 million to 49.9 million	43
50 million to 99.9 million	24
Over 100 million	15

GSMA Intelligence

Survey details

Survey questions

Network transformation priorities and spending

What is the primary goal driving your network transformation strategy?

How important are the following priorities as a part of your network transformation strategy?

When do you expect to complete the phase-out of your 2G and 3G operations?

In the next 12 months, what share of your network spend do you expect to support the following?

How do you expect that network spend to be split between opex and capex?

Compared to last year, how much do you expect to spend on your network investments in the next 12 months?

How likely are you to invest in private wireless networks for enterprise customers?

Which verticals are the top candidates for private network investment?

Network transformation technologies

Which technologies hold the most promise of driving opex savings in your network and service operations?

Where are you in the process of adopting the following technologies?

How likely are you to migrate support for network segments to public cloud resources?

Rank the following technologies in terms of their return on investment (RoI)?

What is the greatest obstacle to deploying the following technologies?

Rank the following use cases for the application of artificial intelligence and automation in your network.

What degree of opex savings do you expect network automation to generate when fully deployed?

Network solution and vendor strategies

What are the most important factors in purchasing a given network product or solution?

How important is it for you to introduce new product or technology vendors into your network?

How important is it for you to integrate open source and open networking technologies into your network?

In engaging new network vendors, which types of vendors are you most likely to engage with?

In engaging new network vendors, which types of products are you most likely to procure?

What are the primary obstacles to introducing new vendors into your network

What are the primary obstacles to introducing open source / open networking technologies in your network?

5G network strategies and concerns

Considering your 5G radio access network, which areas of investment are most important?

Considering your 5G core and service network, which areas of investment are most important?

Considering your 5G network assets and strategy, when do you plan standalone versus non-standalone 5G?

Rank the following benefits of deploying standalone 5G in your network.

How likely are you to use 5G to introduce new vendors into your network?

What is the greatest barrier to increasing your planned network investment in 5G?

GSMA Intelligence

In numbers: network transformation priorities and spending

64% Two-thirds of operators prioritise top-line concerns (generating revenues) over bottom-line concerns in network transformation strategies.

78% More than any other priority, IT transformation is deemed very or extremely important – nearly 80% of operators highlight it as such.

50% While 3G networks will be phased out over many years, half of operators plan to phase out their 2G networks by the end of 2020.

8% With 5G builds on the horizon, only a small minority of operators expect network investment spend to decline in 2019.

39% Most operators plan to invest in private wireless networks for verticals; less than 40% have no plans.

17% Smart cities dominate private wireless investment interest; 17% of operators plan to invest in them alongside the enterprise customer.

GSMA Intelligence

In numbers: network transformation technologies

55% Opex represents the majority of operator network spend. IT transformation of networks is seen as the top way to save opex.

48% Deploying telecoms functions on the public cloud was once considered unlikely. Today, almost half of operators claim to be doing so commercially.

49% Almost half of operators are deploying service core functions on the public cloud (with OSS/BSS close behind).

75% Network automation might not be ranked highest for opex efficiencies, but the majority of operators expect it to deliver more than 5% savings.

16% More than any other technology, network deployment automation is seen as the top RoI driver, with 16% highlighting it as such.

23% With understood RoI and opex benefits, what could hold up automation? Internal ownership is a worry for nearly a quarter of operators.

GSMA Intelligence

In numbers: network solution and vendor strategies

57% Network security is a top network transformation priority; it's logical that most operators (57%) also see it as an important vendor criteria.

20% Only a minor share of operators don't feel it's important to integrate new suppliers into their network infrastructure.

65% In working to engage new network vendors, around two thirds of operators will look to work with larger systems suppliers.

32% Vendor references have long been a supplier evaluation (and marketing) tool; less than a third of operators rank them as important.

71% Network security concerns rate highest as an obstacle to new supplier integration, highlighted by most operators.

56% Just over half of operators are likely to work with start-ups as new suppliers; the door is open for both large and small players.

GSMA Intelligence

In numbers: 5G network strategies and concerns

20% A fifth of operators see in-building coverage as their top RAN priority, suggesting a keen enterprise focus.

69% More than two thirds of operators failed to claim spectrum refarming as a top three RAN priority, despite highlighting spectrum scarcity.

71% Most operators plan to start 5G deployment in non-standalone mode. However, more than 70% plan standalone launches in three years.

57% More than half of operators think they are likely to introduce new vendors into their 5G network deployments.

6% Only a small minority think they are very unlikely to use 5G to introduce new vendors.

26% More than a quarter of operators ranked infrastructure costs as the no.1 barrier to increased 5G spend – more than any other barrier.

GSMA Intelligence

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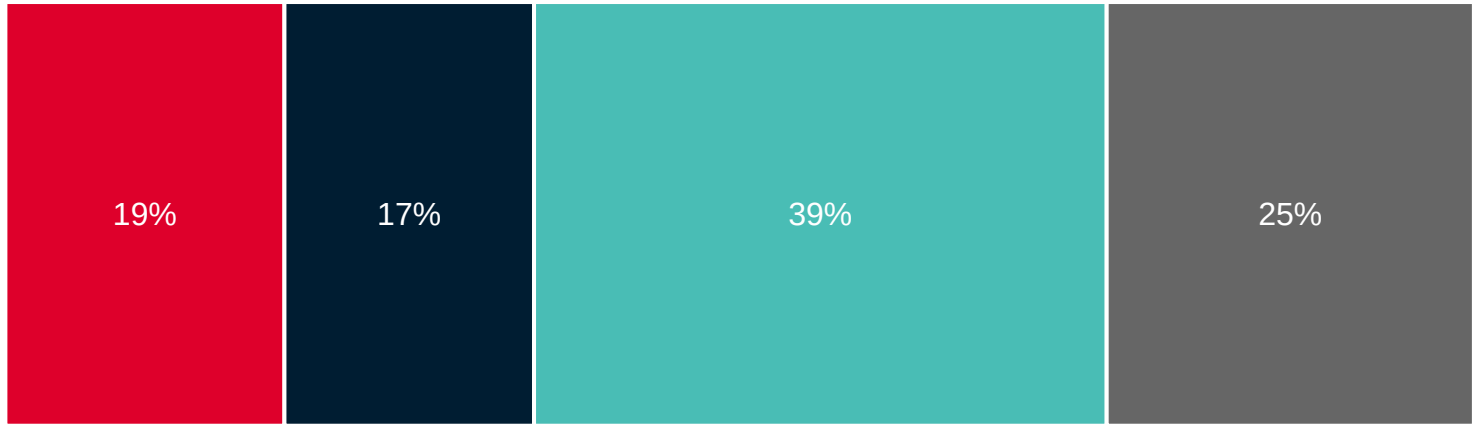
Network transformation goals

Revenues over cost savings

What is the primary goal driving your network transformation strategy?

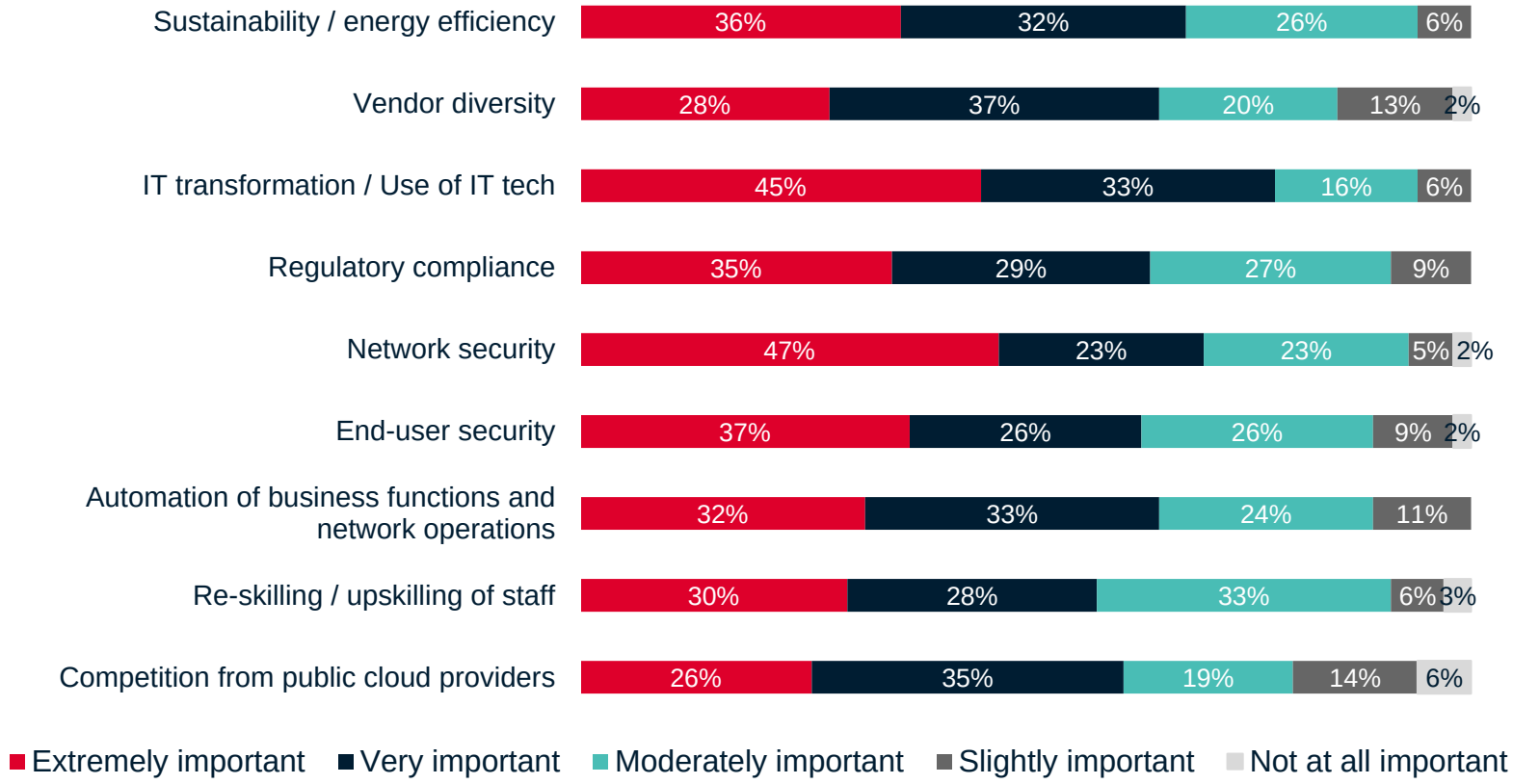


- **Top-line concerns**: Revenue generation and customer experience (64% of all responses) reflect a focus on the top line.
- **Churn reduction**. While linked to revenues via customer acquisition, improved experiences also reflect concerns around churn.
- **Top versus bottom line.** With new services and use cases (5G, IoT, verticals) on the horizon, a focus on growth is unsurprising.
- **Small companies need growth.** Small operators care least about opex, highlighting it as their primary goal about 25% as often as other operators. Low revenues versus a fixed cost base likely explains the need to prioritise revenue growth.

Network transformation priorities

IT transformation key – but not to compete with cloud players

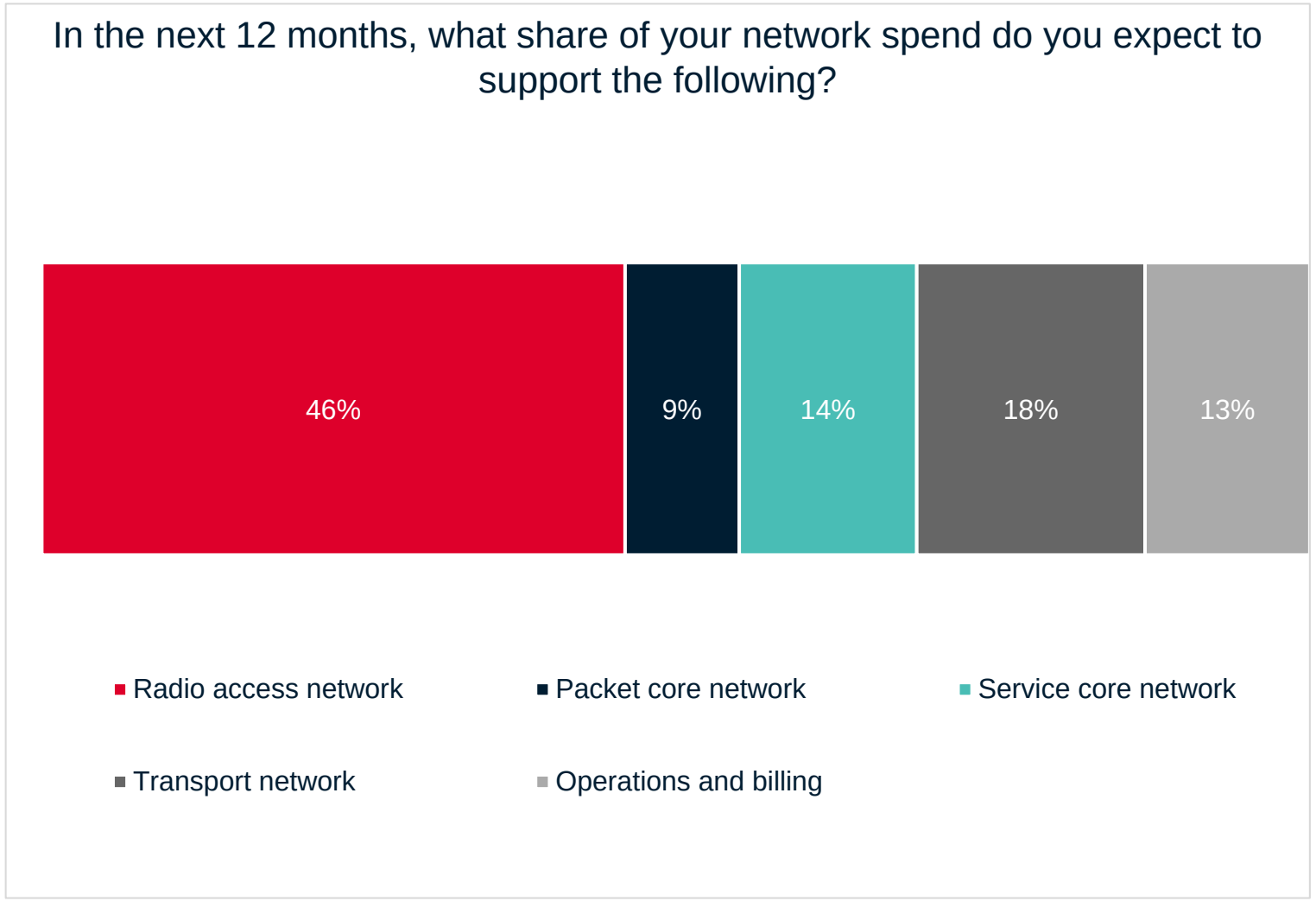
How important are the following priorities as a part of your network transformation strategy?



- **Software and cloud.** An industry shift to software-defined and cloud architectures is reflected in IT transformation as a top priority.
- **Cloud competition**. A lack of focus on competition with cloud players suggests a potential blind spot, particularly as those players begin to host telecoms functions.
- **IT expertise**. Where IT technologies represent new ground for many operators, upskilling would presumably be a higher priority.
- **New suppliers**. The poor showing of “vendor diversity” is surprising; 51% of operators note elsewhere that it is important to introduce new suppliers into their networks. How honest the focus on new vendor introductions truly is must be questioned.

Network spending plans

RAN dominates spend, supported by transport

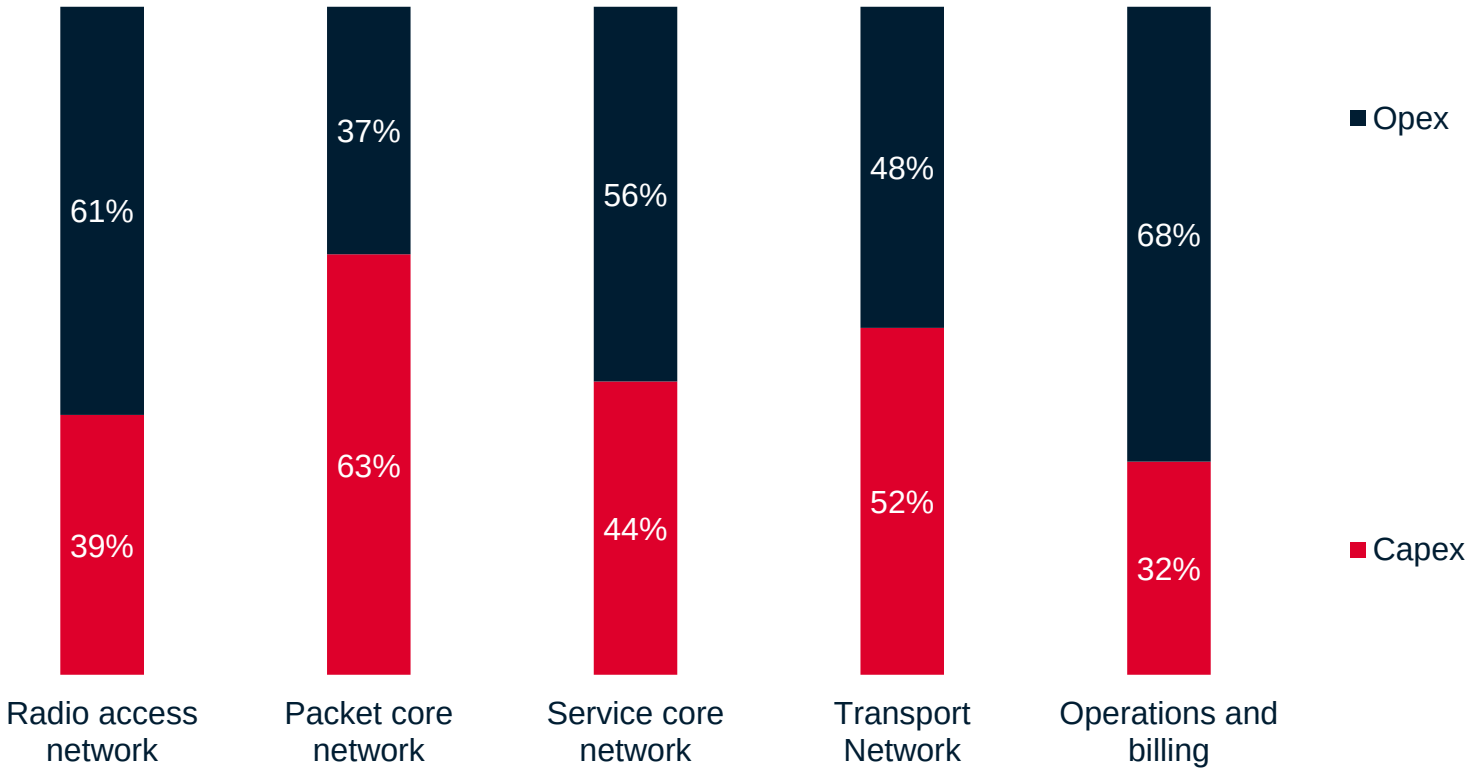


- **RAN domination.** The most distributed part of the network, RAN always represents a major cost – nearly 50% of network spend of the surveyed operators.
- **Age of virtualisation**. Virtual RAN innovation could keep costs in check, though not in a meaningful way in the next 12 months. Transport, ranked second, may not see the same benefit.
- **Virtualisation – part 2.** The move to virtual and cloud architectures has been under way for some time in the core (packet/service) and OSS/BSS.
- **Spend versus capex**. When asked about “network spend”, operators were forced to think about opex and capex together, recognising that some categories come with higher operation and integration costs.

Network spending plans

Opex drives spend across top segments

How do you expect that network spend to be split between opex and capex?

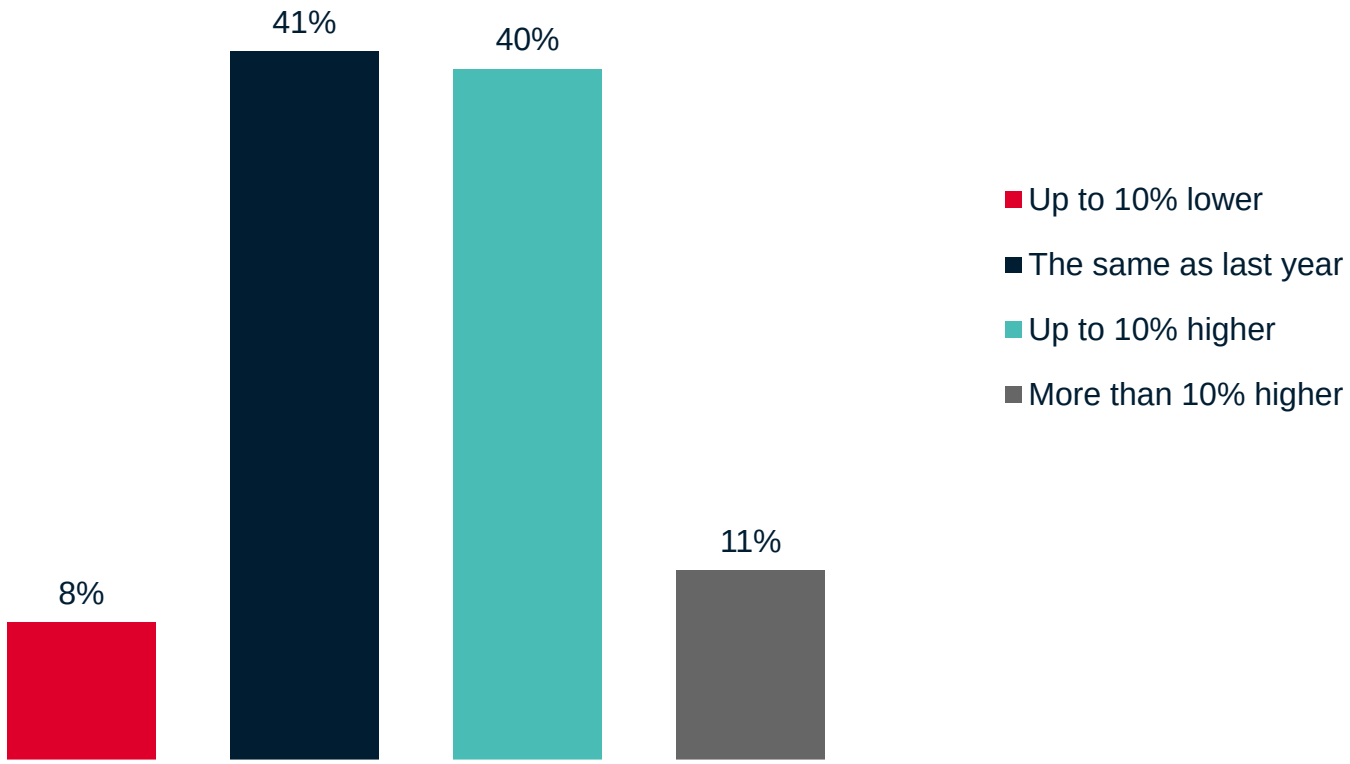


- **Virtualisation beneficiary: packet core.** If operators see packet core as capex heavy, the move towards virtual solutions could help cut costs – and may explain a focus on virtual EPC.
- **Virtualisation multiplier: RAN.** Operators already see opex driving RAN costs. Site upkeep and rental help to explain this – and a move to virtual RAN will only intensify the opex burden.
- **Virtualisation benefits**? The use of (less expensive) IT hardware is often positioned as a core value of new virtual architectures. So too, however, is a reduction in opex, driven by the use of standard IT operations. How that factors into any operator's thinking is unclear across network components.

Network spending plans

Expectations of lower spend are rare

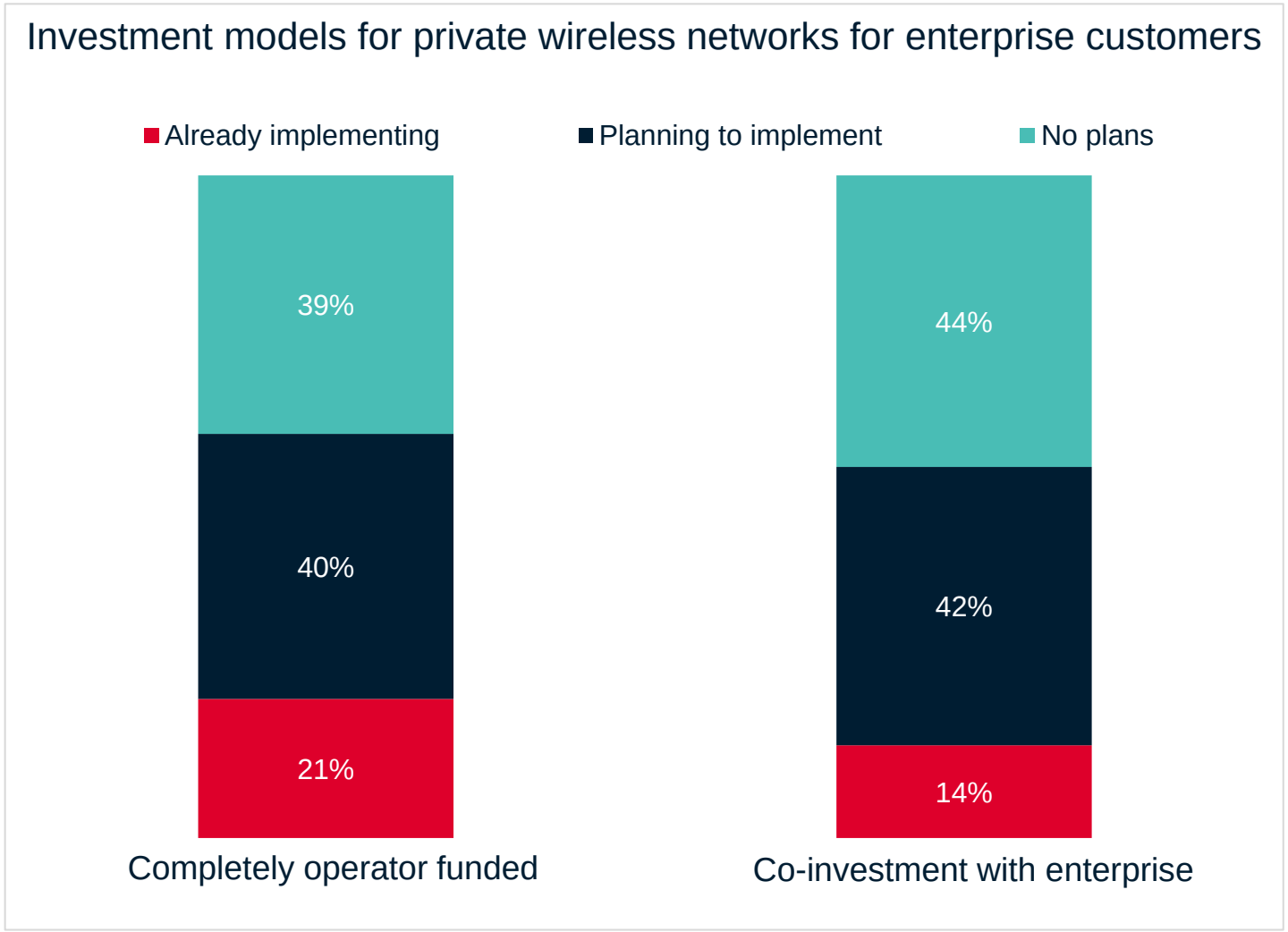
Compared to last year, how much do you expect to spend on your network investments in next 12 months?



- **Split decision.** Roughly half of operators surveyed (51%) expect spend to increase this year, with half expecting it to be stable or decline.
- **Growth wins**. While most expect stability, operators planning for costs to go up (51%) outnumber those expecting a decline (8%).
- **5G on the horizon**. Despite cost-cutting innovations, imminent 5G rollouts are likely to be a factor in near-term spend expectations.
- **Latin America up; Europe down**. European operators are more likely to plan on spending cuts (22% plan lower spending), while Latin American operators expect to spend more, potentially reflecting current network expansions (4G) versus new 5G rollouts.

Network spending plans

Most operators deploying (or planning) private wireless

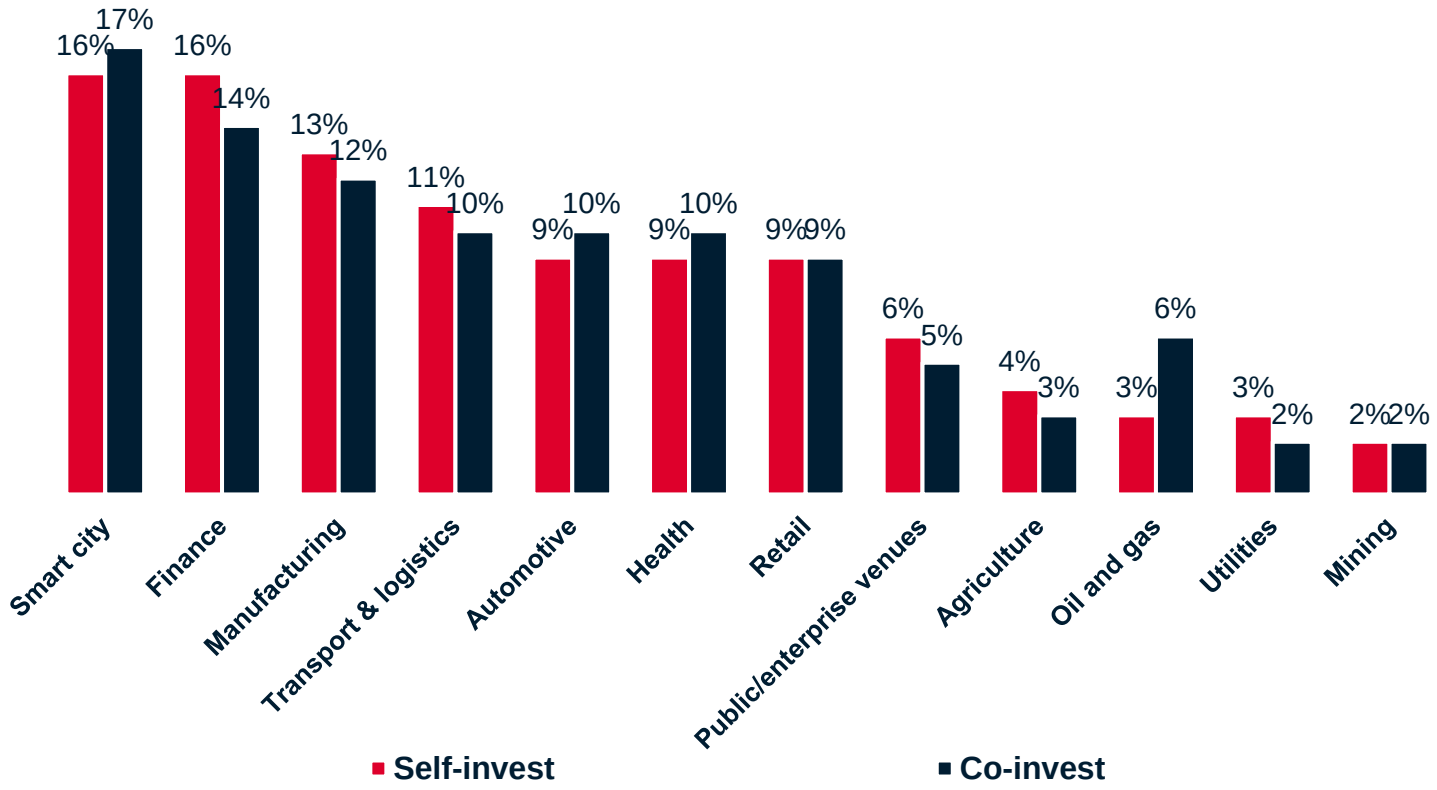


- **Split decision.** Beyond operators now investing in private wireless, the rest are evenly divided between those planning to invest and those without plans.
- **Private networks are already underway.** Often positioned as a future plan, 21% of operators already claim to be investing in them.
- **Co-investment aspirations**. Co-investment is less common today (14% versus 21%) but a bigger plan going forward. Sharing investment costs is attractive, but it is unclear how solid the plans are.
- **Large operator capabilities**. Large operators are most likely to be investing today – 33% claim to do so. The sales and product assets needed to target verticals are likely a factor.

Network spending plans

Smart cities on top, with or without co-investment

Top candidates for private network investment by funding model

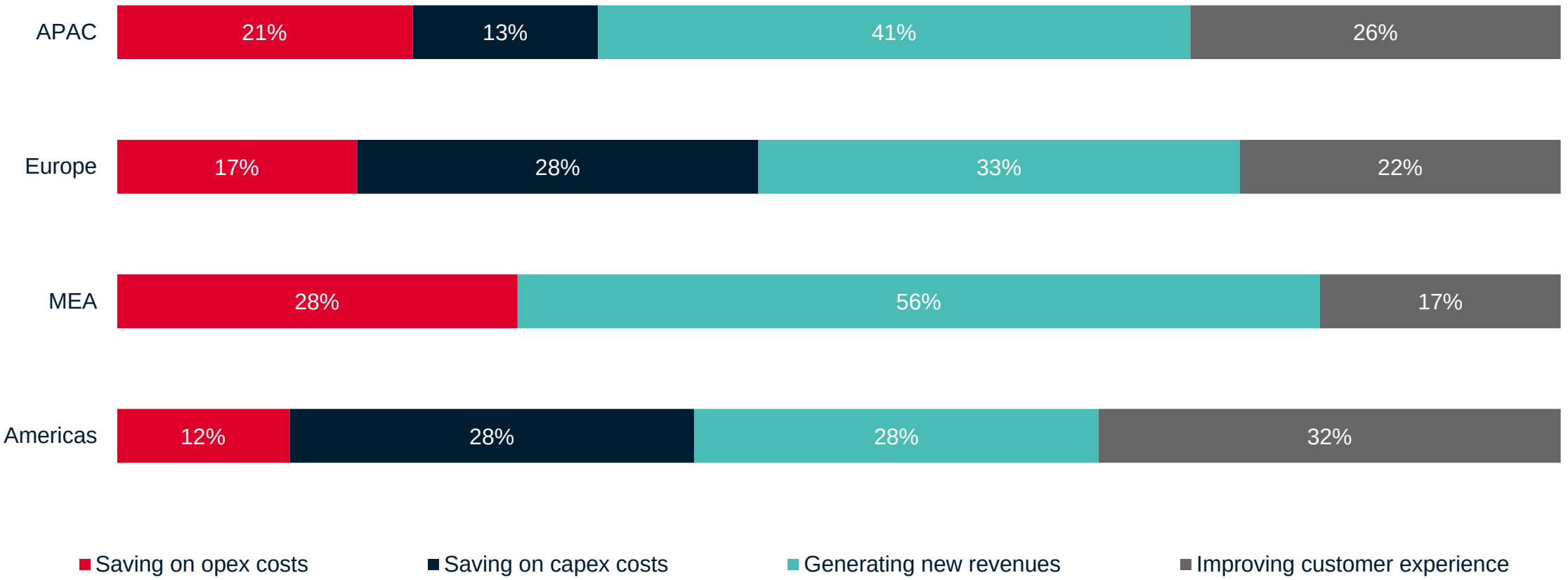


- **Smart cities, finance, and manufacturing on top.** Smart cities have been an operator focus, given coverage demands and revenue potential. Investment budgets and requirements of finance and manufacturing make them targets.
- **Co-invest versus self-invest parity**. Across most verticals, there is little difference in interest between investing alongside the vertical or investing directly.
- **What about venues, energy, agriculture, mining and utilities?** While often cited as natural targets for operators targeting enterprises, few in the survey flagged a major interest in investing in networks for these.

Network transformation goals

Results by region

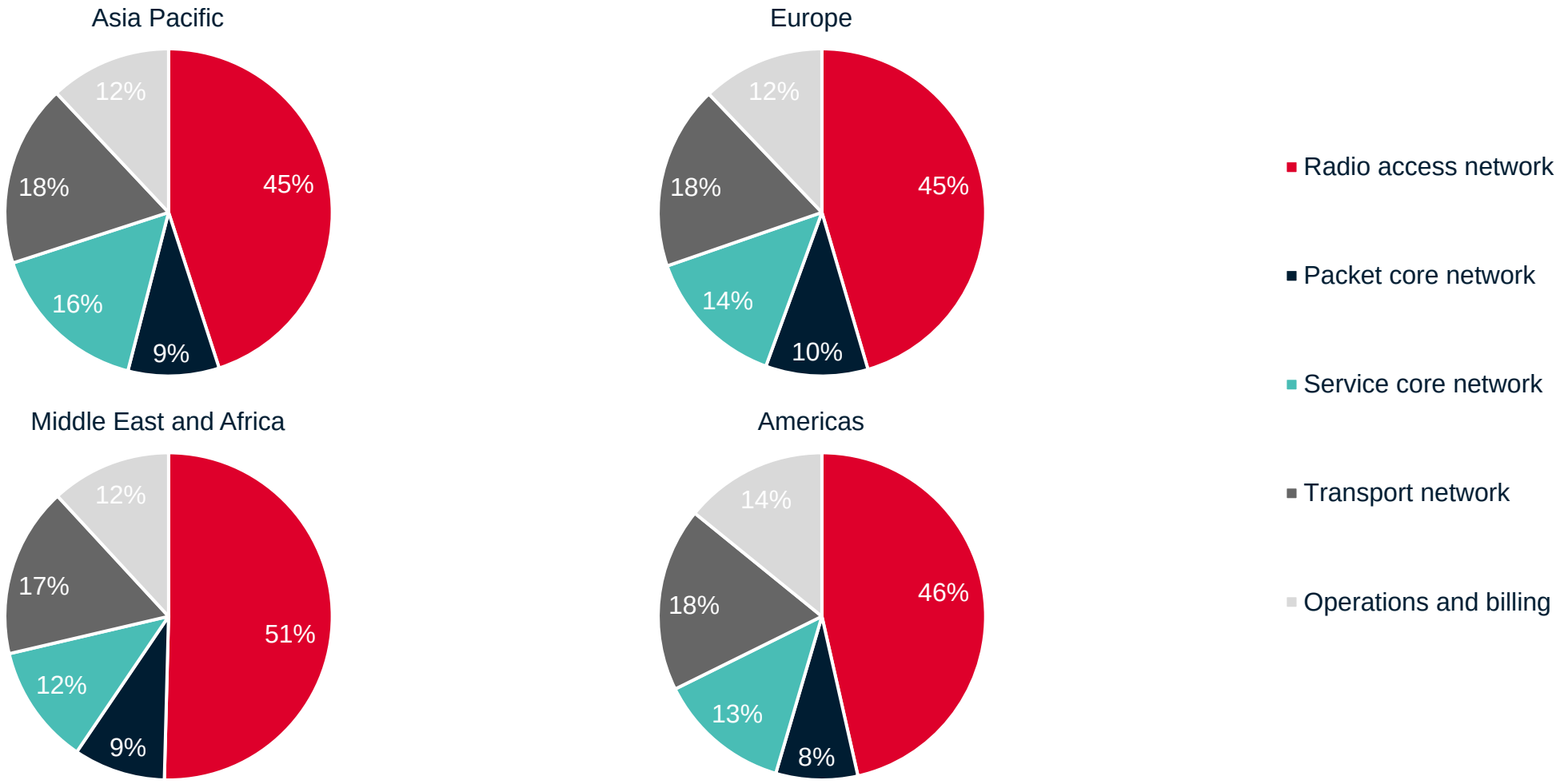
What is the primary goal driving your network transformation strategy?



Network spending plans

Results by region

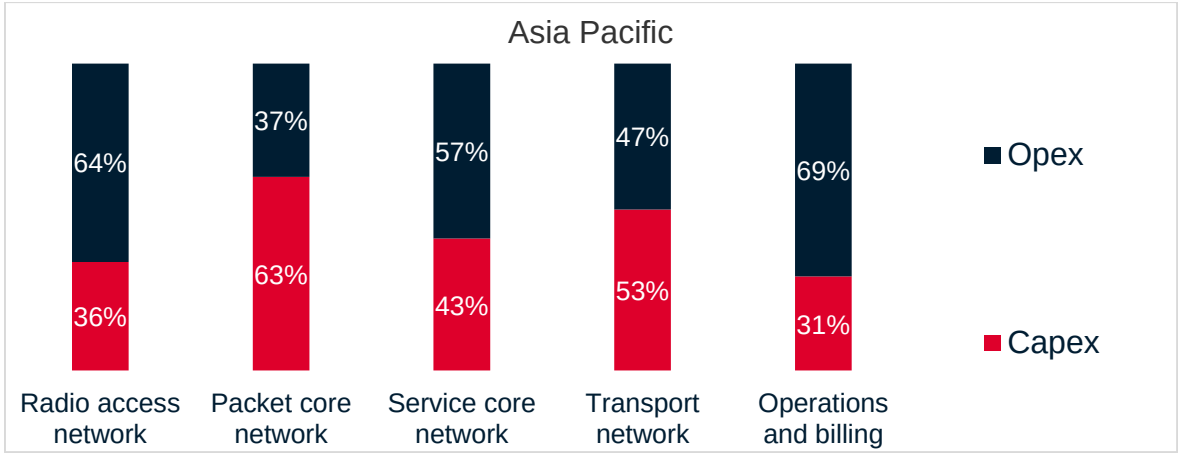
Over the next 12 months, what share of your network spend do you expect to support the following segments of your network?

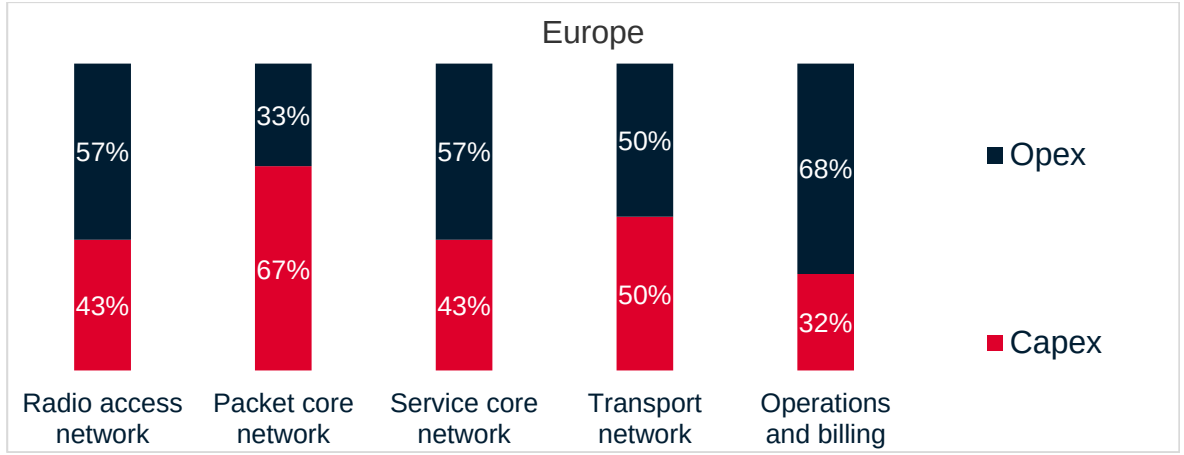


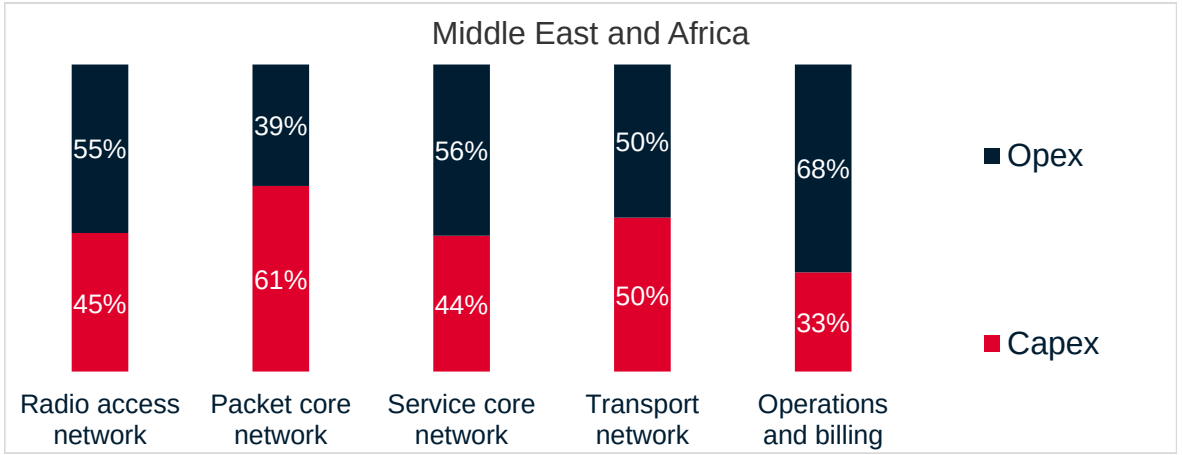
Network spending plans

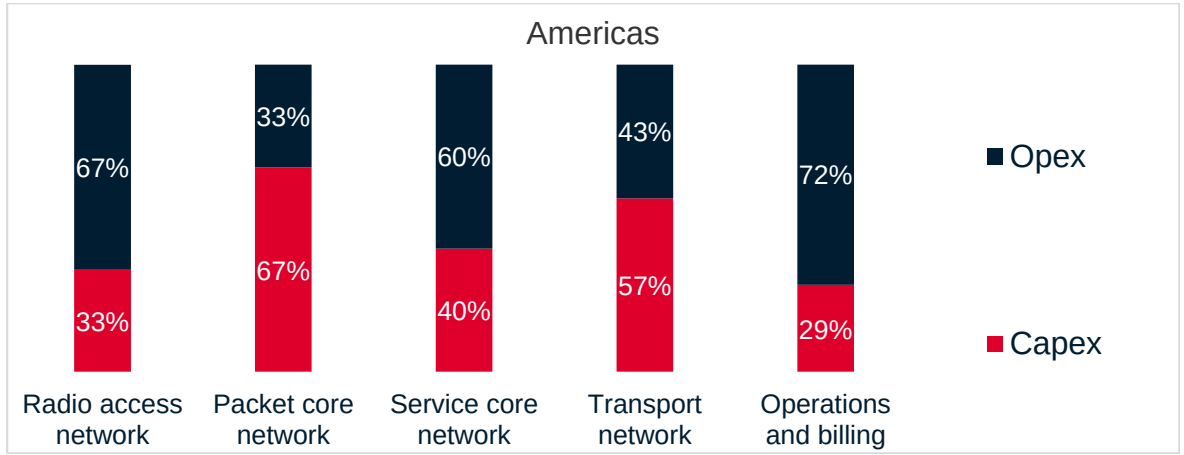
Results by region

How do you expect that network spend to be split between opex and capex?





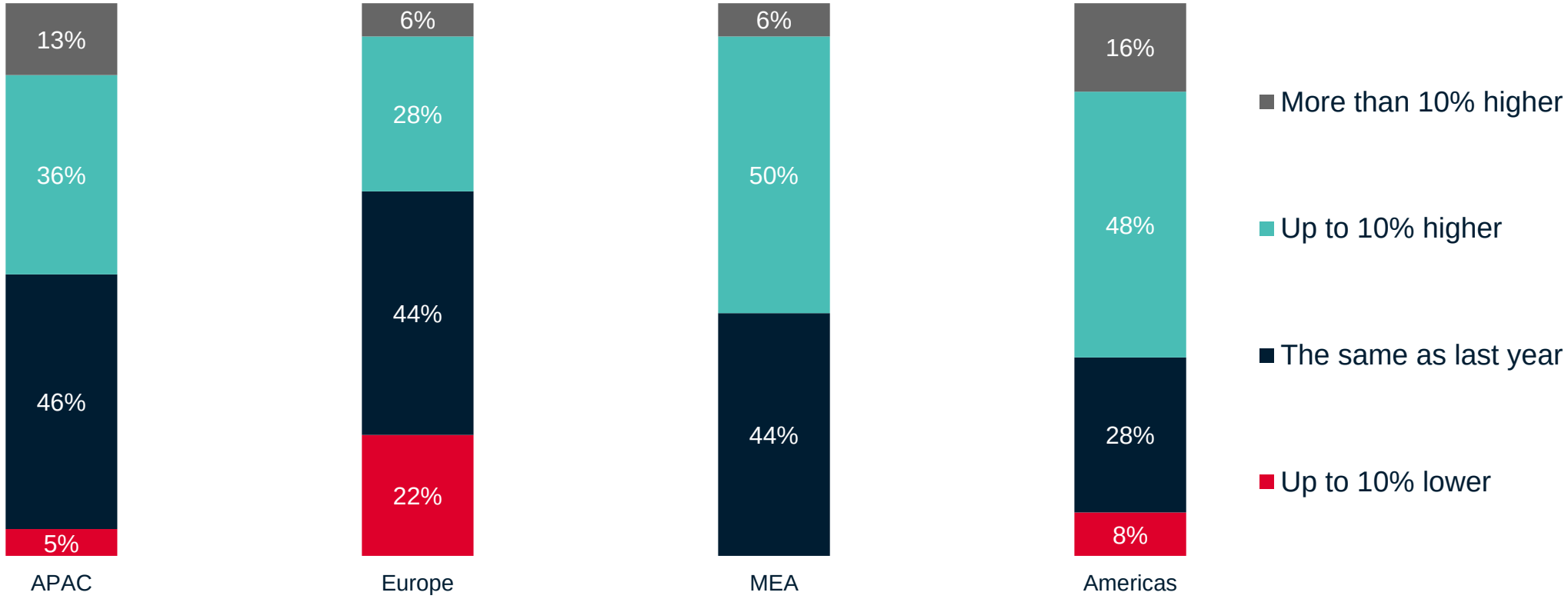




Network spending plans

Results by region

Compared to last year, how much do you expect to spend on your network investments in next 12 months?

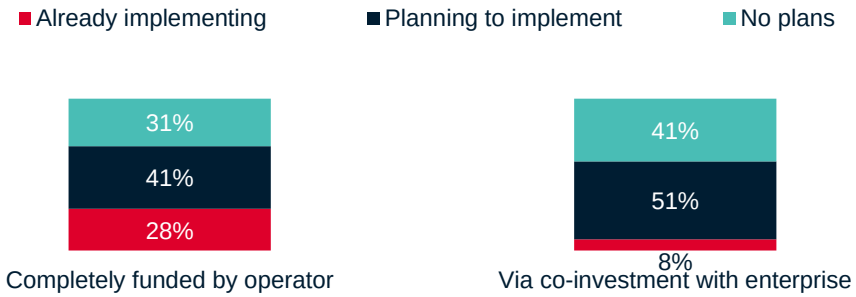


Network spending plans

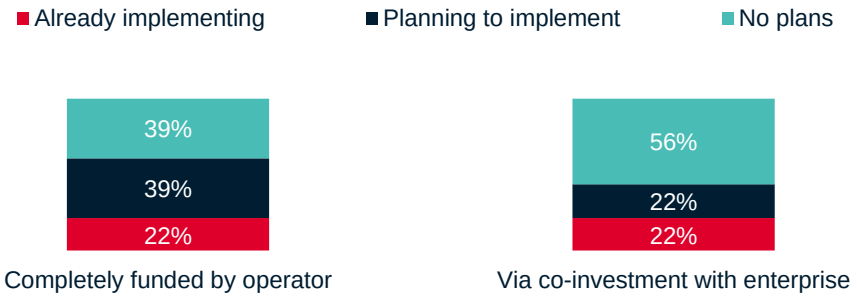
Results by region

Investment models for private wireless networks for enterprise customers

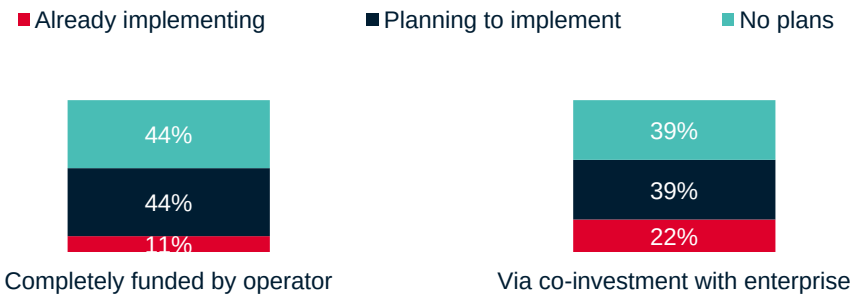
Asia Pacific



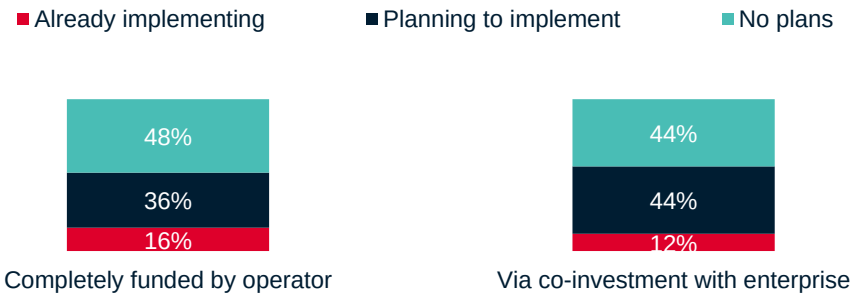
Europe



Middle East and Africa



Americas

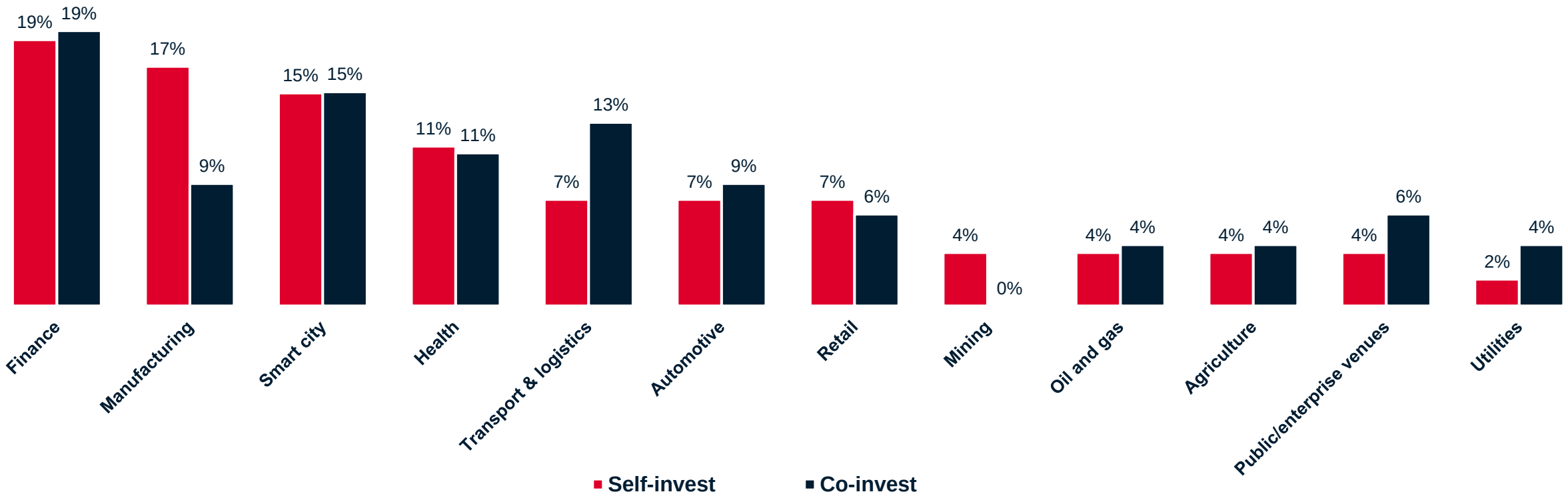


Network spending plans

Results by region

Top candidates for private network investment by funding model

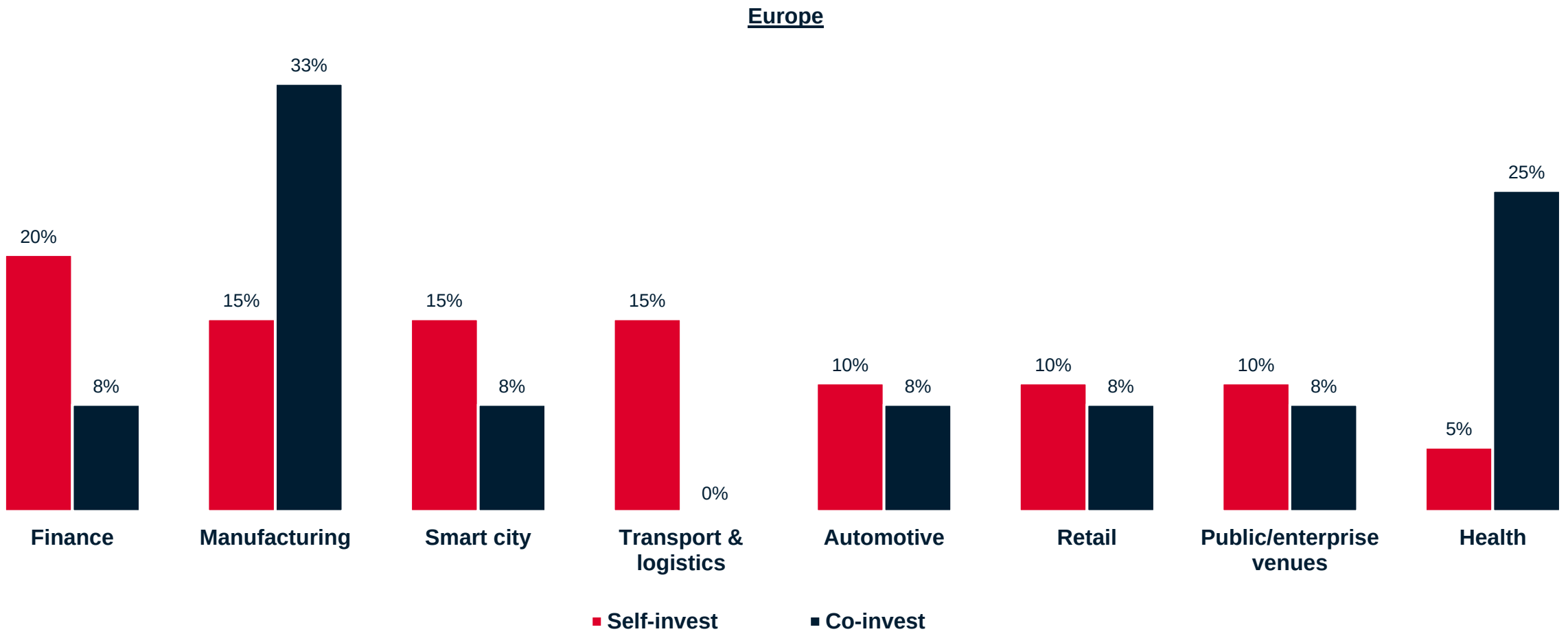
Asia Pacific



Network spending plans

Results by region

Top candidates for private network investment by funding model

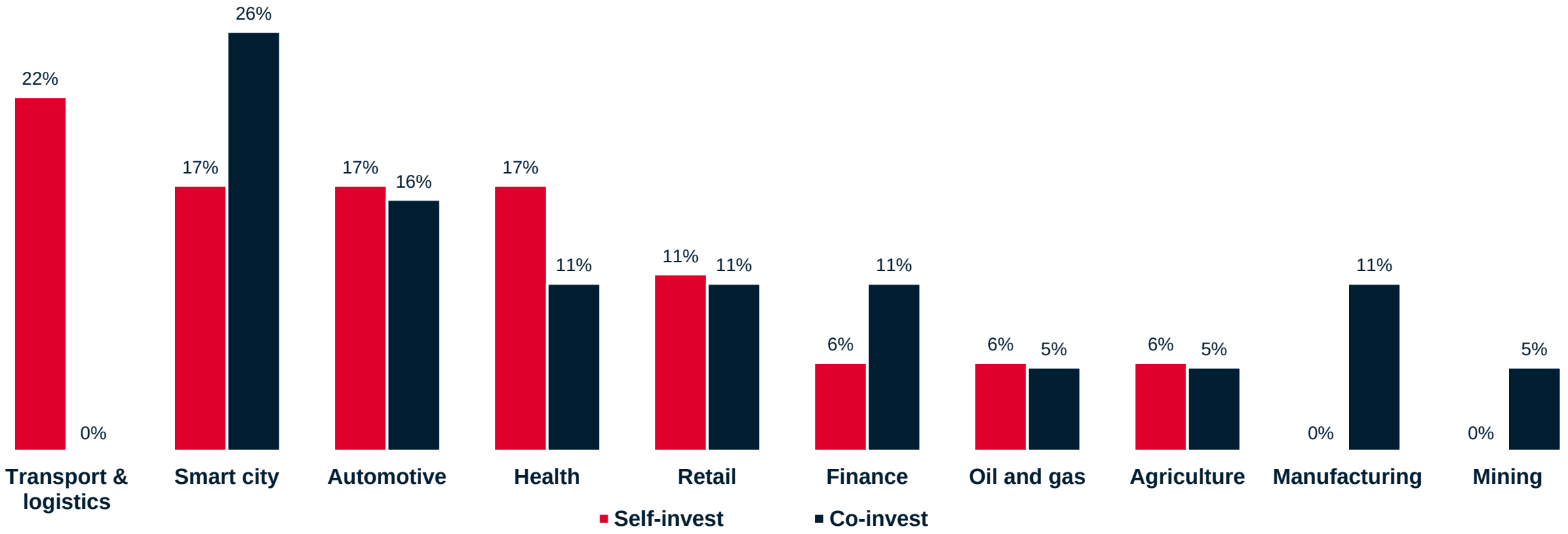


Network spending plans

Results by region

Top candidates for private network investment by funding model

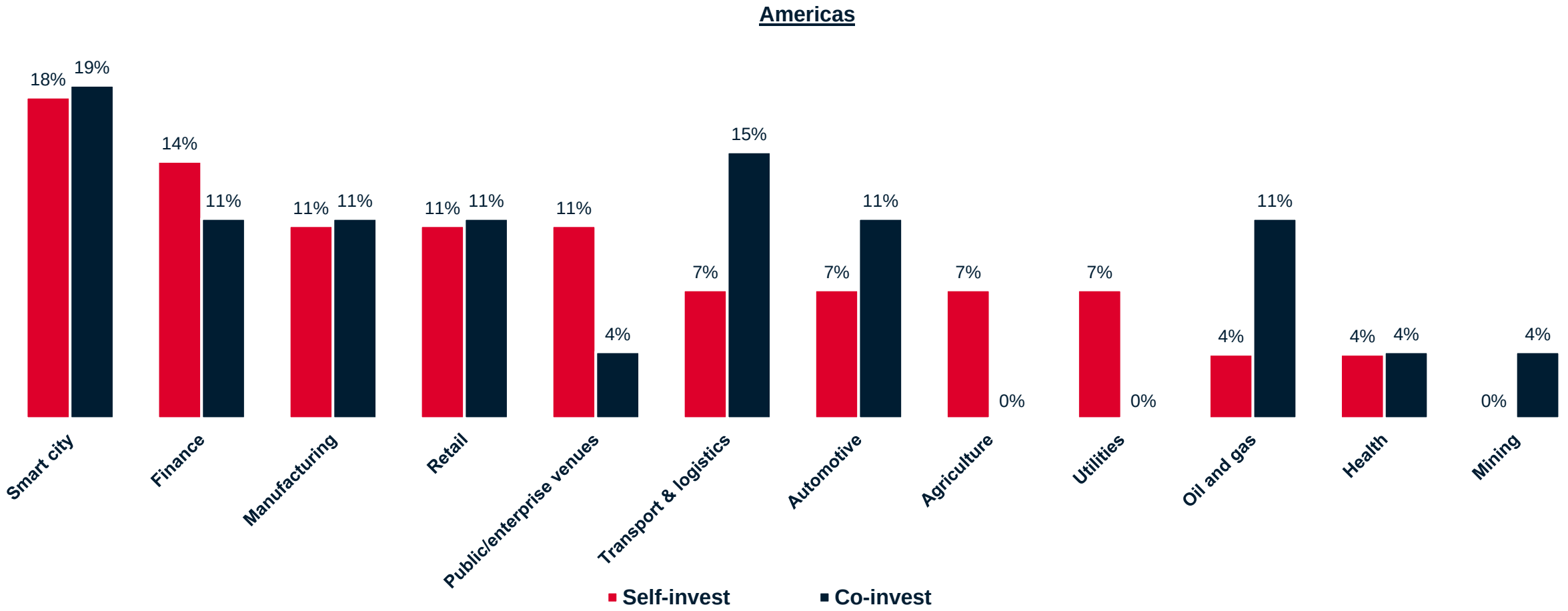
Middle East and Africa



Network spending plans

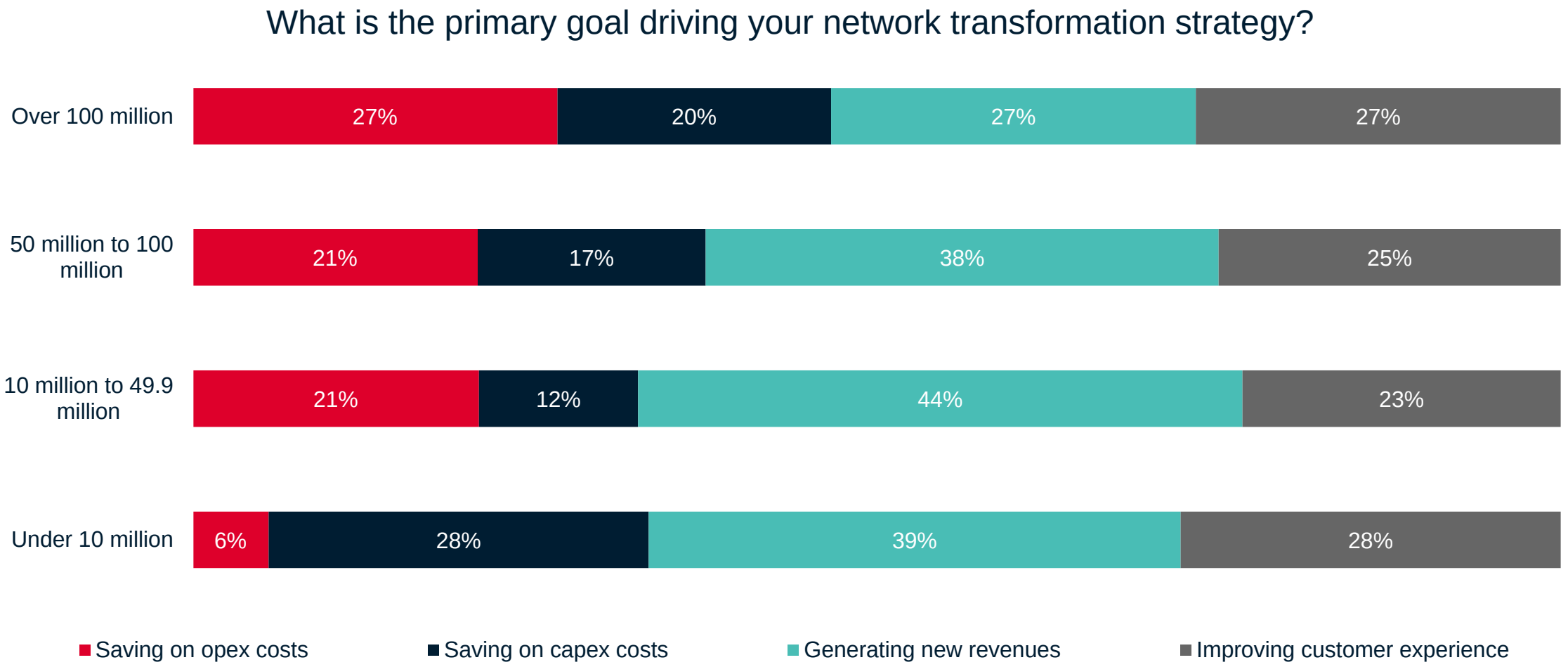
Results by region

Top candidates for private network investment by funding model



Network transformation goals

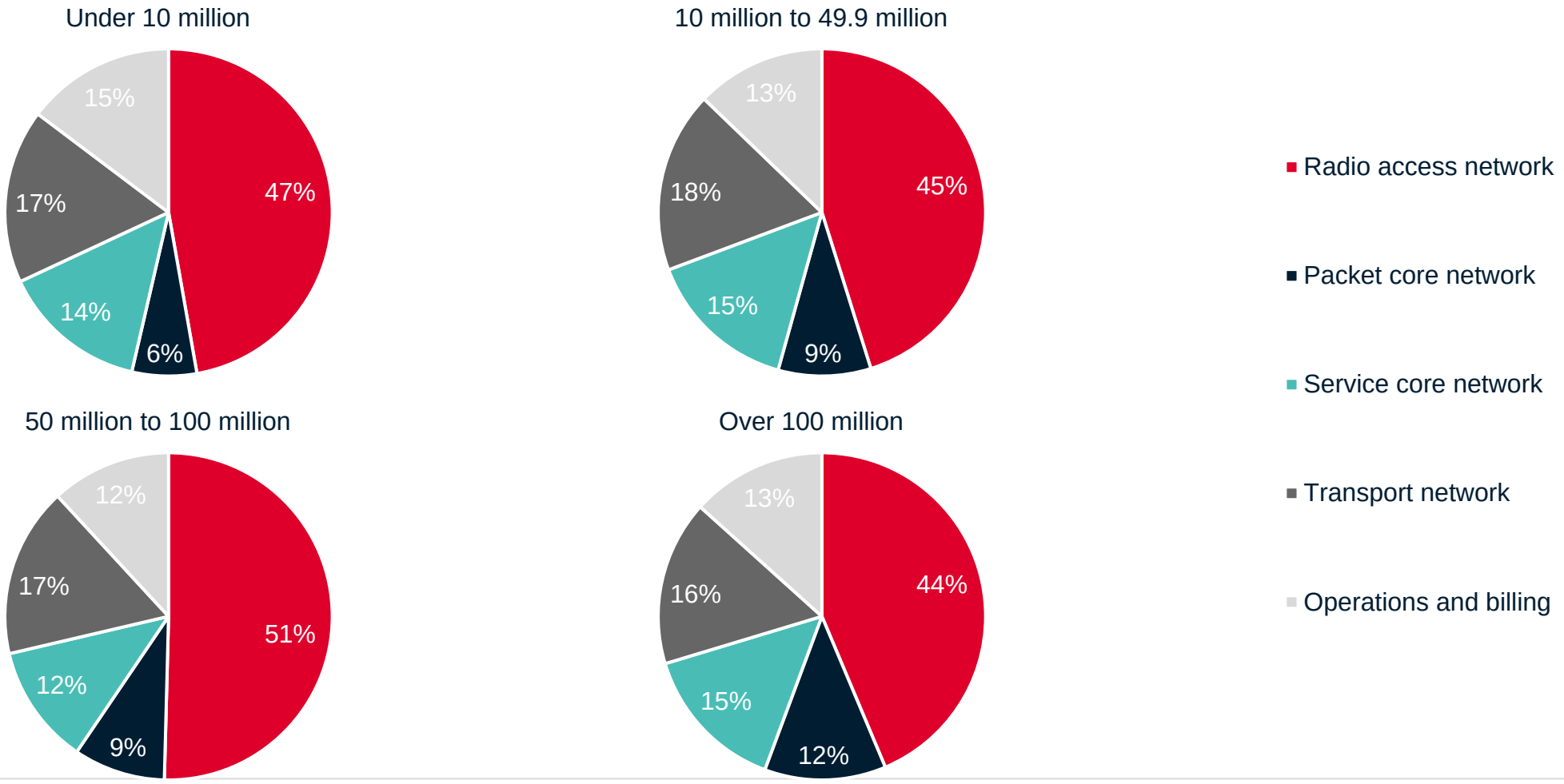
Results by operator size (by number of connections)



Network spending plans

Results by operator size (by number of connections)

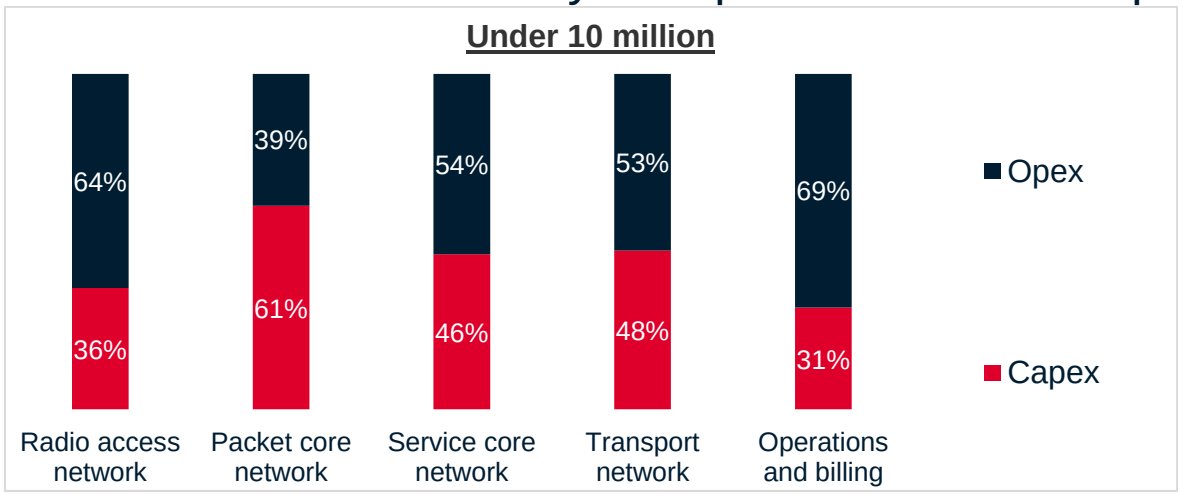
Over the next 12 months, what share of your network spend do you expect to support the following segments of your network?

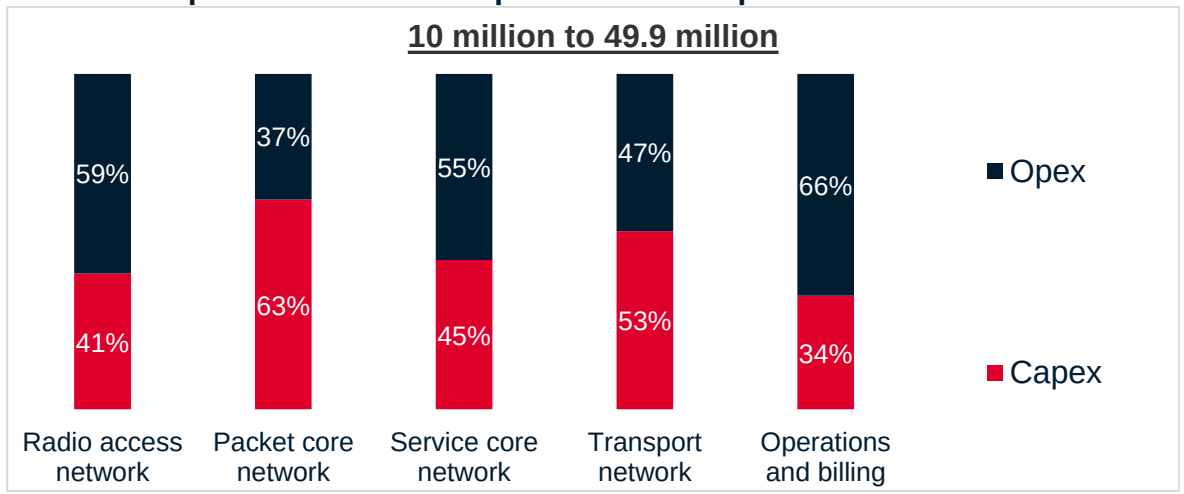


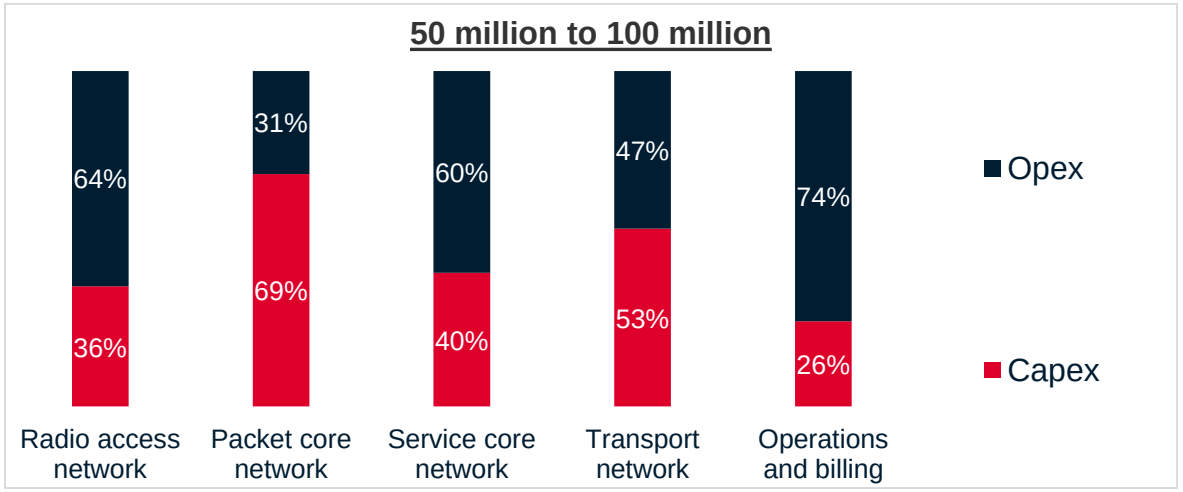
Network spending plans

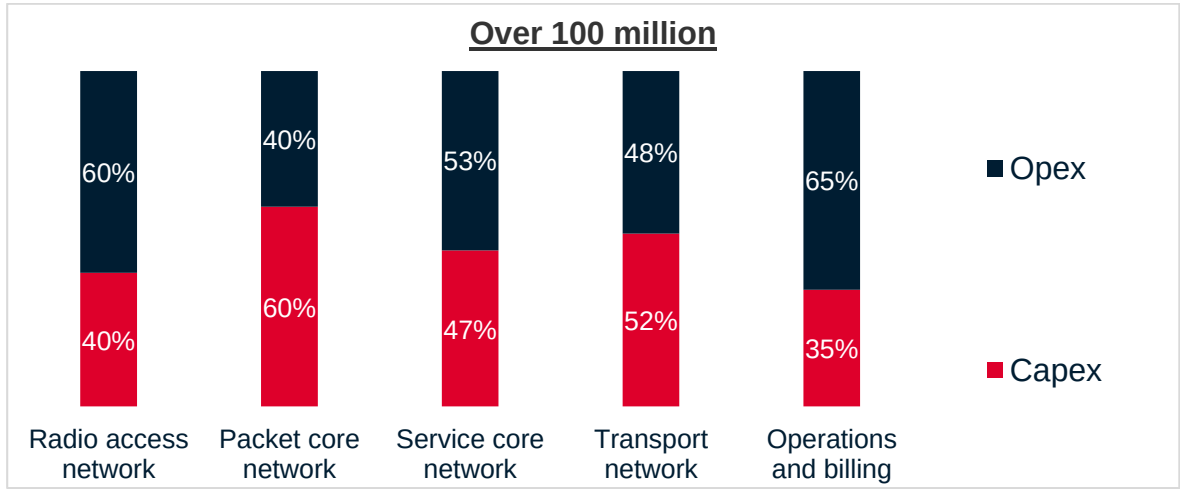
Results by operator size (by number of connections)

How do you expect that network spend to be split between opex and capex?





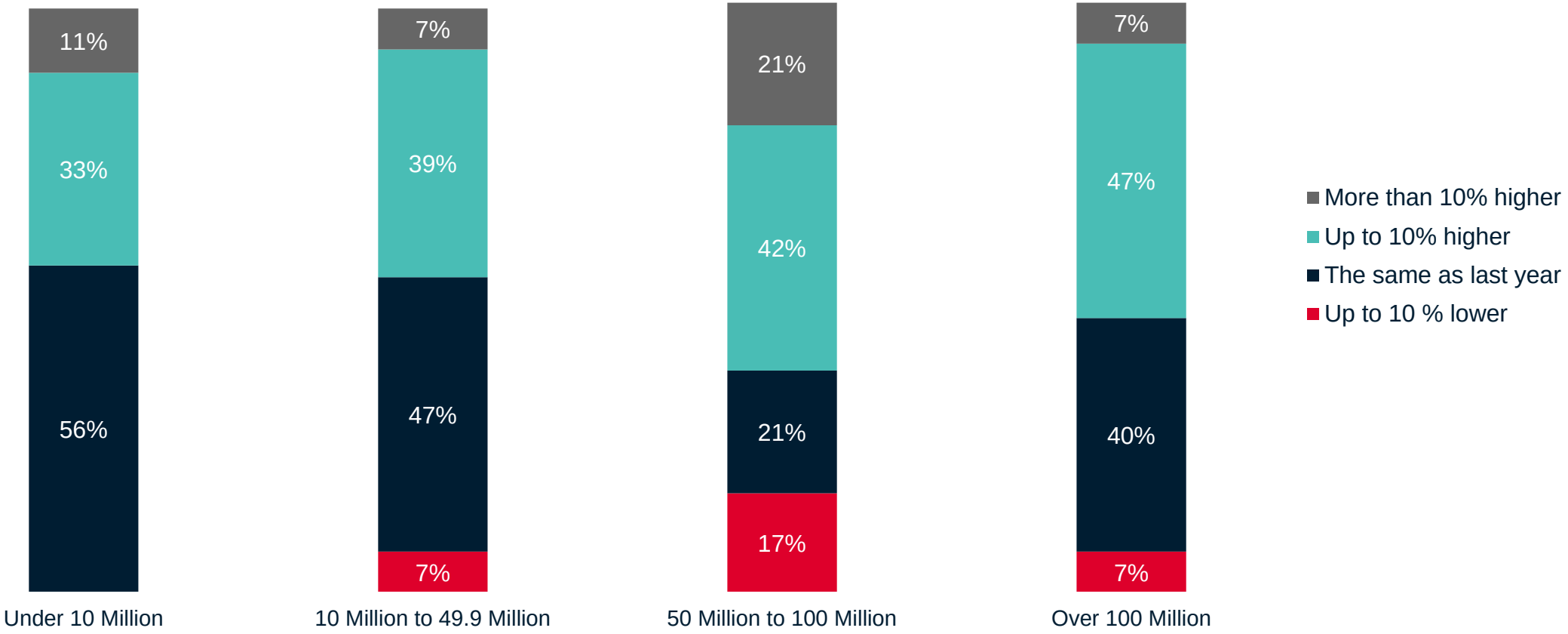




Network spending plans

Results by operator size (by number of connections)

Compared to last year, how much do you expect to spend on your network investments in next 12 months?

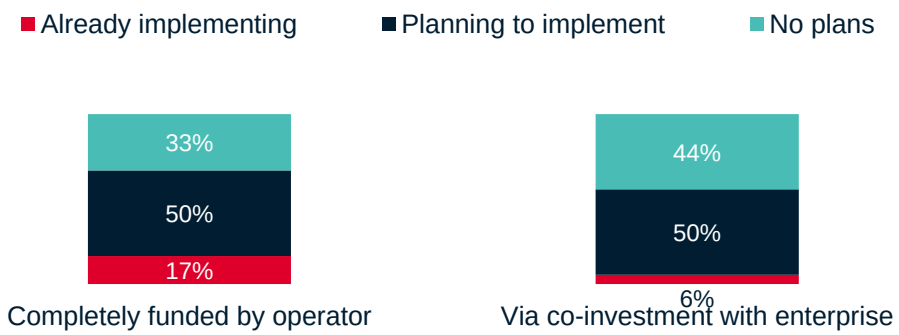


Network spending plans

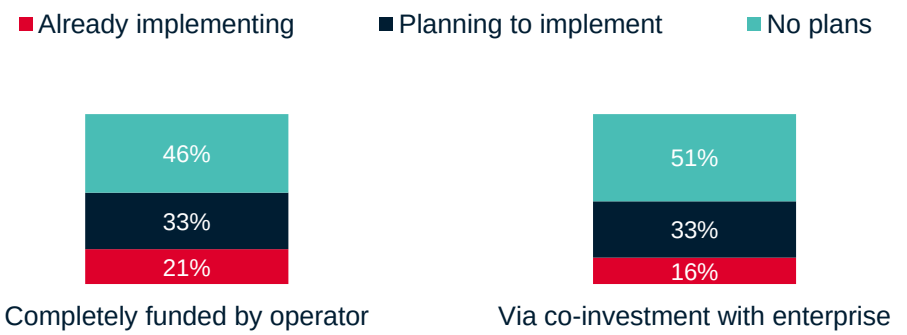
Results by operator size (by number of connections)

Investment models for private wireless networks for enterprise customers

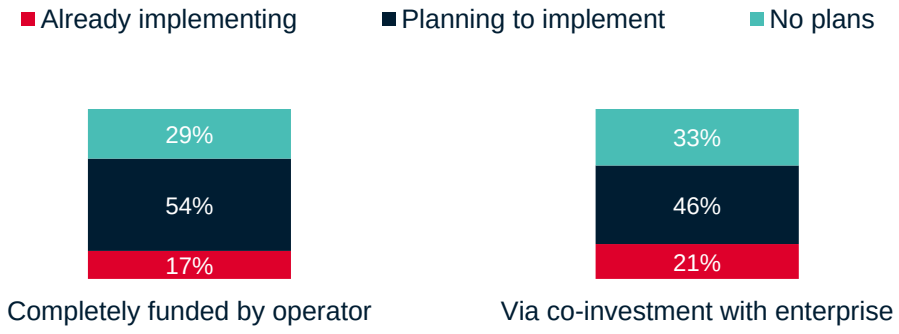
Under 10 million



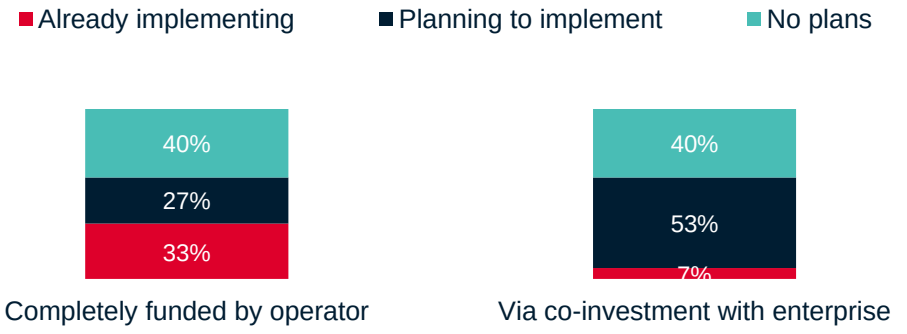
10 million to 49.9 million



50 million to 100 million



Over 100 million

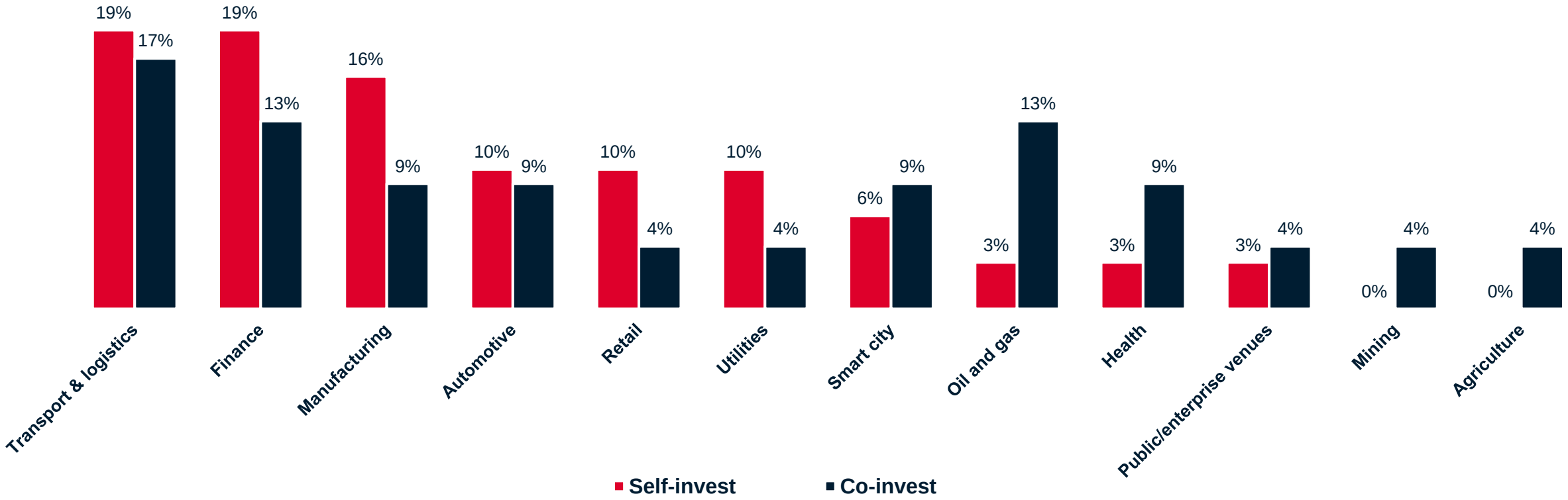


Network spending plans

Results by operator size (by number of connections)

Top candidates for private network investment by funding model

Under 10 million

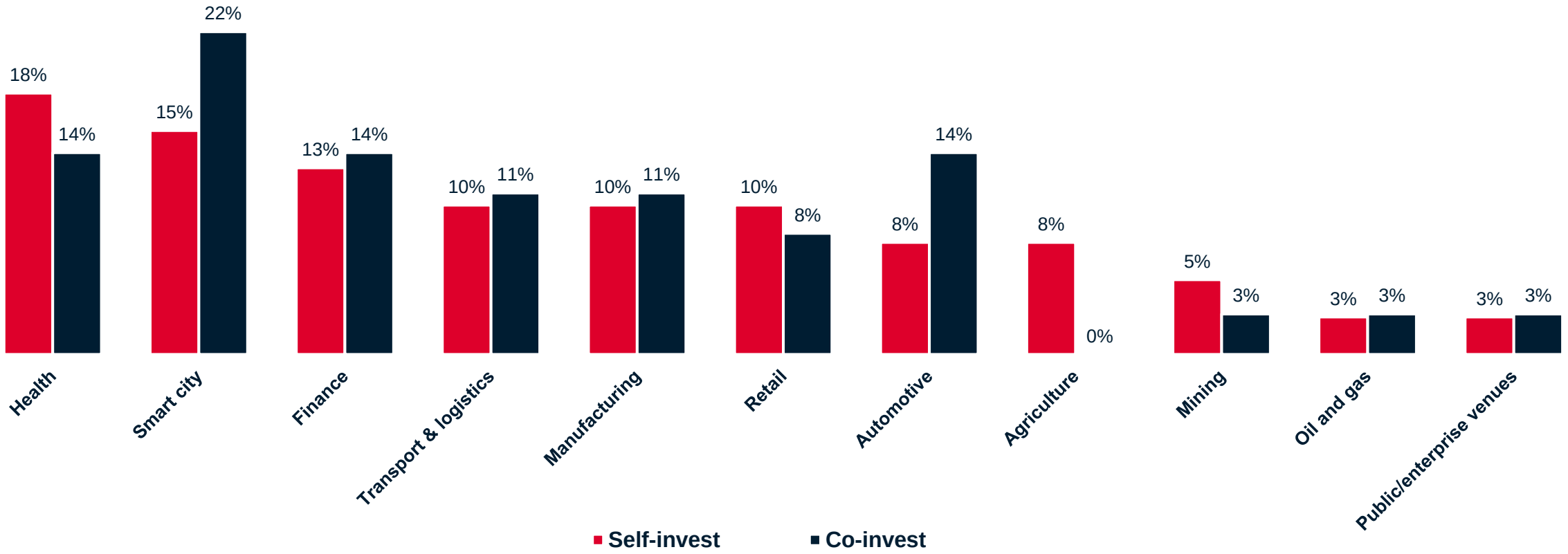


Network spending plans

Results by operator size (by number of connections)

Top candidates for private network investment by funding model

10 million to 49.9 million

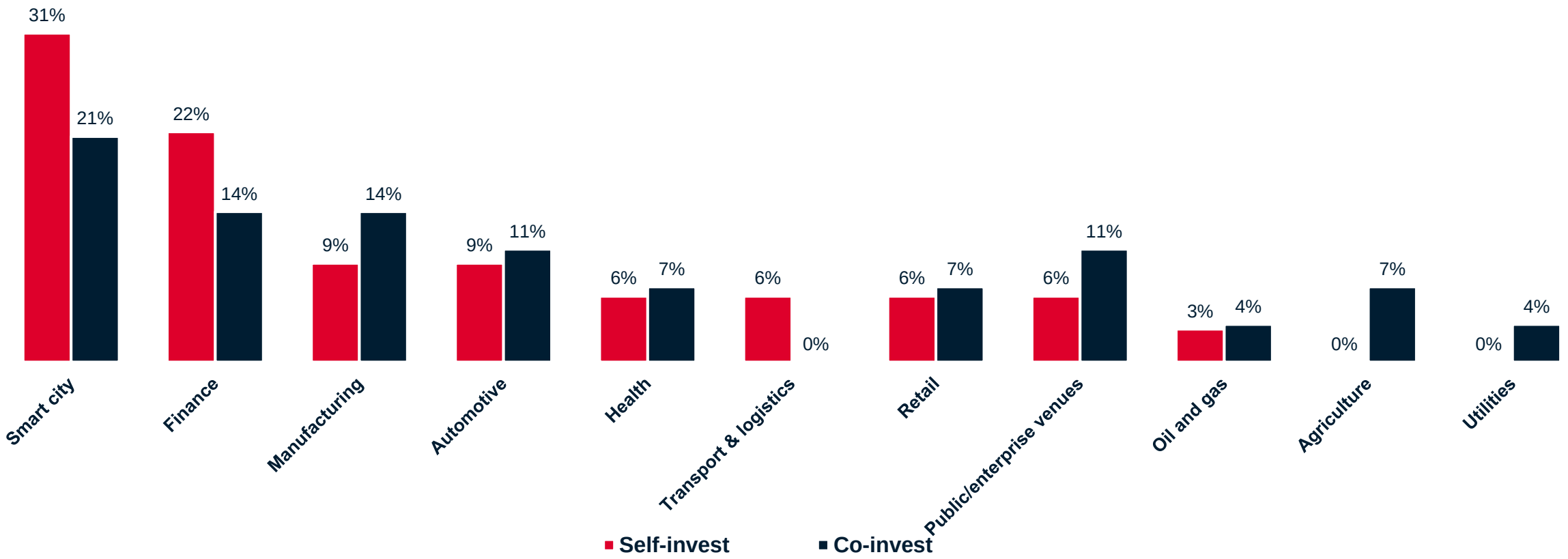


Network spending plans

Results by operator size (by number of connections)

Top candidates for private network investment by funding model

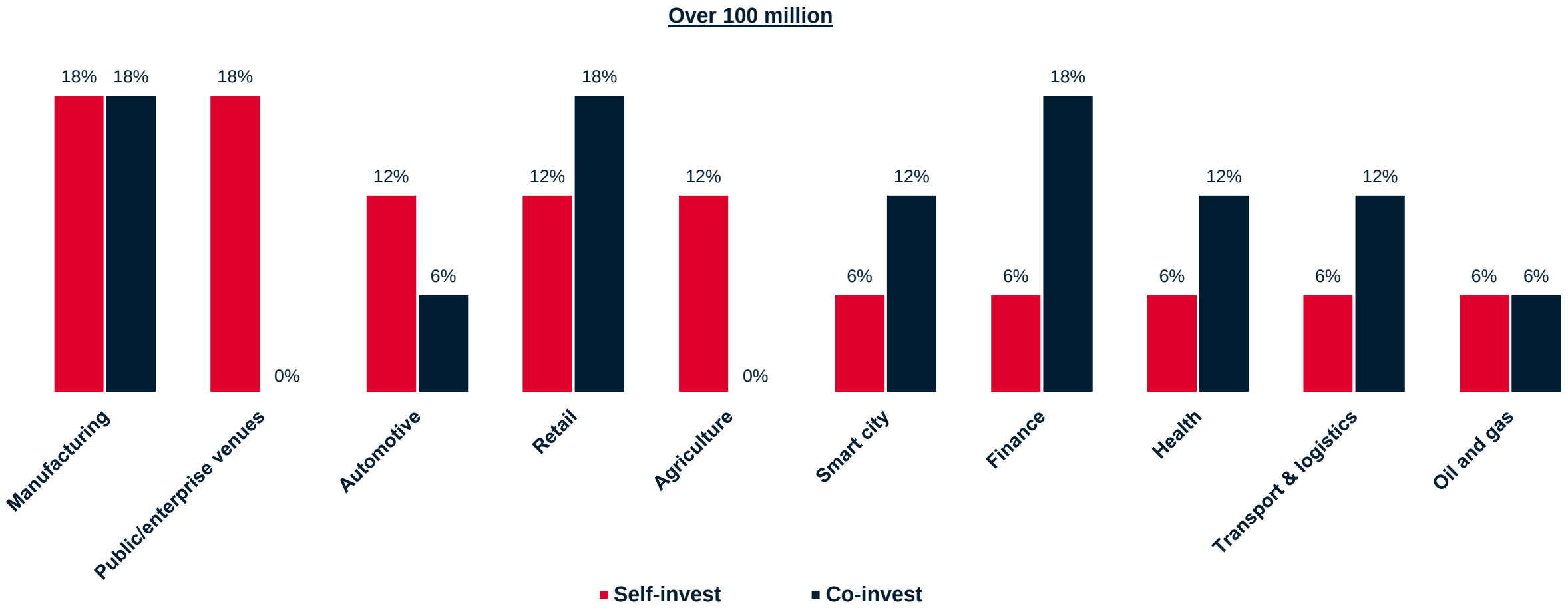
50 million to 100 million



Network spending plans

Results by operator size (by number of connections)

Top candidates for private network investment by funding model



GSMA Intelligence

GSMA Intelligence

In numbers: network transformation technologies

55% Opex represents the majority of operator network spend. IT transformation of networks is seen as the top way to save opex.

48% Deploying telecoms functions on the public cloud was once considered unlikely. Today, almost half of operators claim to be doing so commercially.

49% Almost half of operators are deploying service core functions on the public cloud (with OSS/BSS close behind).

75% Network automation might not be ranked highest for opex efficiencies, but the majority of operators expect it to deliver more than 5% savings.

16% More than any other technology, network deployment automation is seen as the top RoI driver, with 16% highlighting it as such.

23% With understood RoI and opex benefits, what could hold up automation? Internal ownership is a worry for nearly a quarter of operators.

Survey details

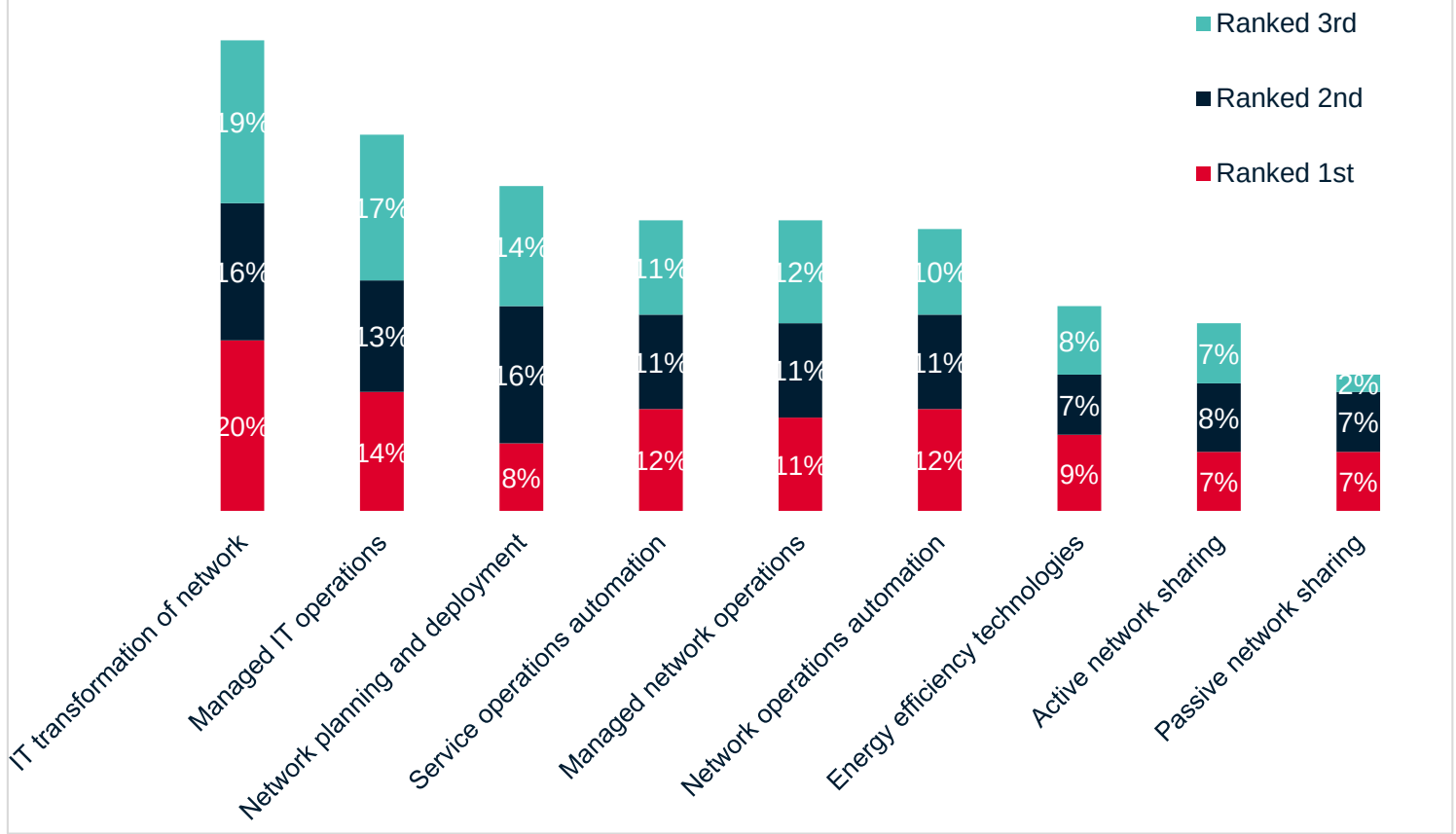
Sample sizes

Segment	Sample size
Total	100
Region	
Asia Pacific	39
Europe	18
Middle East and Africa	18
Americas	25
Organisation size (by connections)	
Fewer than 10 million	18
10 million to 49.9 million	43
50 million to 99.9 million	24
Over 100 million	15

Network technologies and opex

IT solutions drive the opex savings agenda

Technologies that hold the most promise of driving opex savings in network and service operations (top three choices)

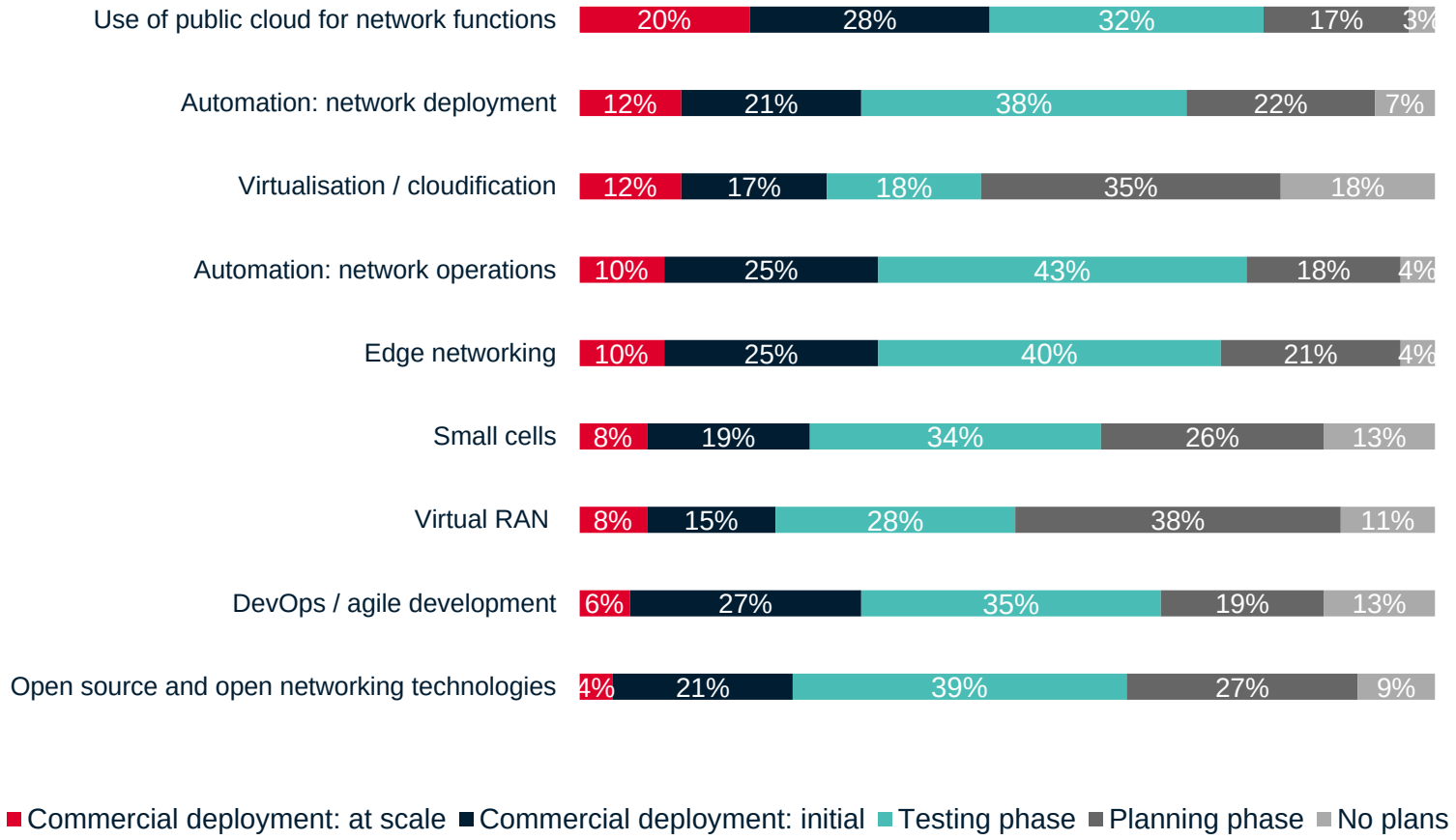


- **IT innovation focus**. IT systems and evolution (operations, network transformation) lead opex savings thinking – in line with software-driven telecoms network innovations.
- **Automation hype?** While on top in terms of RoI expectations, the promise of opex savings from automation surprisingly scored near the middle of the pack.
- **Sharing and capex**. A limited focus on network sharing might be due to positioning as a capex savings tool, though opex savings should follow.
- **Green tech hype?** Unlike sharing, energy efficiency technologies are most often positioned around opex efficiencies; a limited focus from operators suggests the messaging is not having an impact.

Network technology and cloud

Public cloud enthusiasm versus public cloud realism

Where are you in the process of adopting the following technologies?

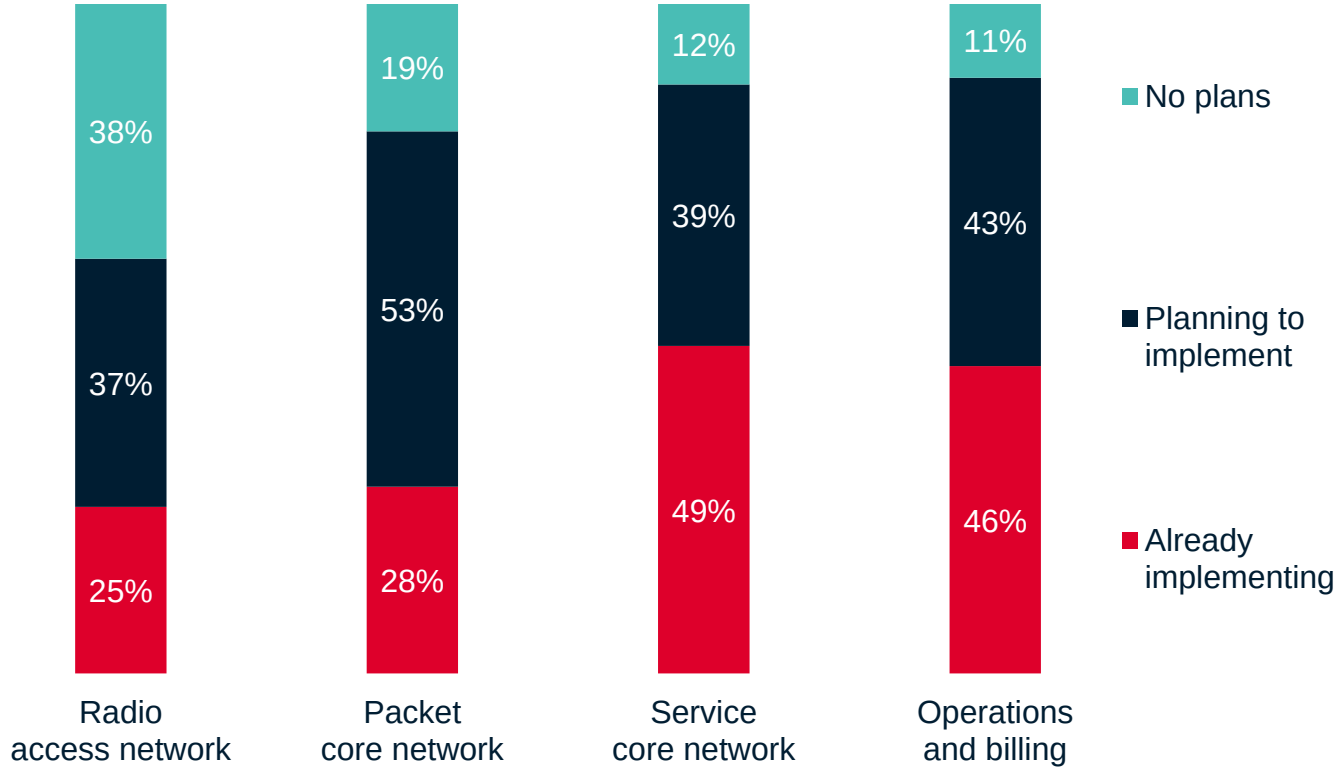


- **Public cloud on the mind.** Half of operators are unlikely to be already deploying telecoms core functions on public cloud, but it is clearly a current focus.
- **Public cloud without virtualisation?** Further questioning public cloud adoption progress is the weak showing for virtualisation; moving functions to the cloud should follow virtualisation.
- **Virtual RAN maturity**. Less surprising is that virtual RAN is still in the planning and testing phases (given recent commercialisation).
- **vRAN at smaller operators**. Operators with fewer than 50 million connections are much more likely to have no virtual RAN plans given the maturity and current complexity.

Network technology and cloud

Software in the cloud first

Migrating support for network segments to public cloud resources

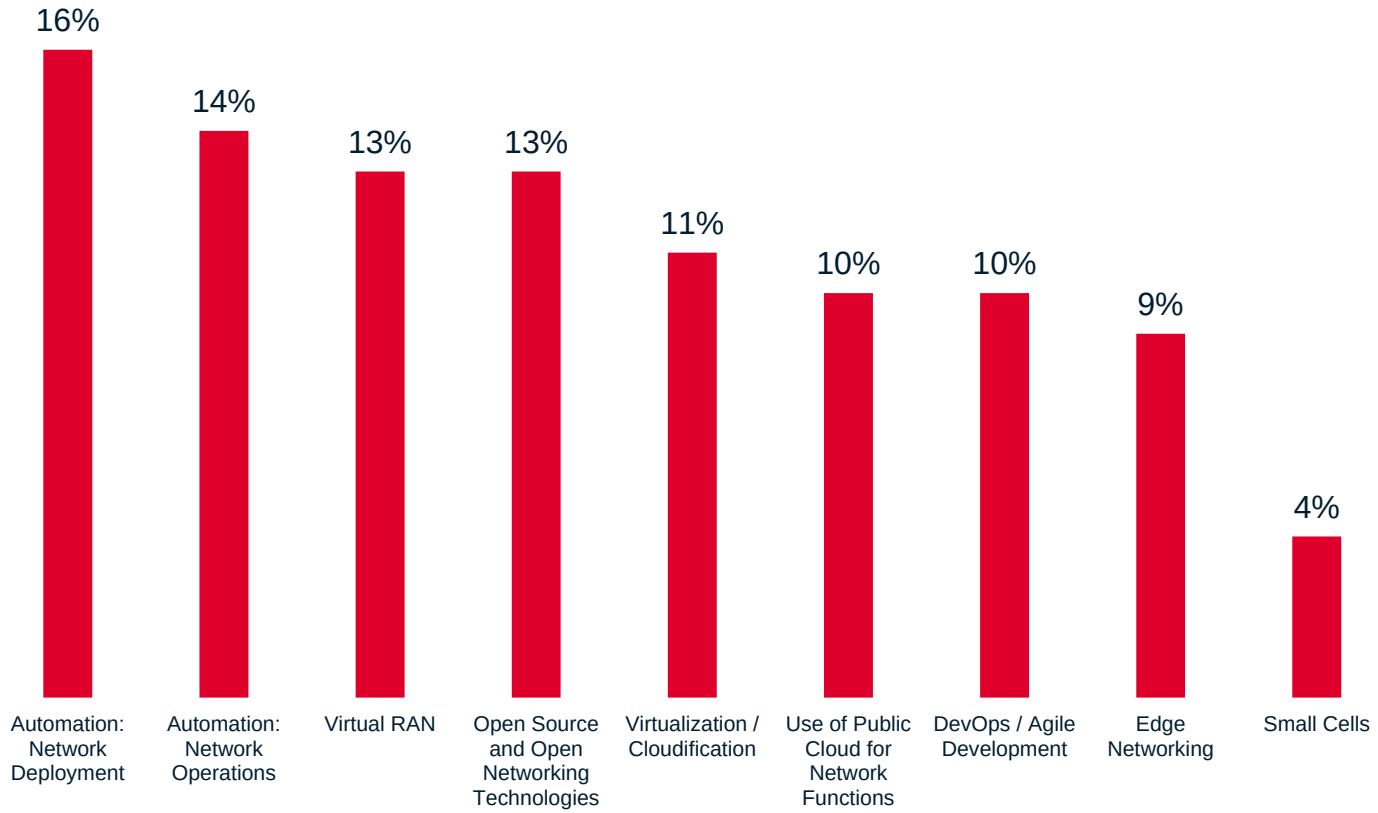


- **Today's cloud focus: service core, operations, billing**. Half of operators claim to be migrating support for their service core and OSS/BSS to the public cloud.
- **Tomorrow's cloud focus**: **everything**. A majority of operators see some level of support for moving all network segments to the cloud.
- **RAN confusion?** Aspirations aside, it is difficult to believe that 25% of operators are already rolling out RAN on the public cloud – though "implementing" tests of vRAN on public cloud may be realistic.
- **Large operator vRAN momentum**. Operators with more than 100 million connections are most likely to be implementing public cloud vRAN and least likely to have no plans.

Network technology RoI

Automation delivers in RoI (despite opex expectations)

Rank the following technologies in terms of their return on investment (RoI)? (Top choice)

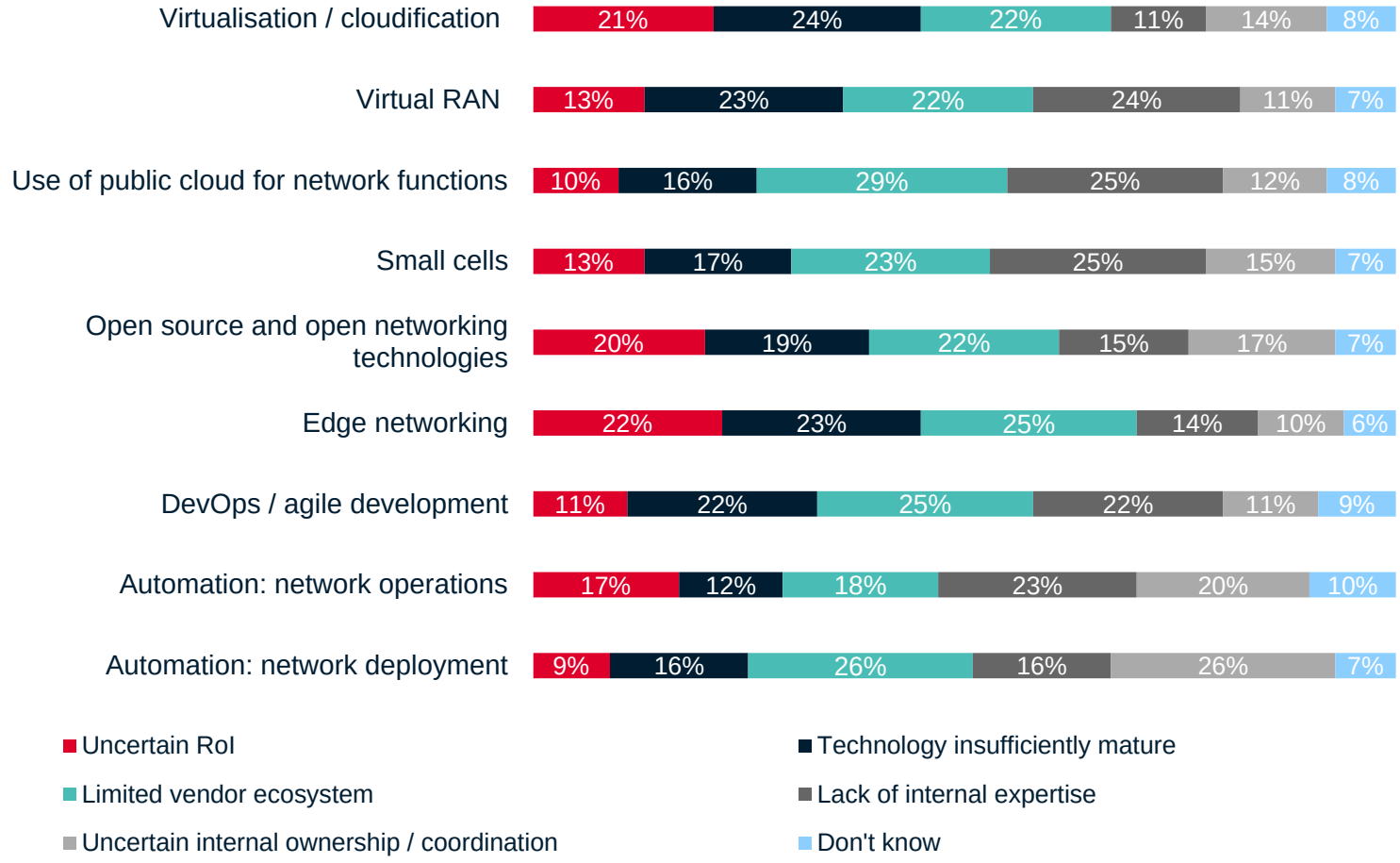


- **Automation wins.** Some 30% ranked some form of automation as the top technology for delivering a solid RoI.
- **But not for opex?** When asked about technologies that could deliver opex savings, automation was not highly ranked; it's unclear if operators fully understand what automation can/should deliver.
- **Small cell costs versus returns.** Small cells are used to improve coverage and capacity and may be critical with high-band 5G. They can also, however, be costly to deploy.
- **Ranking and priorities**. Every technology may deliver a solid RoI, but operator assets and service strategies will dictate which are seen as most important at a given point.

Network technology obstacles

Limited ecosystems and tech maturity dominate

What is the greatest obstacle to deploying the following technologies?

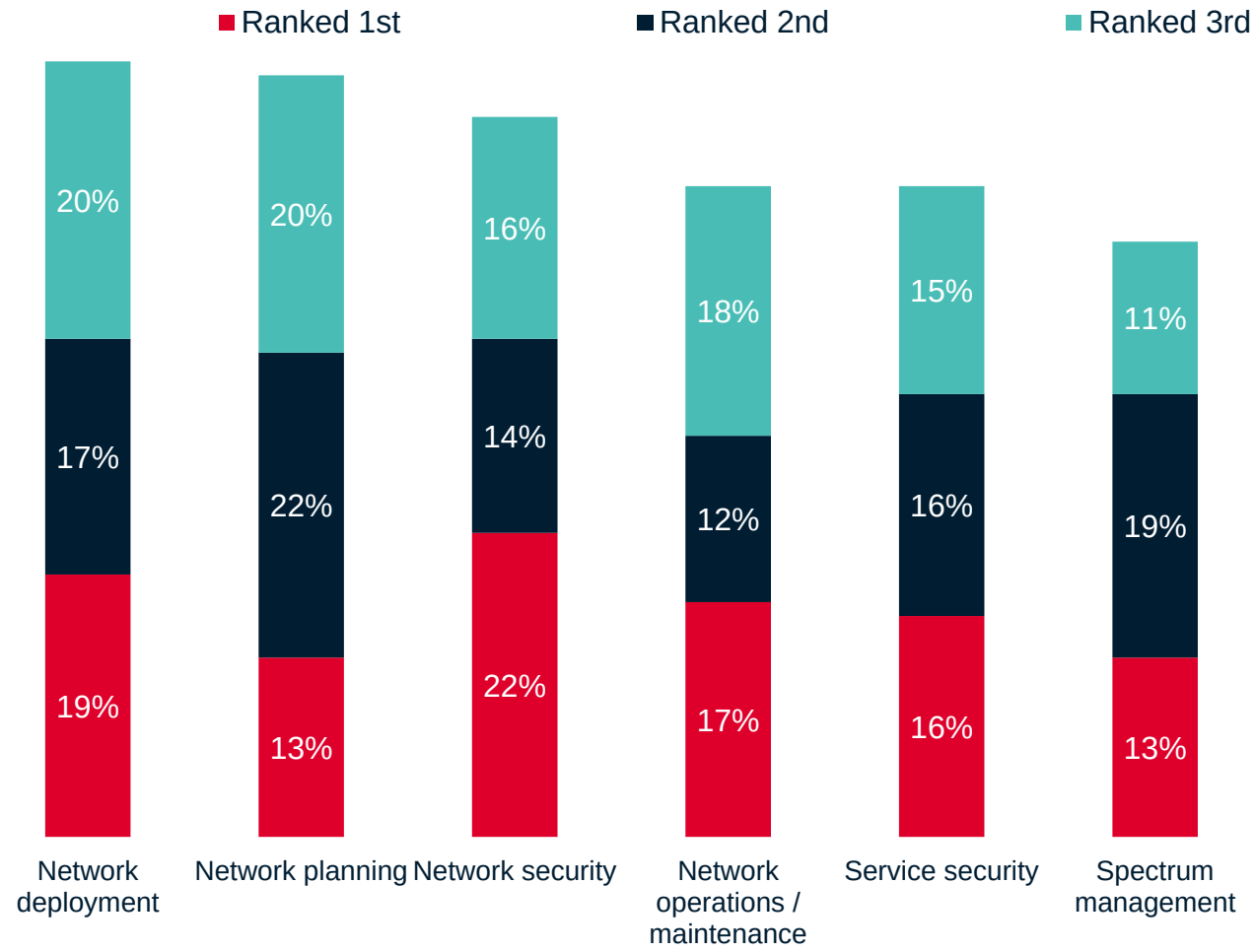


- **Automation and structural barriers**. Automation ranks highest for RoI expectations, but also for internal ownership as an obstacle, likely since it can touch multiple parts of the network.
- **Public cloud options**. Operators might want to deploy functions on the public cloud, but a limited number of webscale players and vendors with cloud-ready functions are holding them back.
- **Industry versus internal**. Internal obstacles (expertise/ownership) take a backseat to industry ones (ecosystem/maturity) for virtualisation, edge and open technologies; operators may be waiting on vendors to solve their problems.

AI and automation use cases

Building and securing networks takes precedence

Rank the following use cases for the application of artificial intelligence and automation in your network (top three choices)

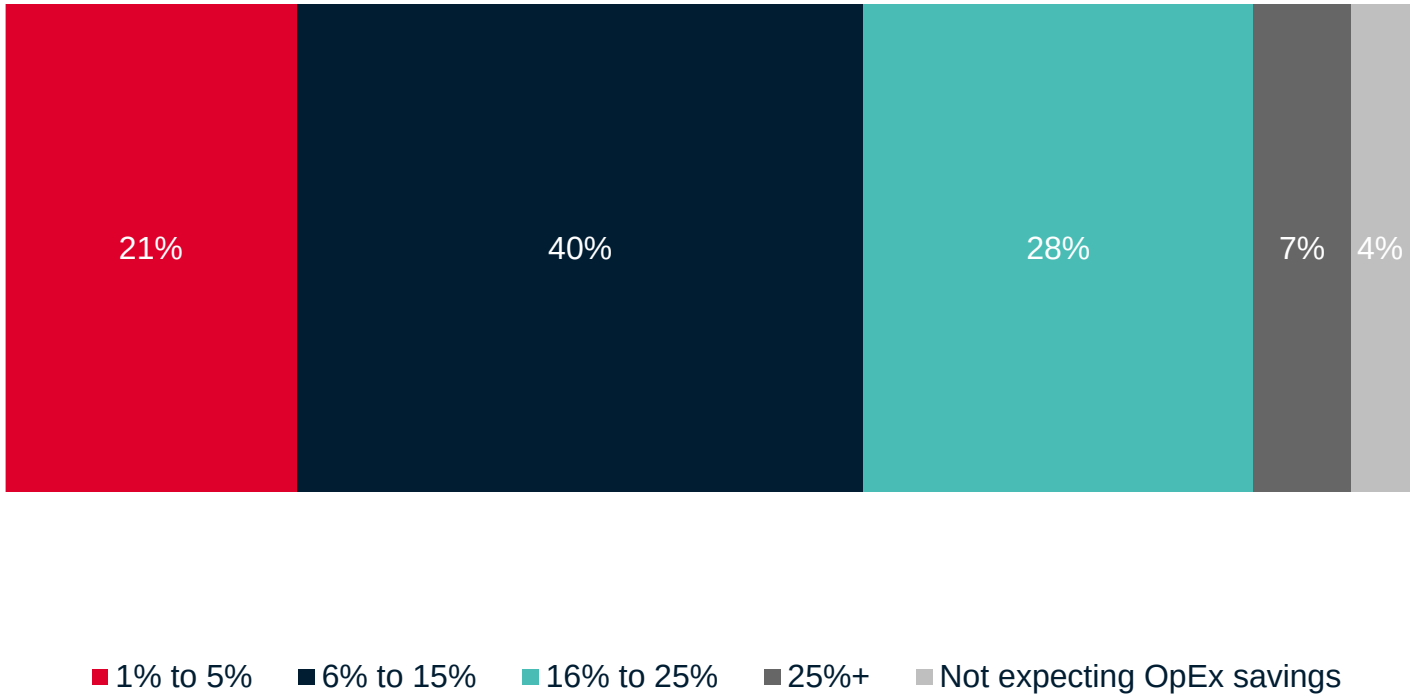


- **Security above all**. More operators highlight network security as the no.1 use case for AI and automation (despite a less stellar top three showing), in line with it being a top network transformation priority.
- **Network versus service**. The relative importance of deployment and planning versus operations and service security argues that automation is seen as pre-launch focused or more important for mature functions.
- **Holistic spectrum confusion.** Spectrum is key to service launches (and a top barrier to increased 5G investment). A limited view on how AI and automation can make the best use of spectrum assets suggests narrow operator thinking, or that vendor marketing is lacking on this front.

Automation opex expectations

Great expectations from automation

What degree of opex savings do you expect network automation to generate when fully deployed?

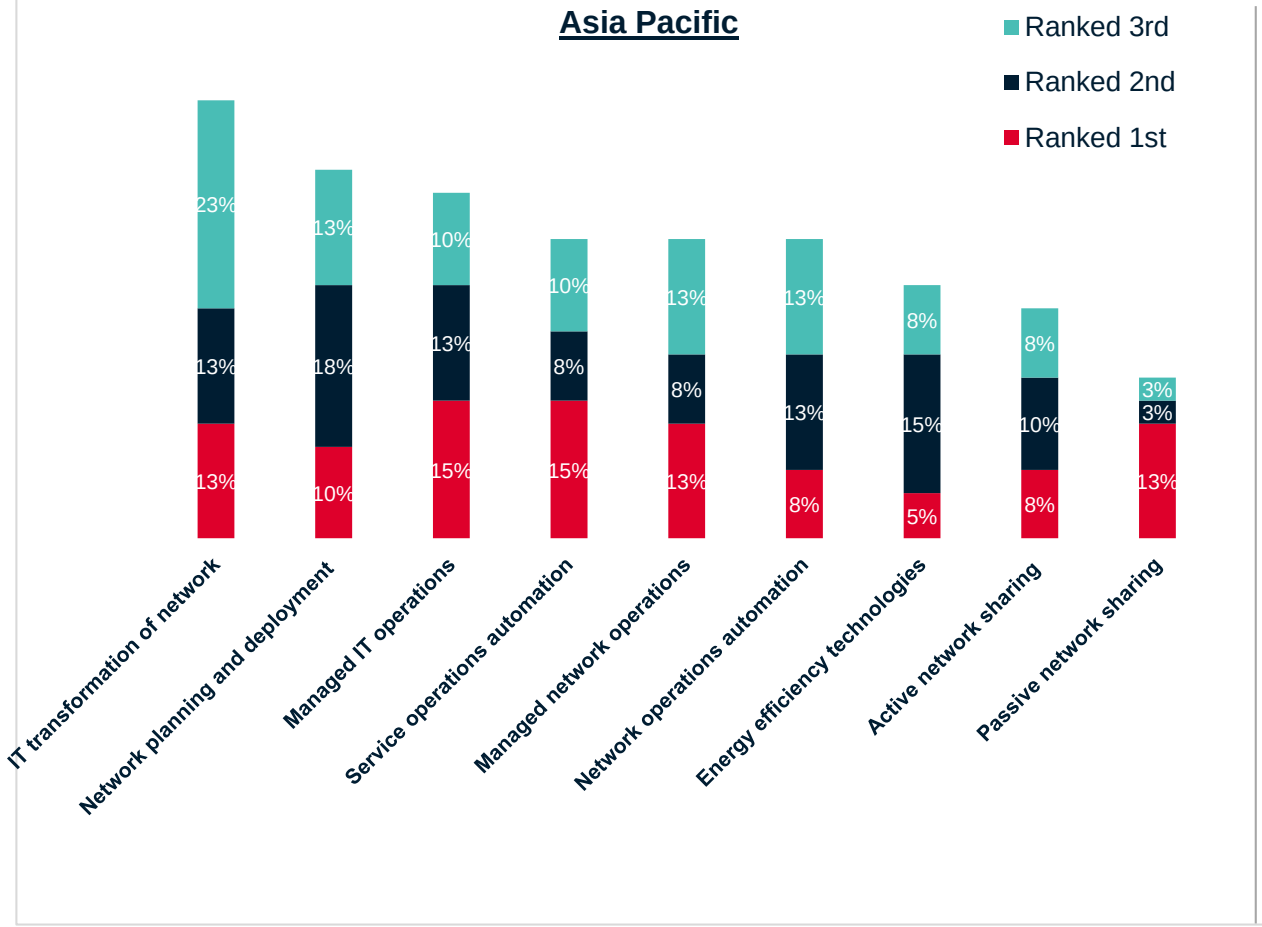


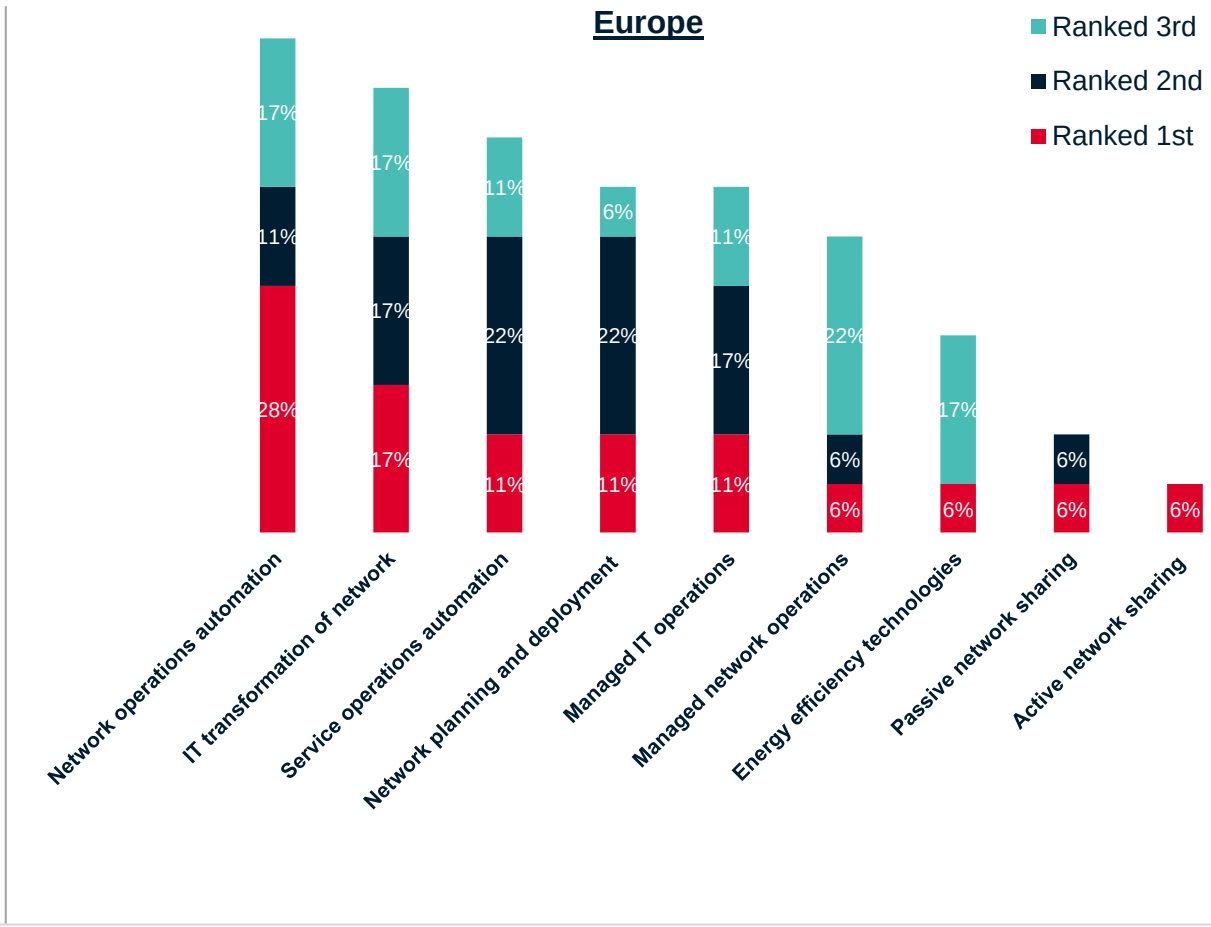
- **Automation optimism**. 25% of operators expect savings from automation of 5% or less. Three quarters expect upwards of 5%, with a third expecting upwards of 16%.
- **Savings versus experience**. Operators expecting no savings (4%) may see automation as valuable in terms of improved service experience.
- **Large-operator optimism.** Almost 80% of operators with over 100 million connections expect opex savings of more than 15%. Given the complexity of managing a large network, the value of operations automation is an obvious line of logic.
- **North American optimism.** Nearly 50% of North American operators expect opex savings of 16% or more – greater than any other region.

Network technologies and opex

Results by region

Technologies that hold the most promise of driving opex savings in network and service operations (top three choices)

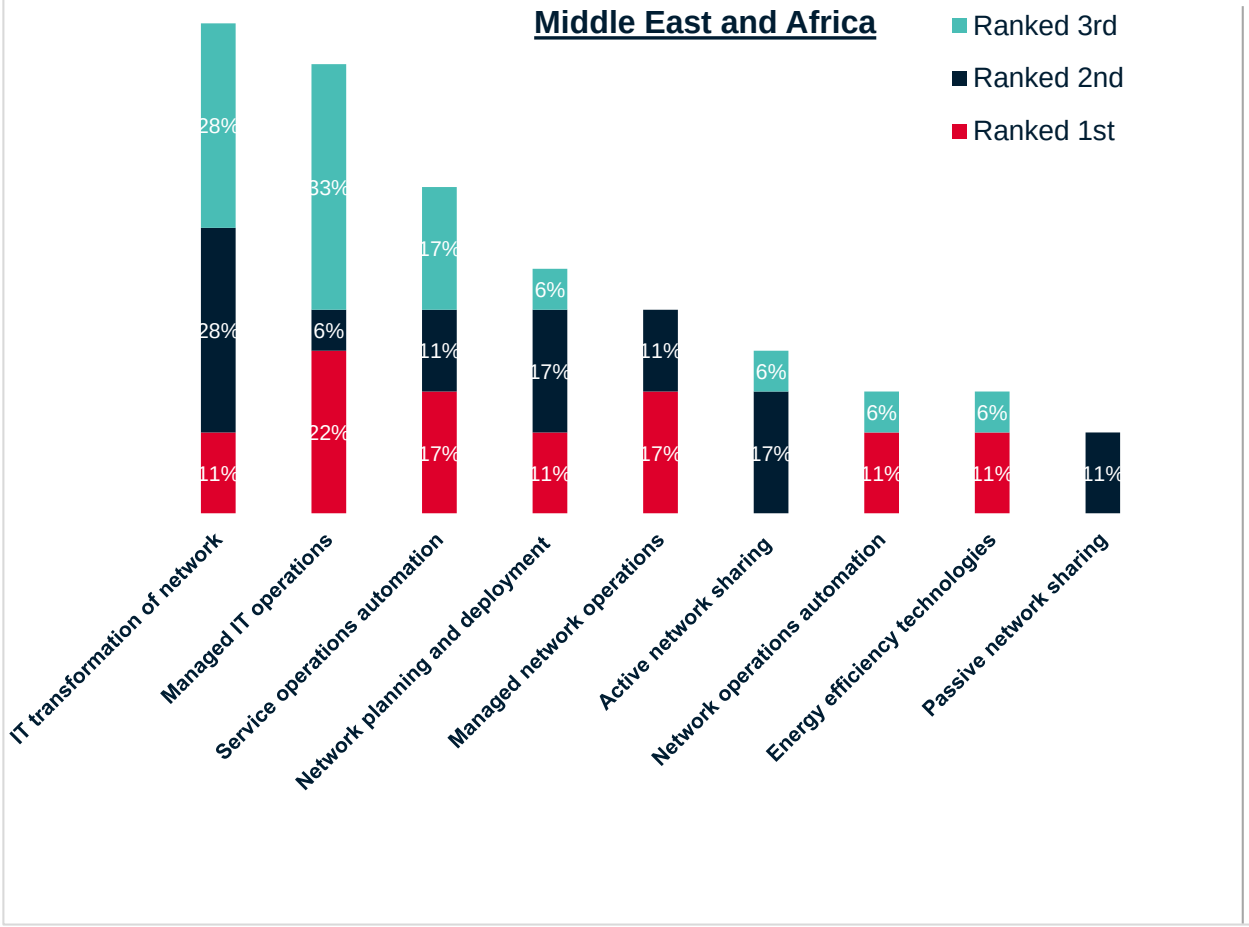


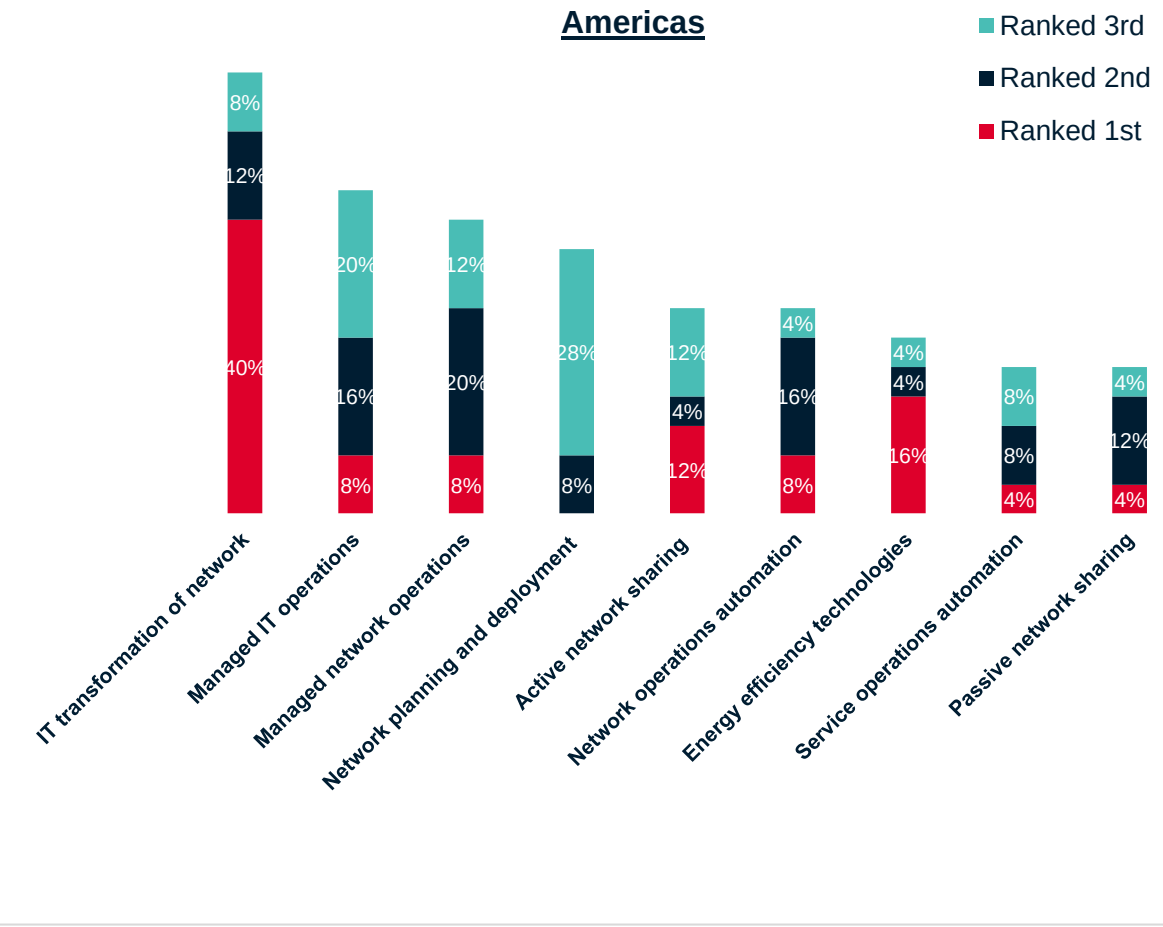


Network technologies and opex

Results by region

Technologies that hold the most promise of driving opex savings in network and service operations (top three choices)

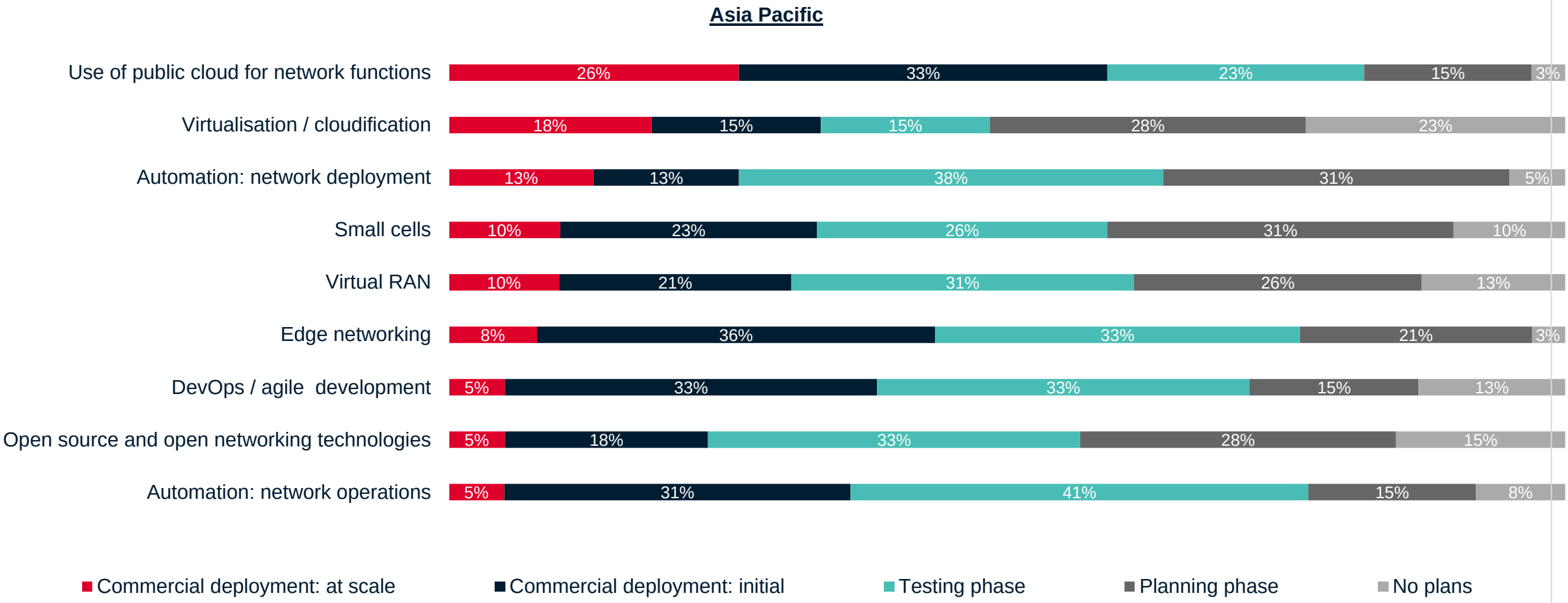




Network technology adoption

Results by region – Asia Pacific

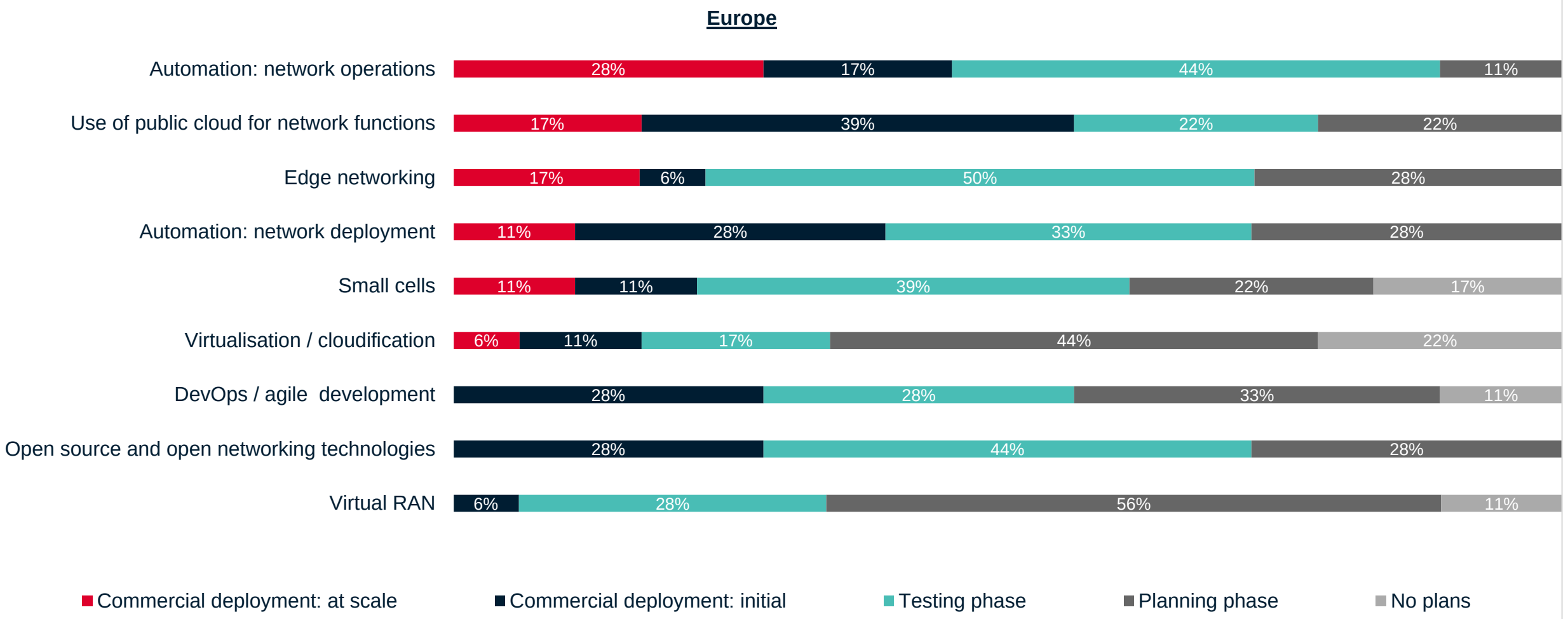
Where are you in the process of adopting the following technologies?



Network technology adoption

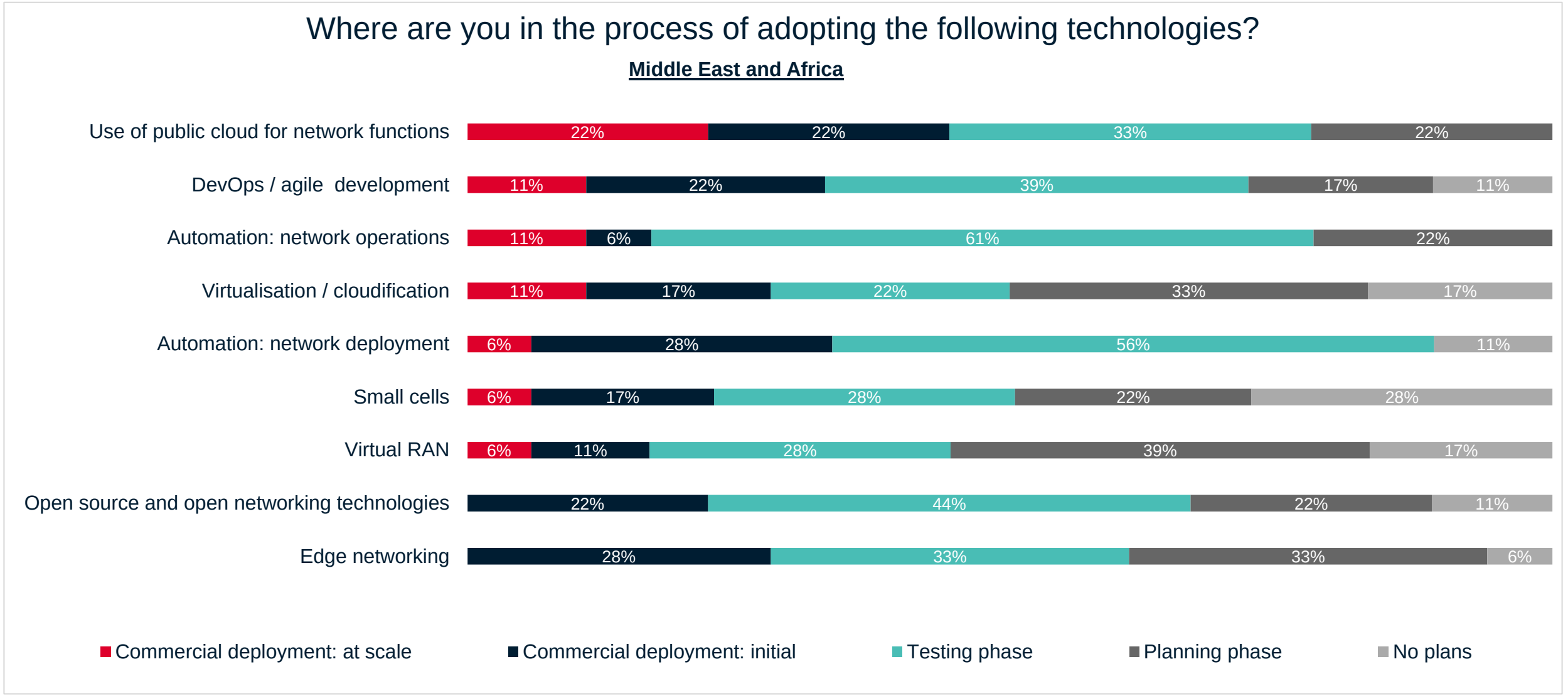
Results by region – Europe

Where are you in the process of adopting the following technologies?



Network technology adoption

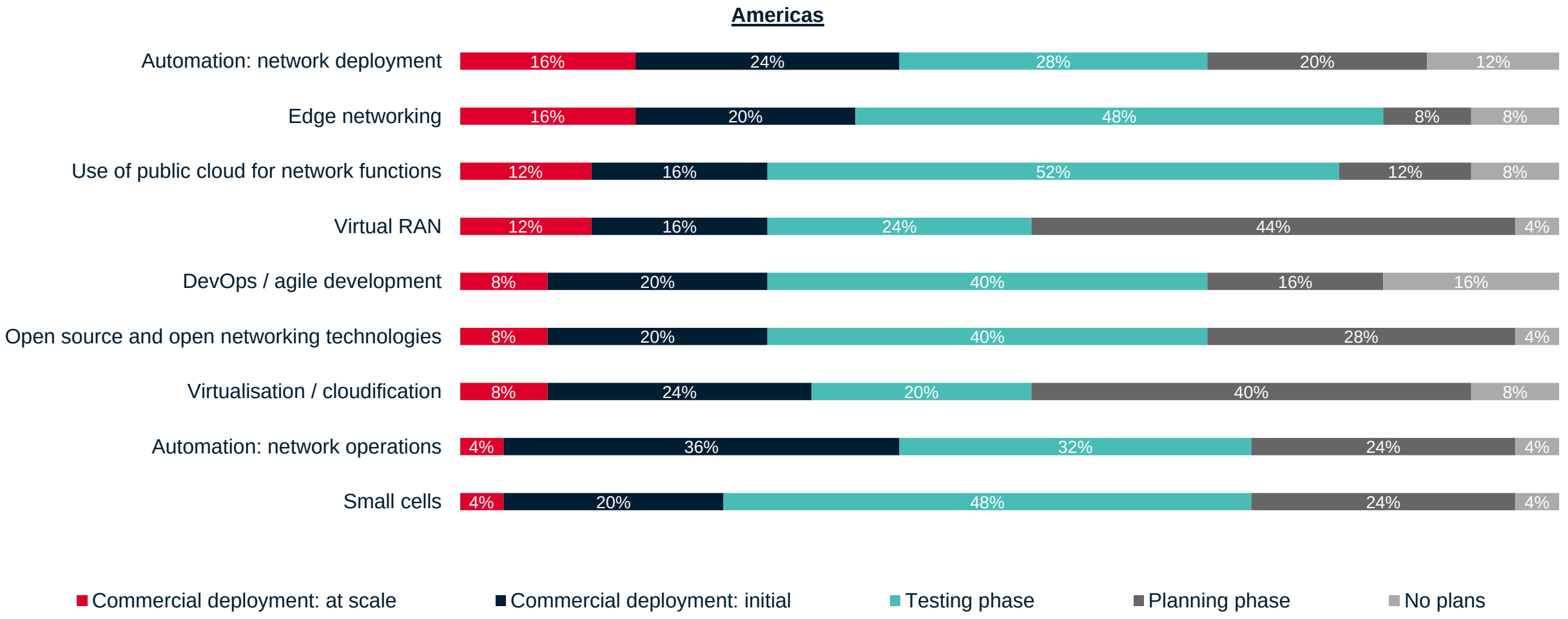
Results by region – Middle East and Africa



Network technology adoption

Results by region – Americas

Where are you in the process of adopting the following technologies?

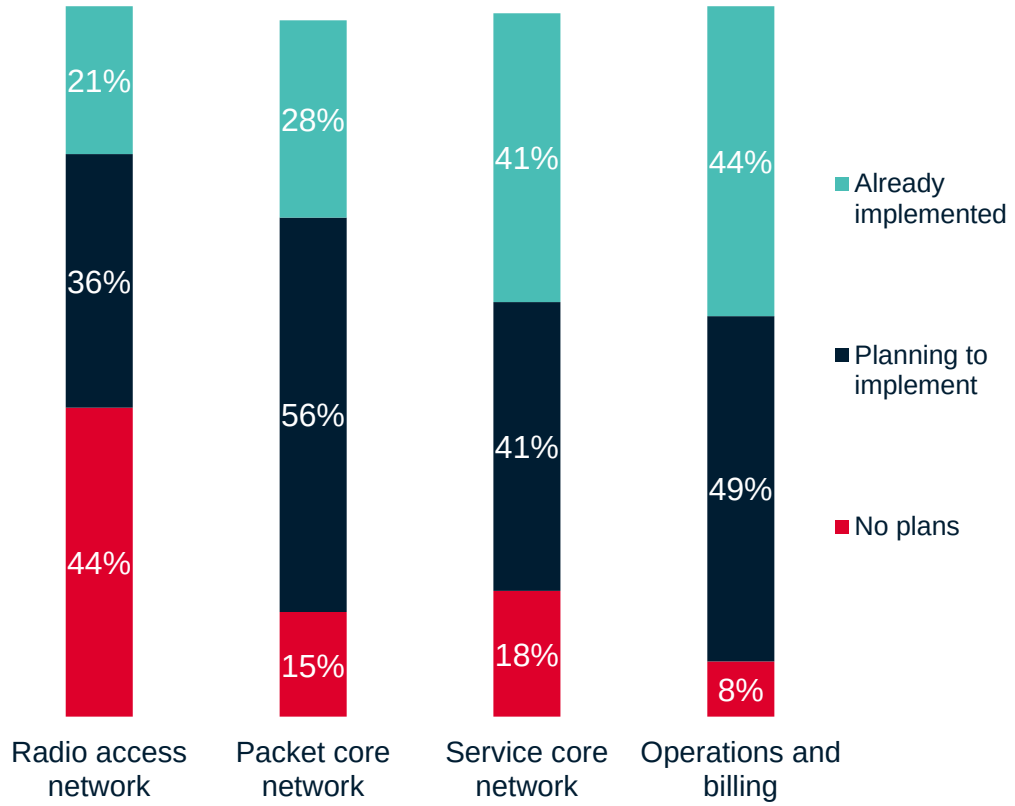


Network technology and cloud

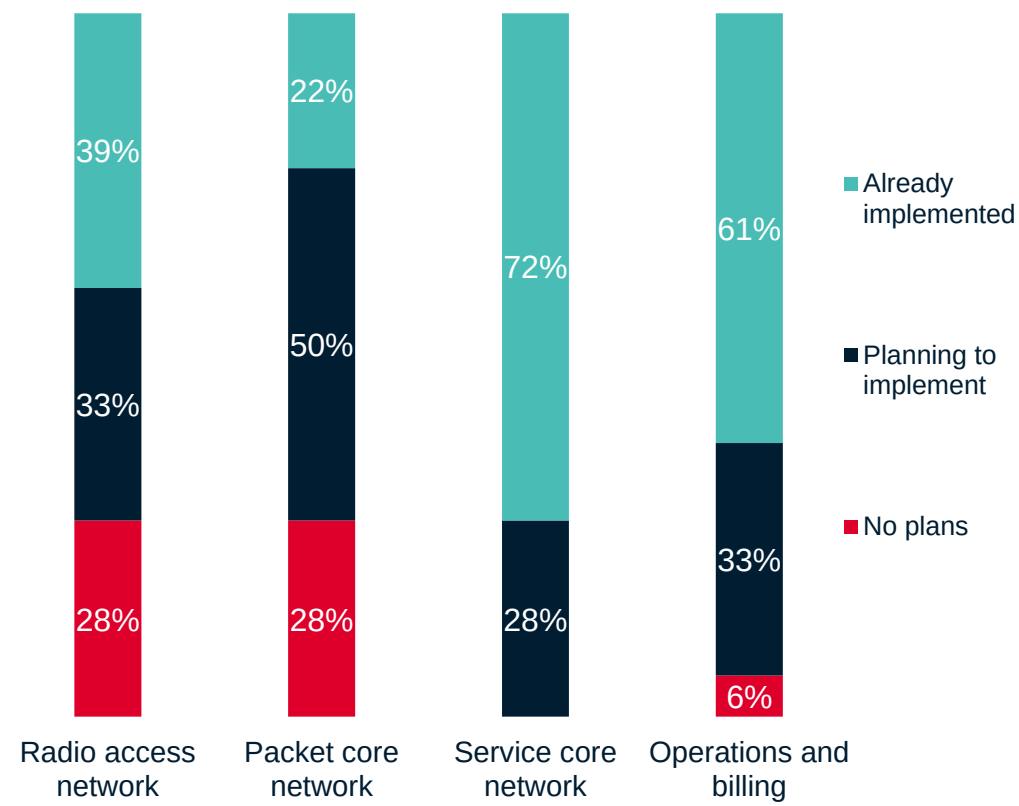
Results by region

Migrating support for network segments to public cloud resources

Asia Pacific



Europe

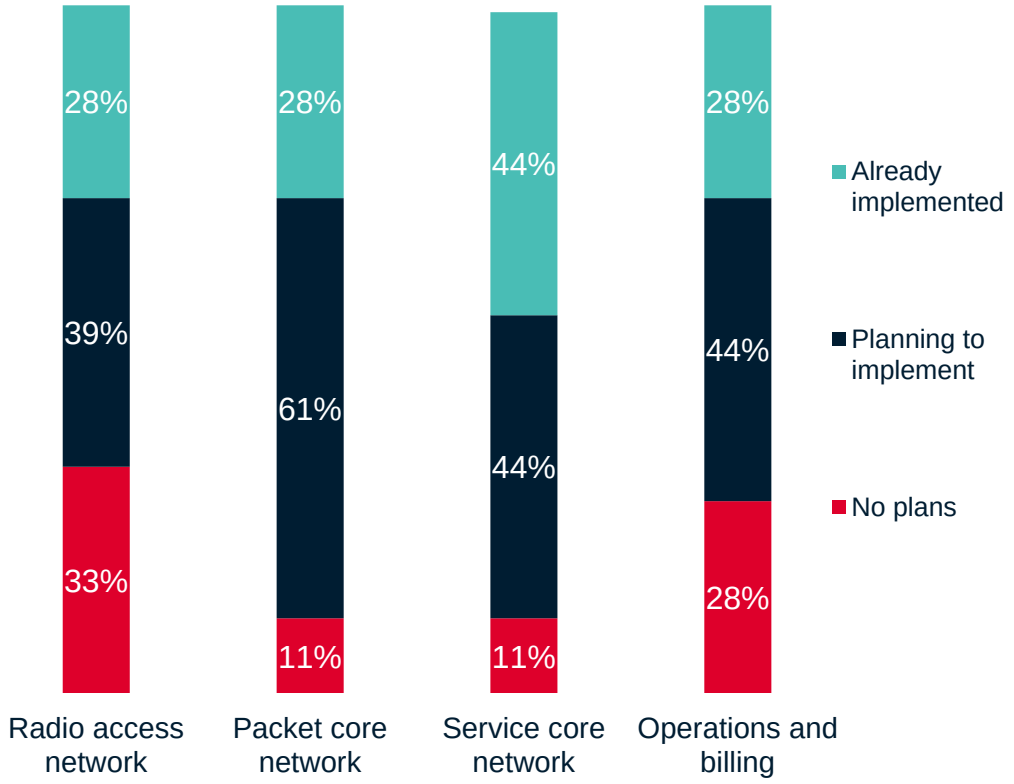


Network technology and cloud

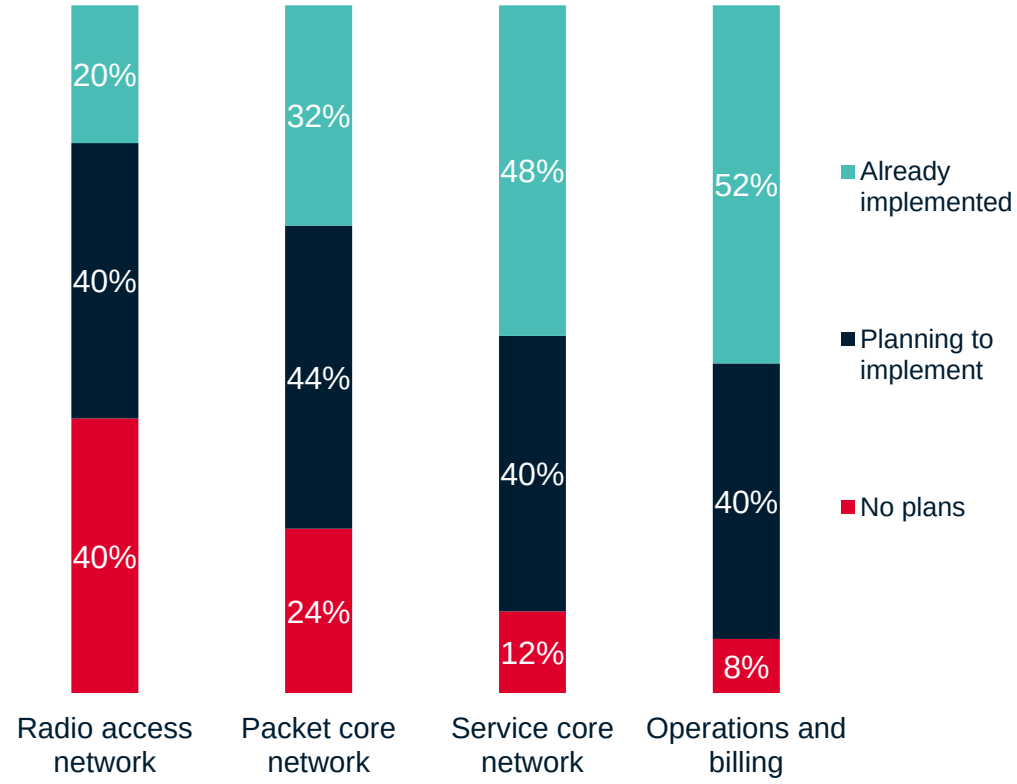
Results by region

Migrating support for network segments to public cloud resources

Middle East and Africa



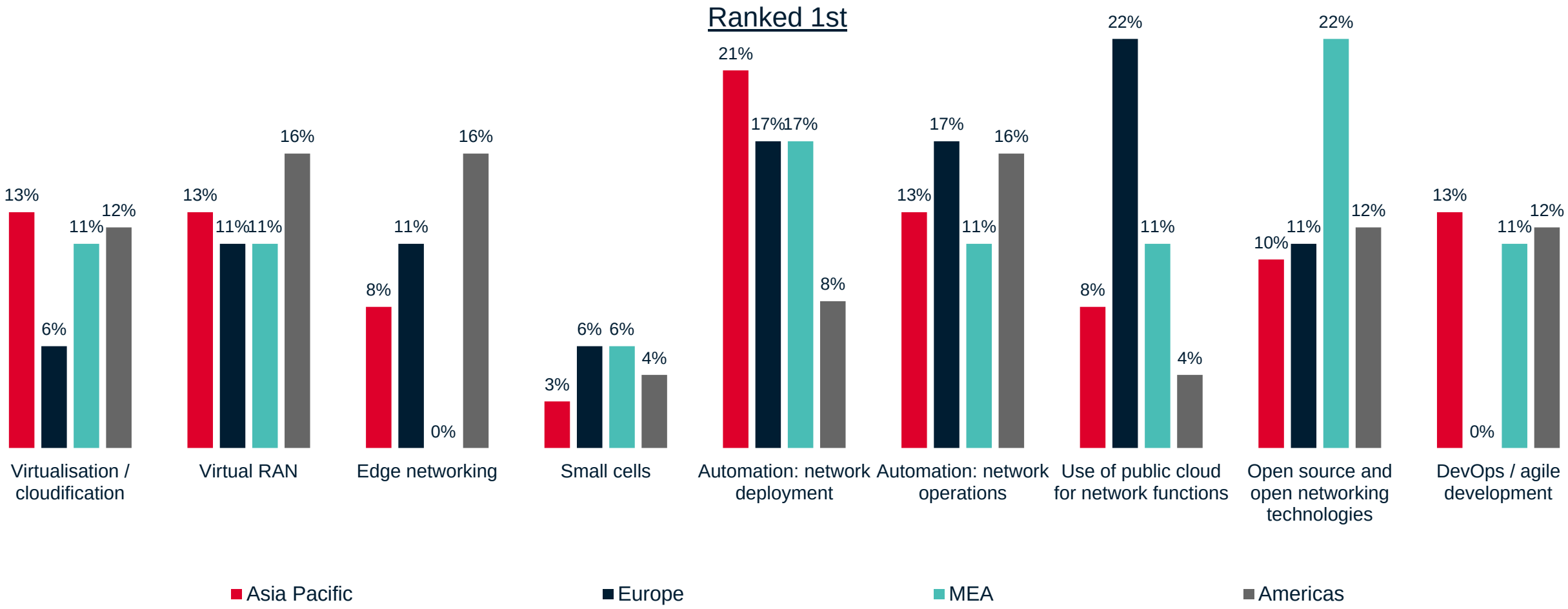
Americas



Network technology RoI

Results by region

Rank the following technologies in terms of their return on investment (RoI)?

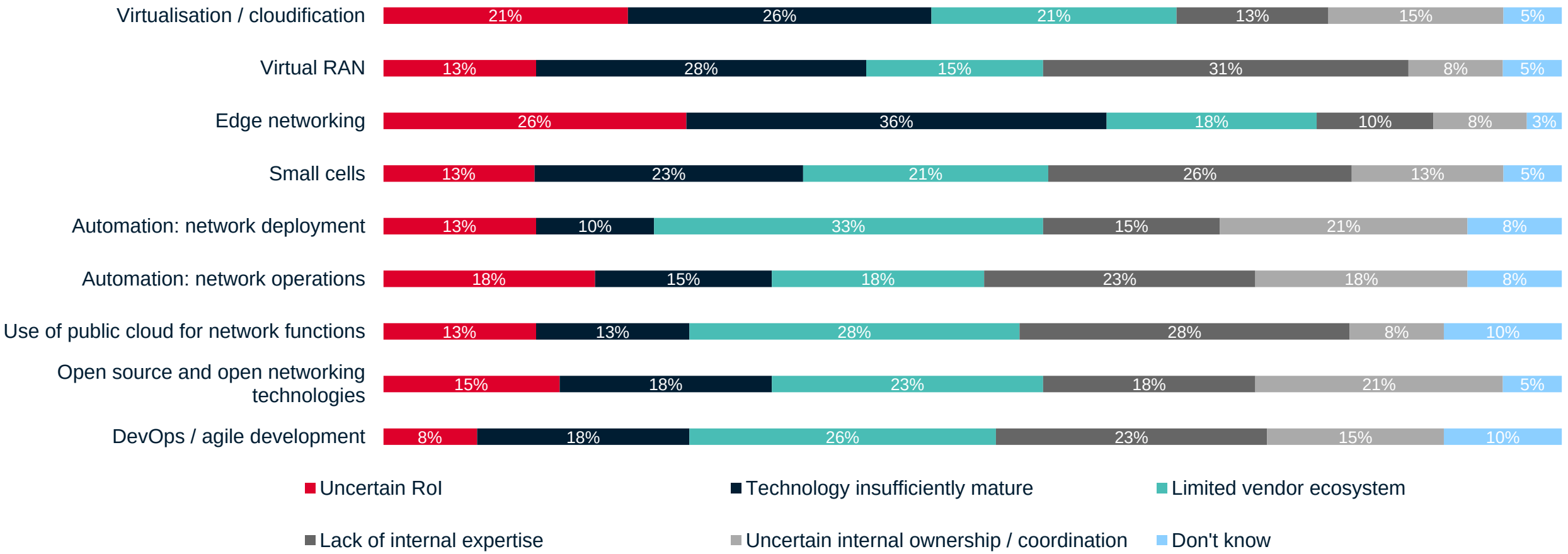


Network technology obstacles

Results by region – Asia Pacific

What is the greatest obstacle to deploying the following technologies?

Asia Pacific

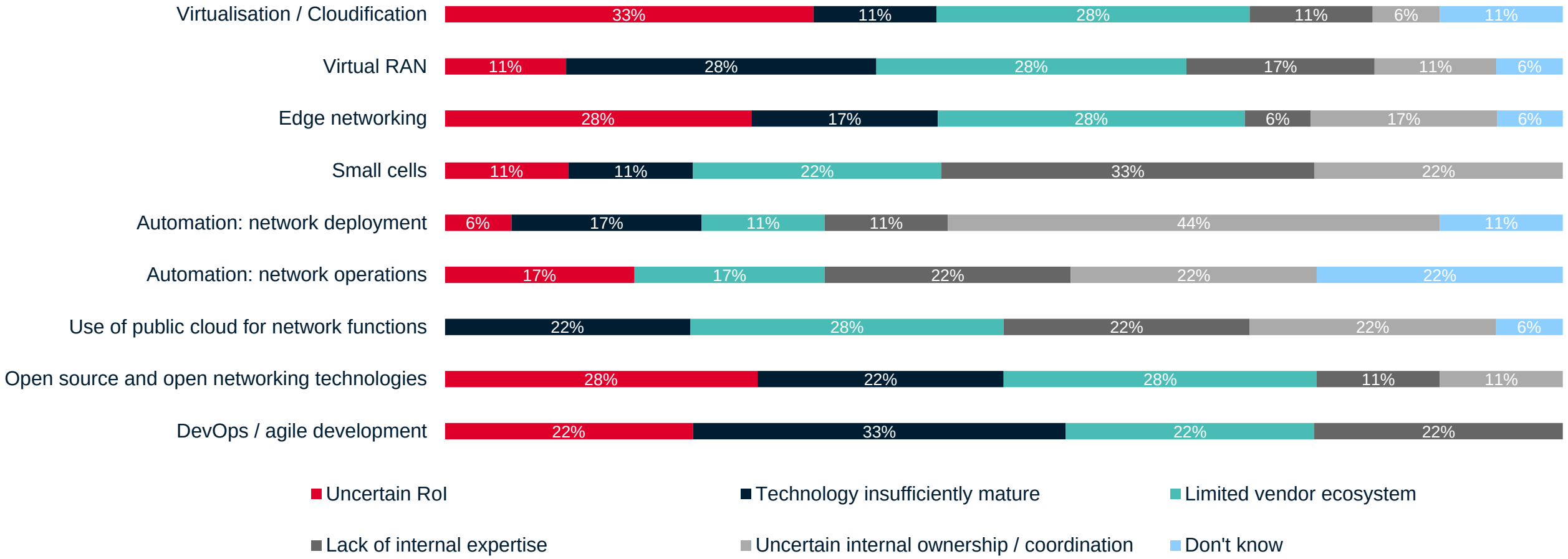


Network technology obstacles

Results by region – Europe

What is the greatest obstacle to deploying the following technologies?

Europe

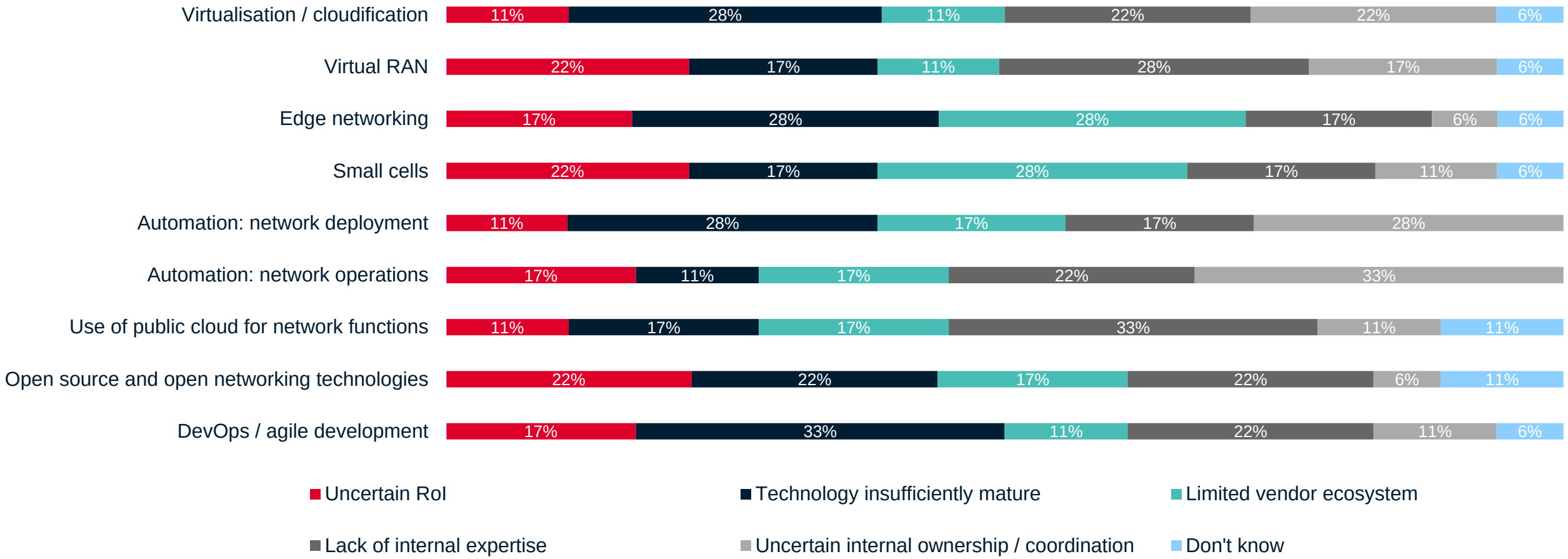


Network technology obstacles

Results by region – Middle East and Africa

What is the greatest obstacle to deploying the following technologies?

Middle East and Africa

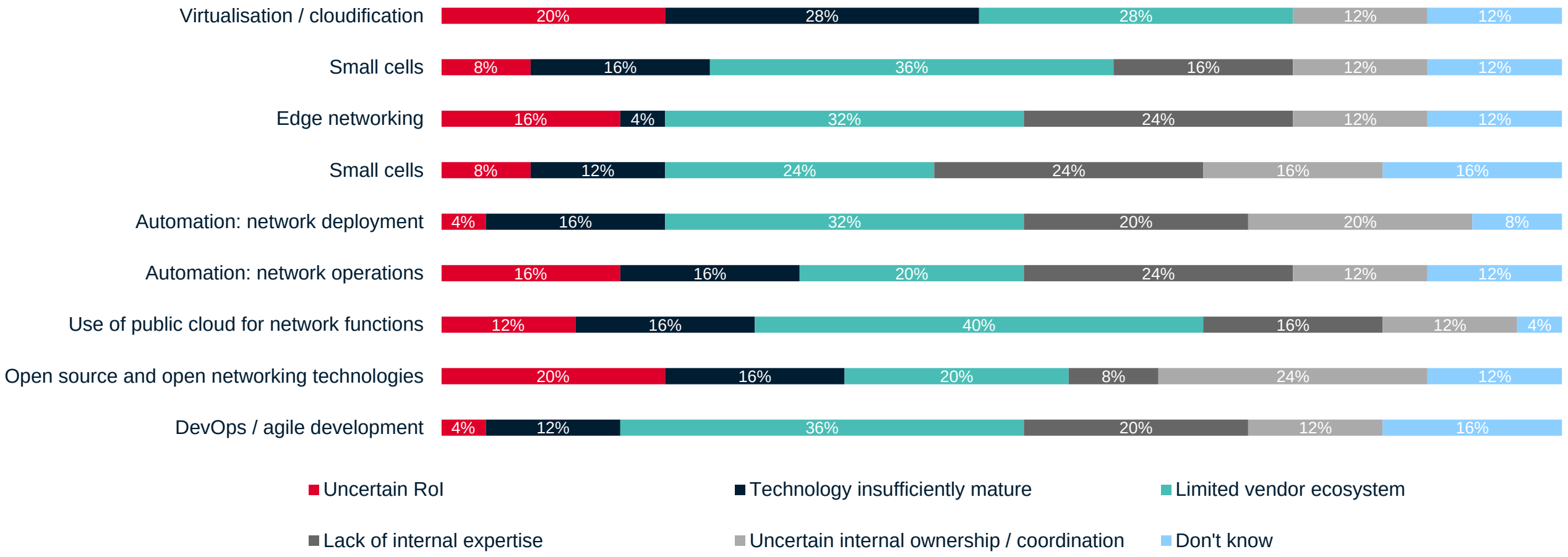


Network technology obstacles

Results by region – Americas

What is the greatest obstacle to deploying the following technologies?

Americas

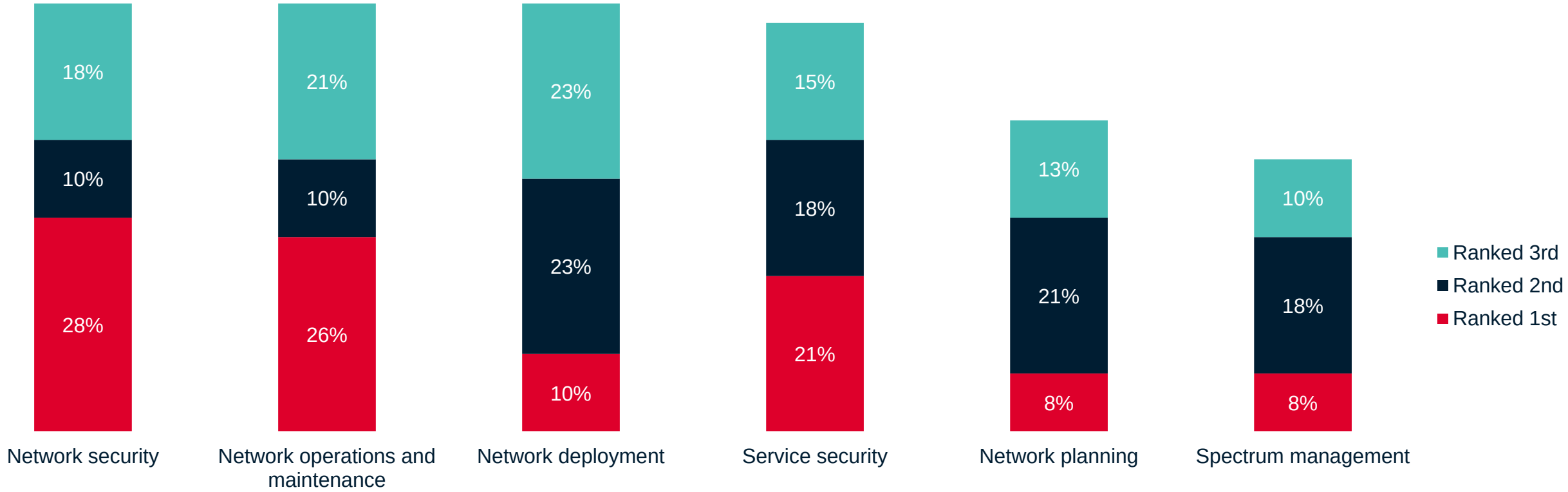


AI and automation use cases

Results by region – Asia Pacific

Rank the following use cases for the application of artificial intelligence and automation in your network (top three choices)

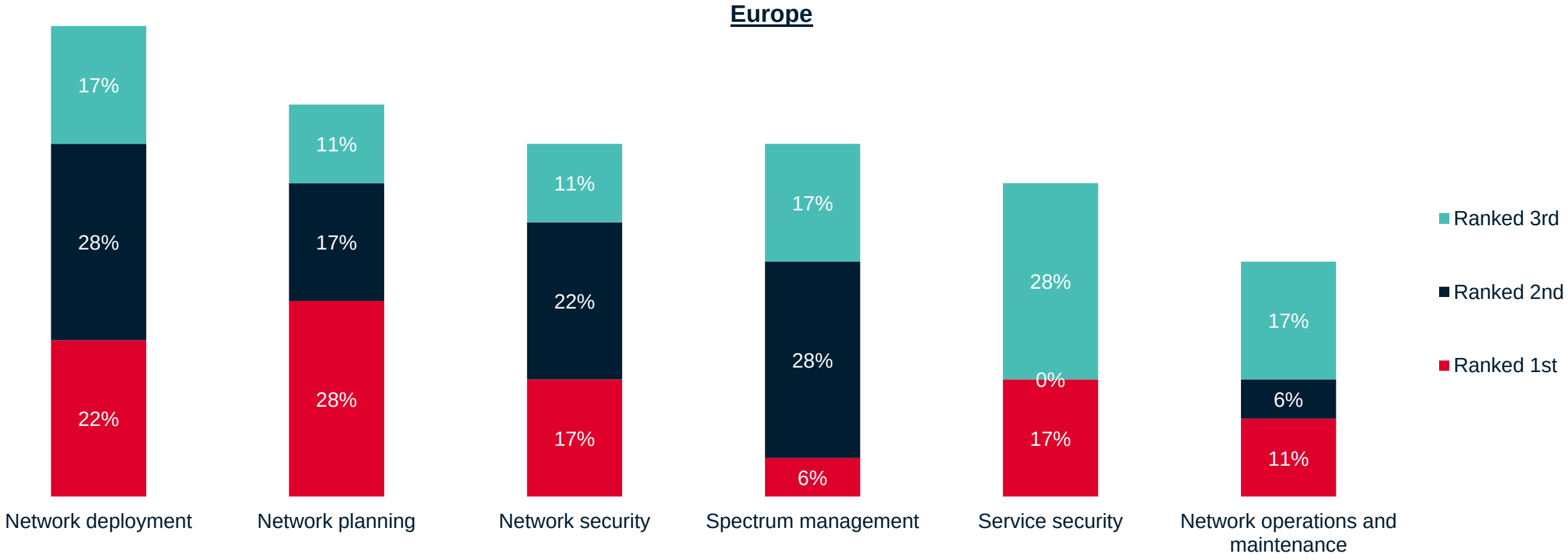
Asia Pacific



AI and automation use cases

Results by region – Europe

Rank the following use cases for the application of artificial intelligence and automation in your network (top three choices)

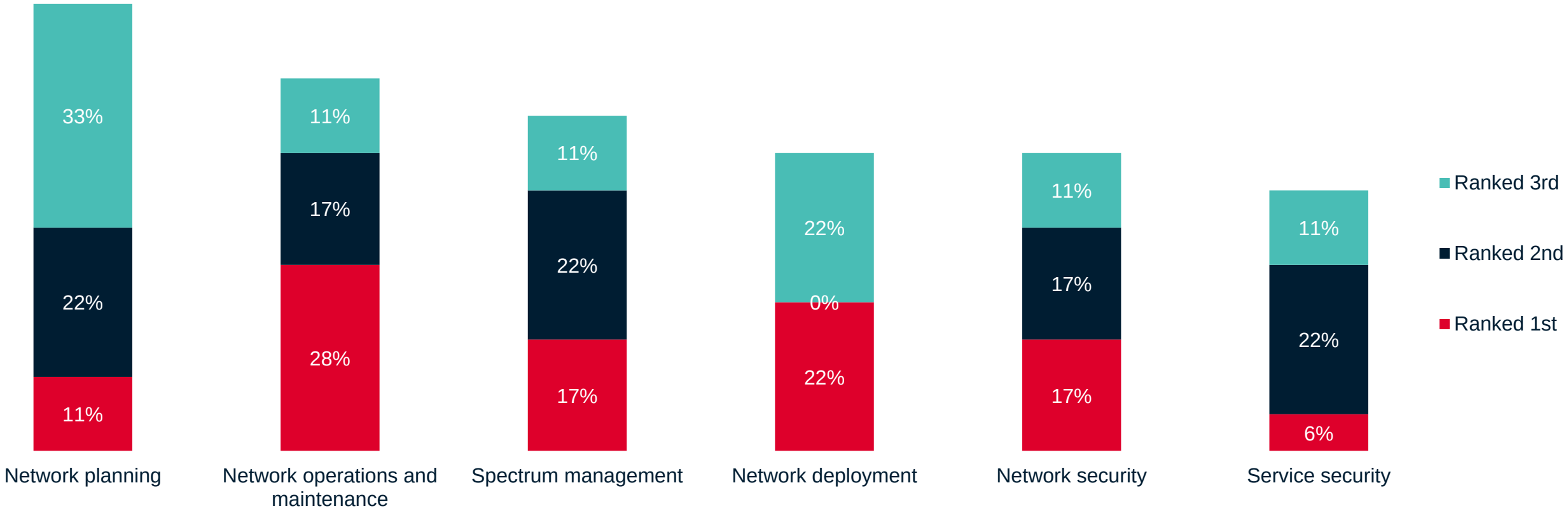


AI and automation use cases

Results by region – Middle East and Africa

Rank the following use cases for the application of artificial intelligence and automation in your network (top three choices)

Middle East and Africa

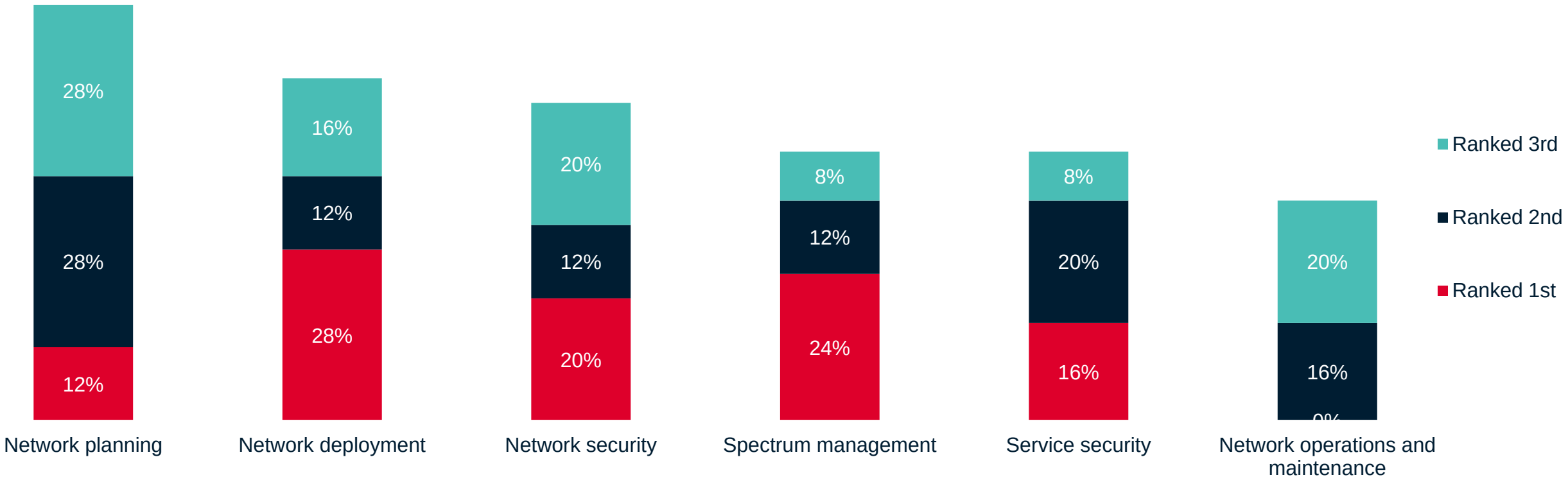


AI and automation use cases

Results by region – Americas

Rank the following use cases for the application of artificial intelligence and automation in your network (top three choices)

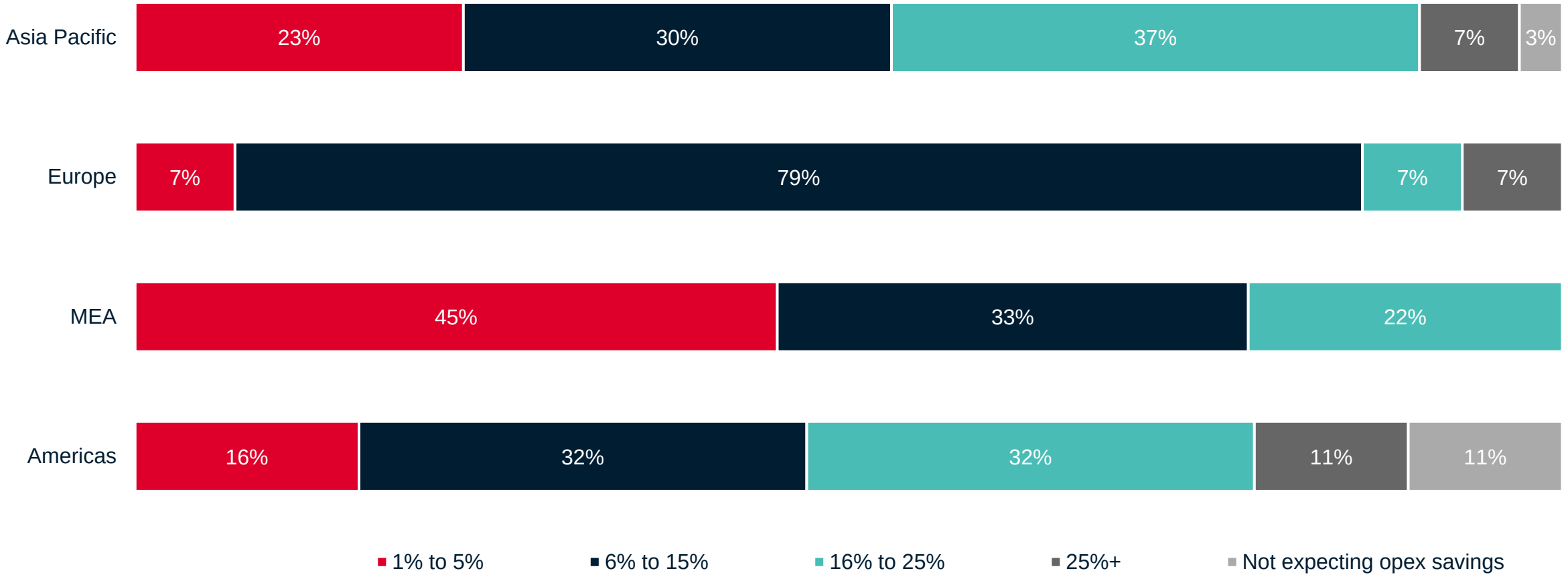
Americas



Automation opex expectations

Results by region

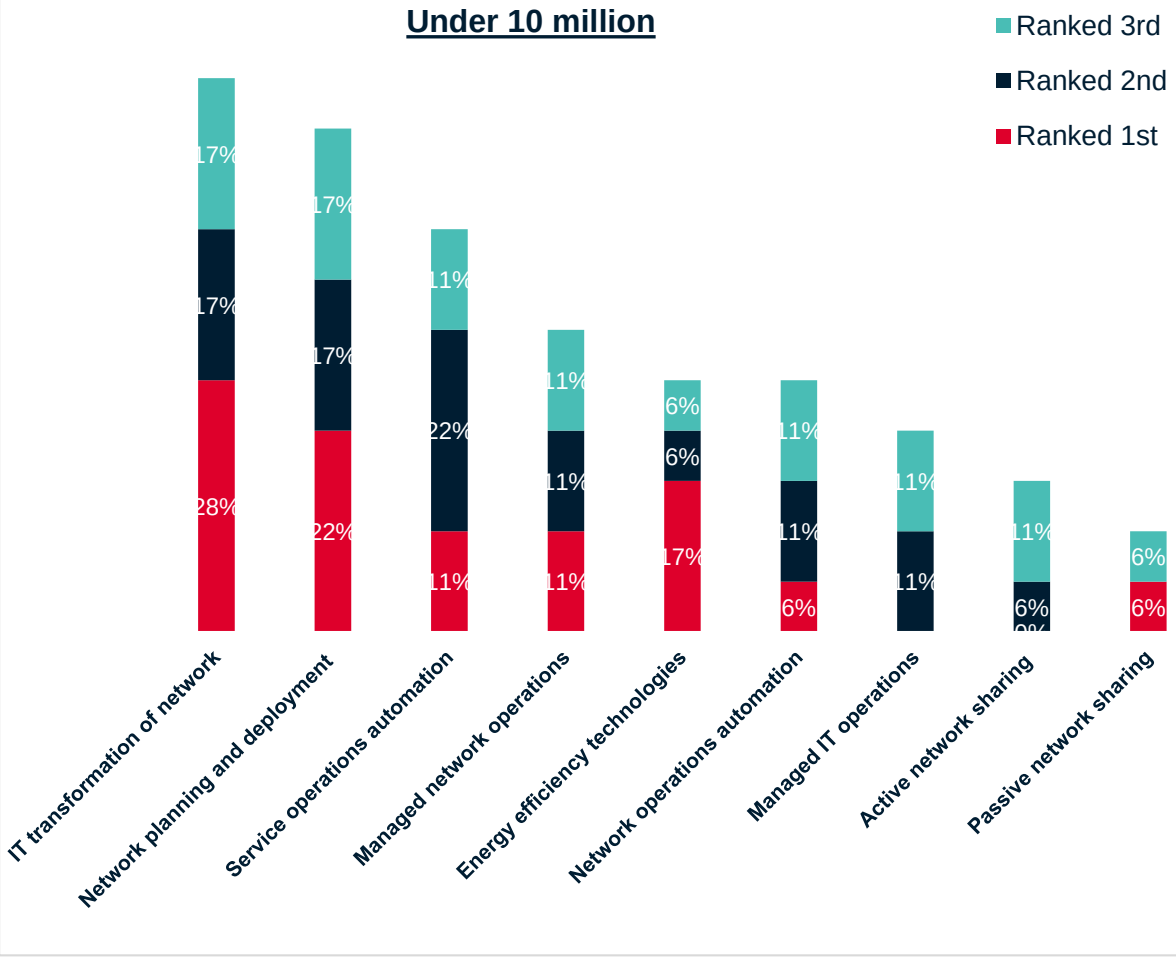
What degree of opex savings do you expect network automation to generate when fully deployed?

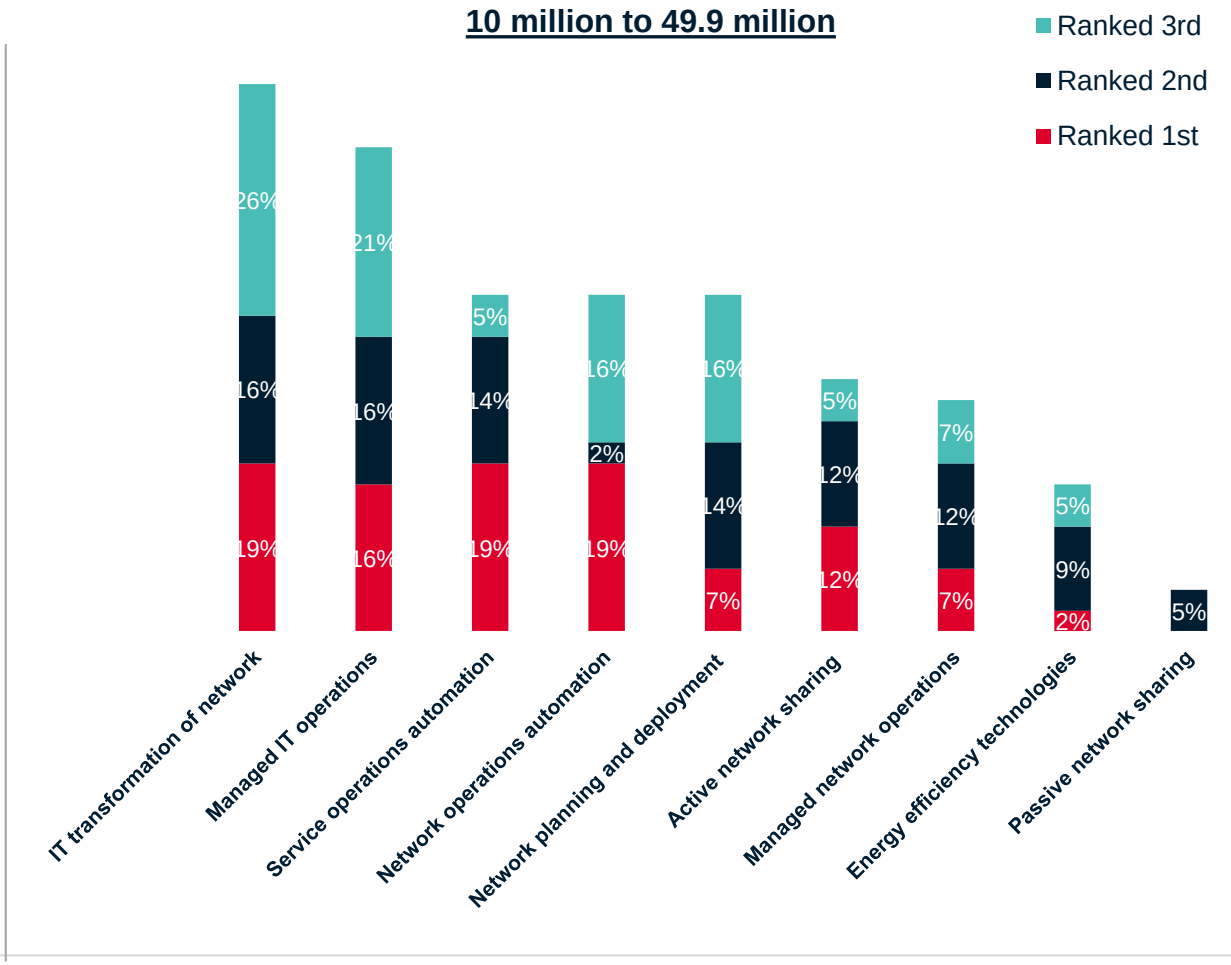


Network technologies and opex

Results by operator size (by number of connections)

Technologies that hold the most promise of driving opex savings in network and service operations (top three choices)





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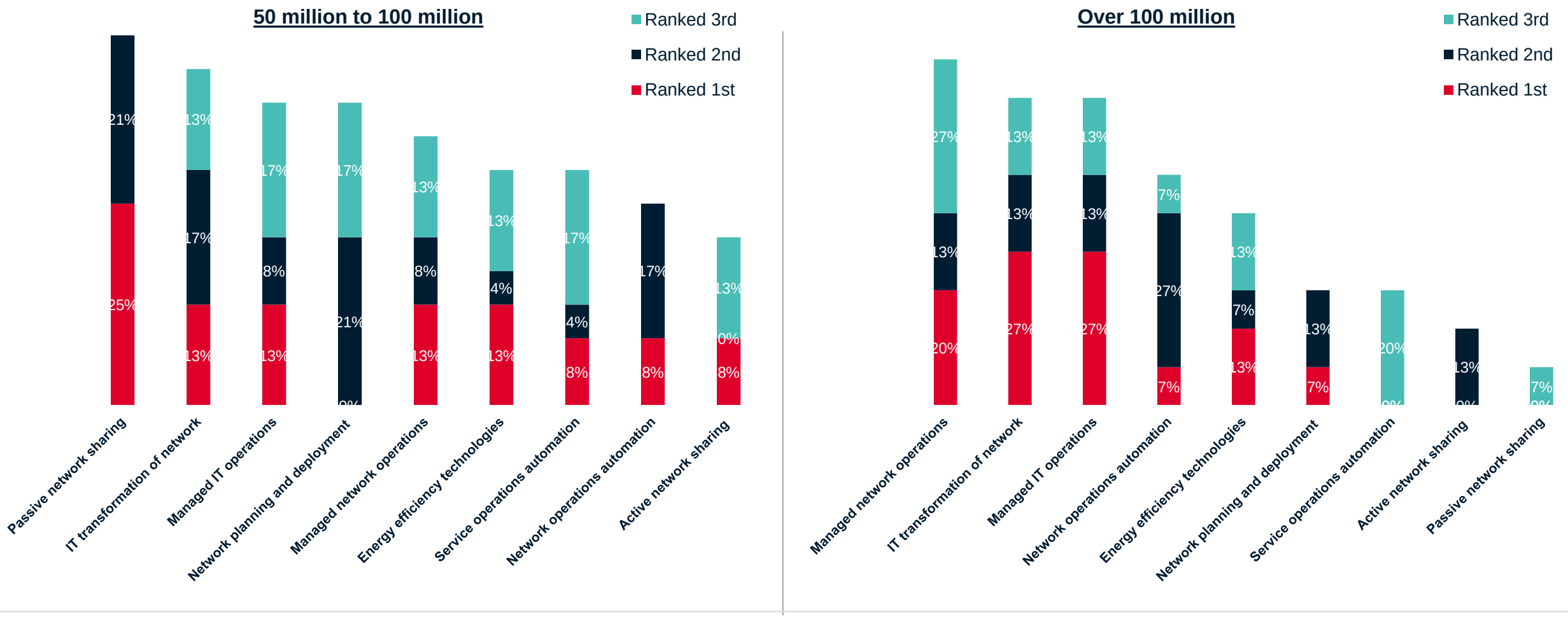
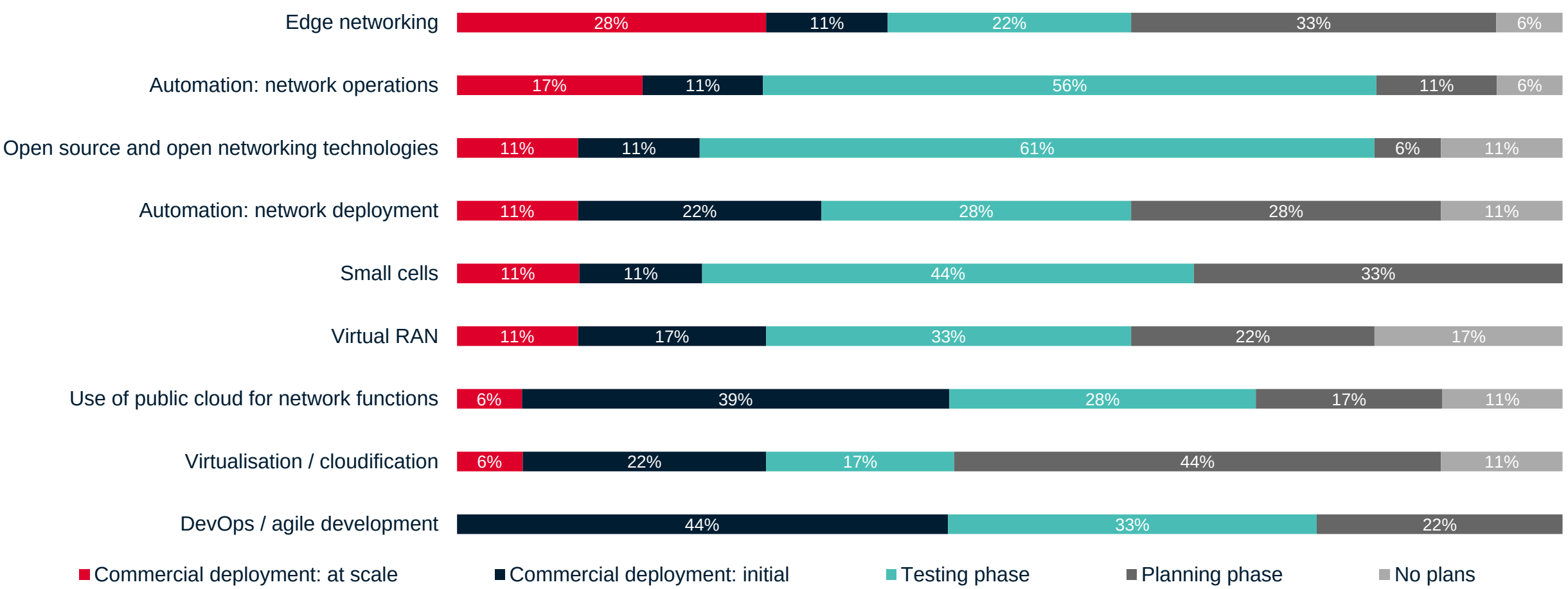


Network technology adoption

Results by operator size (by number of connections)

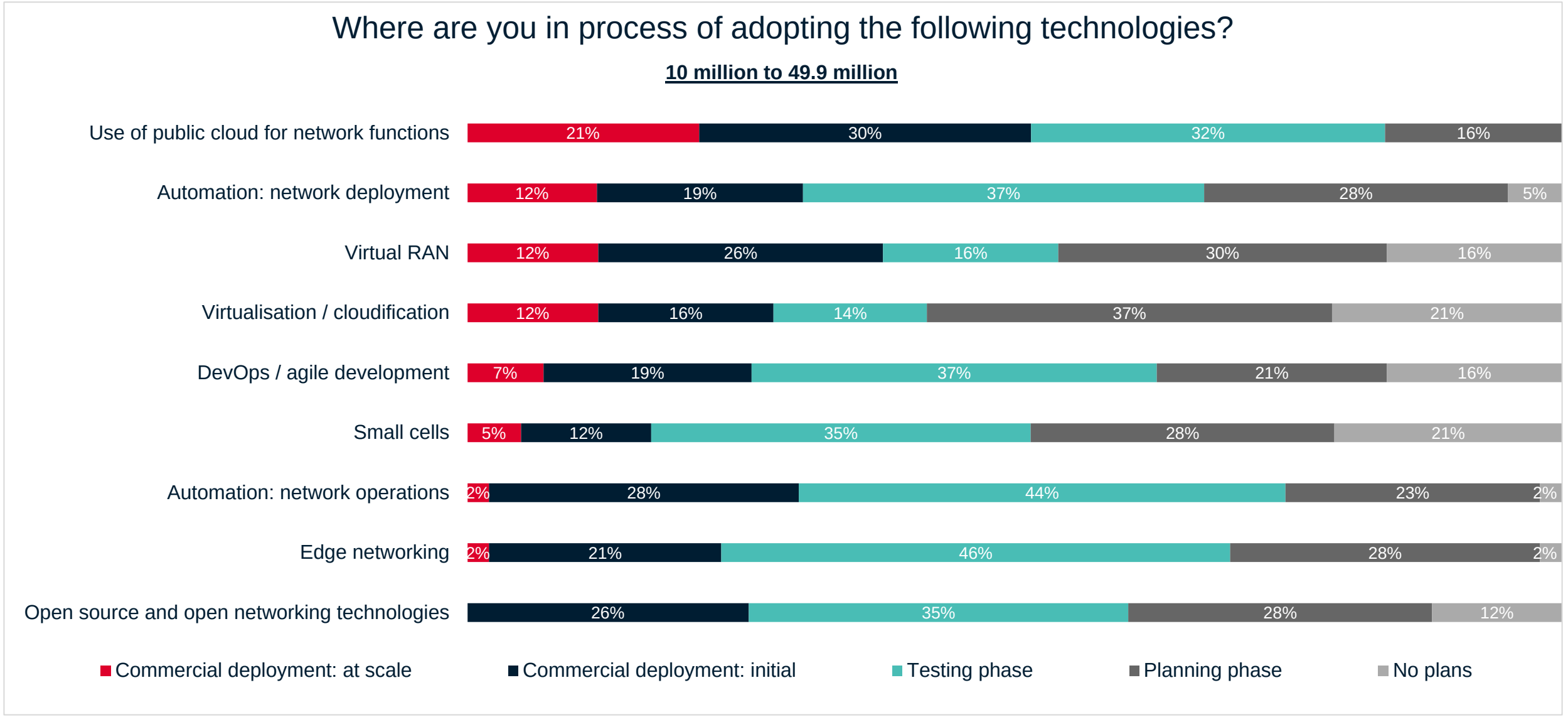
Where are you in the process of adopting the following technologies?

Under 10 million



Network technology adoption

Results by operator size (by number of connections)



Network technology adoption

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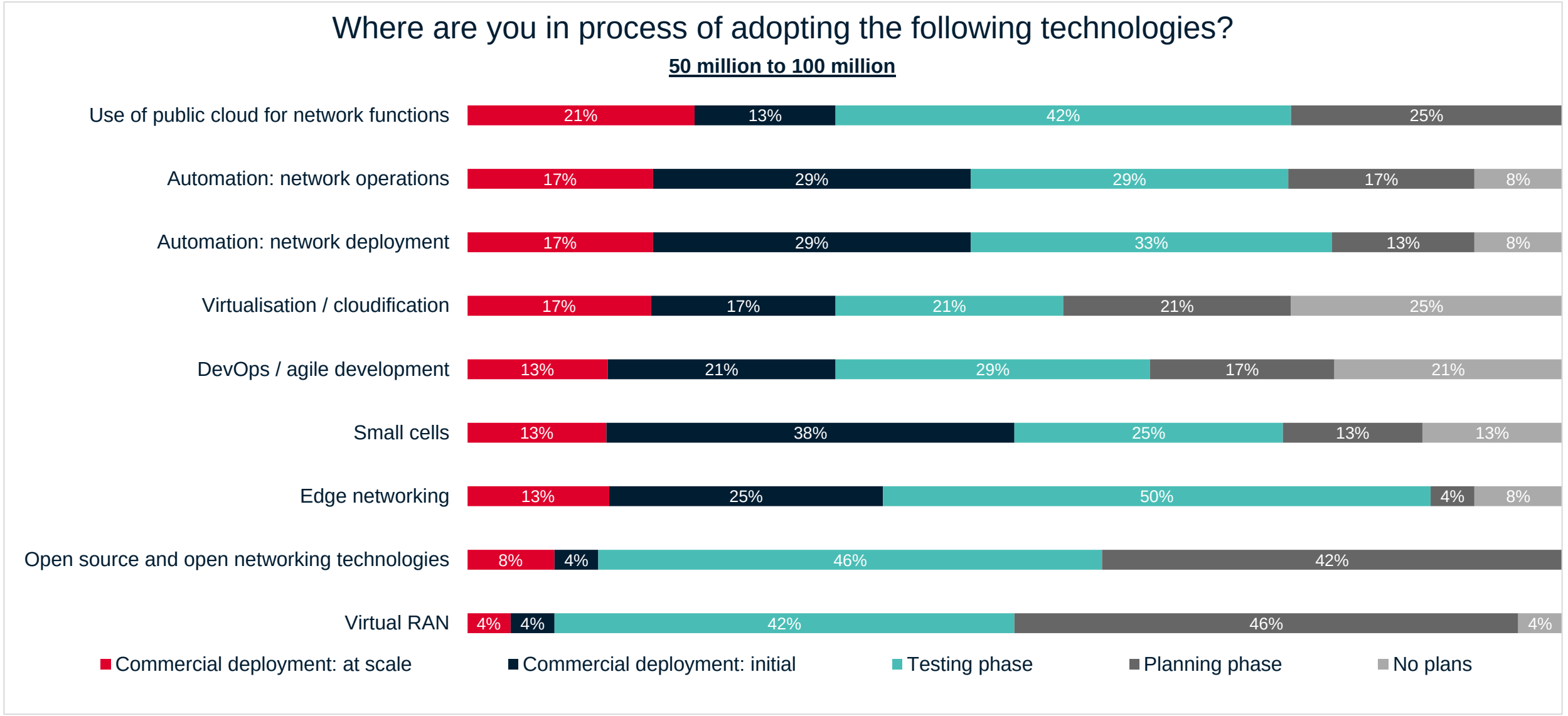

Network technology adoption

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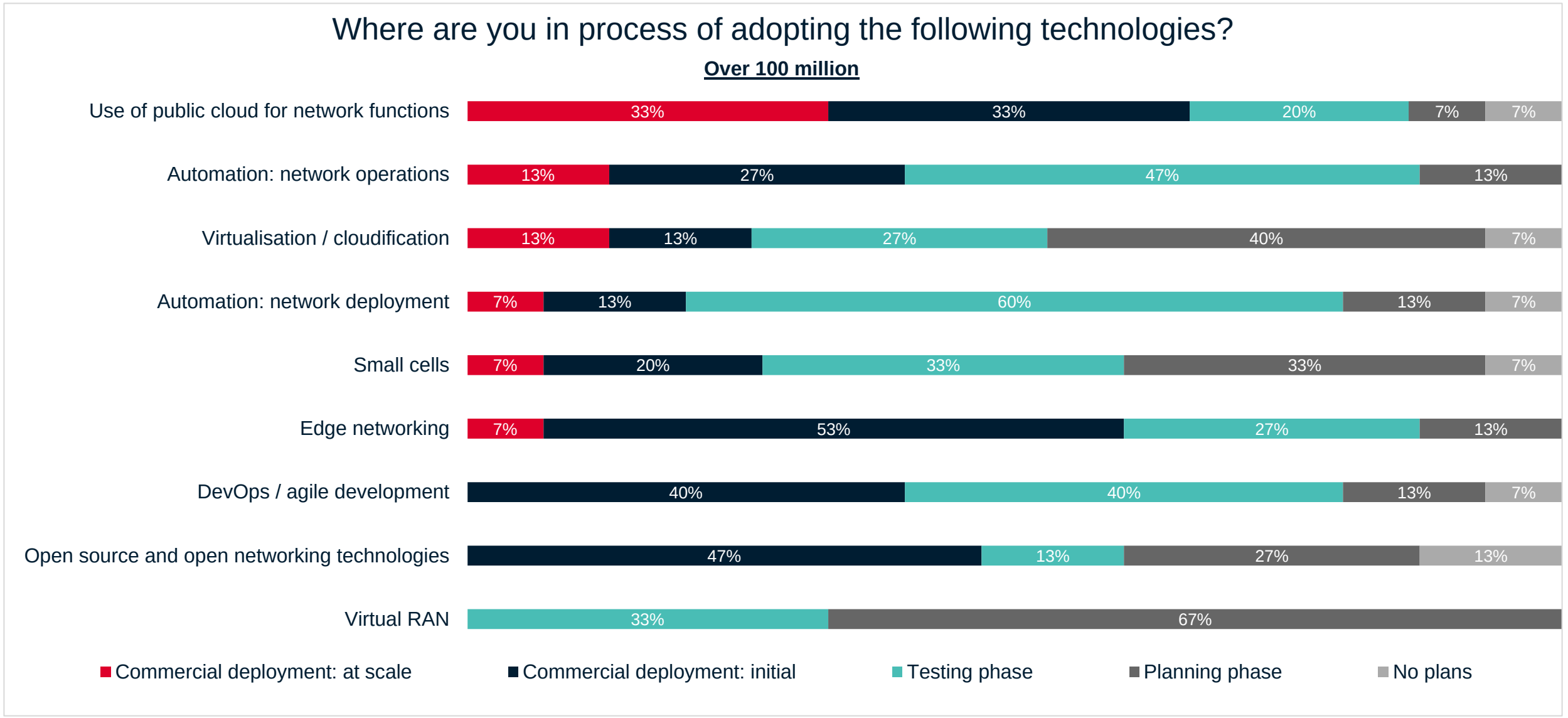
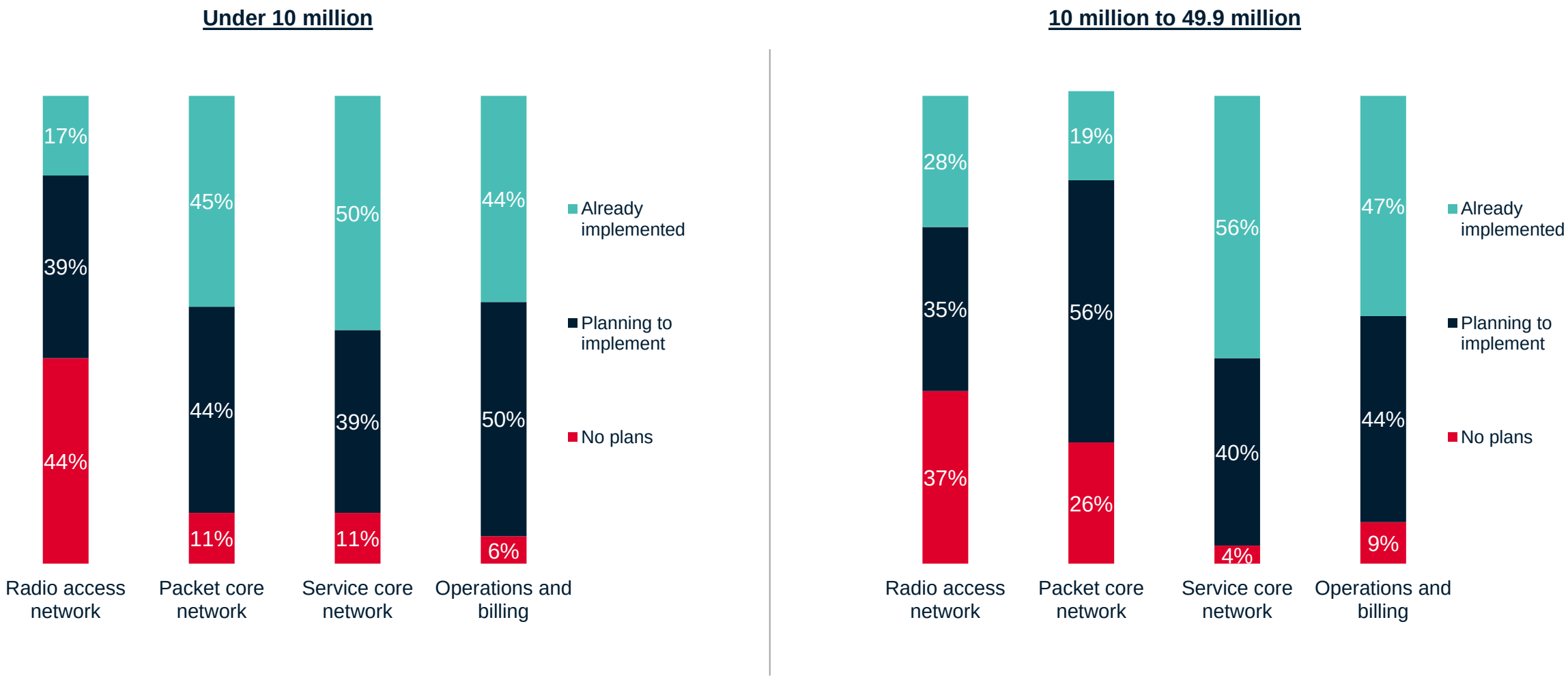


Network technology and cloud

Results by operator size (by number of connections)

Migrating support for network segments to public cloud resources



Network technology and cloud

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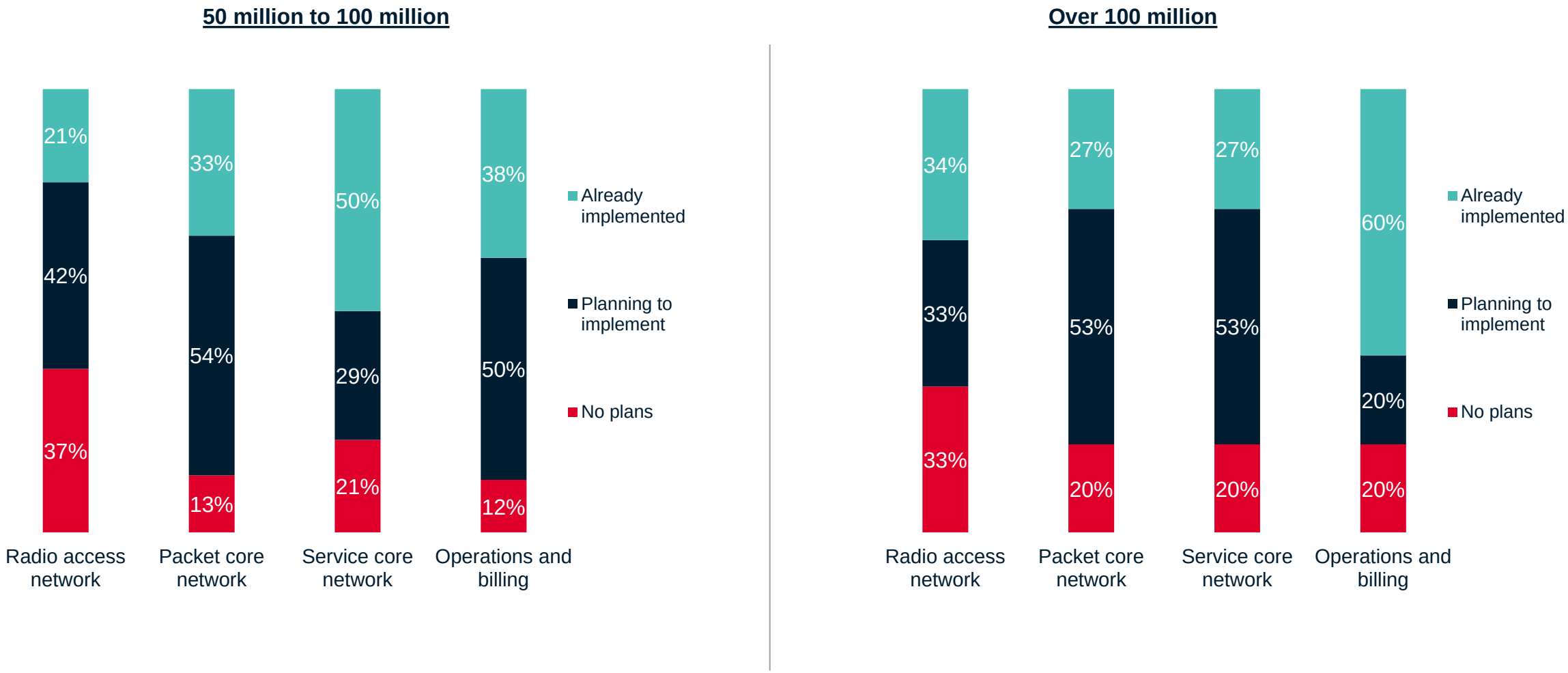
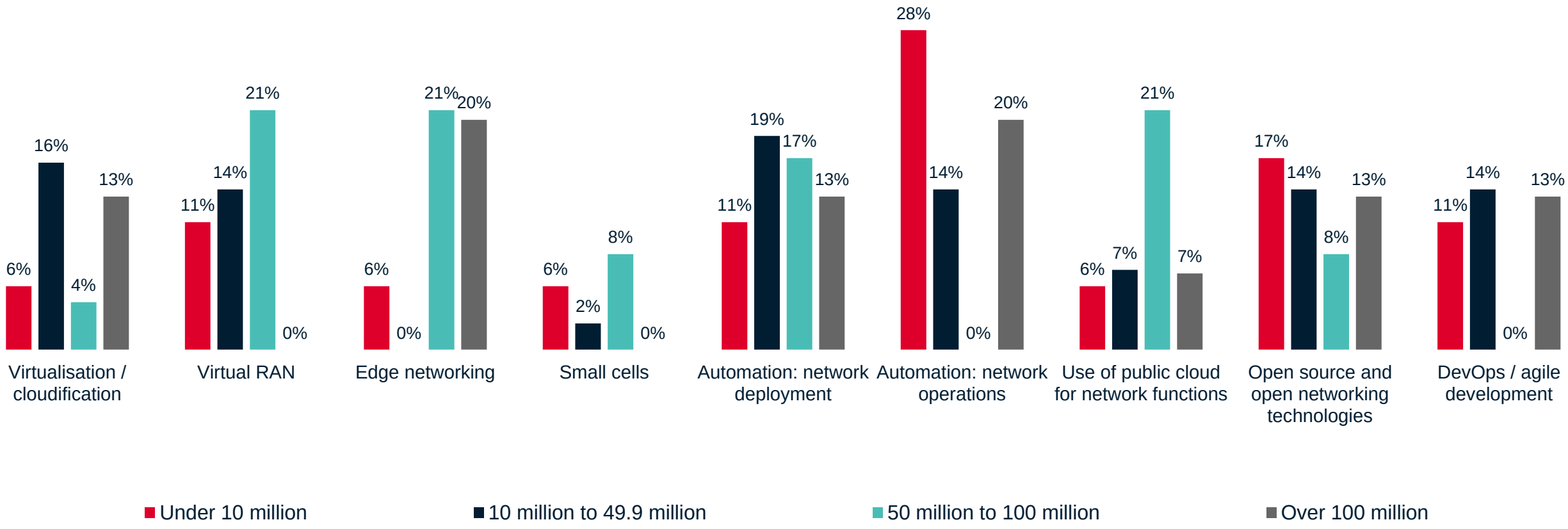


Network technology RoI

Results by operator size (by number of connections)

Rank the following technologies in terms of their return on investment (RoI)?

Ranked 1st

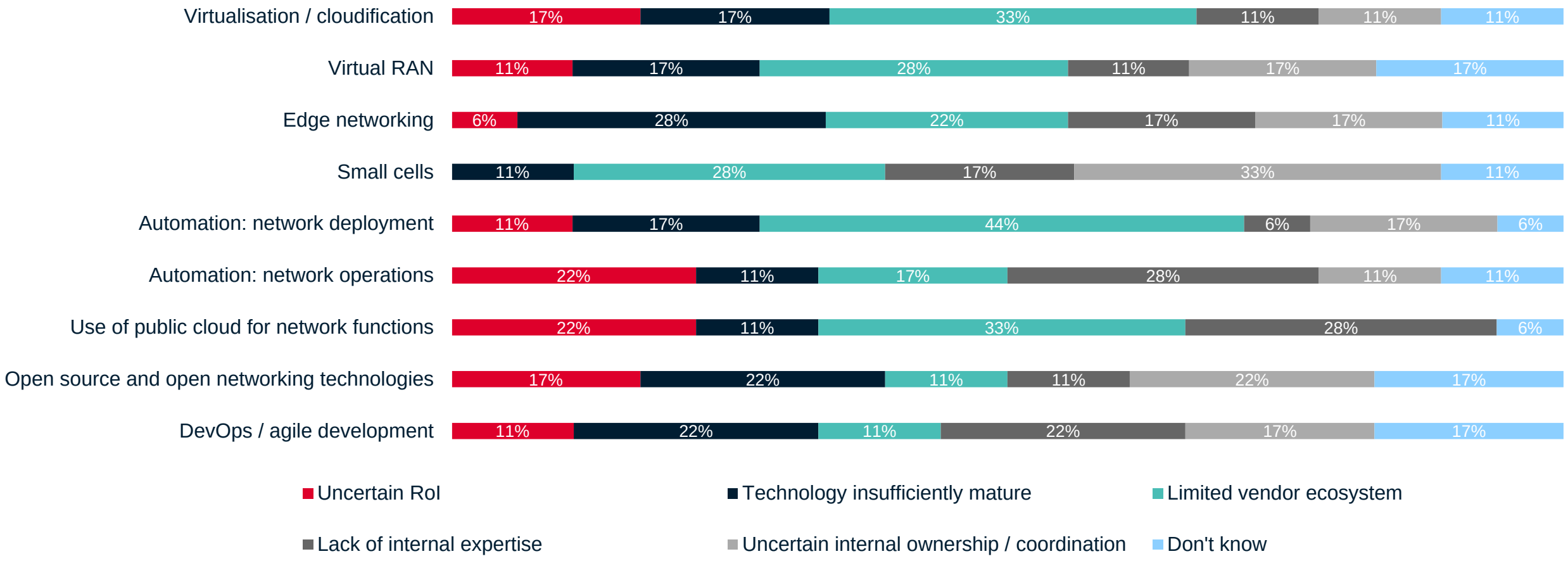


Network technology obstacles

Results by operator size (by number of connections)

What is the greatest obstacle to deploying the following technologies?

Under 10 million

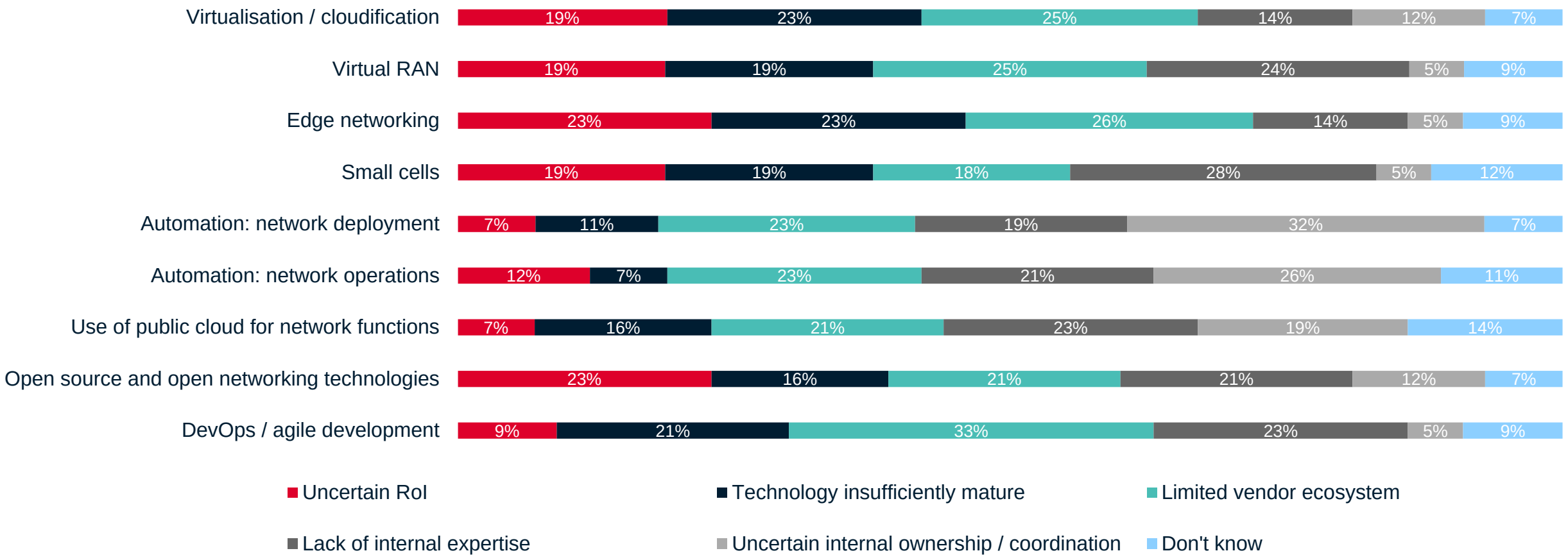


Network technology obstacles

Results by operator size (by number of connections)

What is the greatest obstacle to deploying the following technologies?

10 million to 49.9 million

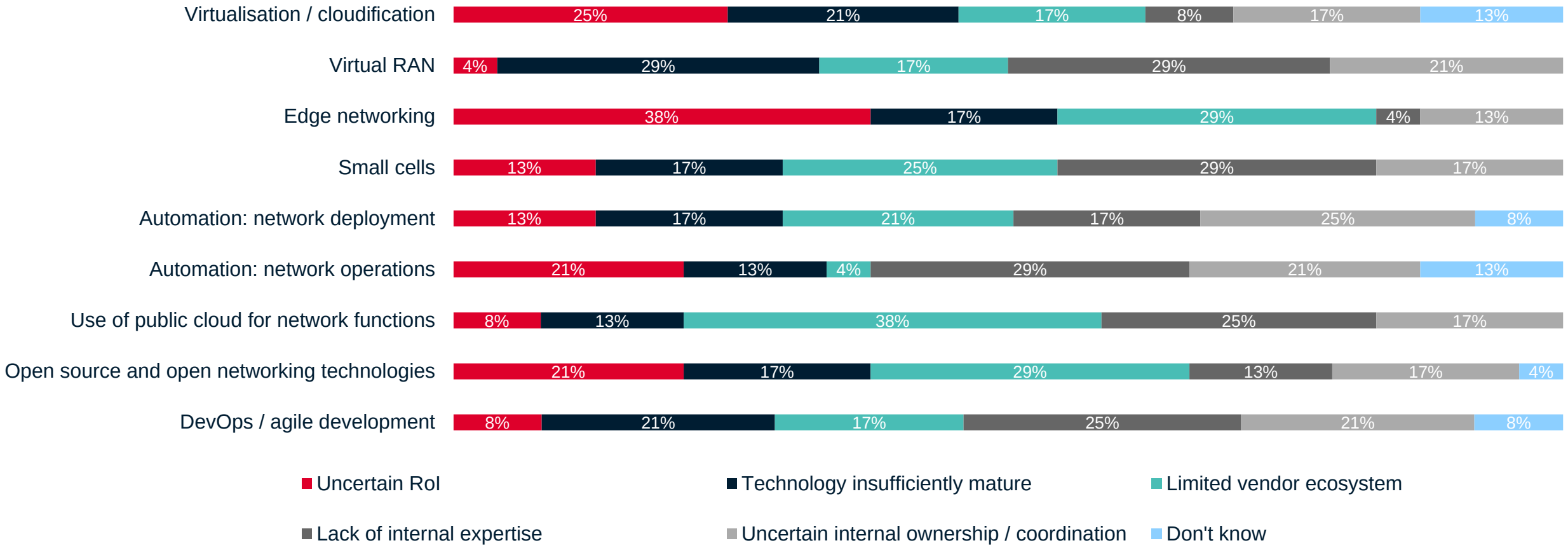


Network technology obstacles

Results by operator size (by number of connections)

What is the greatest obstacle to deploying the following technologies?

50 million to 100 million

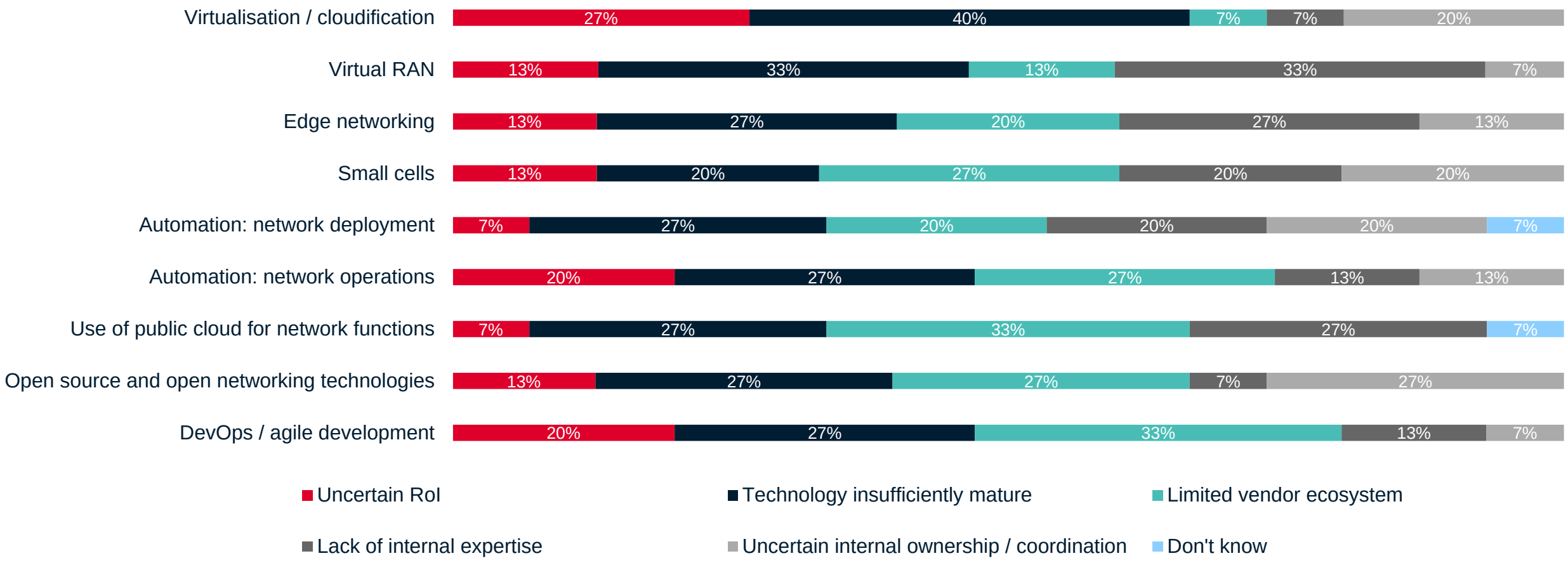


Network technology obstacles

Results by operator size (by number of connections)

What is the greatest obstacle to deploying the following technologies?

Over 100 million

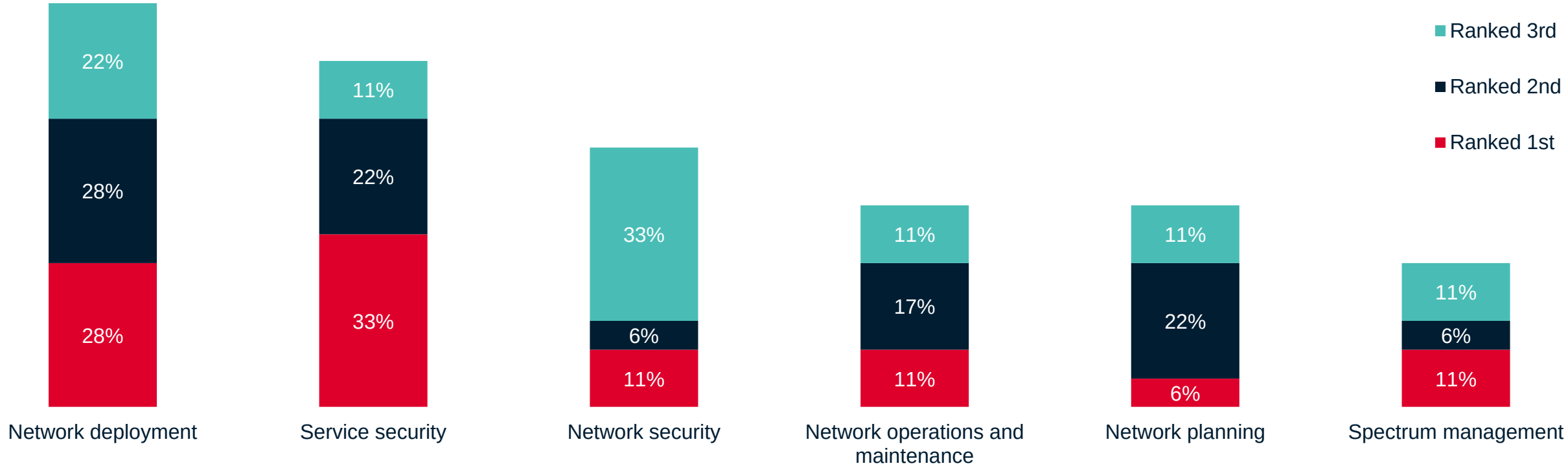


AI and automation use cases

Results by operator size (by number of connections)

Rank the following use cases for the application of artificial intelligence and automation in your network (top three choices)

Under 10 million



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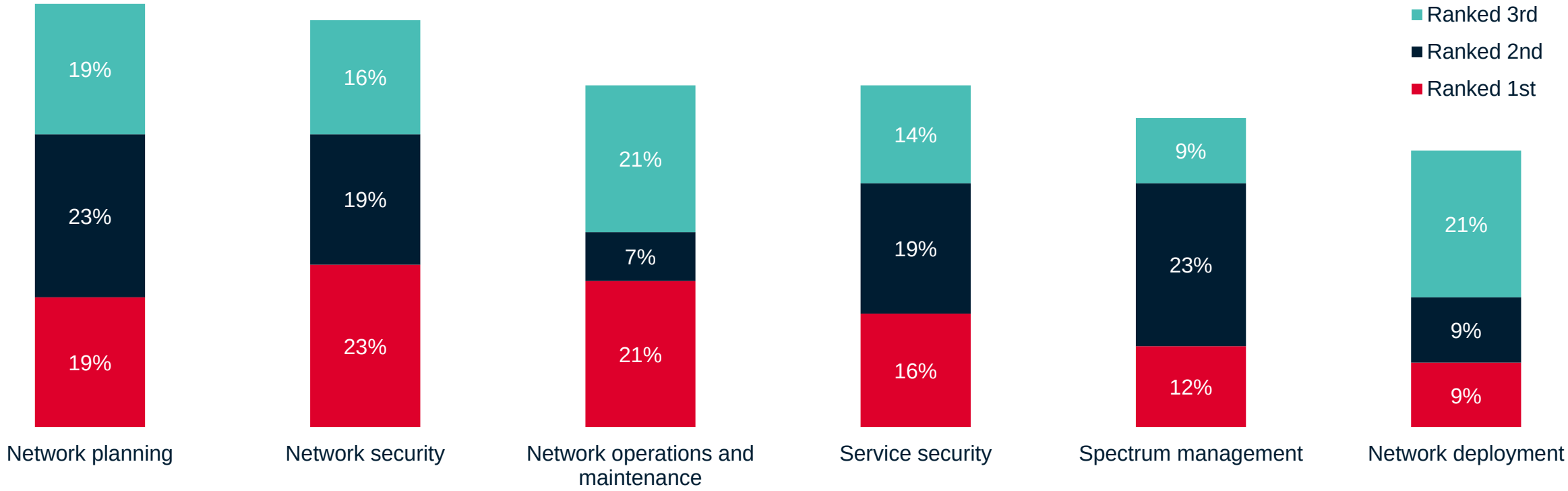

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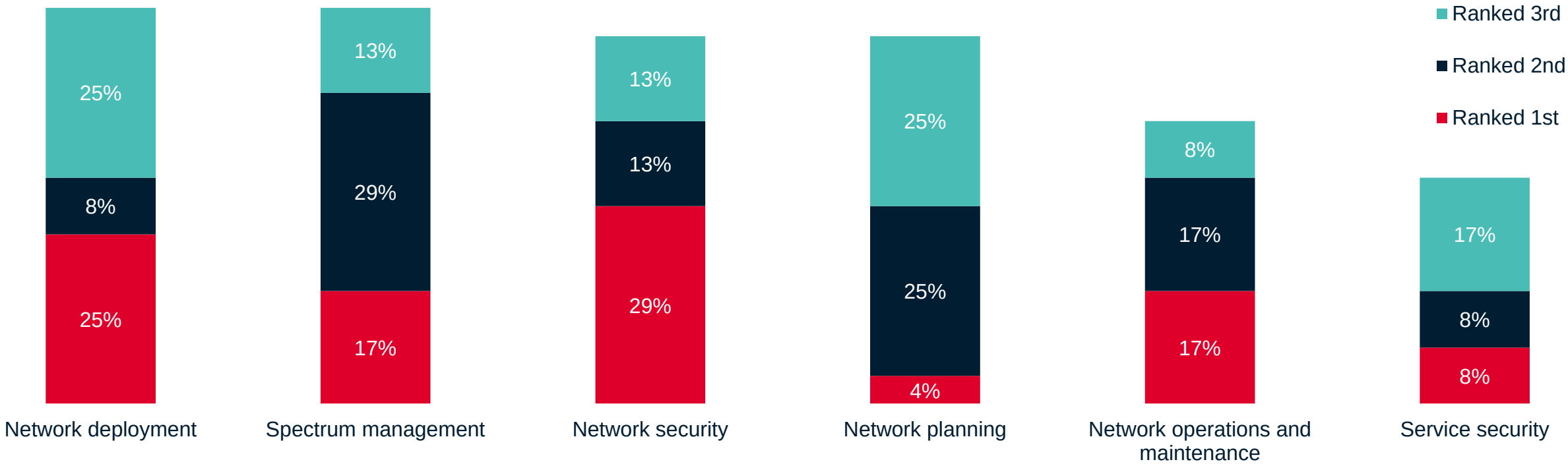

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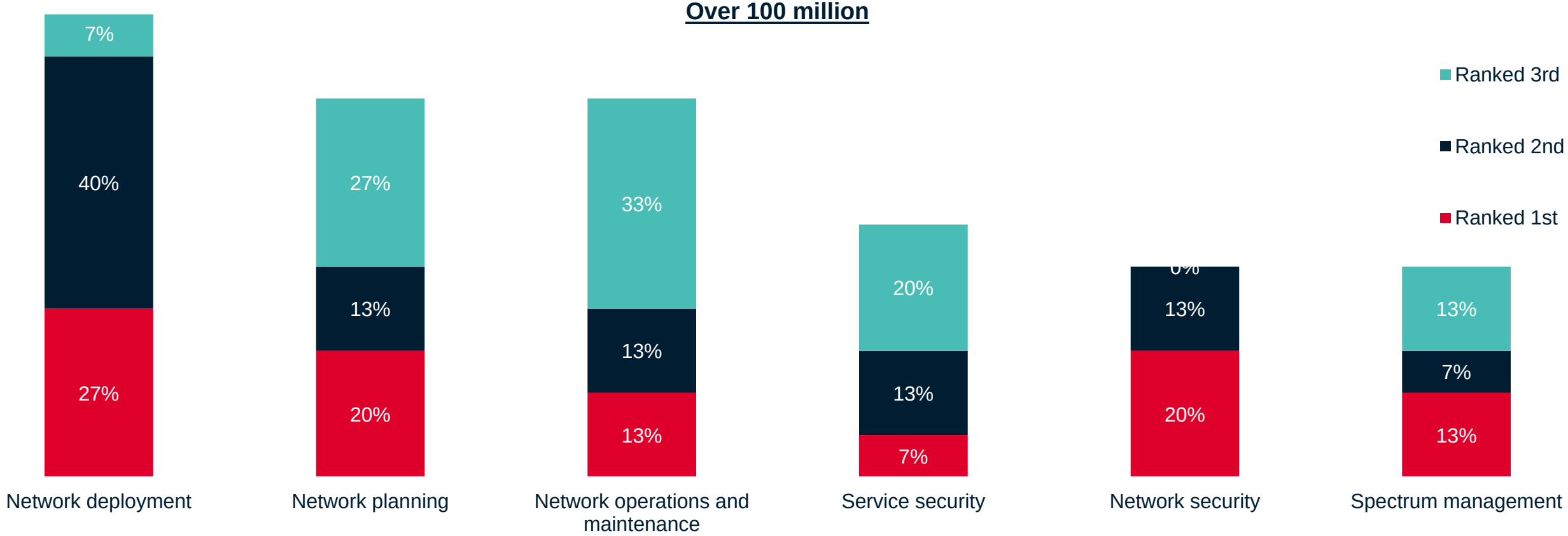

Automation opex expectations

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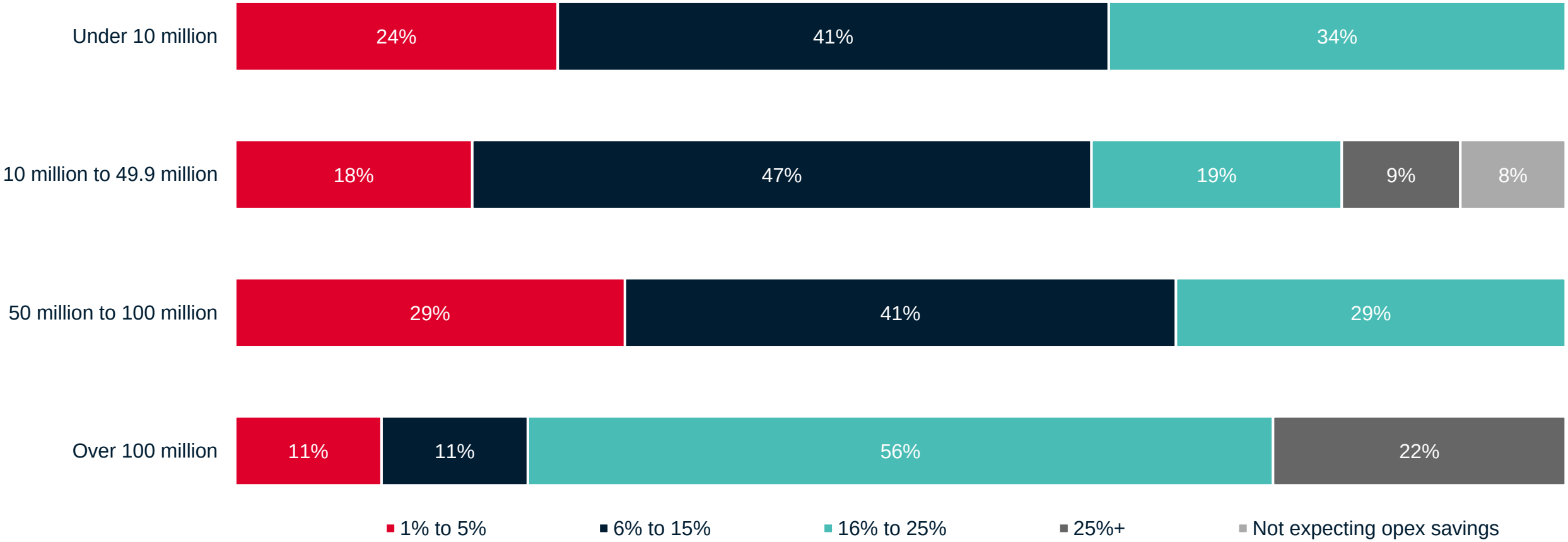


GSMA Intelligence

GSMA Intelligence

In numbers: network solution and vendor strategies

57% Network security is a top network transformation priority; it's logical that most operators (57%) also see it as an important vendor criteria.

20% Only a minor share of operators don't feel it's important to integrate new suppliers into their network infrastructure.

65% In working to engage new network vendors, around two thirds of operators will look to work with larger systems suppliers.

32% Vendor references have long been a supplier evaluation (and marketing) tool; less than a third of operators rank them as important.

71% Network security concerns rate highest as an obstacle to new supplier integration, highlighted by most operators.

56% Just over half of operators are likely to work with start-ups as new suppliers; the door is open for both large and small players.

Survey details

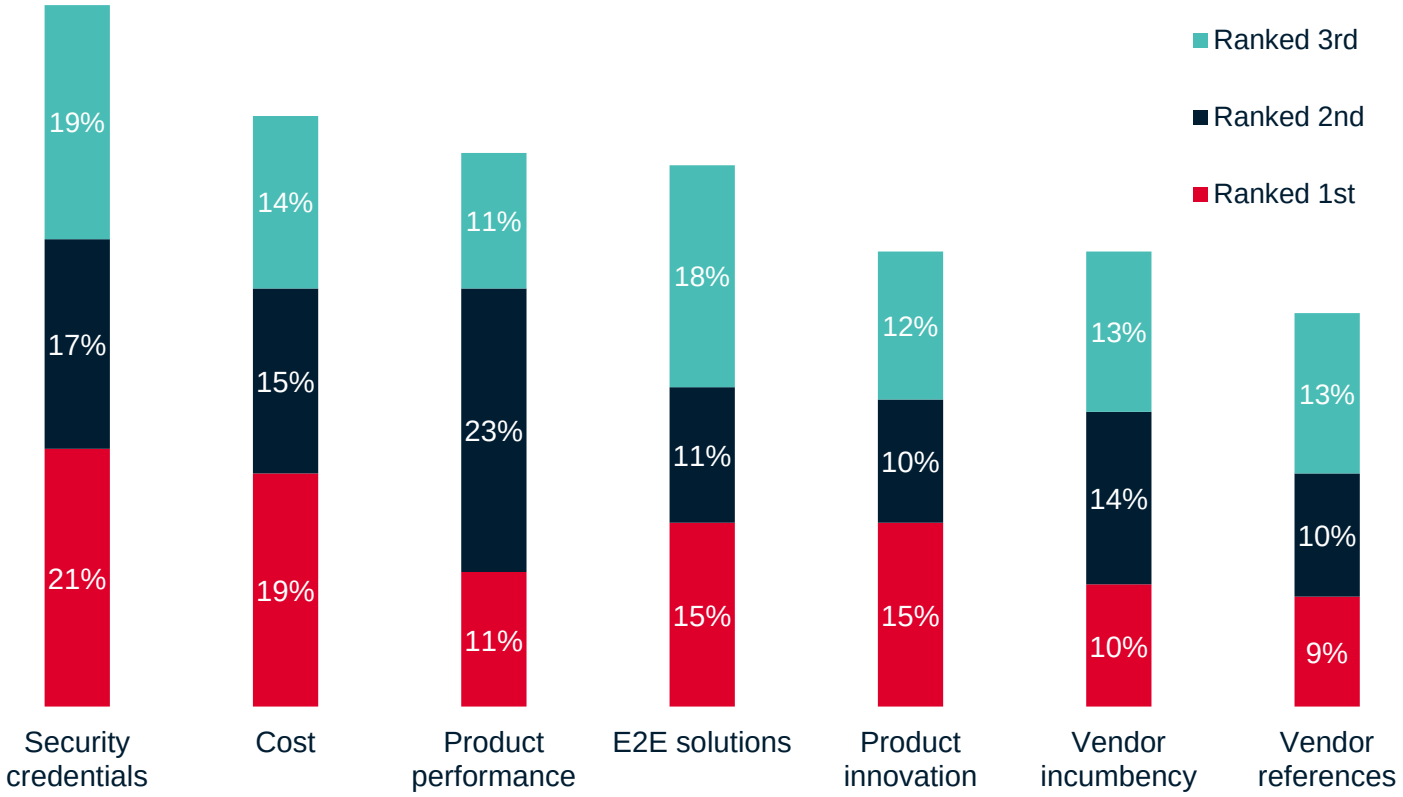
Sample sizes

Segment	Sample size
Total	100
Region	
Asia Pacific	39
Europe	18
Middle East and Africa	18
Americas	25
Organisation size (by connections)	
Fewer than 10 million	18
10 million to 49.9 million	43
50 million to 99.9 million	24
Over 100 million	15

Network solution priorities

Security is top of mind; pricing is surprising

What are the most important factors in purchasing a given network product or solution?

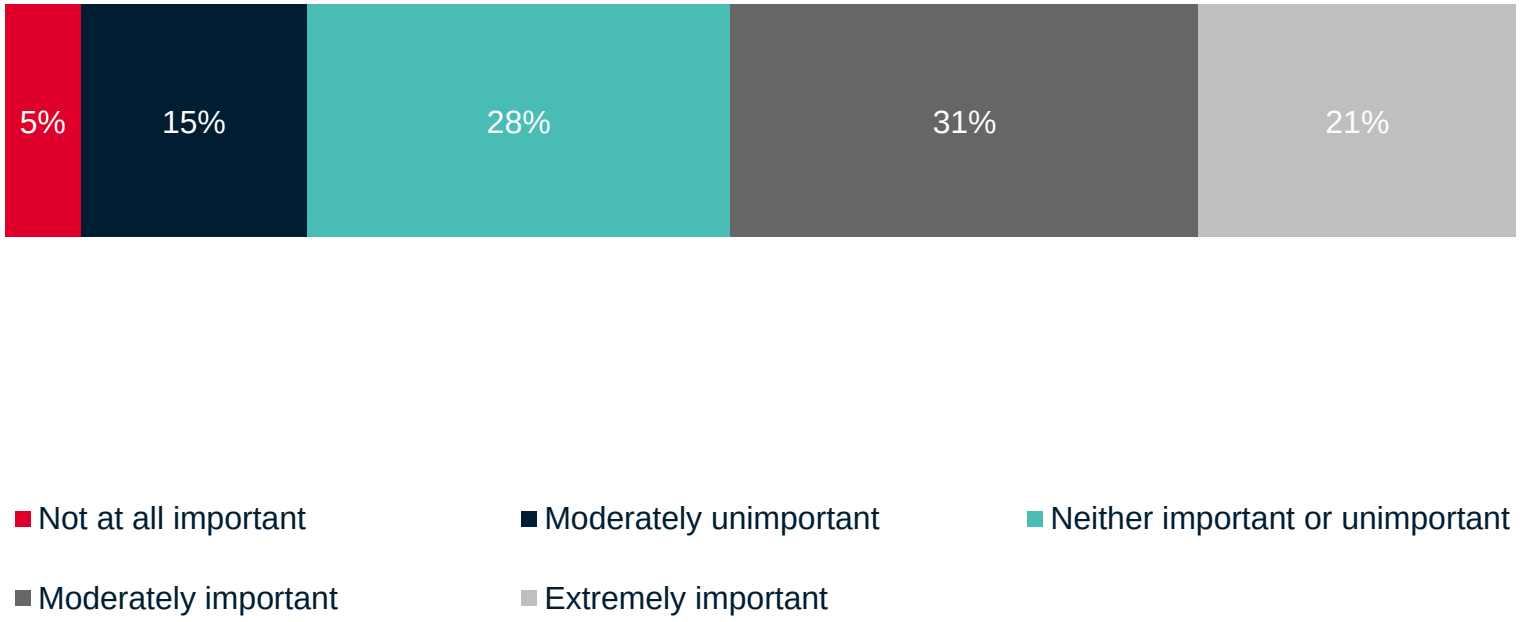


- **Foundational security**. As network threat vectors proliferate, putting security first is understandable, with recent concerns around vendor security an important backdrop.
- **Cost (of ownership)?** Few operators would suggest they select solutions purely based on cost, but it is an important consideration. Large operators (100+ million connections) see it as less important, though.
- **Marketing loses.** References and product innovation are traditional vendor marketing tools – but rank low.
- **Large operator security expertise**. Of operators claiming security as important, those with 100+ million connections were least likely to highlight it as top, potentially trusting their internal security processes/assets.

Network priorities: new suppliers

Supply chain diversity cannot be ignored

How important is it for you to introduce new product or technology vendors into your network?

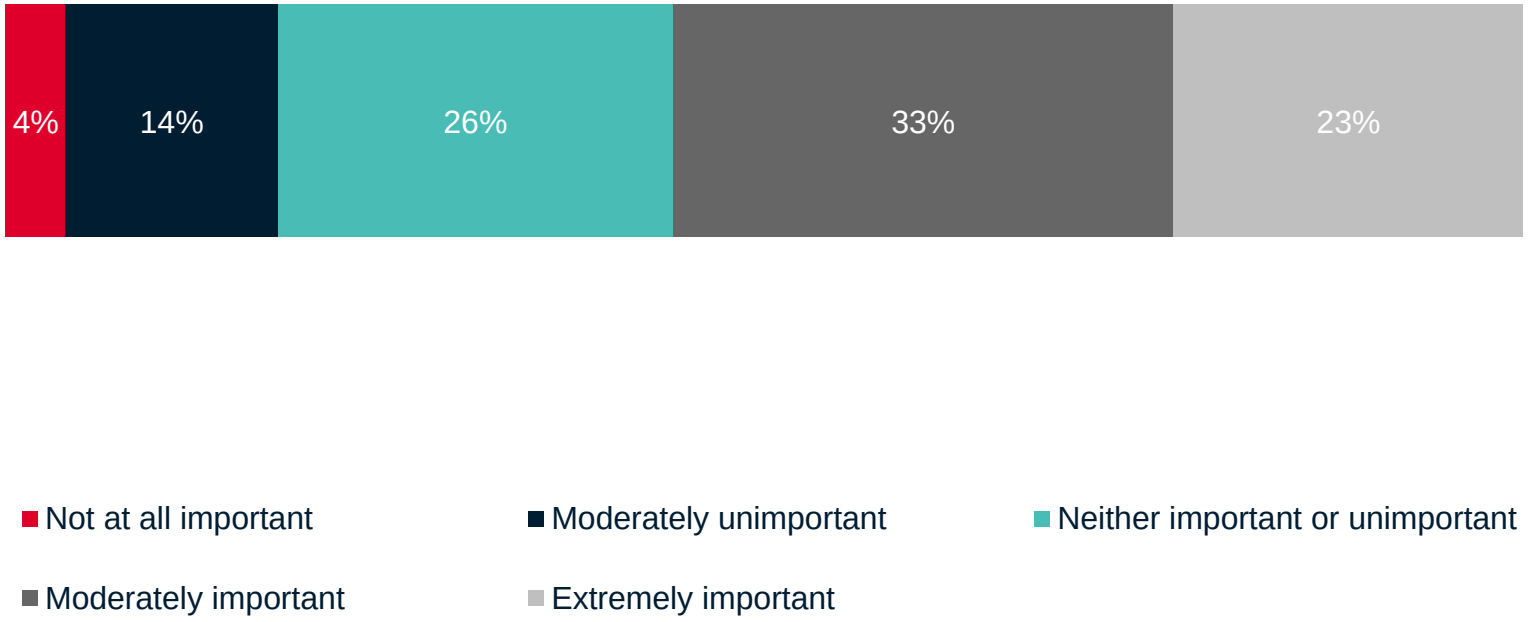


- **Vendor diversity imperative**. Supplier diversity is only slightly less important than open source technologies; only 20% see it as unimportant, likely focused on consolidation and security concerns.
- **Priorities versus actions.** It is not clear how operators will prioritise vendor introductions; other priorities (price, security, etc.) will also play a part.
- **Large operators on board**. Roughly 50% of large operators feel it is important to add new suppliers. More significantly, none claim it is not.
- **Small operators expect 5G to be different**. While a third of small operators see new vendor introductions as important, 75% expect to include them in 5G builds, making 5G a turning point.

Network priorities: open networks

Operators are “open” to change in their networks

How important is it for you to integrate open source and open networking technologies into your network?

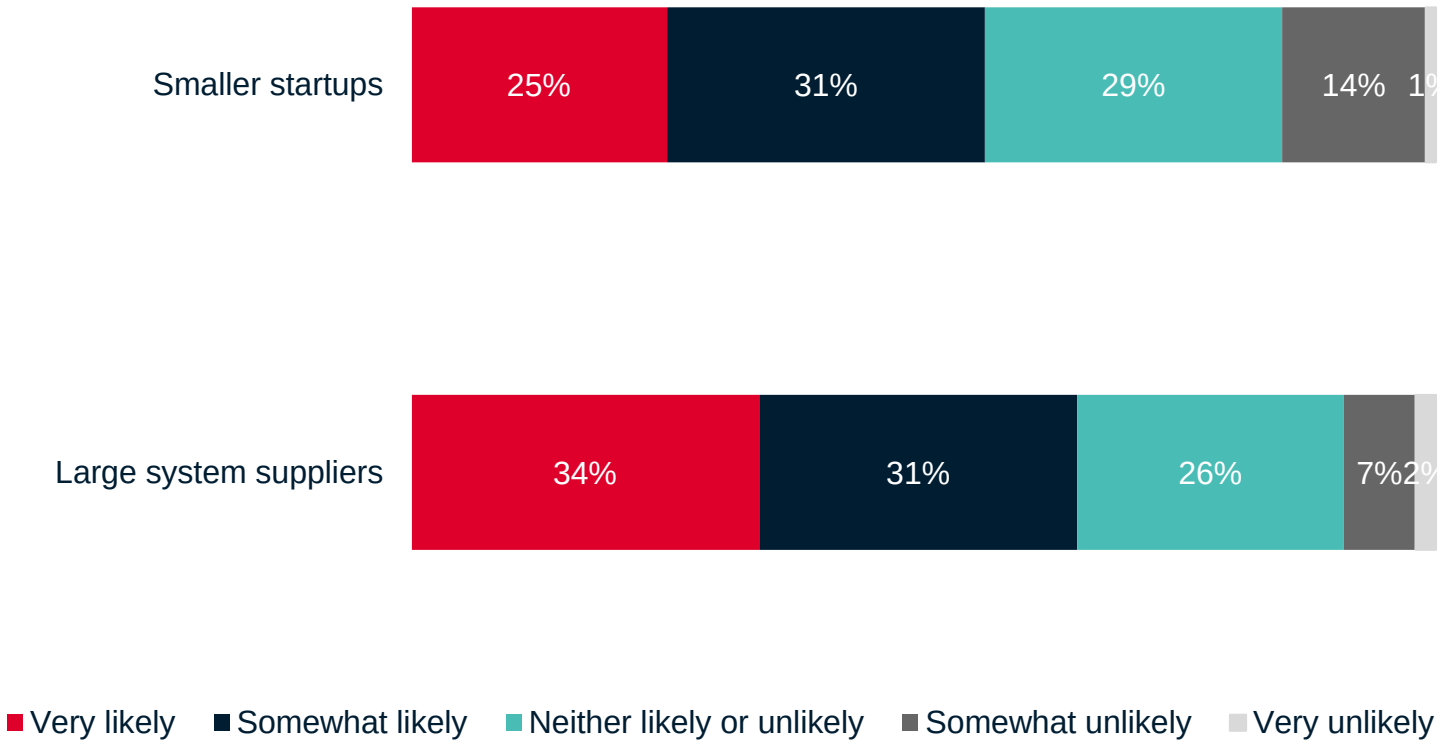


- **Open source imperative**. Some 56% of operators claim it is important to integrate open source technologies into their network sourcing processes. More importantly, less than 20% think it is not important.
- **Priorities versus actions.** While open source is deemed to be important, almost two thirds currently claim to be in the testing or planning phase with open networking technologies. How quickly that transitions to commercial deployment will depend on competing priorities.
- **Universal agreement**. Across all operator sizes, the importance of open networking technologies is seen as similar. Whether or not they all have the ability to deploy it, all sizes of operators understand the critical nature of open networking.

New suppliers: size preference

Large system suppliers offer stability

In engaging new network vendors, which types of **vendors** are you most likely to engage with?

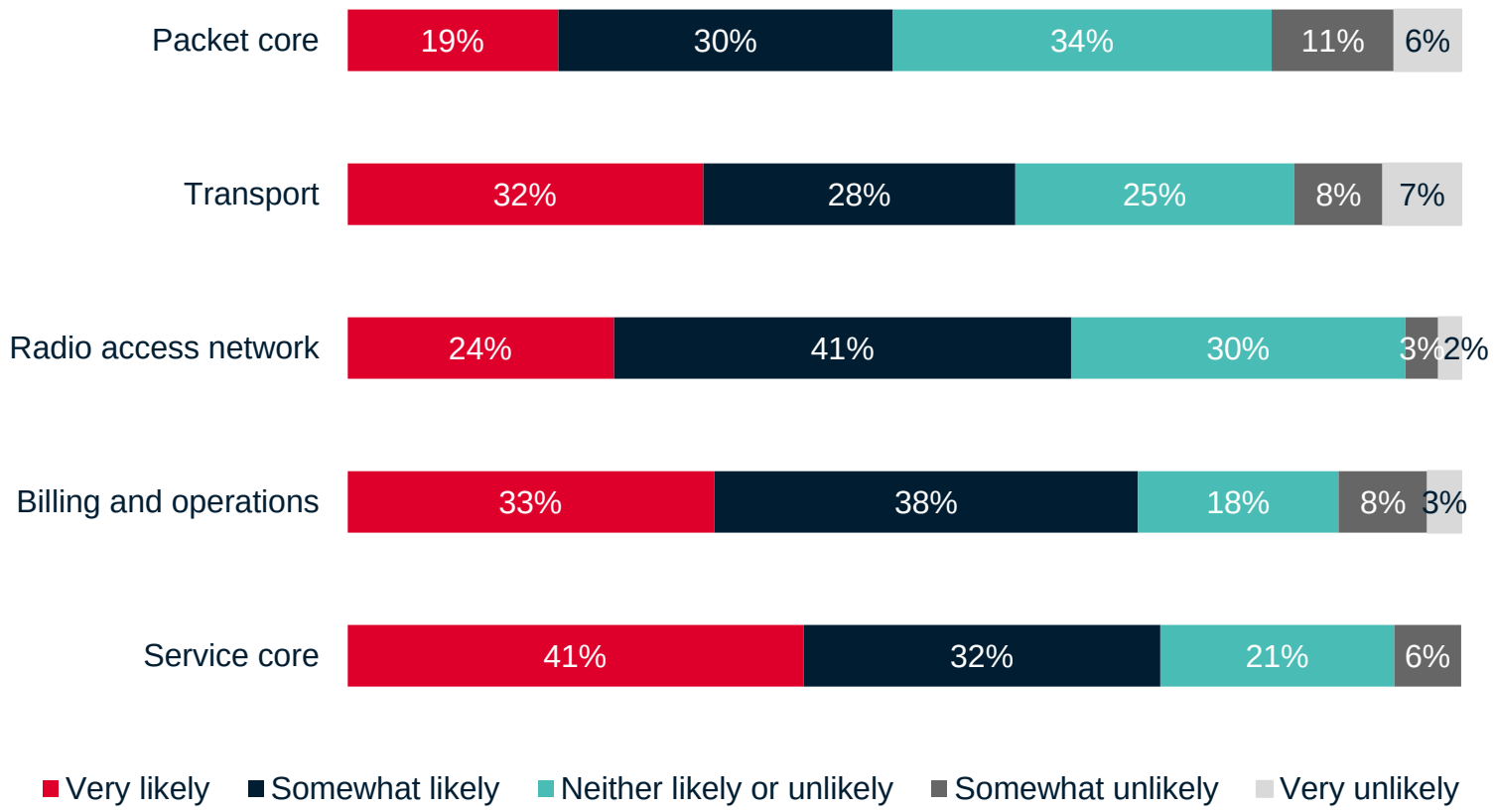


- **Large versus small**. Some 56% of operators say they would likely engage startup vendors when sourcing new suppliers. This jumps to 65% for large system suppliers, signalling a focus on stability and size.
- **No startup opposition.** The preference for large vendors aside, only 15% of operators said they would be unlikely to work with startups.
- **Guided by ecosystem.** Vendor decisions will be shaped by ecosystem dynamics; a lack of startups in one segment, for example, will dictate supplier choice.
- **Small likes small**. Operators with fewer than 10 million connections are more likely to engage startups; if their size allows nimble sourcing, this would be a logical outcome.

New suppliers: product priorities

Software solutions are easiest

In engaging new network vendors, which types of **products** are you most likely to procure?

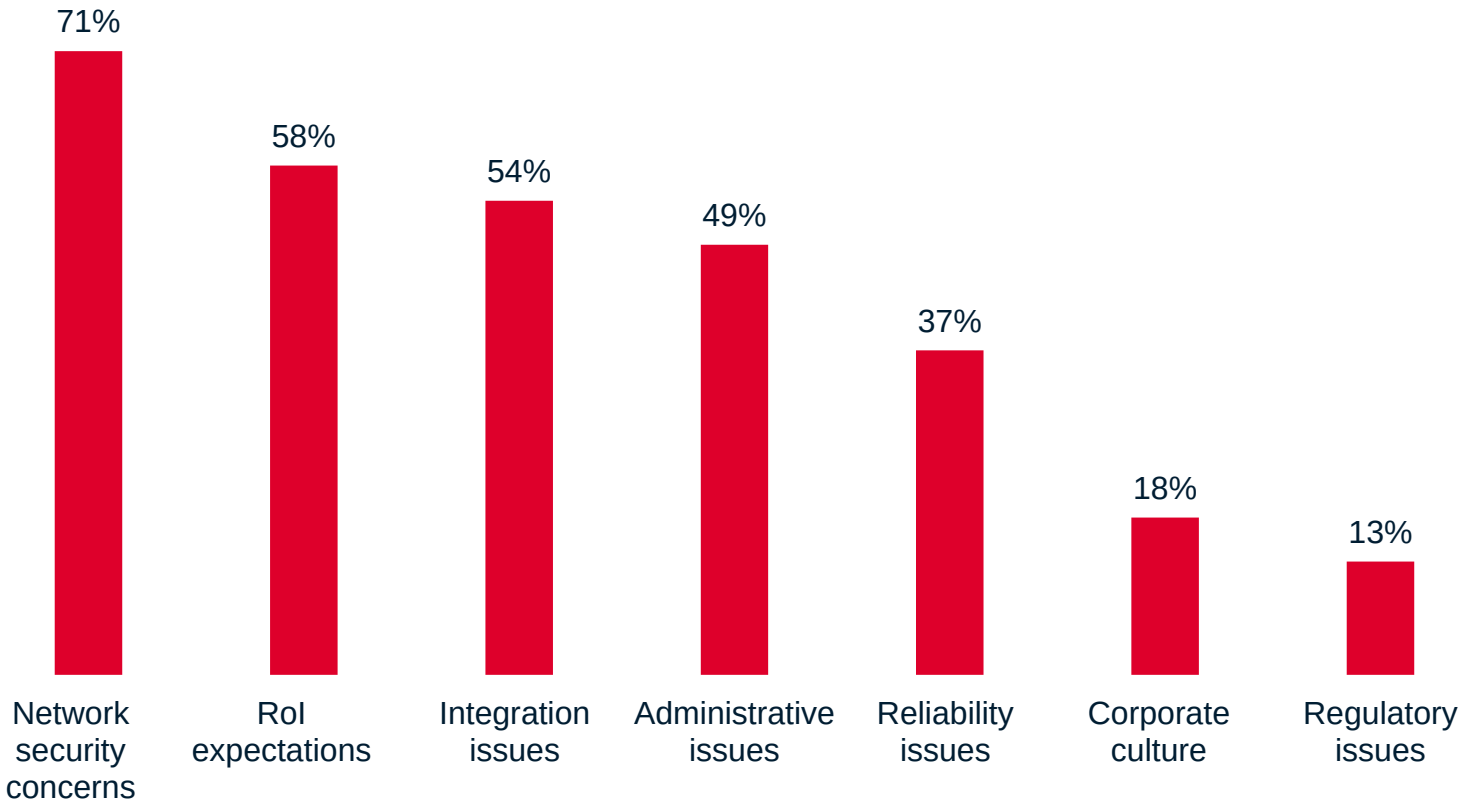


- **New services = new suppliers**. As operators drive new services over their networks (5G, in particular) service core and OSS/BSS vendors should benefit.
- **Open RAN uncertainty?** Only 24% of operators see the RAN as a major opportunity for new suppliers. Either interest in RAN innovations is limited or operators expect that RAN evolutions combined with vendor additions could be difficult.
- **NG core evolution.** Less than half of operators think it is likely that they would look at new suppliers in the packet core, potentially a function of product architectures which allow today's solutions to (supposedly seamlessly) support future technology generations.

Obstacles: new suppliers

Process and security concerns dominate

What are the primary obstacles to introducing **new vendors** into your network?



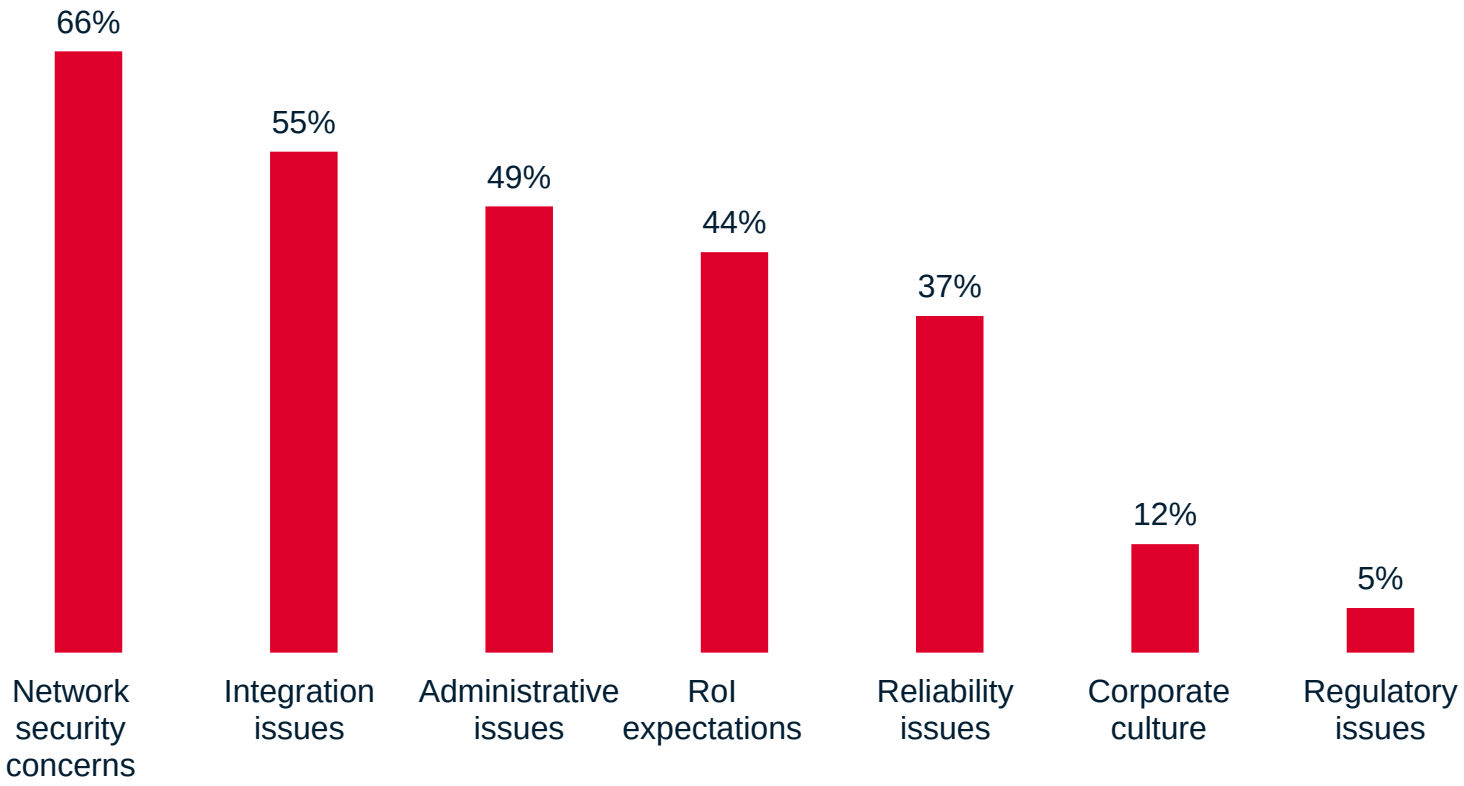
- **Fear of the unknown (security)**. Security was a top-ranked purchasing priority for network solutions; it is only natural for it to be a concern when engaging new (unfamiliar) suppliers.
- **New vendors, current processes**. Inertia around existing processes (integration, admin) and the costs involved in changing them represent the biggest set of obstacles.
- **Cultural optimism?** Operators may believe that their culture encourages using new suppliers, but concerns around processes suggest they may be incorrect.
- **"Big" admin problems**. Admin issues may be an obstacle for 49% of operators overall but were highlighted by 73% of operators with more than 100 million connections.

Multiple responses accepted; chart total adds up to more than 100%

Obstacles: open networking

Process and security concerns dominate, again

What are the primary obstacles to introducing **open source / open networking technologies** in your network?



- **Fear of the unknown – part 2**. As with new supplier introduction, security ranks highest, likely a function of operators building out their familiarity with the technologies.
- **Processes – part 2**. A focus on integration and administration points to process potentially holding back open technologies.
- **RoI versus new suppliers.** Operators see RoI expectations as less of a concern for open networking than for introducing new suppliers, logically following IT transformation priorities.
- **No regulation?** Where “open” technologies could impact network security or reliability (or be used to drive supply chain diversity), it is surprising that so few operators see regulation as an obstacle.

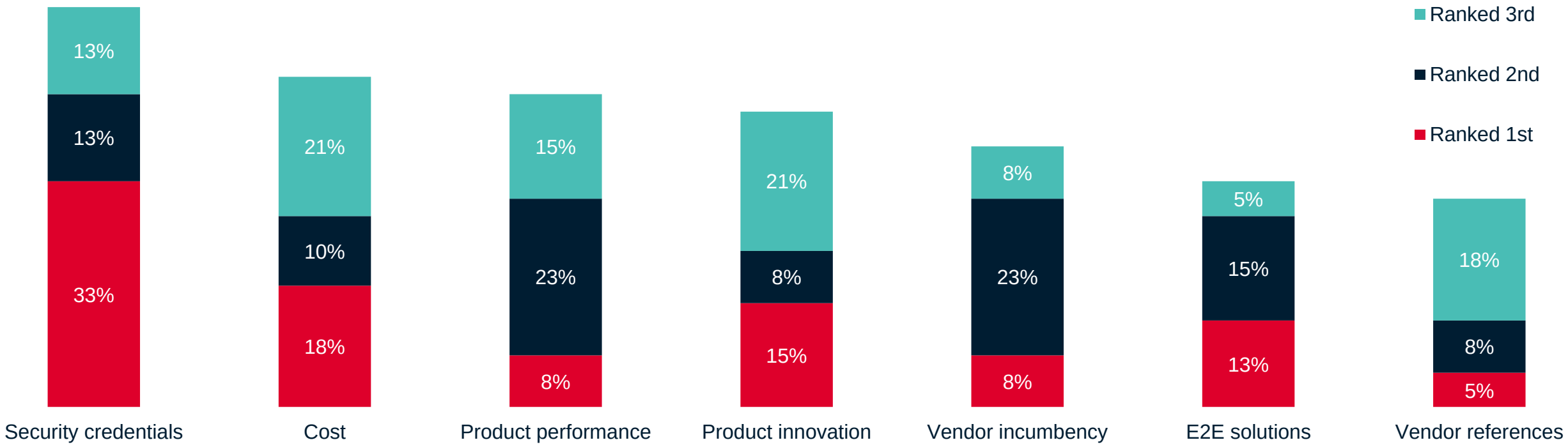
Multiple responses accepted, chart total adds up to more than 100%

Network solution priorities

Results by region

What are the most important factors in purchasing a given network product or solution?
(Top three choices)

Asia Pacific



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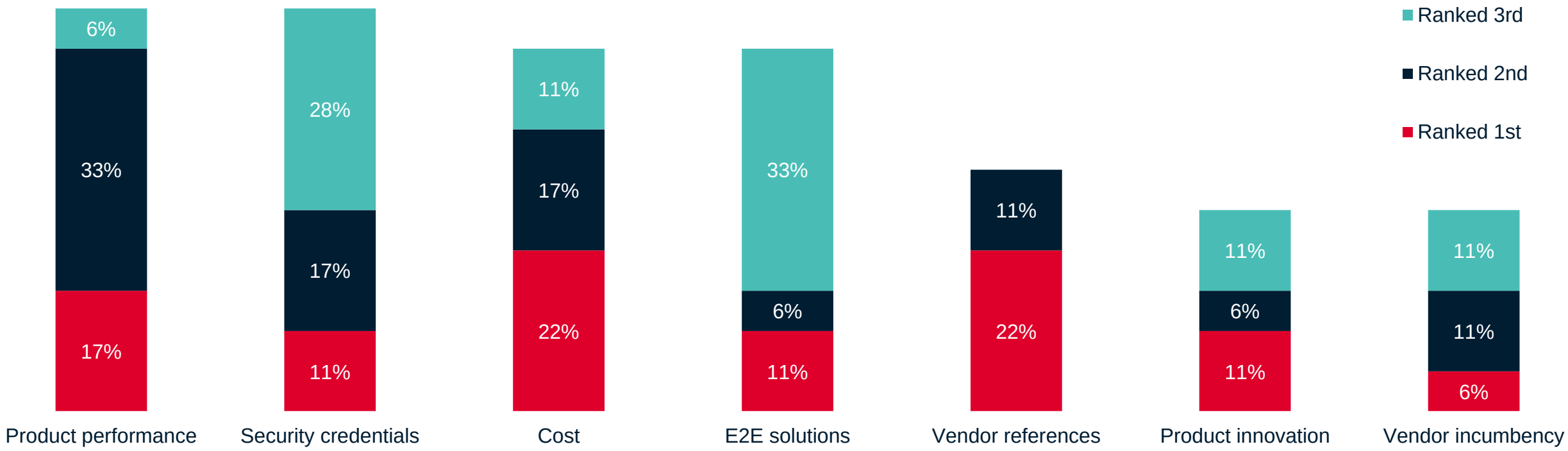
Europe



Network solution priorities

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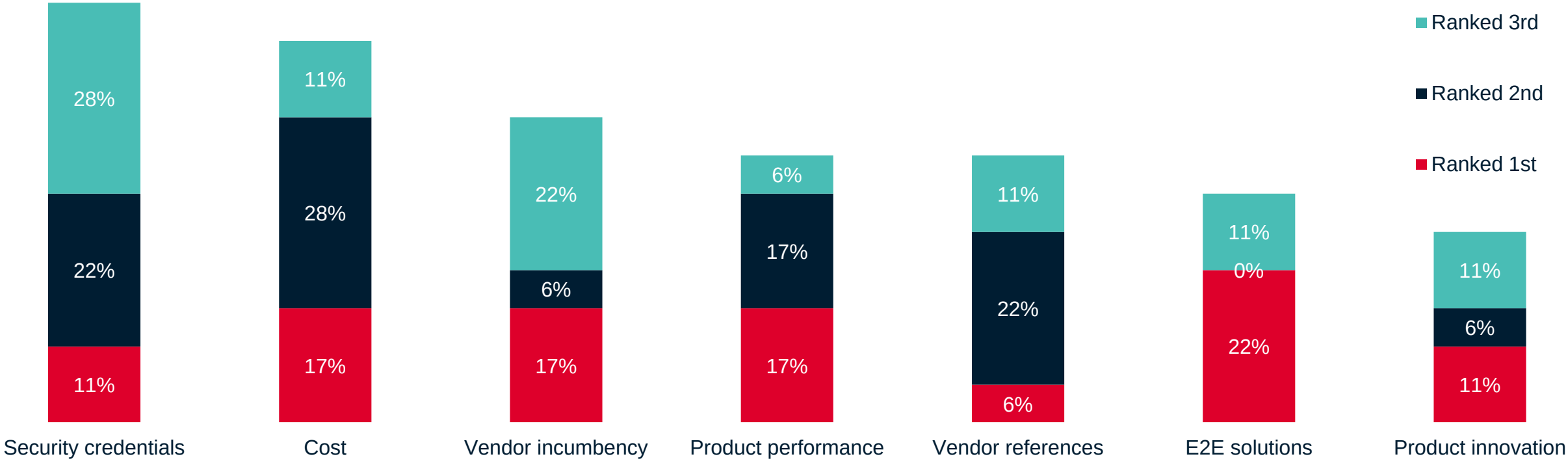
Middle East and Africa



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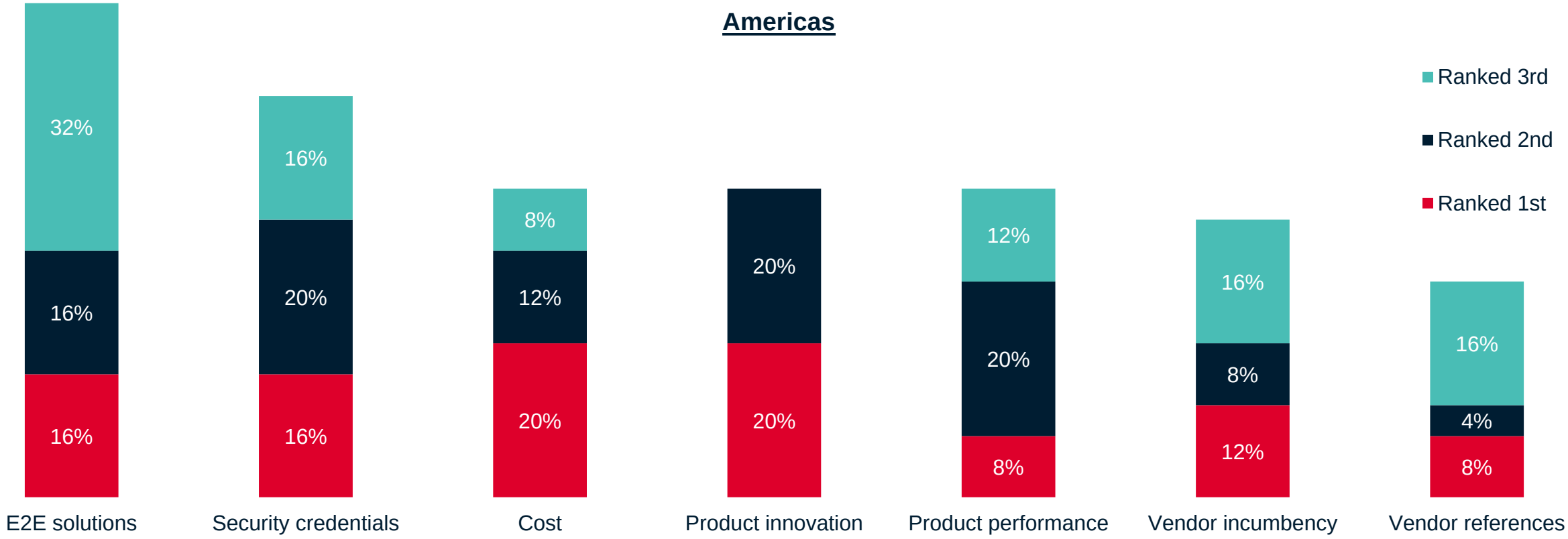
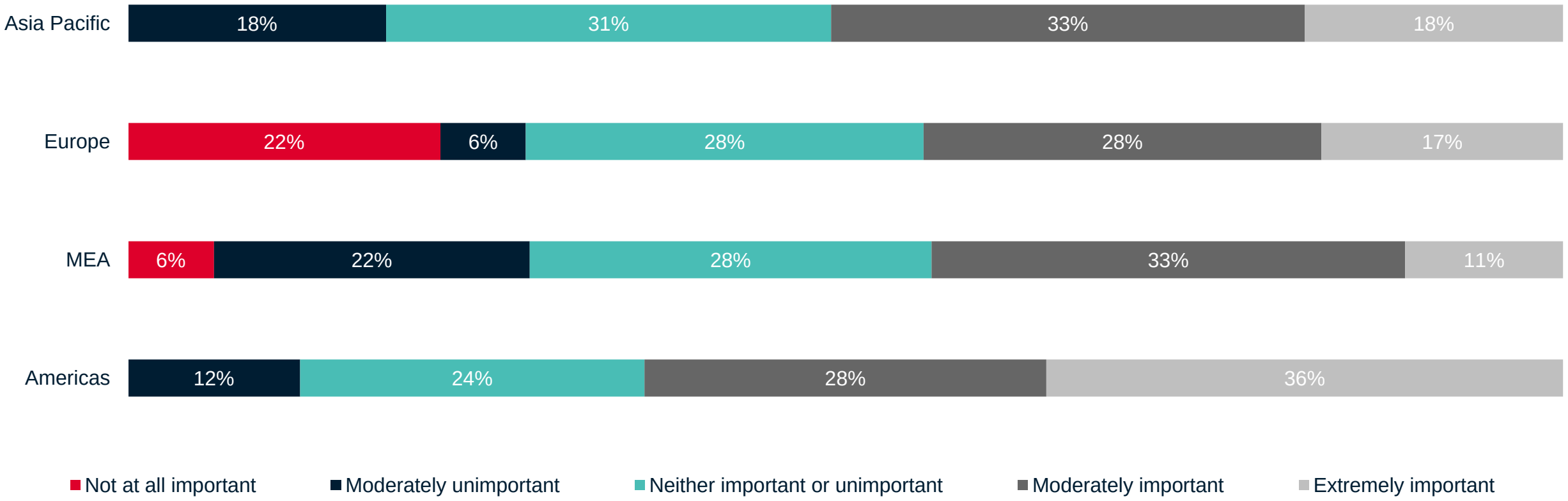


Network priorities: new suppliers

Results by region

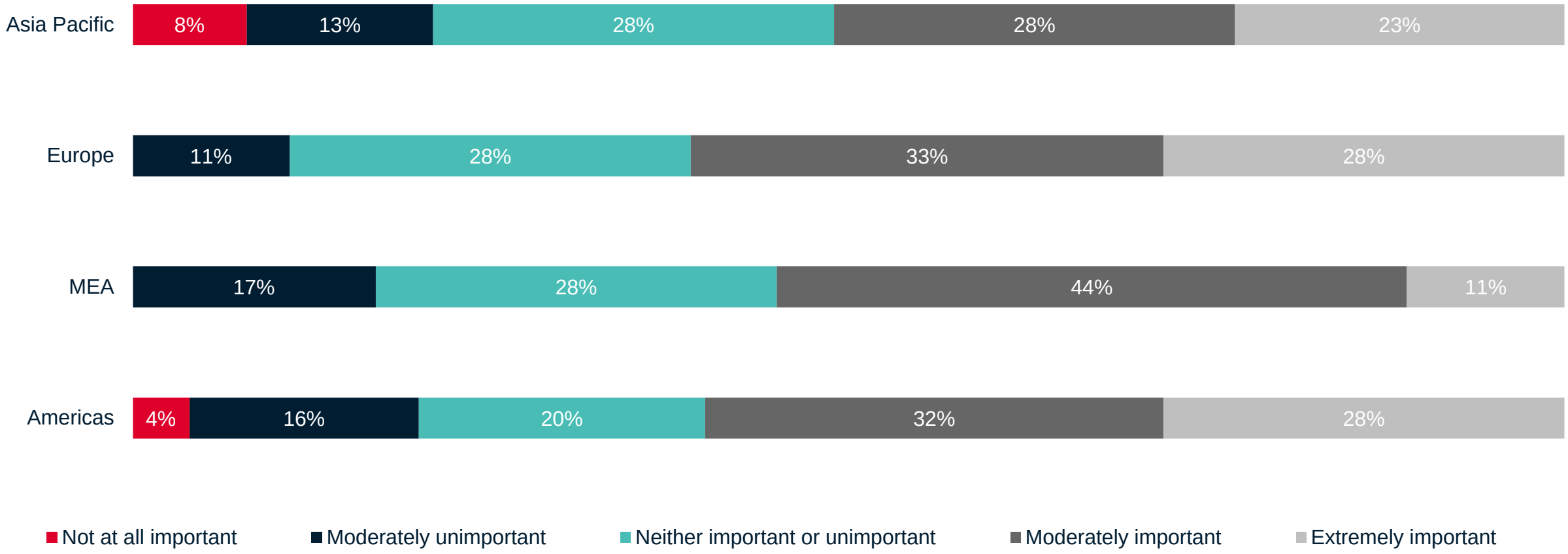
How important is it for you to introduce **new product or technology vendors** (vendors you are not currently working with) into your network?



Network priorities: open networks

Results by region

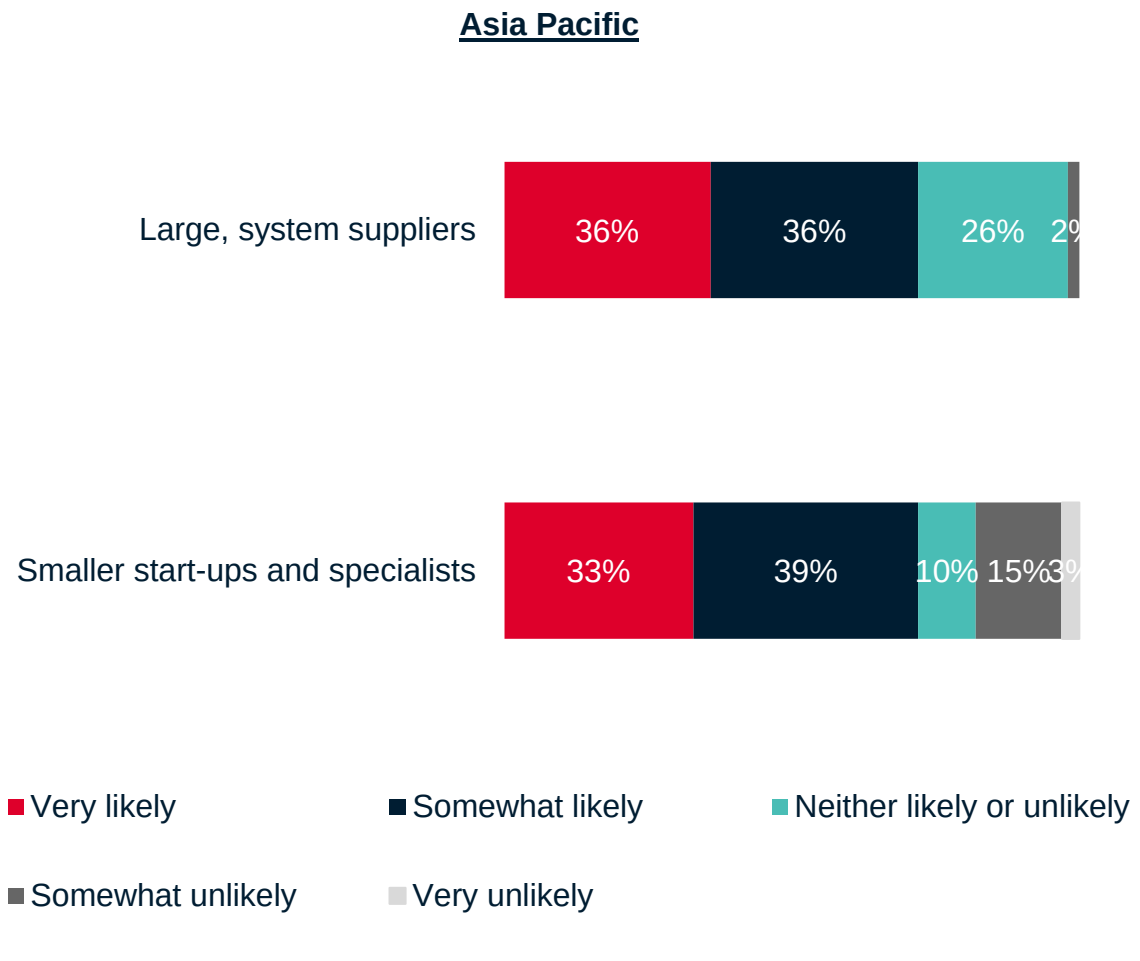
How important is it for you to integrate **open source and open networking** technologies into your network?

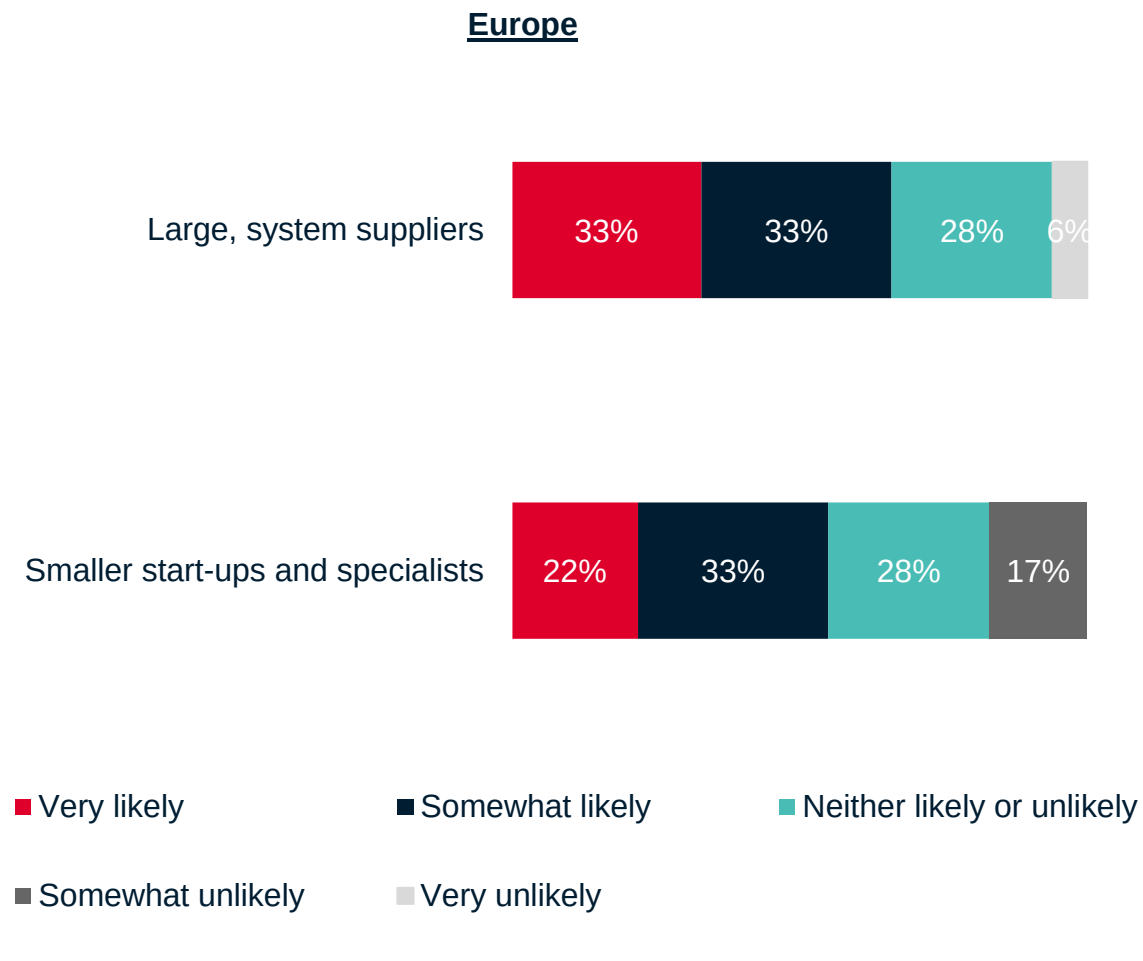


New suppliers: size preference

Results by region

In engaging new network vendors, which types of **vendors and products** are you most likely to introduce into your network?





New suppliers: size preference

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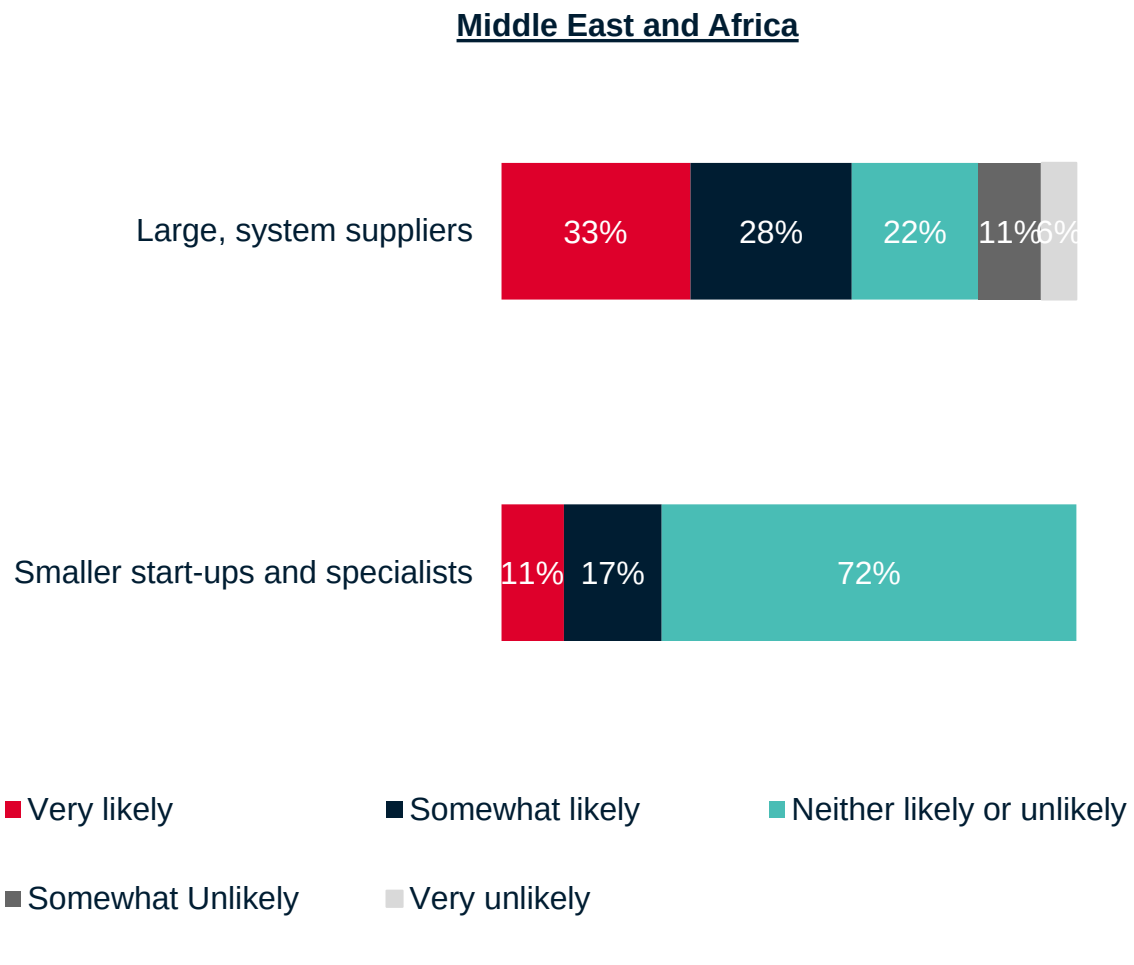
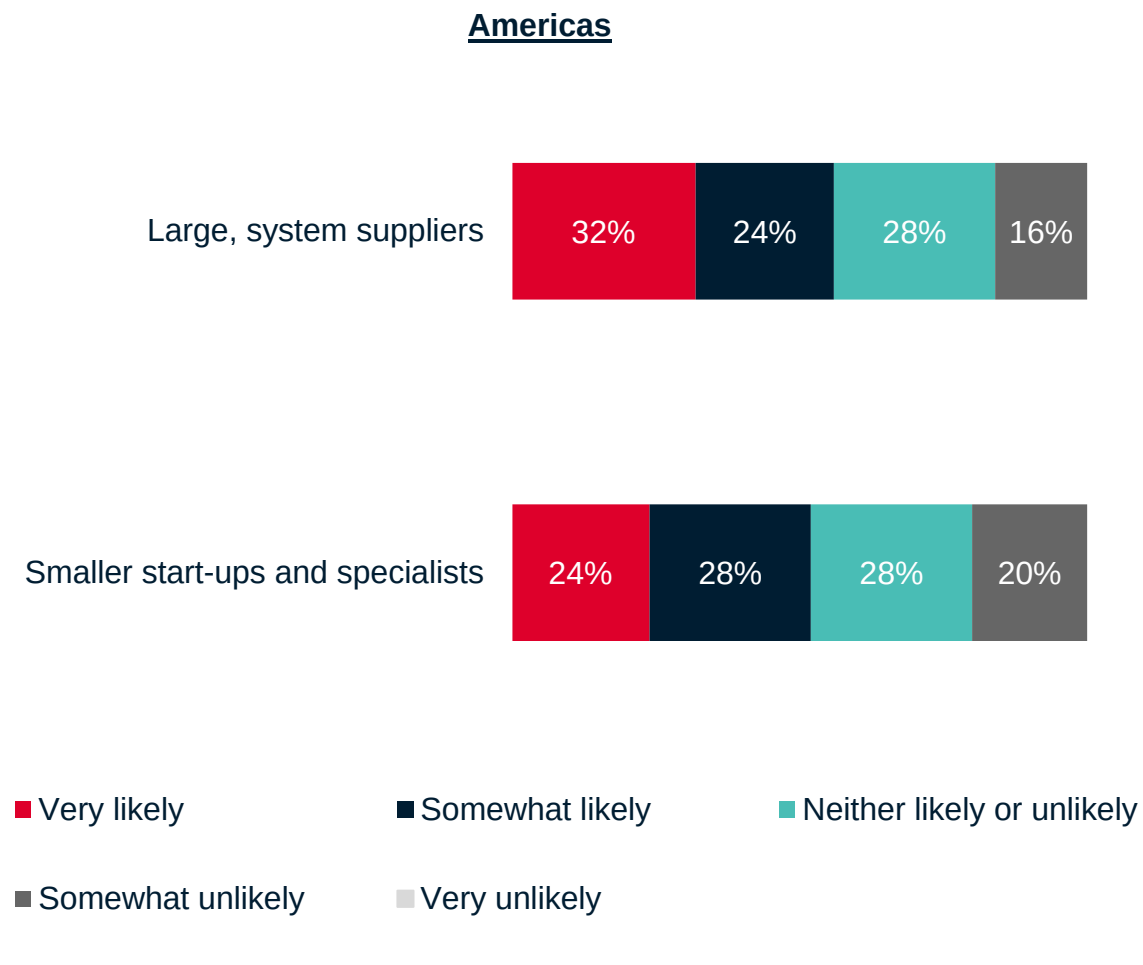
In engaging new network vendors, which types of vendors and products are you most likely to introduce into your network?





New suppliers: product priorities

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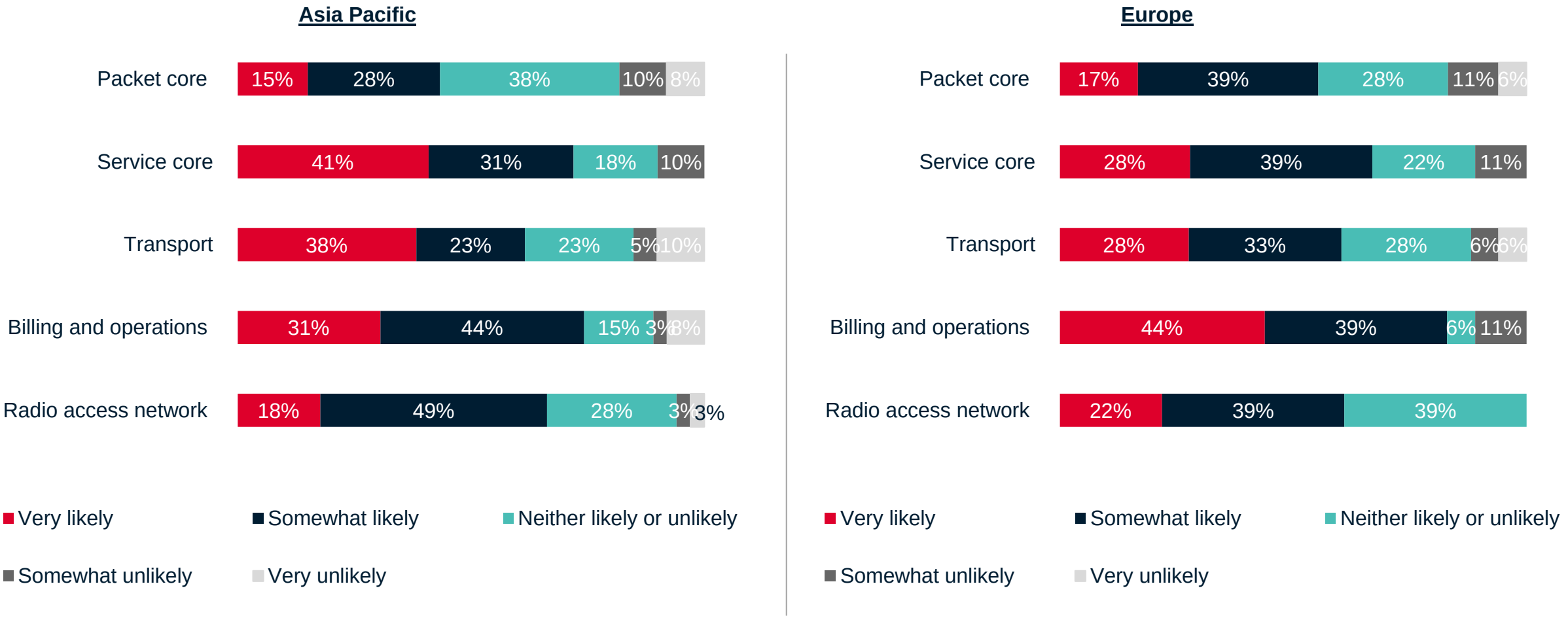

New suppliers: product priorities

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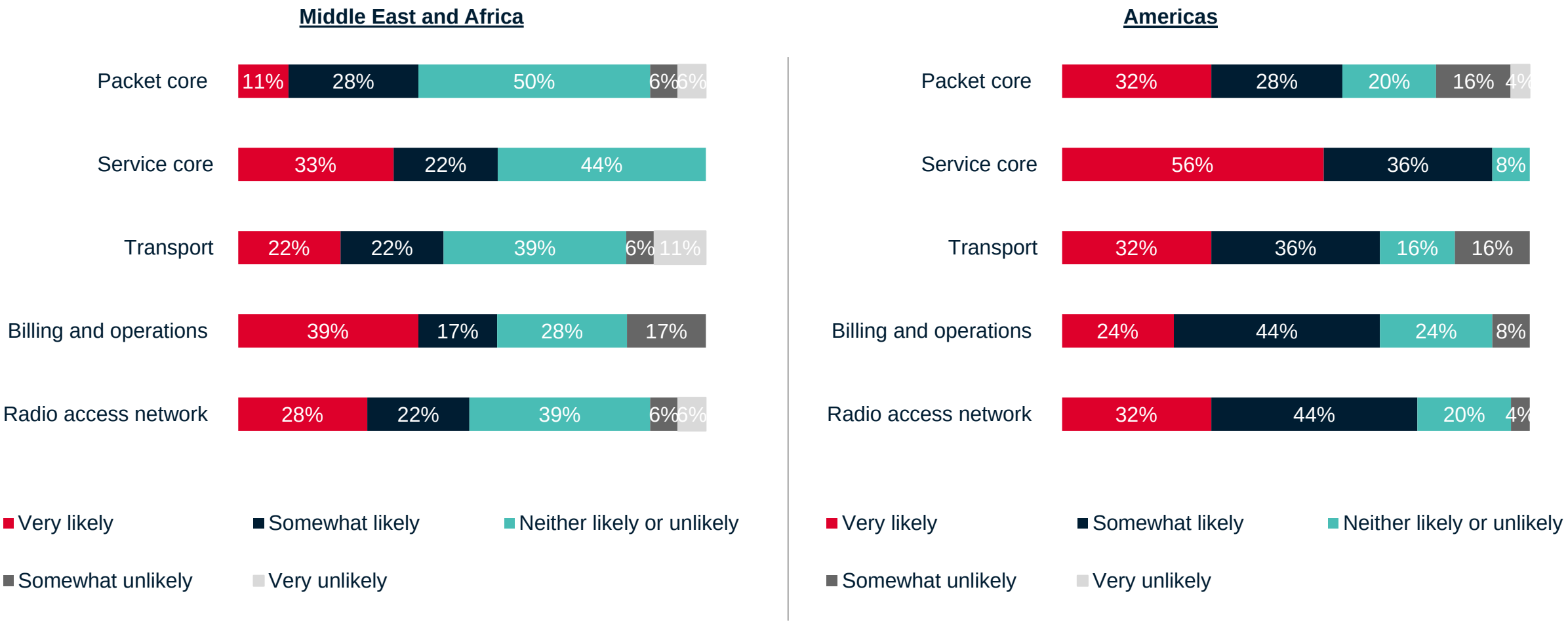
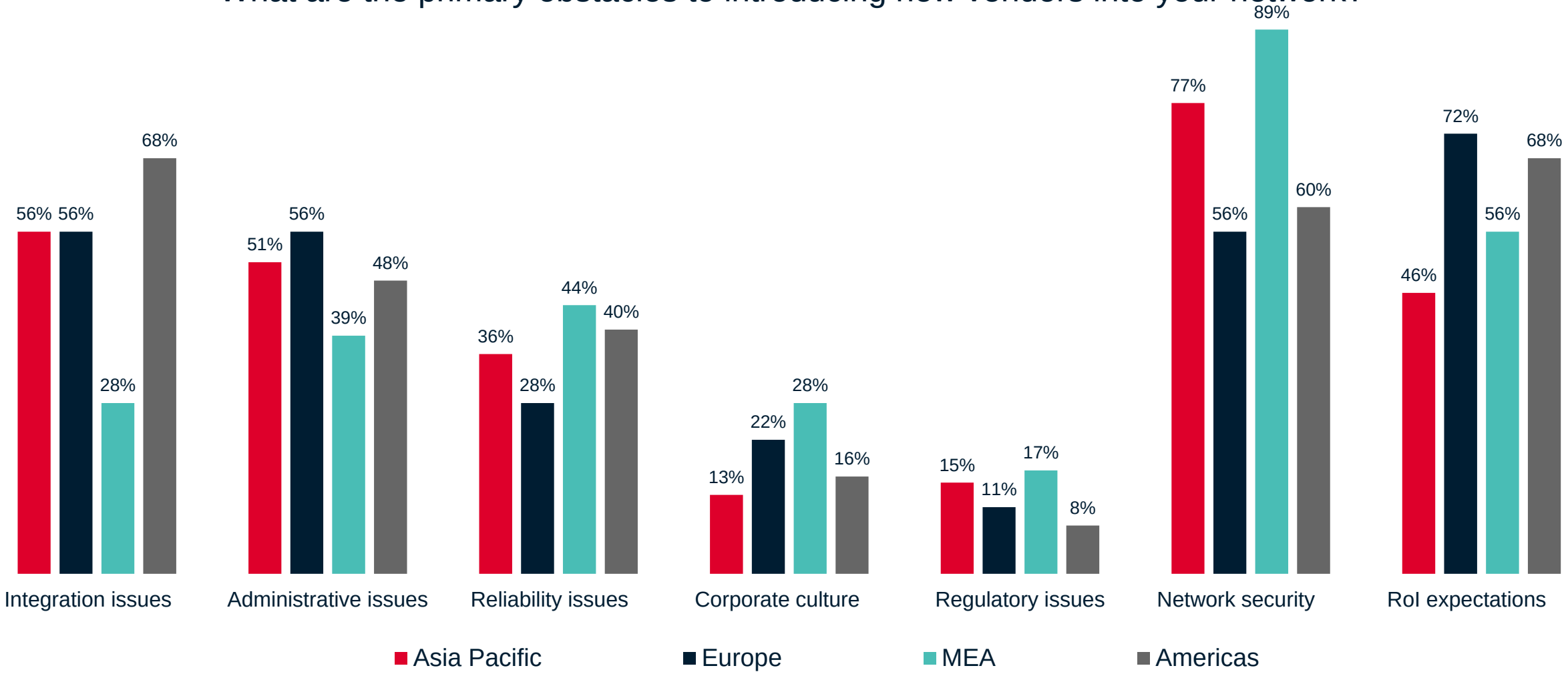


Obstacles: new suppliers

Results by region

What are the primary obstacles to introducing new vendors into your network?



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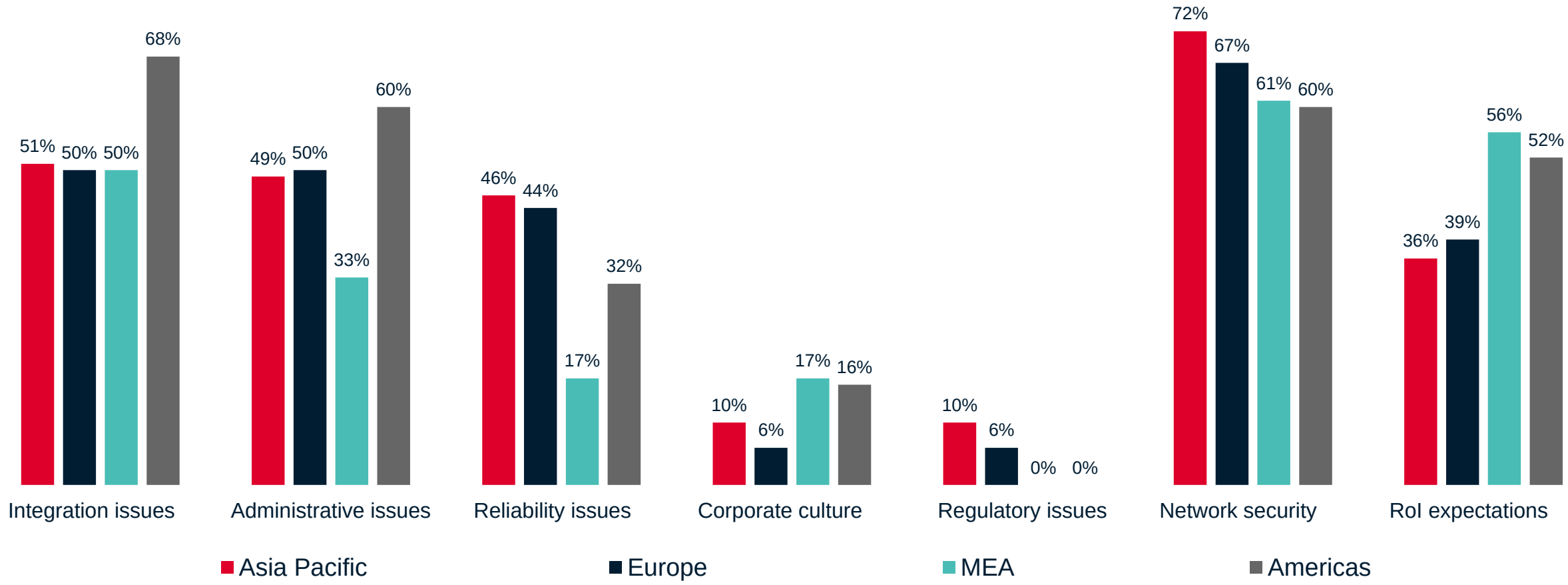
Obstacles: open networking

Results by region

What are the primary obstacles to introducing open source / open networking technologies in your network?



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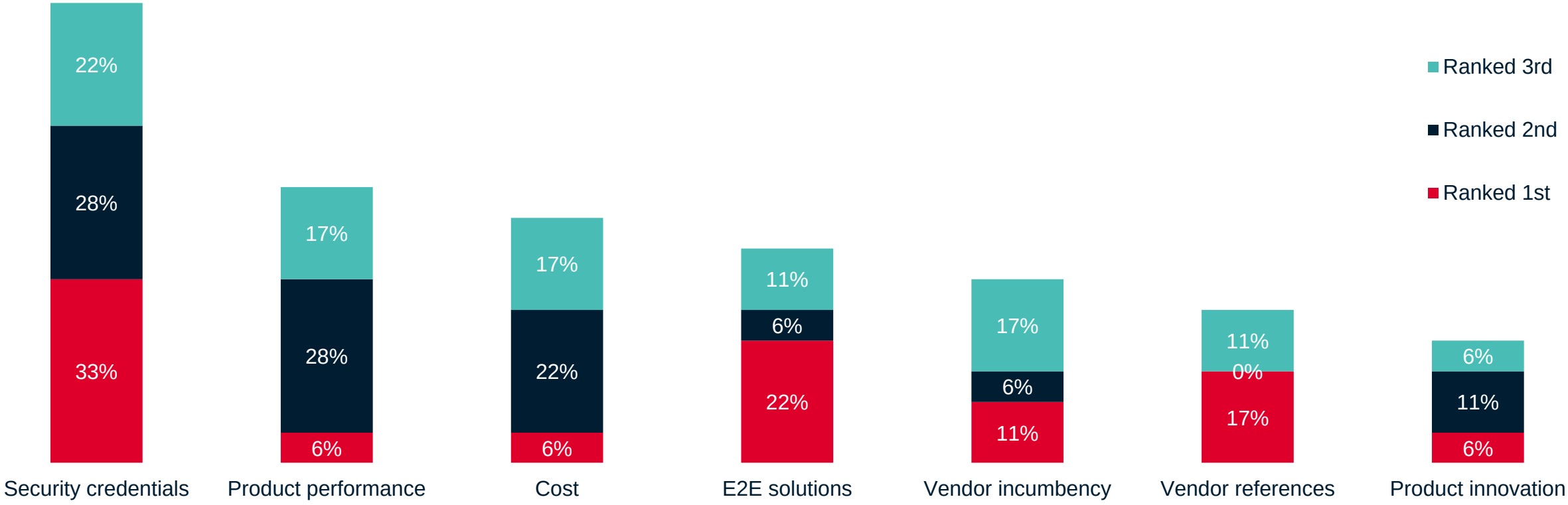
Network solution priorities

Results by operator size (by number of connections)

What are the most important factors in purchasing a given network product or solution?
(Top three choices)

Under 10 million

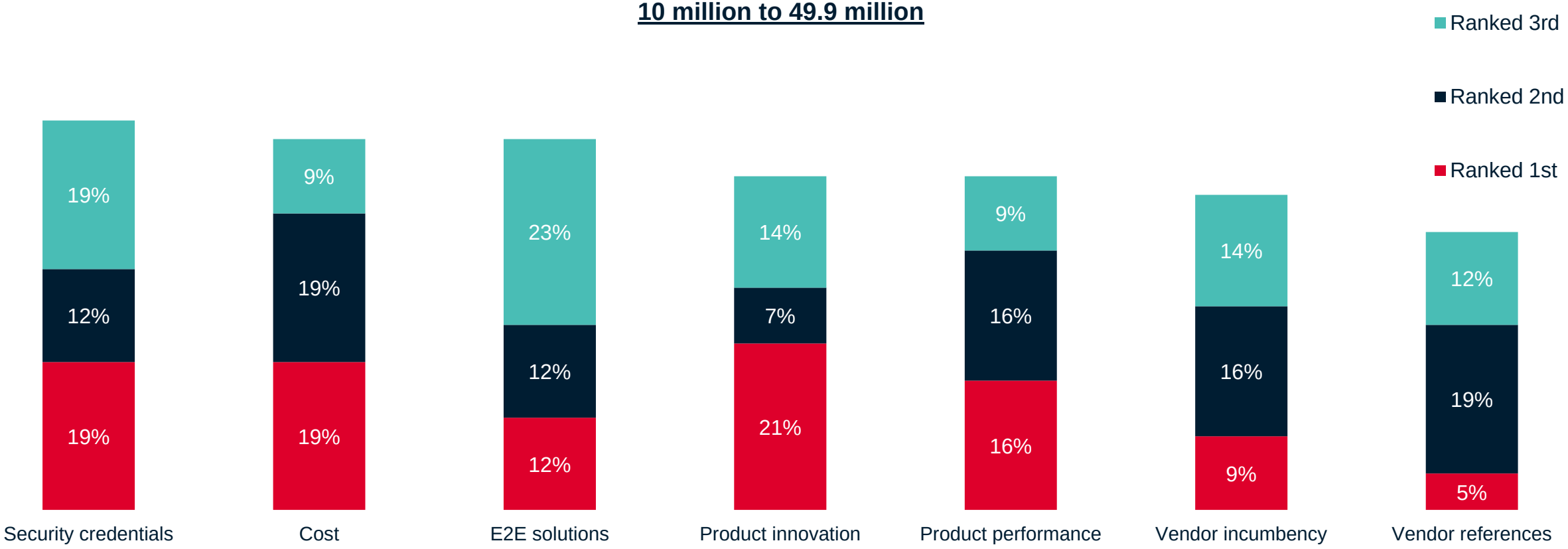


Network solution priorities

Results by operator size (by number of connections)

What are the most important factors in purchasing a given network product or solution?
(Top three choices)

10 million to 49.9 million

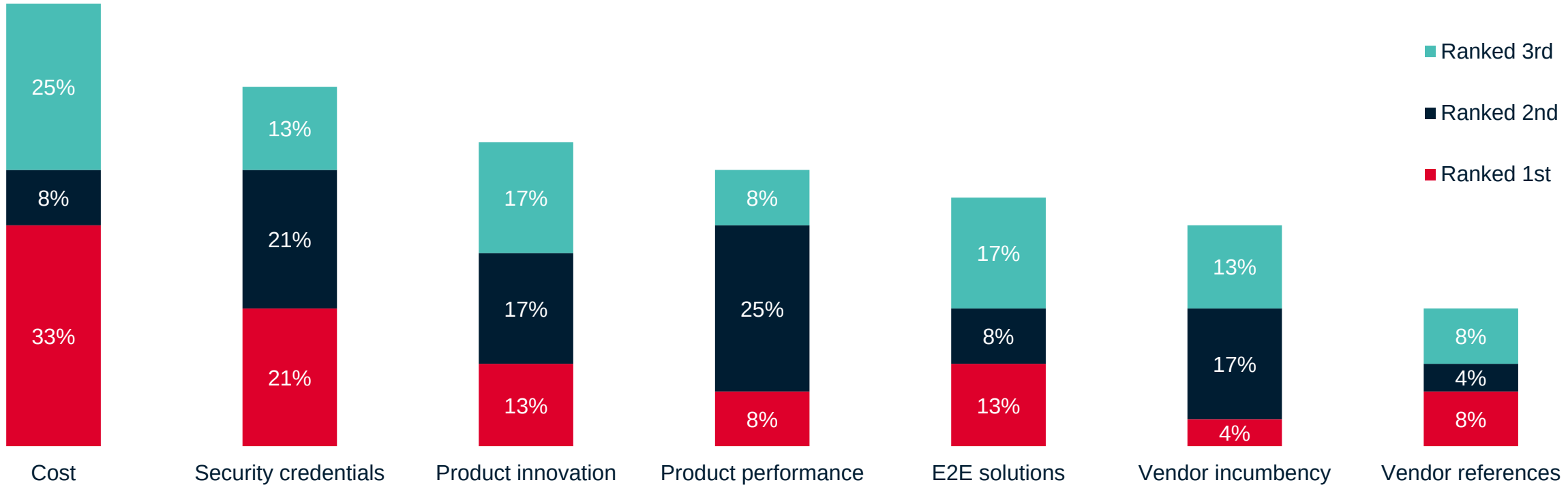


Network solution priorities

Results by operator size (by number of connections)

What are the most important factors in purchasing a given network product or solution?
(Top 3 choices)

50 million to 100 million



Network solution priorities

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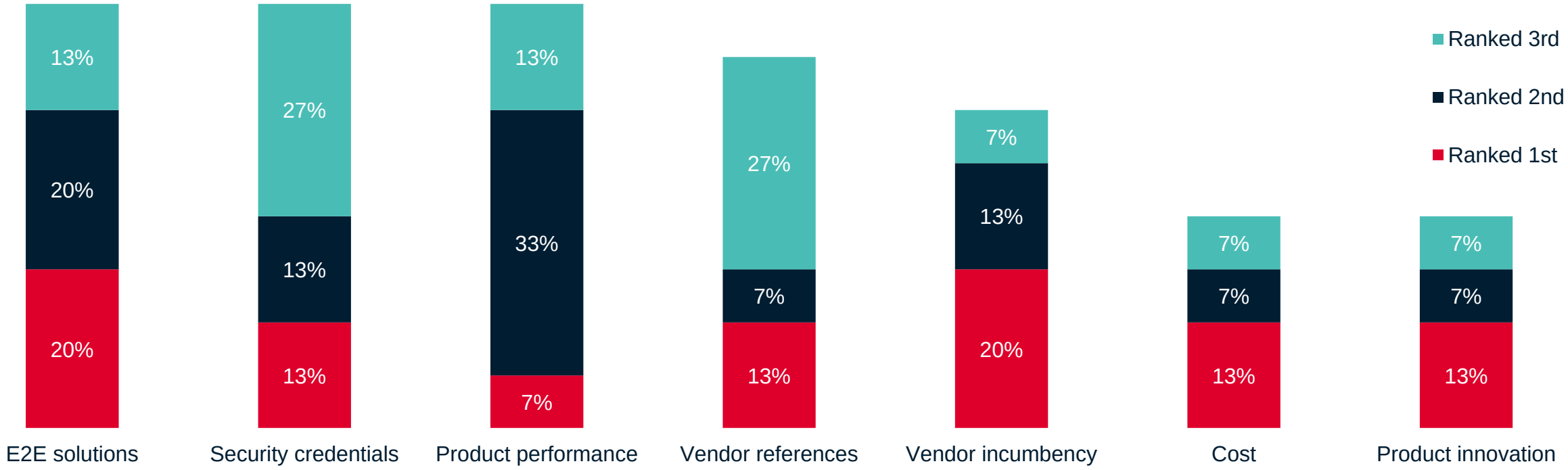
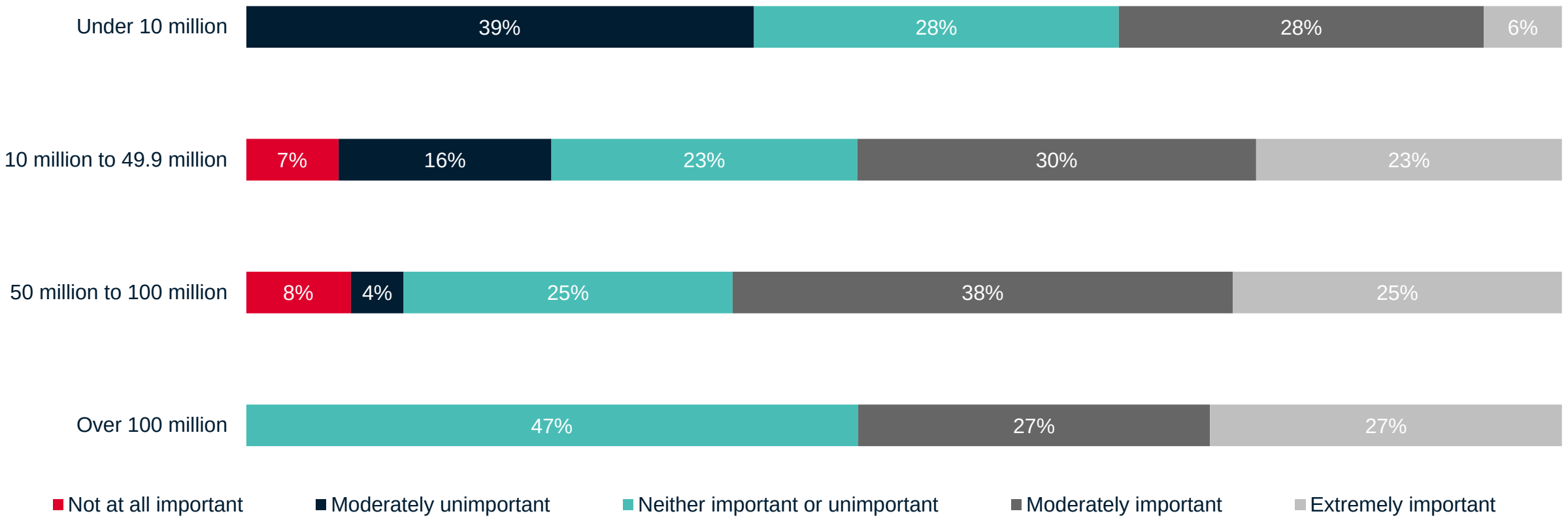


Network priorities: new suppliers

Results by operator size (by number of connections)

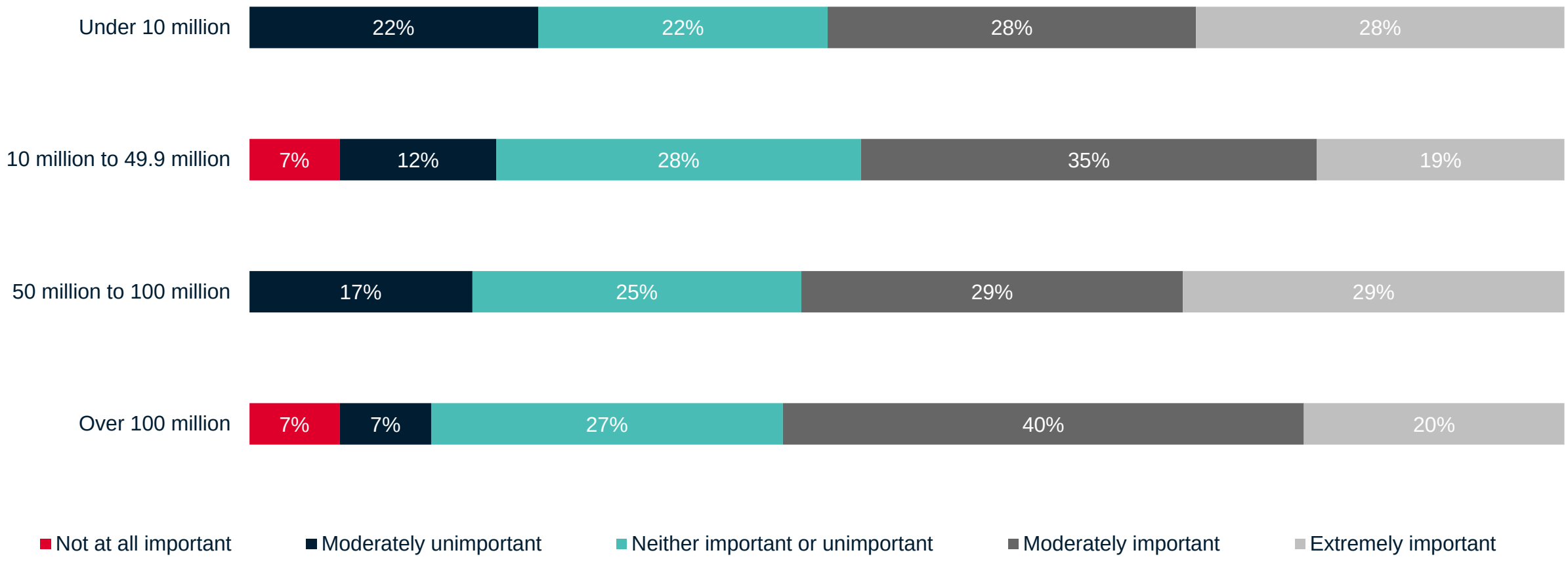
How important is it for you to introduce new **product or technology vendors** (vendors you are not currently working with) into your network?



Network priorities: open networks

Results by operator size (by number of connections)

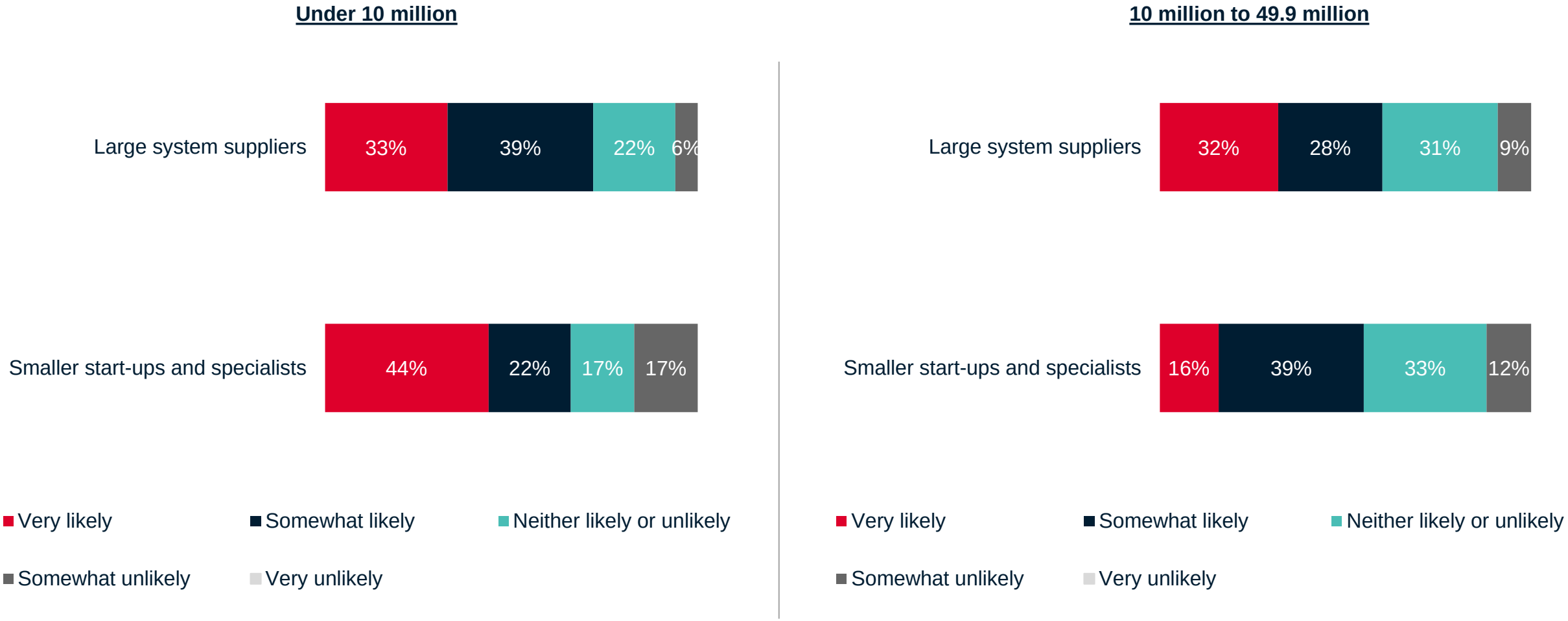
How important is it for you to integrate **open source and open networking technologies** into your network?



New suppliers: size preference

Results by operator size (by number of connections)

In engaging new network vendors, which types of vendors and products are you most likely to introduce into your network?



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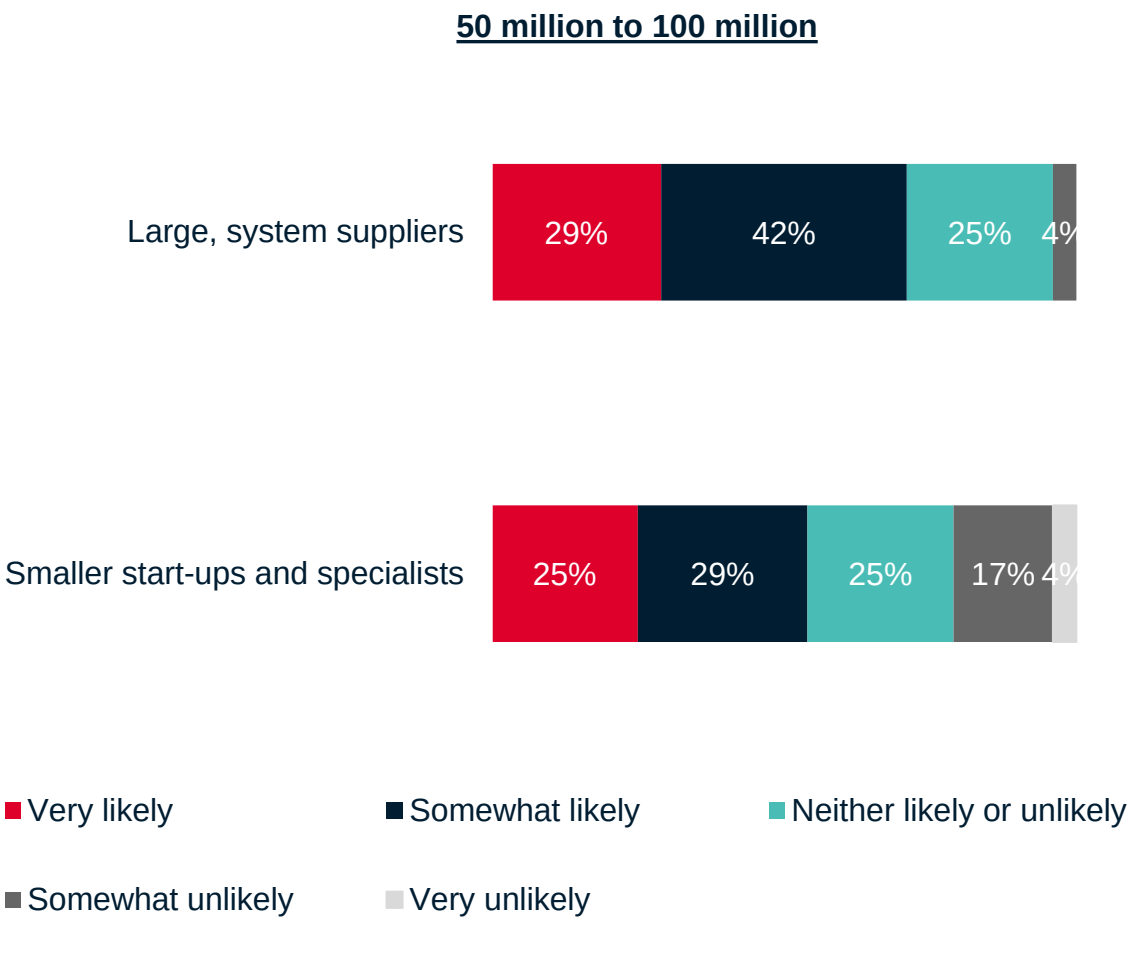

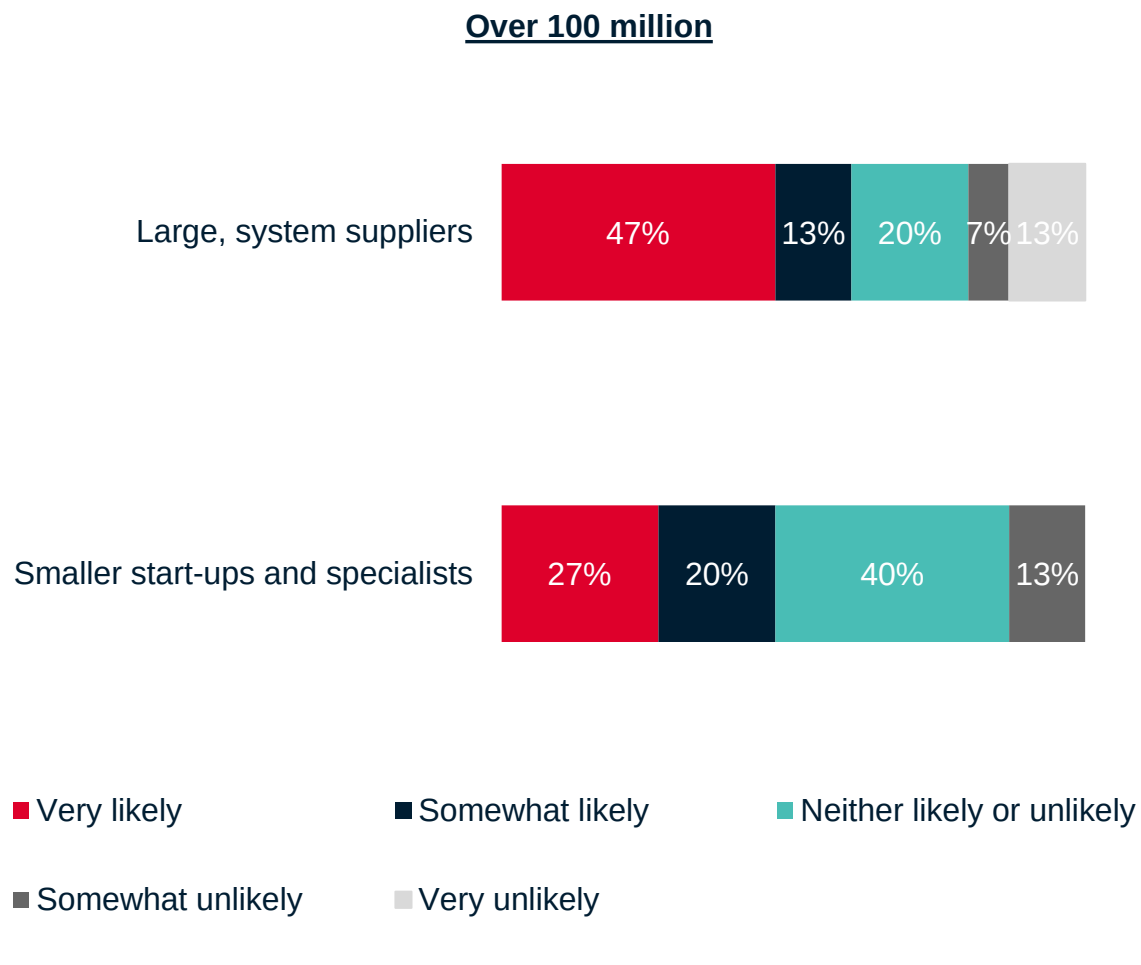

New suppliers: product priorities

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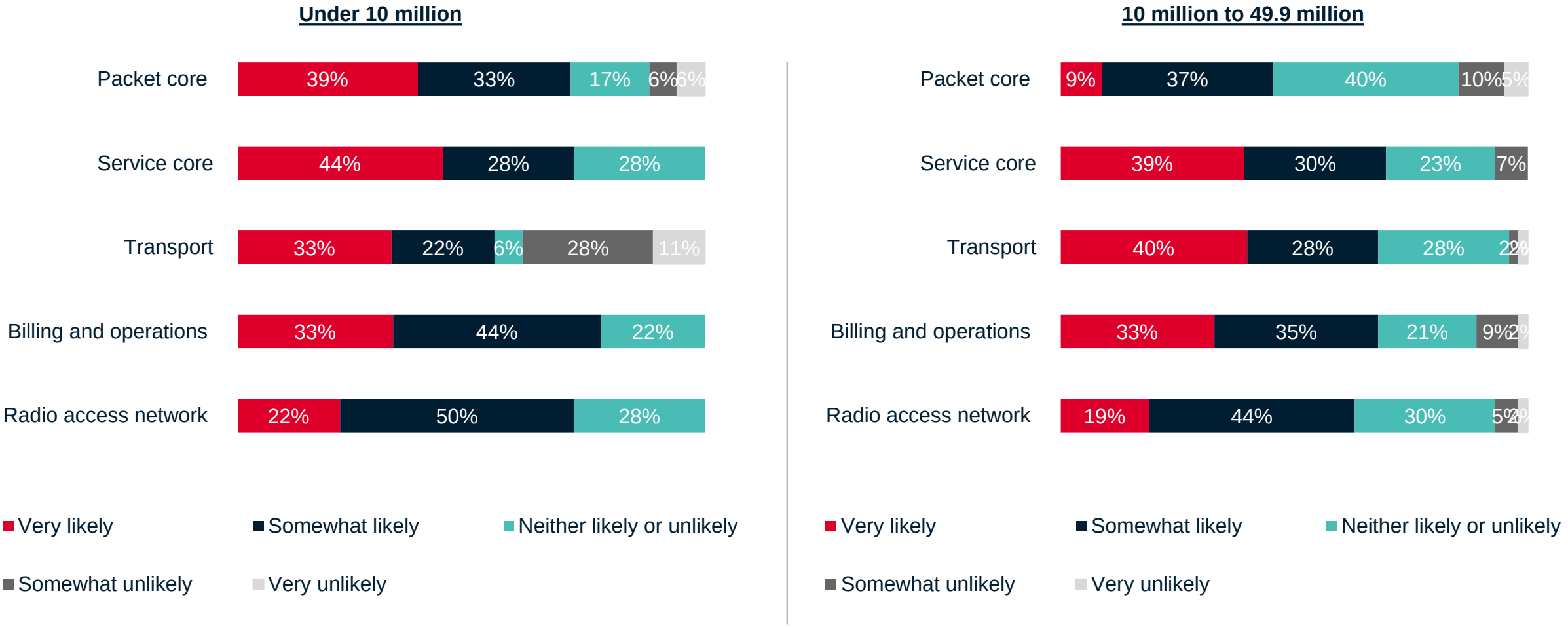

New suppliers: product priorities

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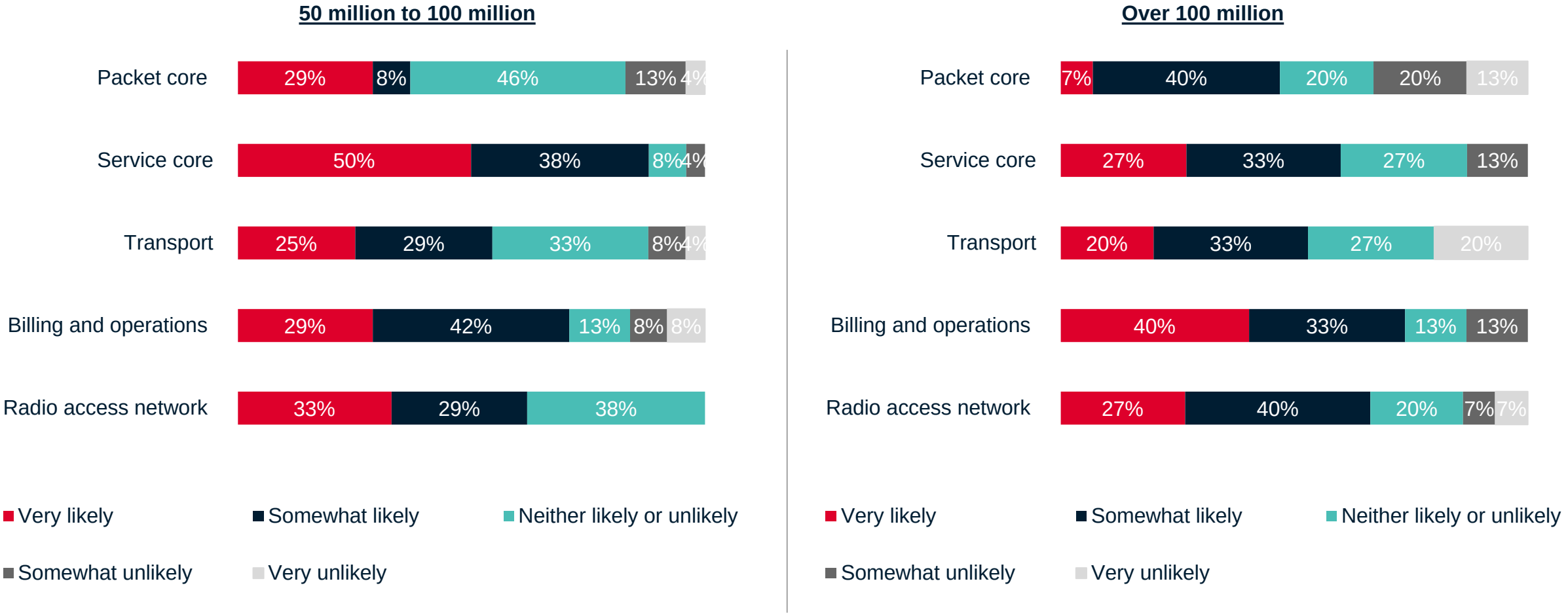
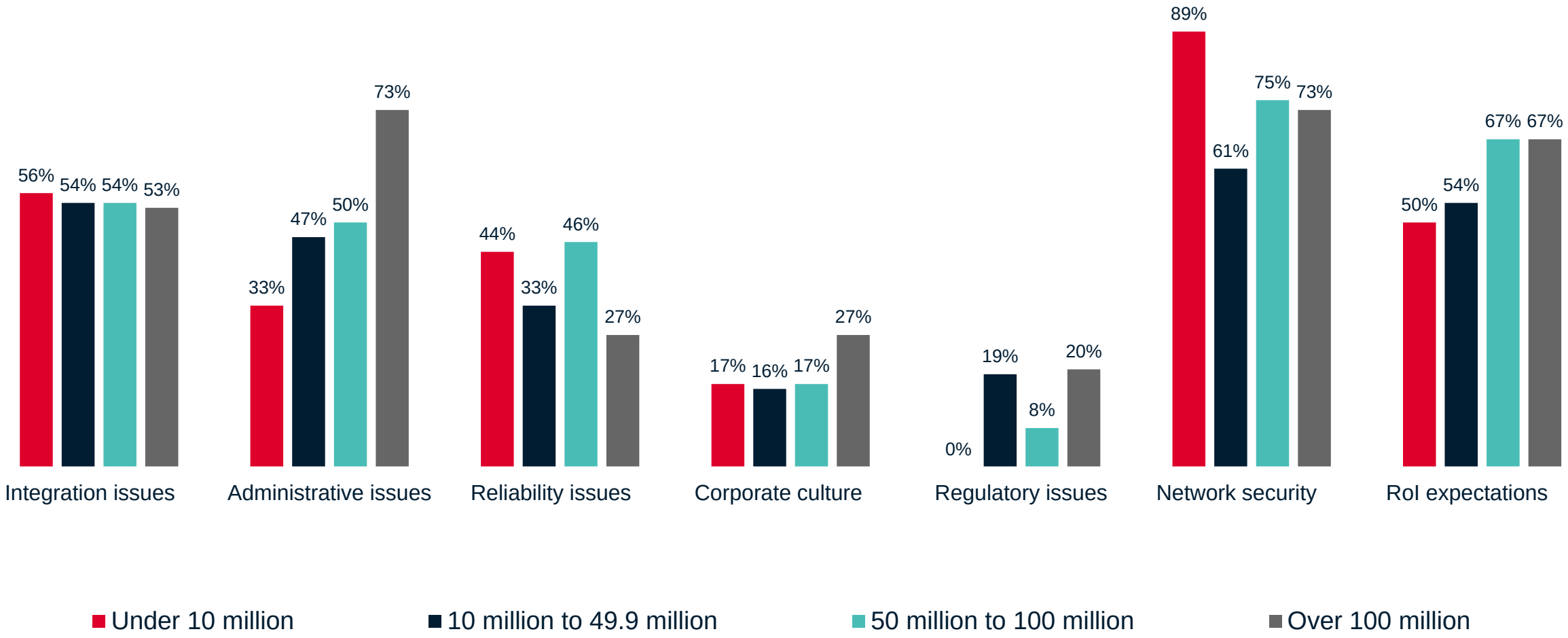


Obstacles: new suppliers

Results by operator size (by number of connections)

What are the primary obstacles to introducing new vendors into your network?

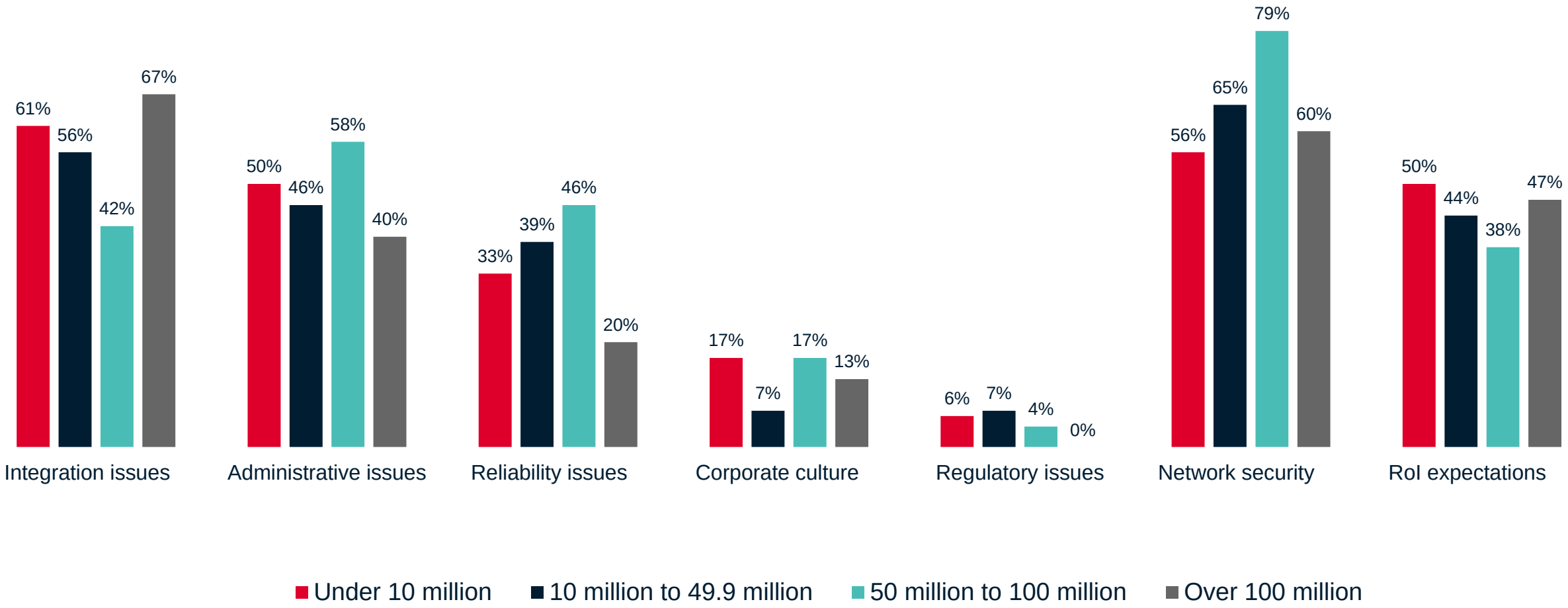


Multiple responses accepted; chart total adds up to more than 100%

Obstacles: open networking

Results by operator size (by number of connections)

What are the primary obstacles to introducing open source or open networking technologies into your network?



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GSMA Intelligence

Survey details

Sample sizes

Segment	Sample size
Total	100
Region	
Asia Pacific	39
Europe	18
Middle East and Africa	18
Americas	25
Organisation size (by connections)	
Fewer than 10 million	18
10 million to 49.9 million	43
50 million to 99.9 million	24
Over 100 million	15

GSMA Intelligence

In numbers: 5G network strategies and concerns

20% A fifth of operators see in-building coverage as their top RAN priority, suggesting a keen enterprise focus.

69% More than two thirds of operators failed to claim spectrum refarming as a top three RAN priority, despite highlighting spectrum scarcity.

71% Most operators plan to start 5G deployment in non-standalone mode. However, more than 70% plan standalone launches in three years.

57% More than half of operators think they are likely to introduce new vendors into their 5G network deployments.

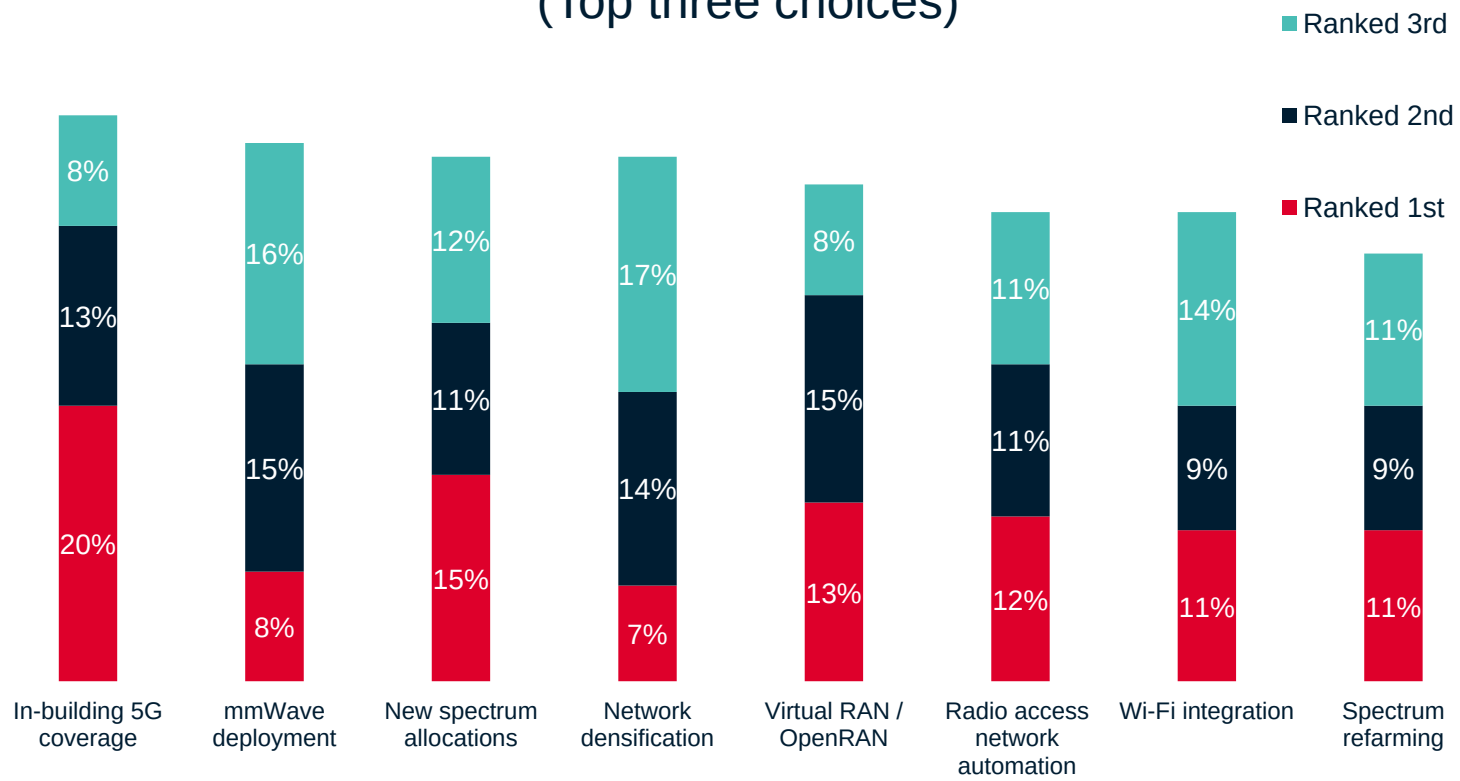
6% Only a small minority think they are very unlikely to use 5G to introduce new vendors.

26% More than a quarter of operators ranked infrastructure costs as the no.1 barrier to increased 5G spend – more than any other barrier.

5G RAN investment priorities

Supporting new customers and network architectures

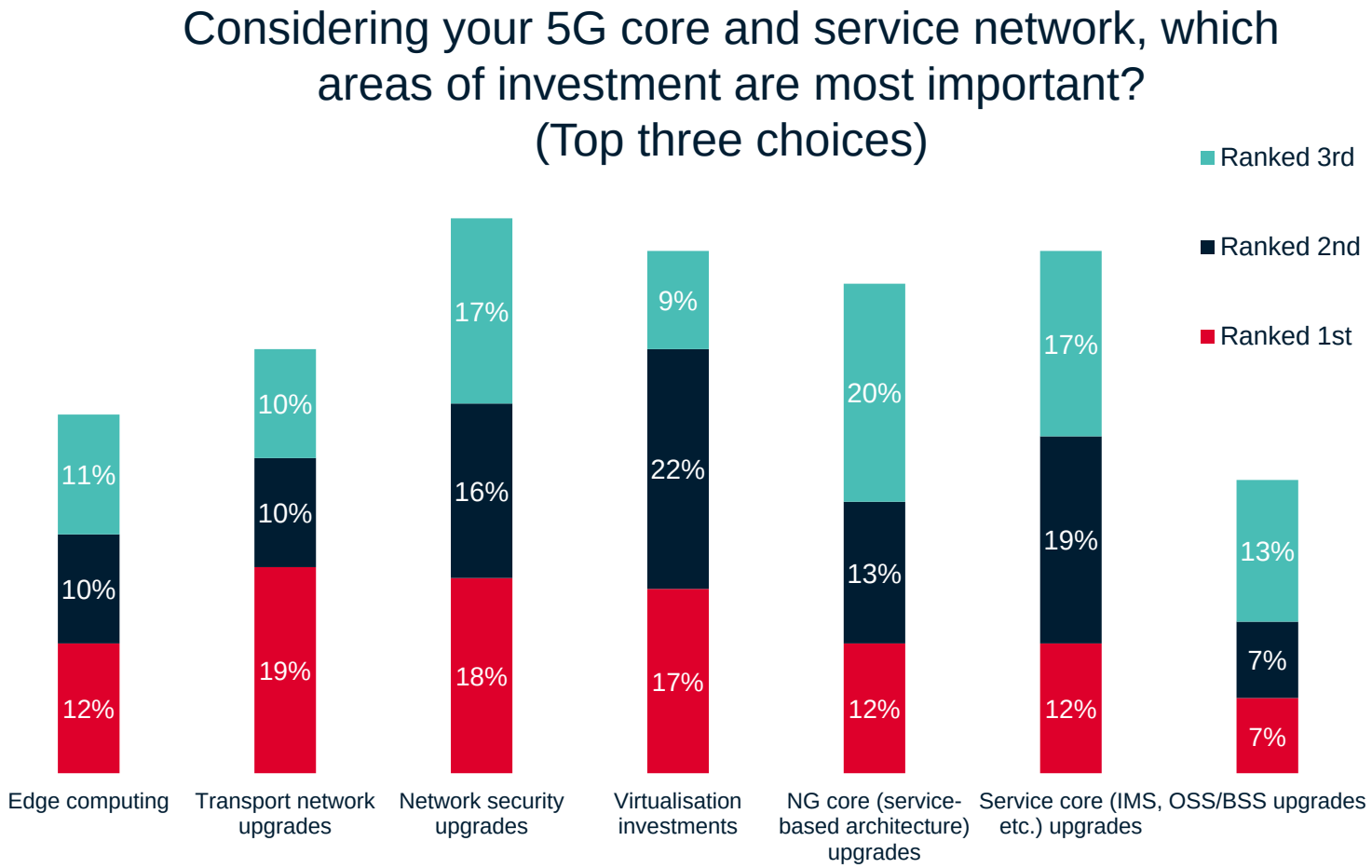
Considering your 5G radio access network, which areas of investment are most important? (Top three choices)



- **In-building = enterprise.** Indoor 5G may not be critical to all consumer use cases but will be key for enterprises – a top 5G priority.
- **vRAN = IT transformation**. A focus on vRAN for 5G tracks well with IT transformation priorities; in order to manage and deploy virtual RAN assets, IT transformation is a must.
- **mmWave and small cells.** Densification is a given to deliver 5G coverage and capacity. But the need to deliver broad coverage early on likely dictates mmWave and small cell investment thinking.
- **New versus old spectrum.** The relatively low importance of spectrum refarming may seem at odds with the advanced state of (and future plans for) 2G/3G sunsets.

5G core investment priorities

Core supports the RAN with backhaul and virtualisation

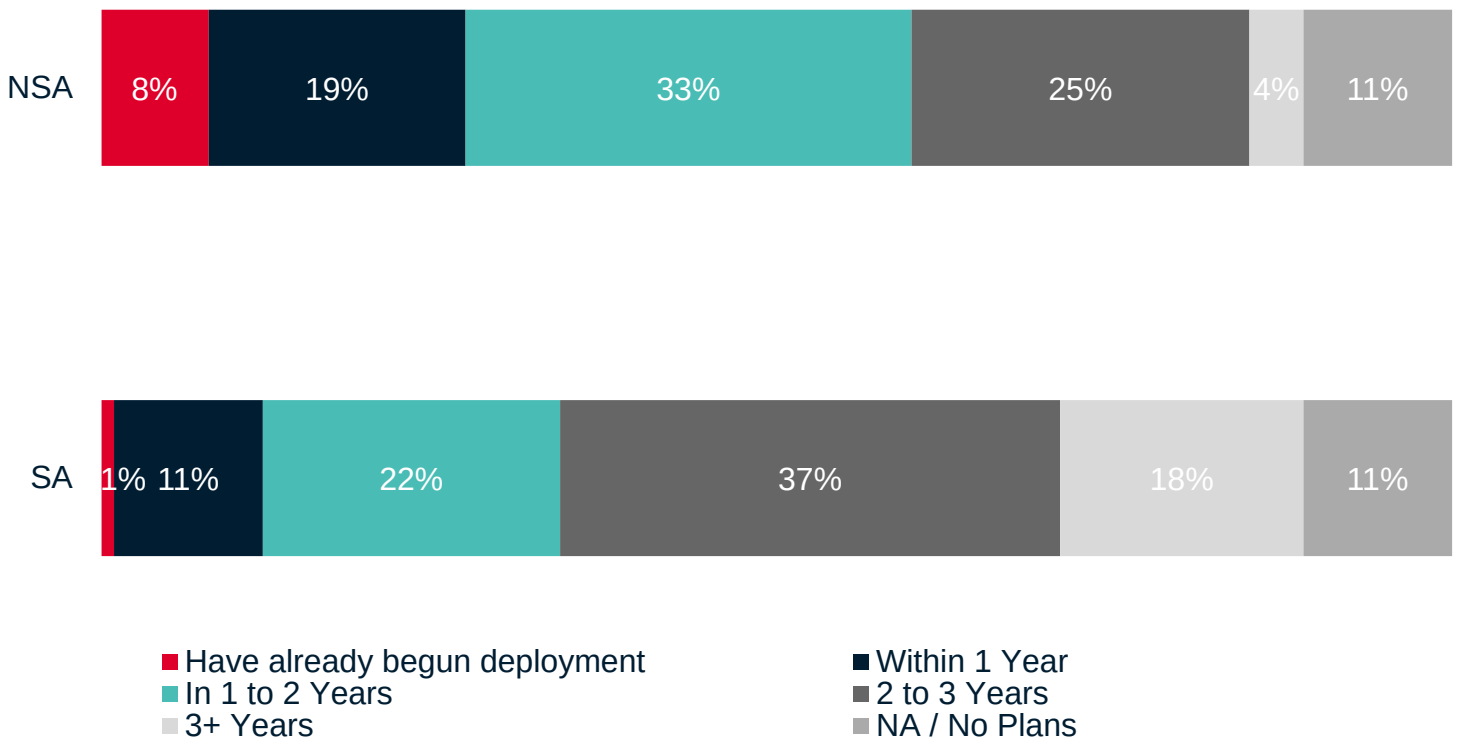


- **Security, again**. An overall strategic and vendor selection priority, network security was bound to be seen as important to 5G core investments.
- **IT transformation, again**. As with the RAN and overall network strategies, IT transformation (virtualisation investment) is a theme in the 5G core.
- **OSS/BSS oversight?** For today's services, existing OSS/BSS assets should suffice. Tackling new services and customers with 5G may require it to be a greater priority.
- **Marginal spread**. In the core (and RAN), the ranking differences across investment priorities are generally small; in the early days of 5G, all may be seen as important until deployments shed light on priorities.

Standalone versus non-standalone

Standalone coming soon

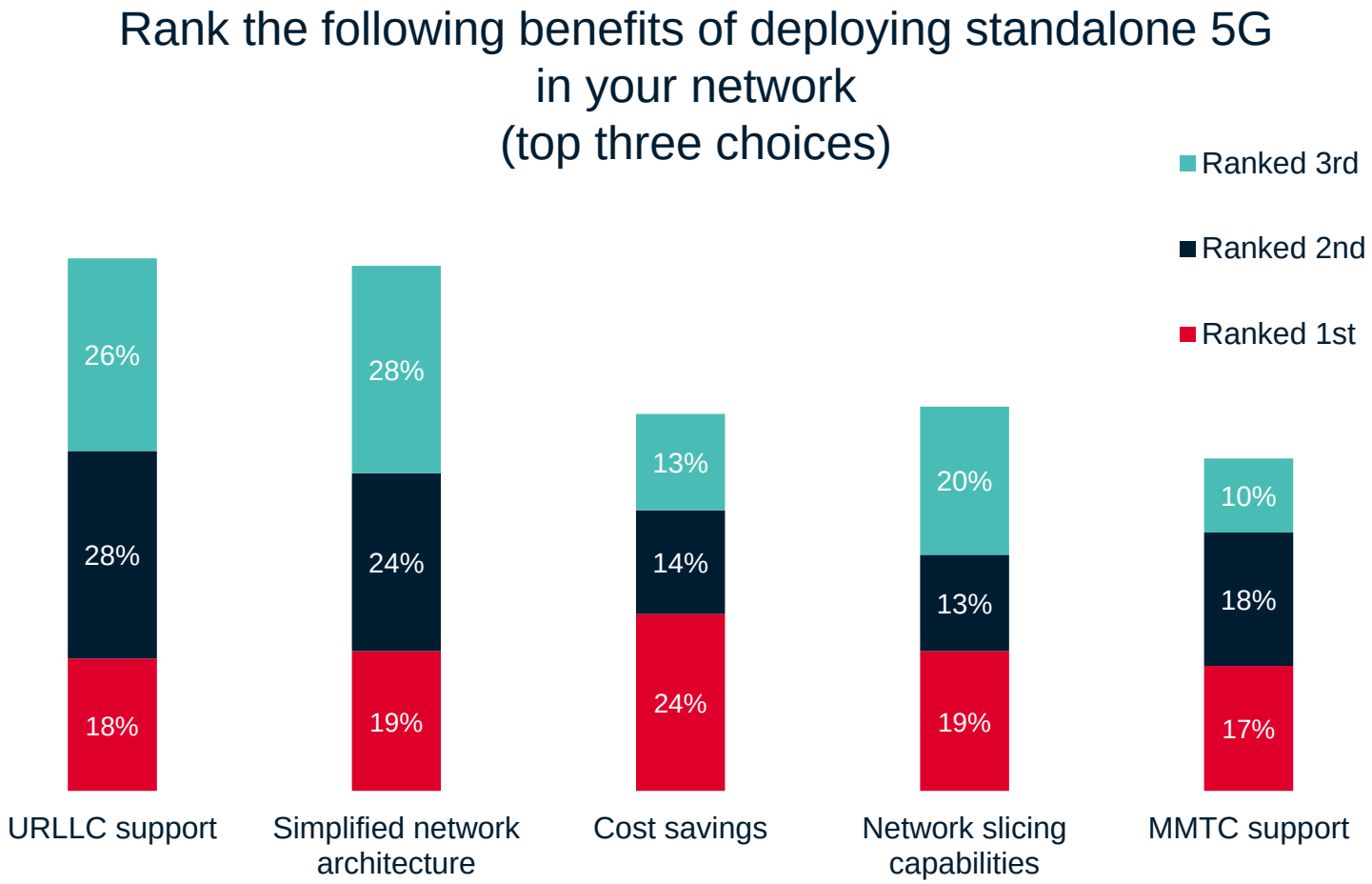
Considering your 5G network assets and strategy, when do you plan standalone versus non-standalone 5G? (Top three choices)



- **Non-standalone leads**. Initial 5G deployment has been in standalone mode; operators surveyed suggest this will continue to be the case.
- **Standalone close behind**. Of operators with plans, 80% plan to deploy standalone 5G within three years, with the greatest set of deployments planned in two to three years.
- **Definition of deployment?** Standalone plans may be aggressive but deployments could span small regions or even venues – likely the case for enterprise use cases.
- **Regional standalone ambitions.** Within the next two years, more than 50% of operators in Latin America and Europe expect to launch standalone. Asia Pacific lags, which is surprising given the advanced state of 5G there.

Standalone 5G benefits

Saving money over making money?

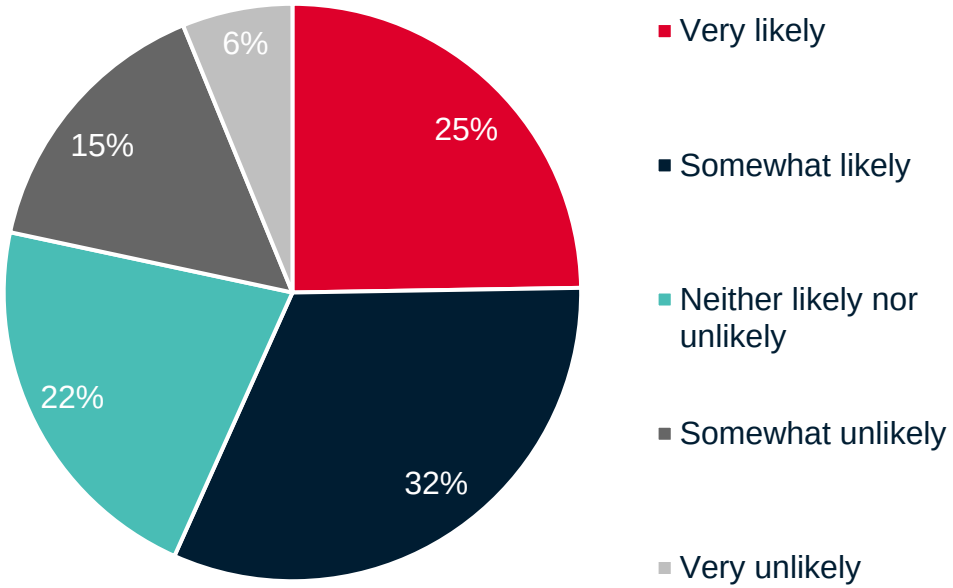


- **Costs dominate**. Standalone 5G is often linked to new use cases. Regardless, operators see cost efficiency as most important (high ranking for cost savings and focus on simplified architecture).
- **Saving money versus making money**. A focus on costs versus new use cases conflicts with the larger network transformation priorities highlighted.
- **IoT and new revenues**. While not the no.1 benefit, MMTC support is clearly distanced from the remaining benefits and feeds into operator priorities around revenue generation.
- **Long-term thinking.** We are still in the early days of 5G, much less standalone 5G. Operators may understandably be confused about its benefits.

5G and new network suppliers

New technologies usher in opportunity

How likely are you to use 5G to introduce new vendors into your network?

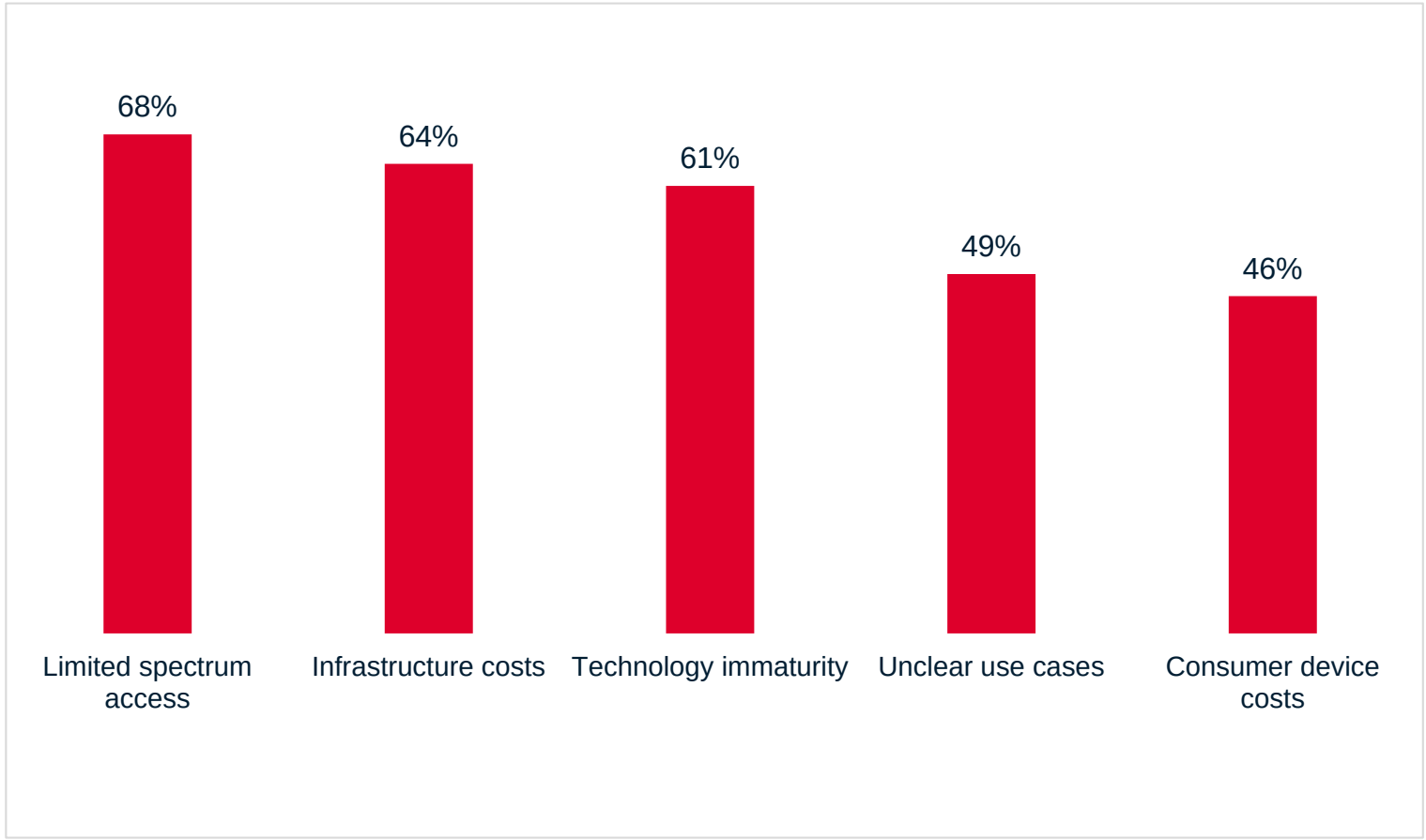


- **New vendors win**. Well over half of operators think it likely that they will leverage new vendors (those they have not worked with) in their 5G deployments. Only about 20% think it is unlikely.
- **Incumbents versus start-ups**. While tempting to see this as a boon to start-ups, new suppliers could include larger vendors – particularly as IT transformation efforts proceed.
- **Replacement or incremental.** Whether small or large, working with new vendors will not necessarily come at the expense of existing ones, particularly where new capabilities (such as IT assets) are needed.
- **Small is big**. Some 75% of small operators are likely to introduce new vendors, with only 6% thinking it not likely.

5G network investment barriers

Spectrum: the lifeblood of mobile services

What is the greatest barrier to increasing your planned network investment in 5G?



- **Spectrum above all**. While marginally leading, a focus on spectrum underscores the perceived scarcity of 5G-suitable radio waves.
- **Spectrum confusion?** If spectrum access is a barrier to 5G, we would expect refarming and even Wi-Fi integration to be greater priorities, suggesting confusion or a marketing opportunity for vendors.
- **Industry versus structural barriers**. Compared with spectrum access, cost and technology maturity concerns are barriers driven by the industry and should resolve themselves over time.
- **Devices versus use cases.** While trailing other responses, nearly half of operators see use cases and device costs 5G barriers – not insignificant.

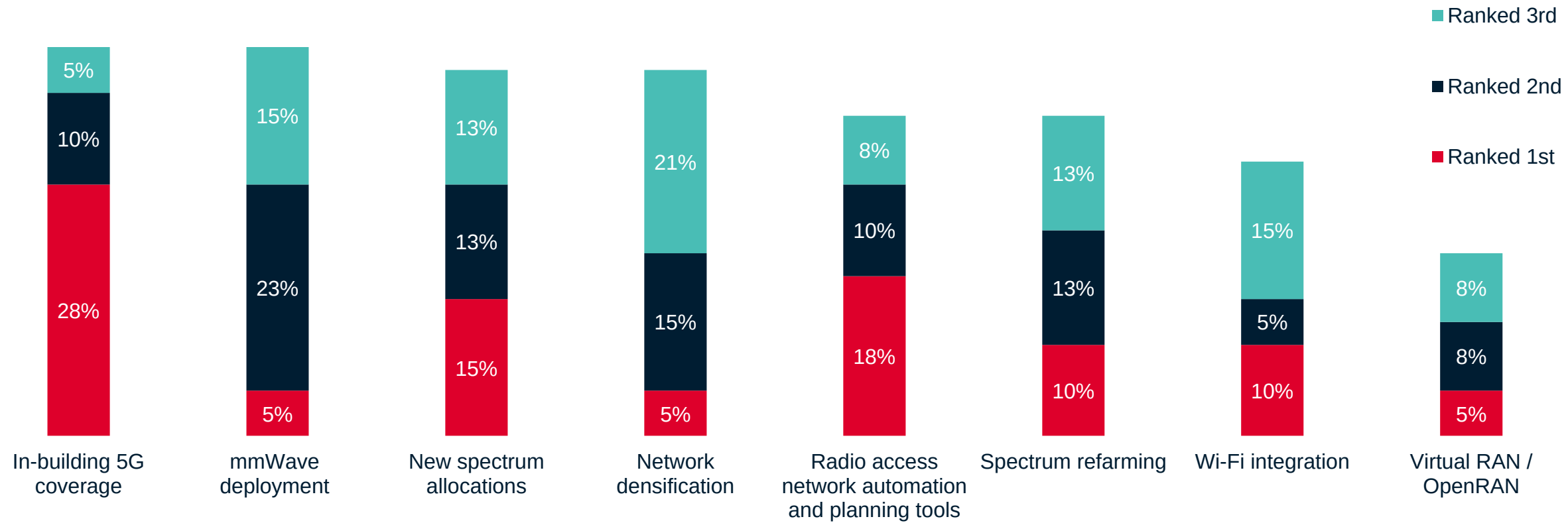
Multiple responses accepted; chart total adds up to more than 100%

5G RAN investment priorities

Results by region

Considering your 5G radio access network, which areas of investment are most important? (Top three choices)

Asia Pacific



5G RAN investment priorities

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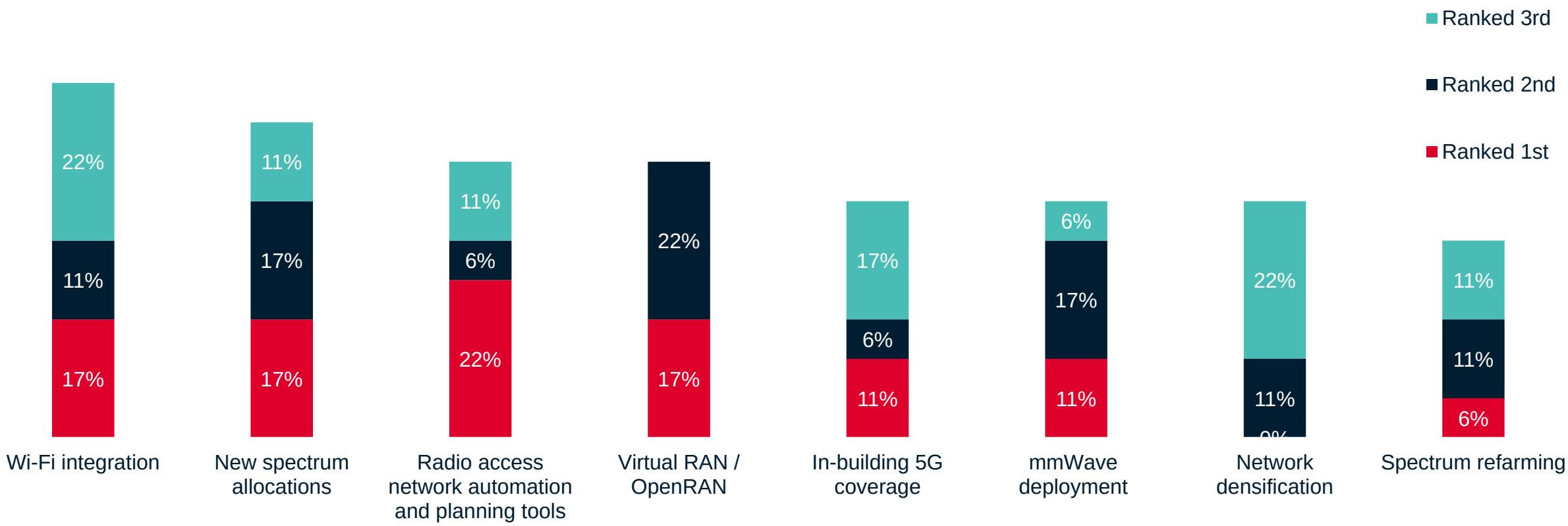
Europe



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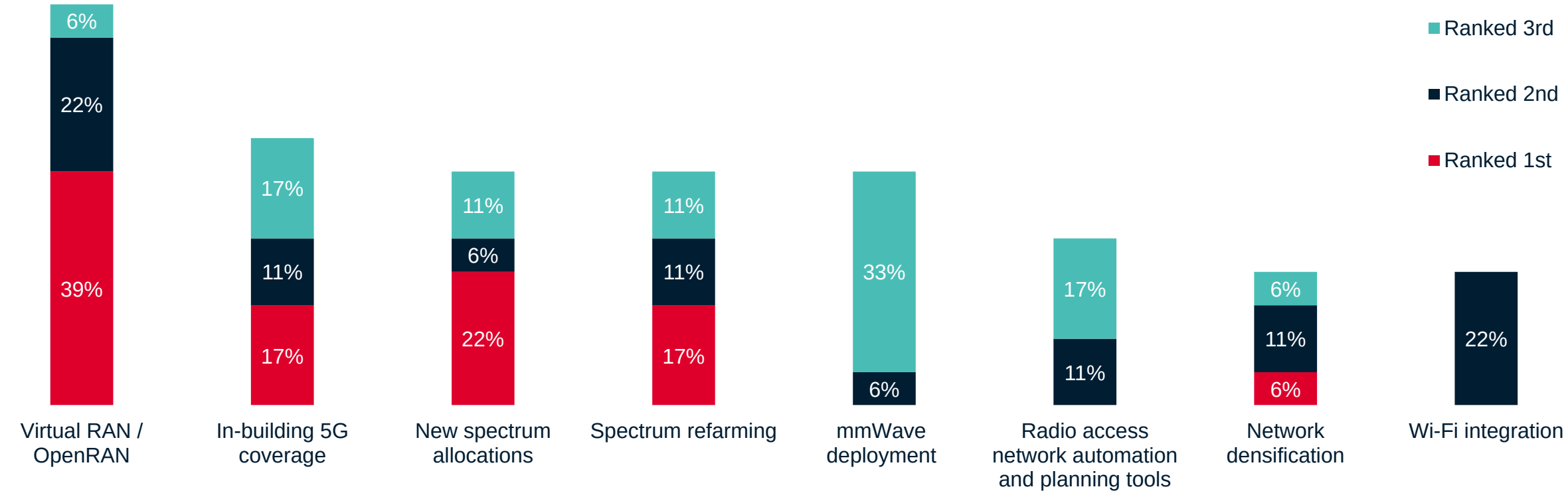
Middle East and Africa



5G RAN investment priorities

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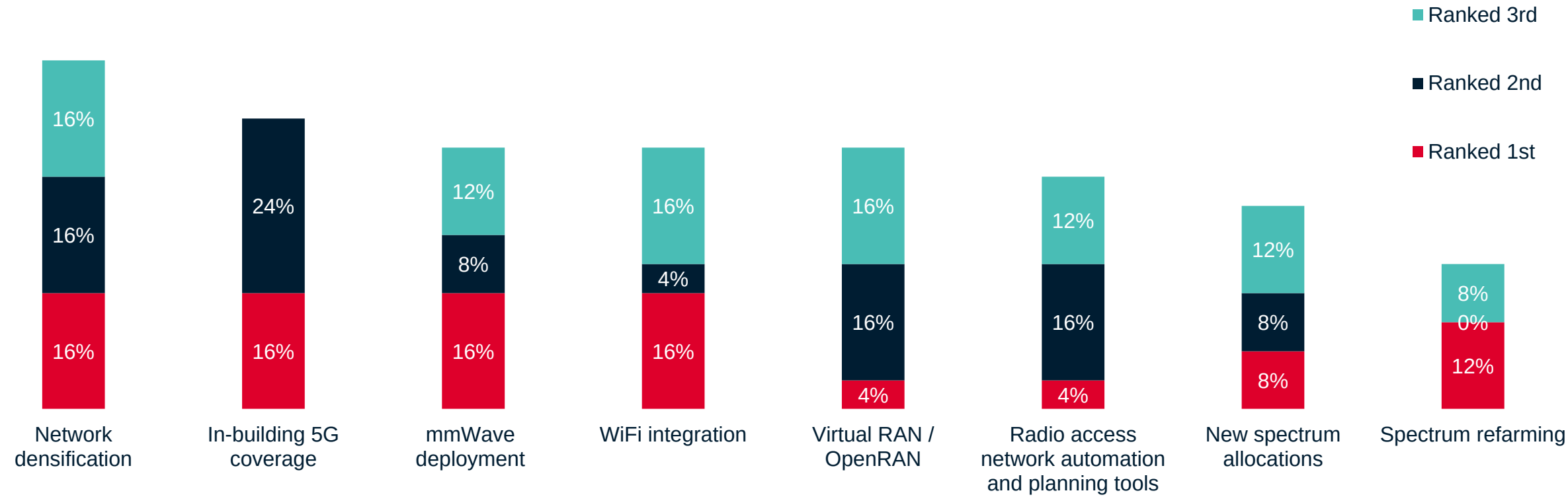

5G core investment priorities

Results by region

Considering your 5G core and service network, which areas of investment are most important? (Top three choices)

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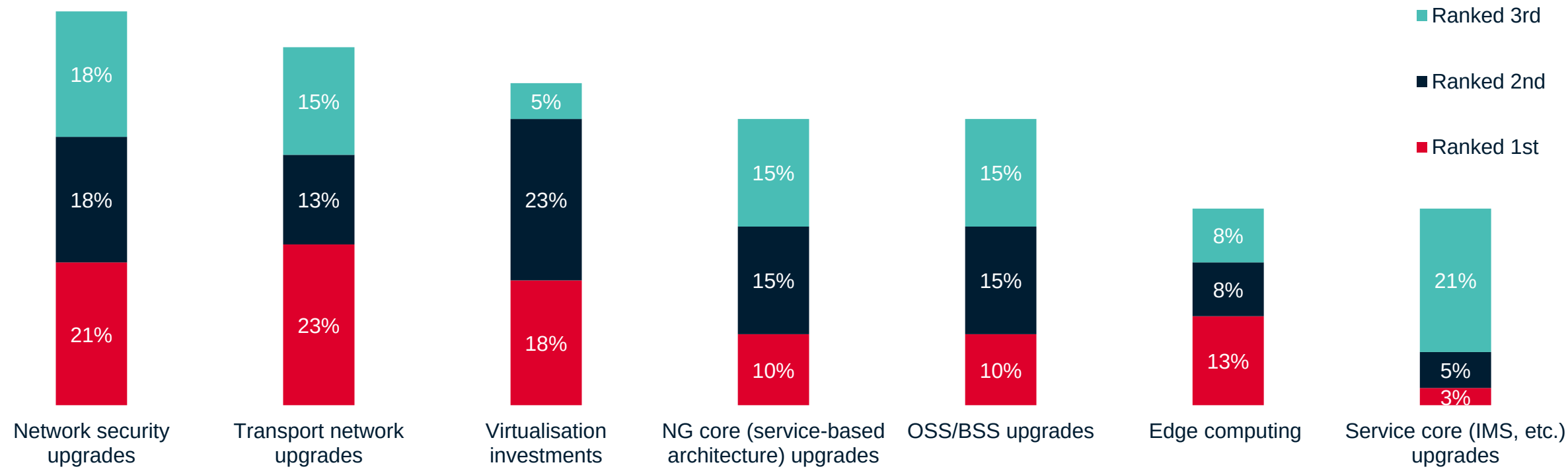

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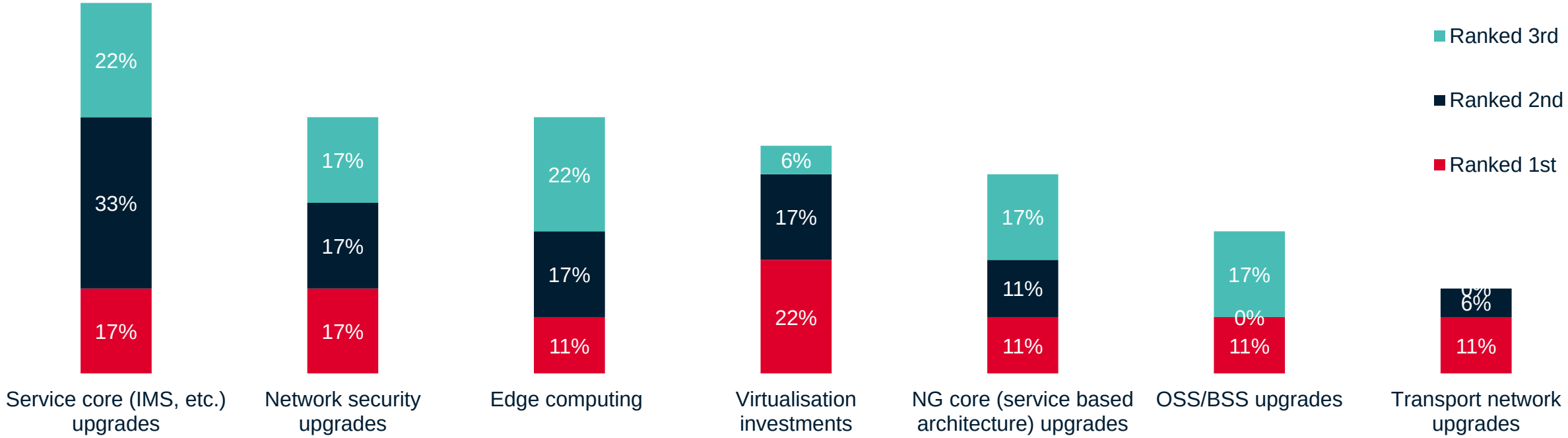

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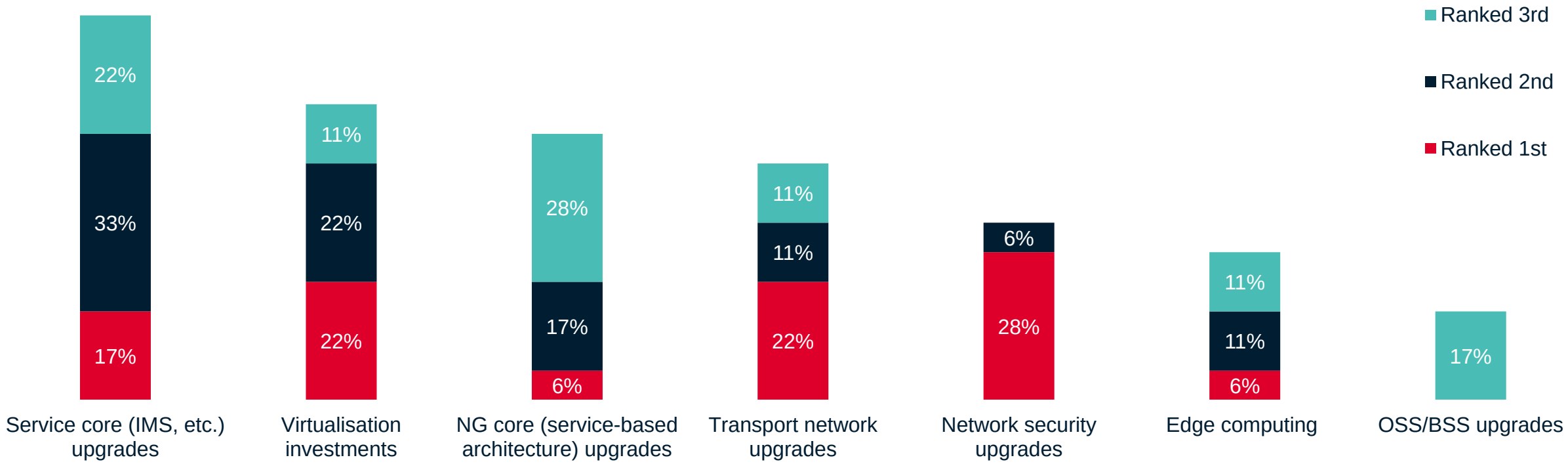

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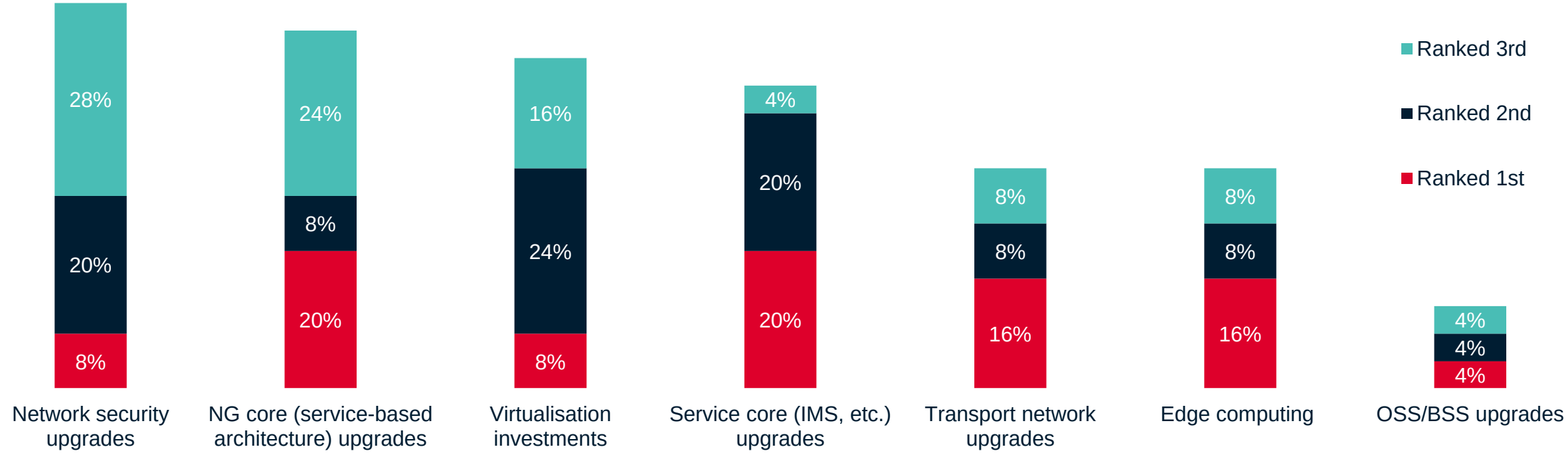

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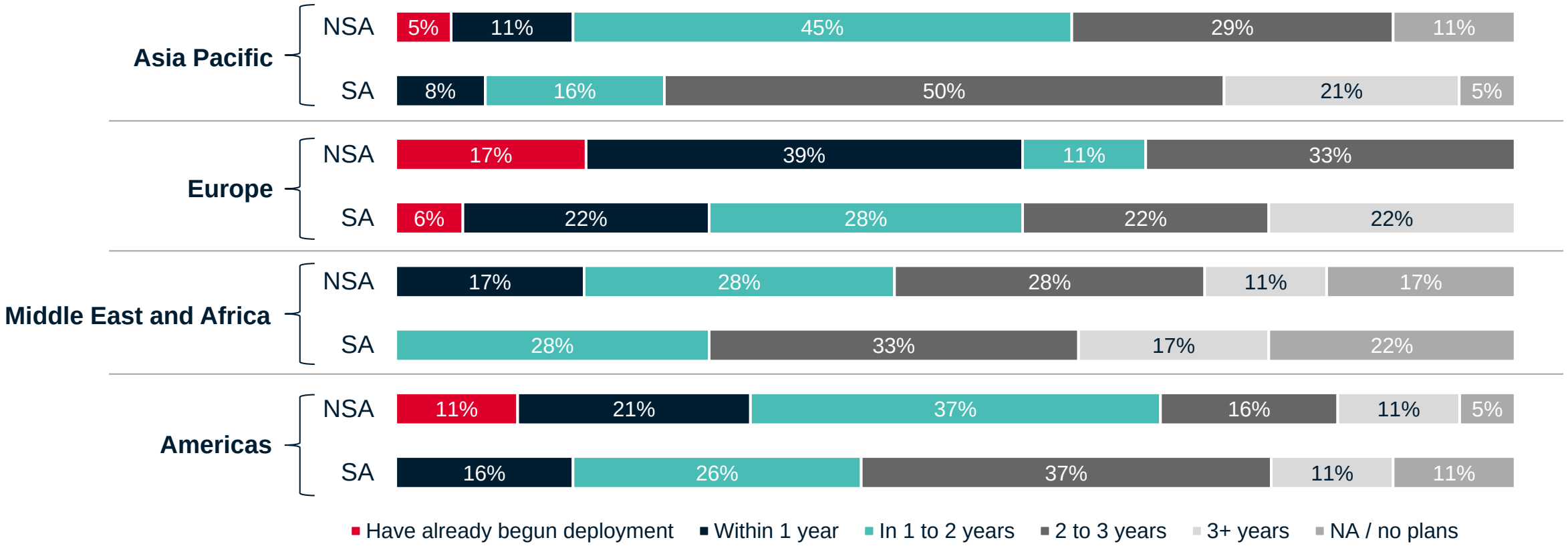

Standalone 5G benefits

Results by region

Rank the following benefits of deploying standalone 5G in your network (top three choices)

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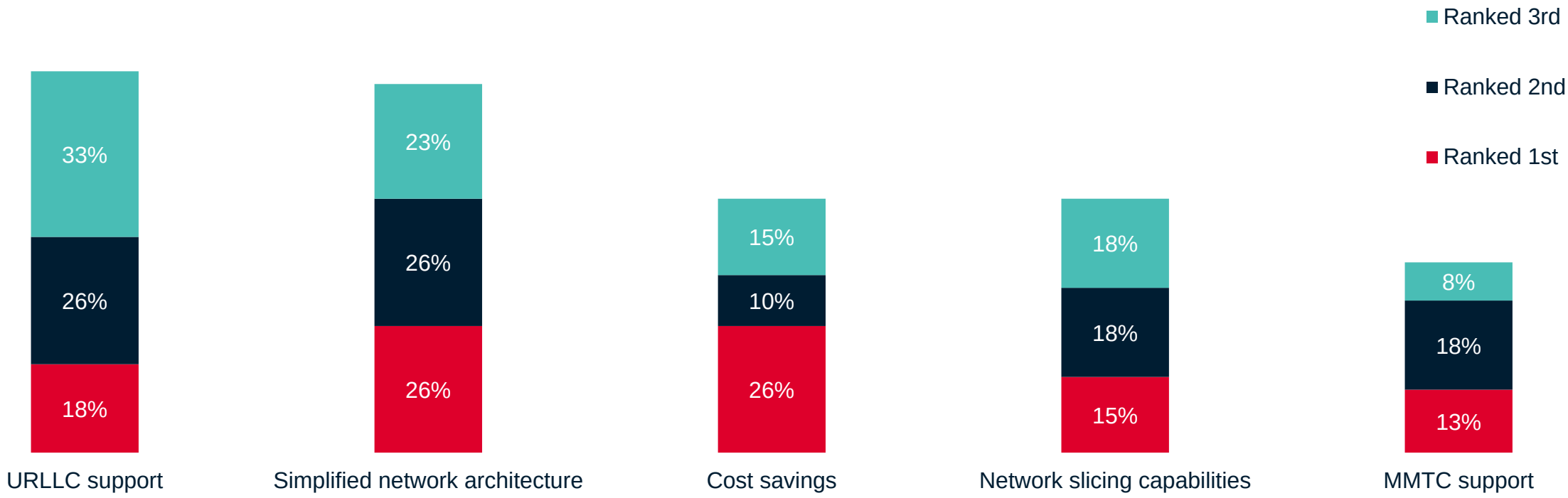

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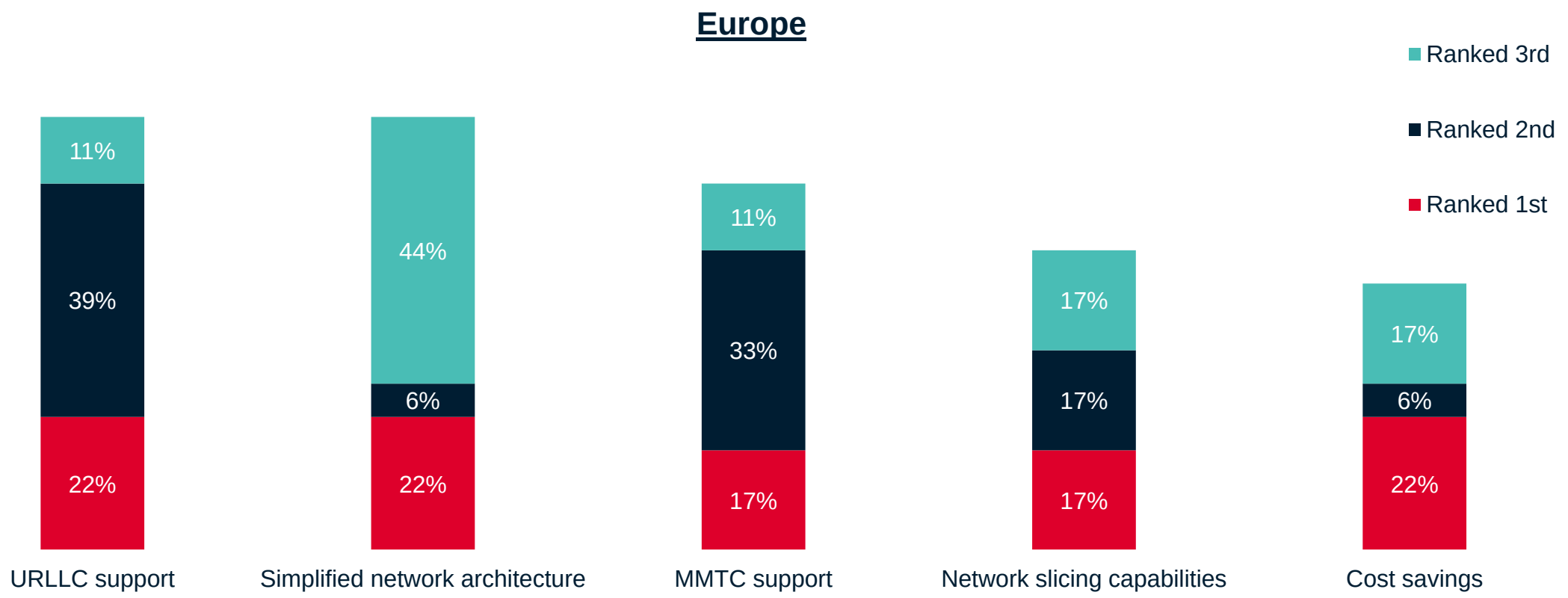

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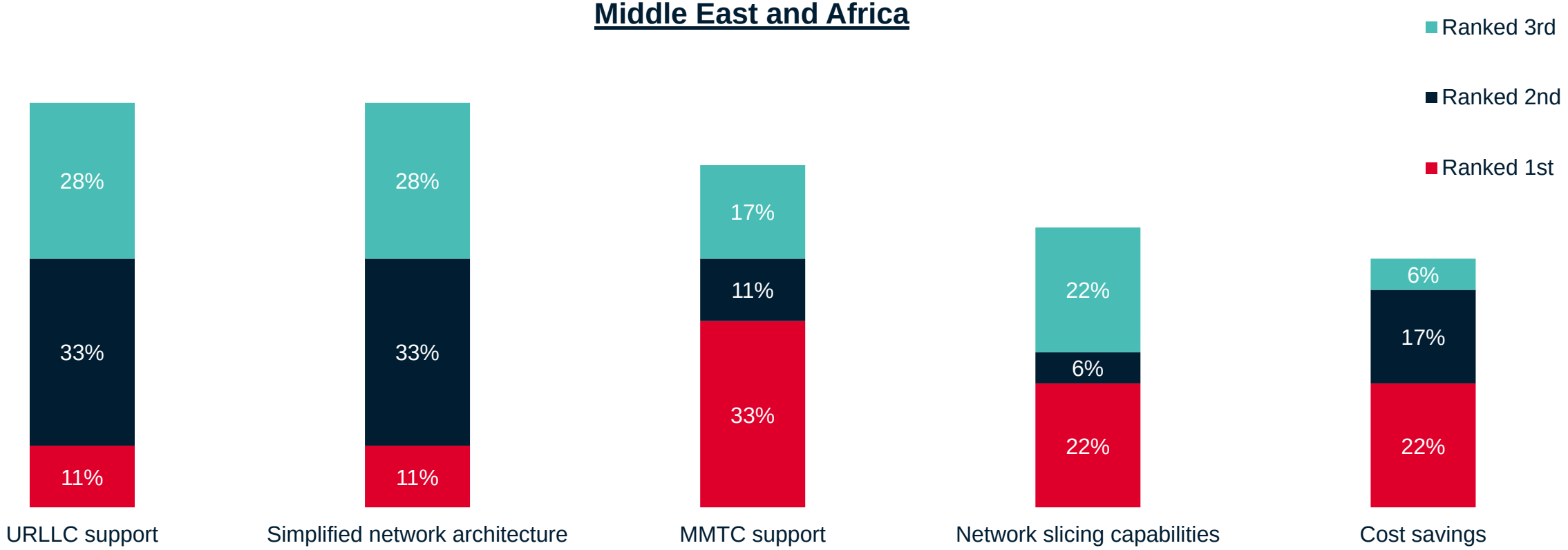

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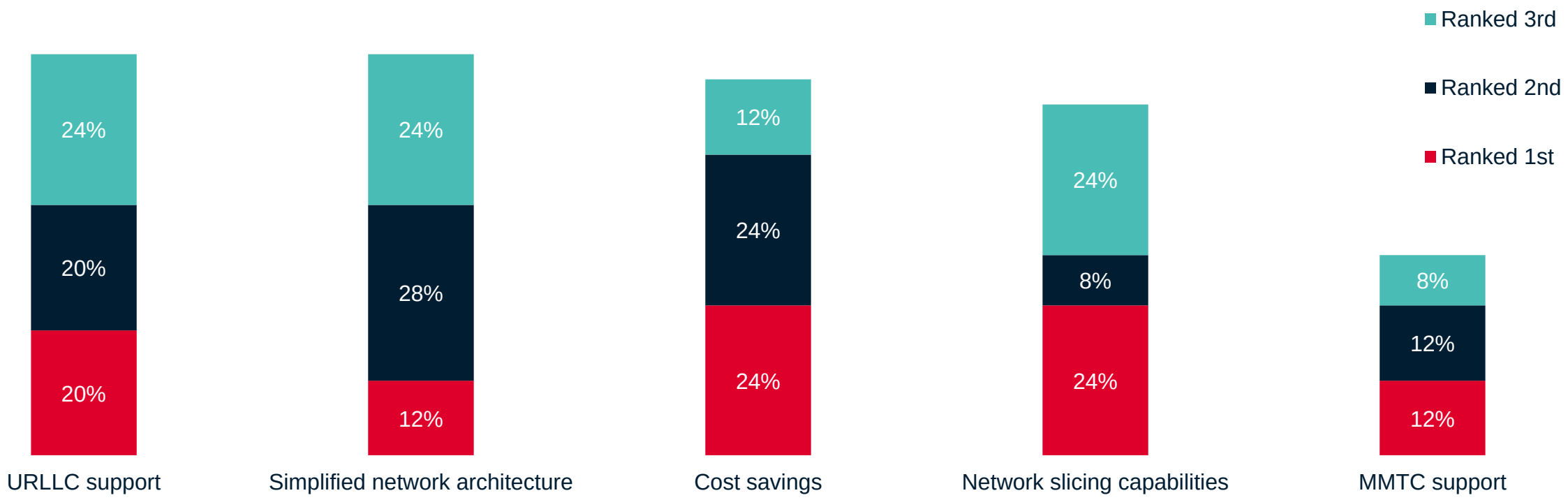

5G and new network suppliers

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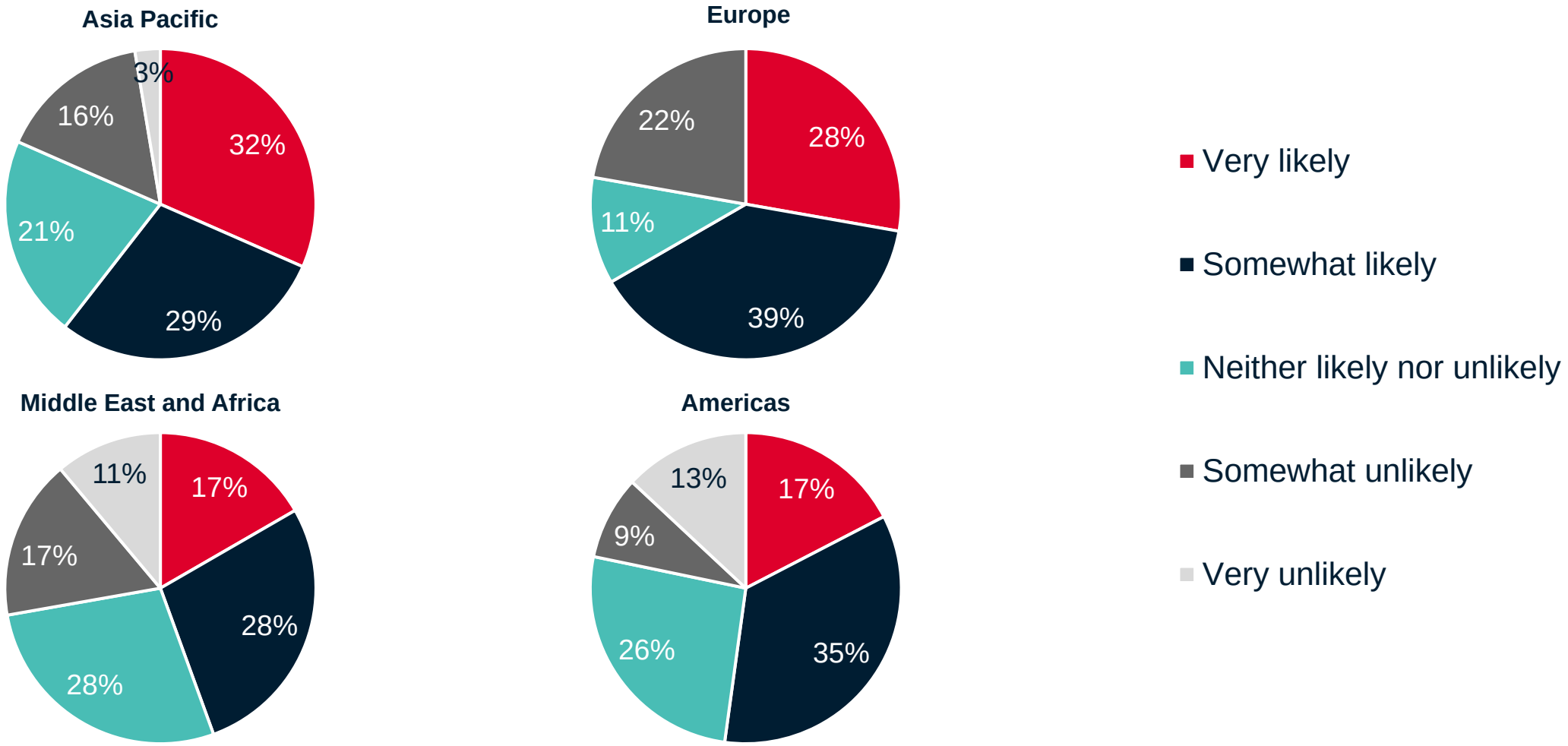

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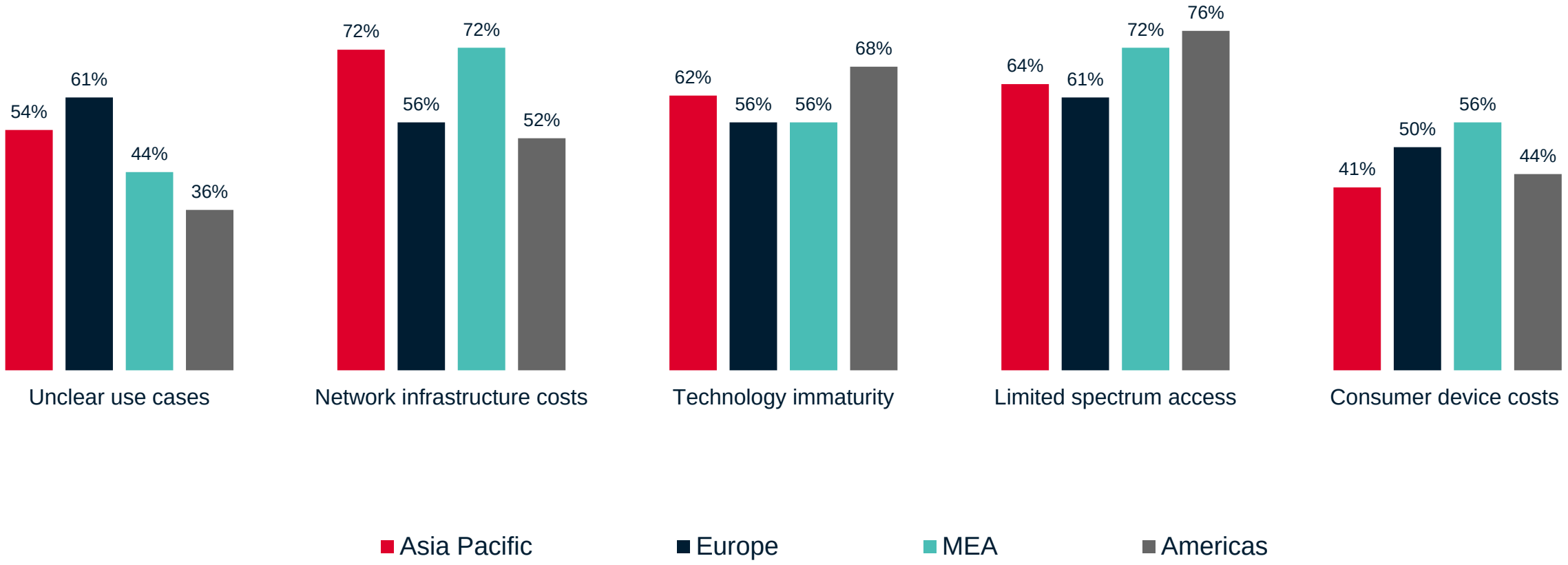

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5G RAN investment priorities

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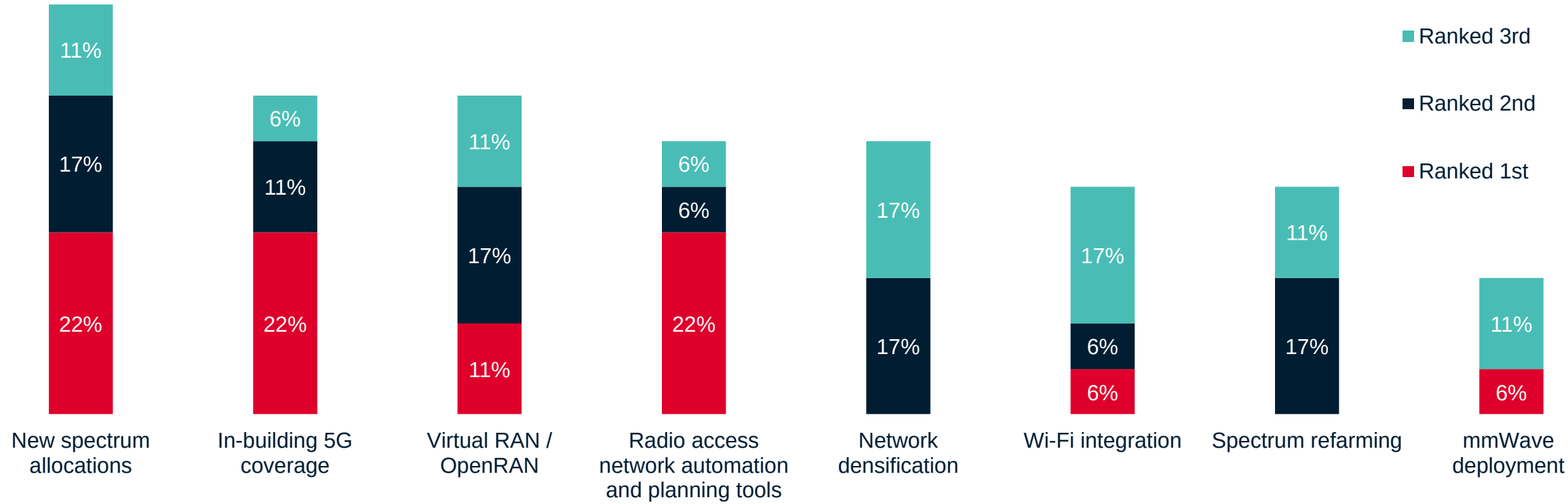

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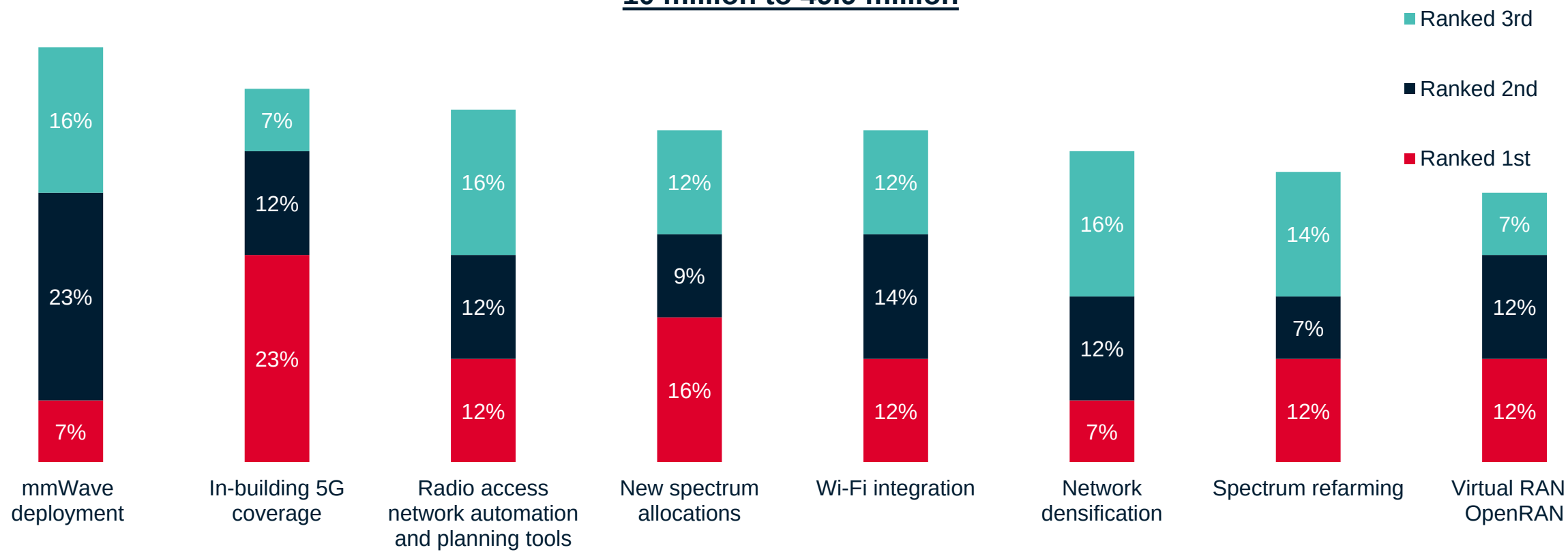

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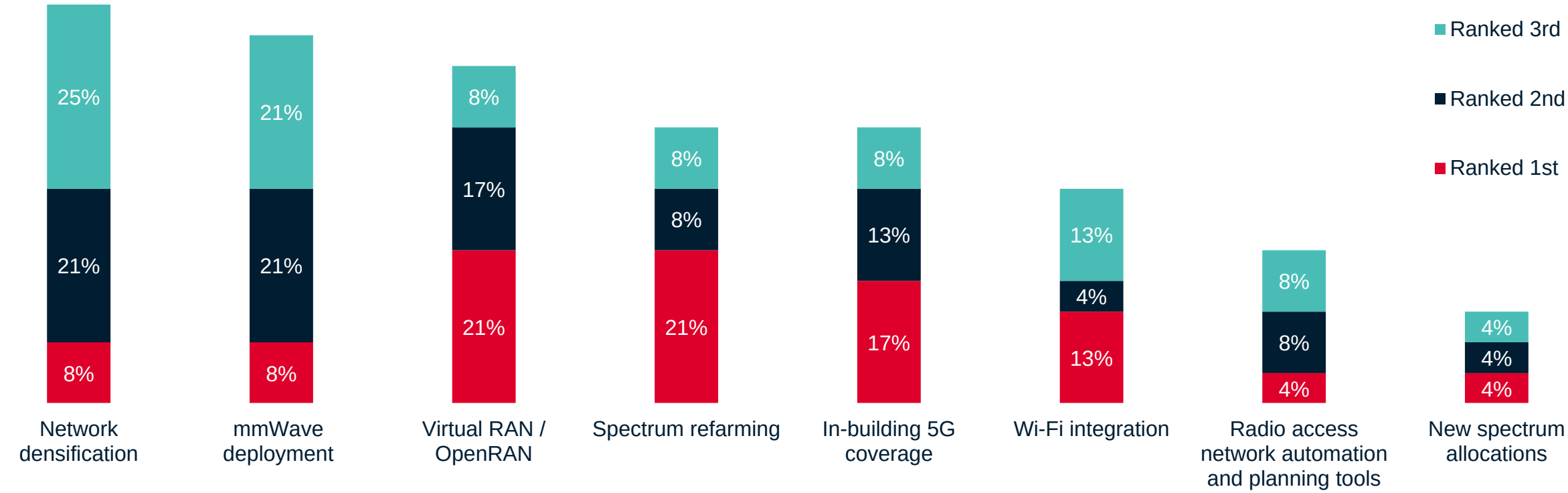

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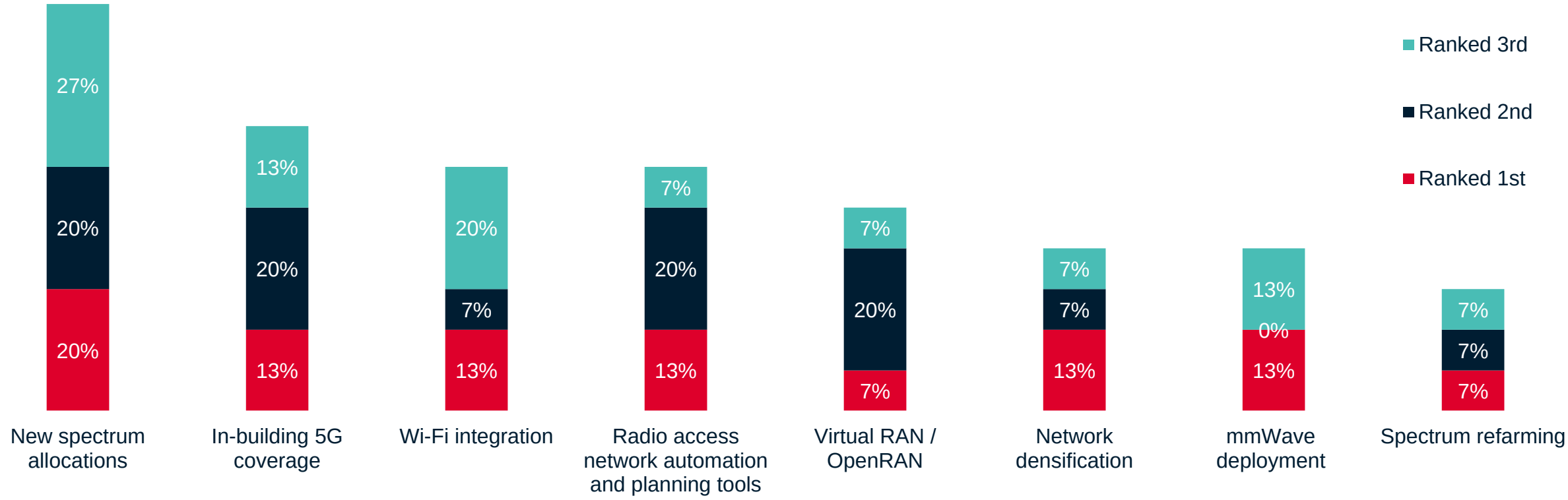

5G core investment priorities

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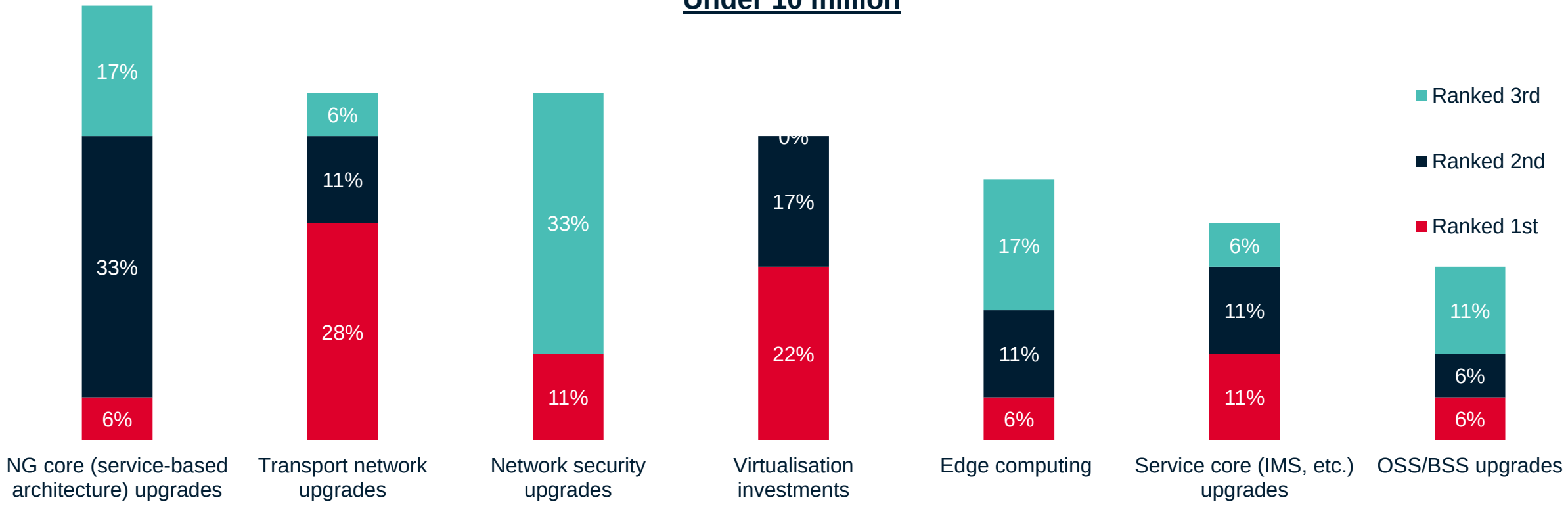

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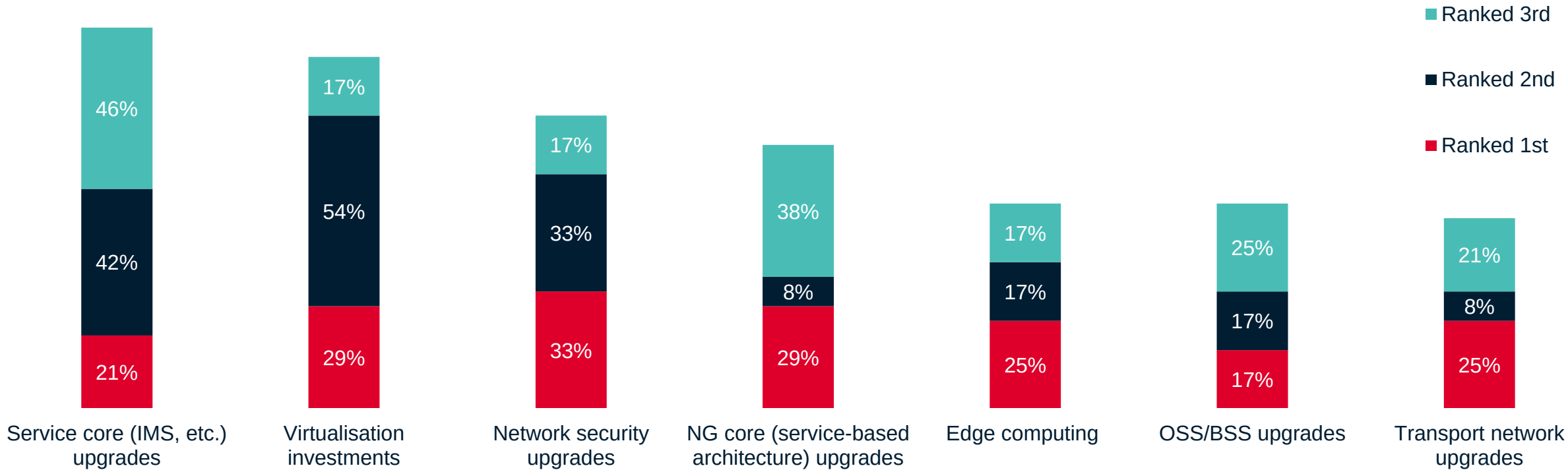

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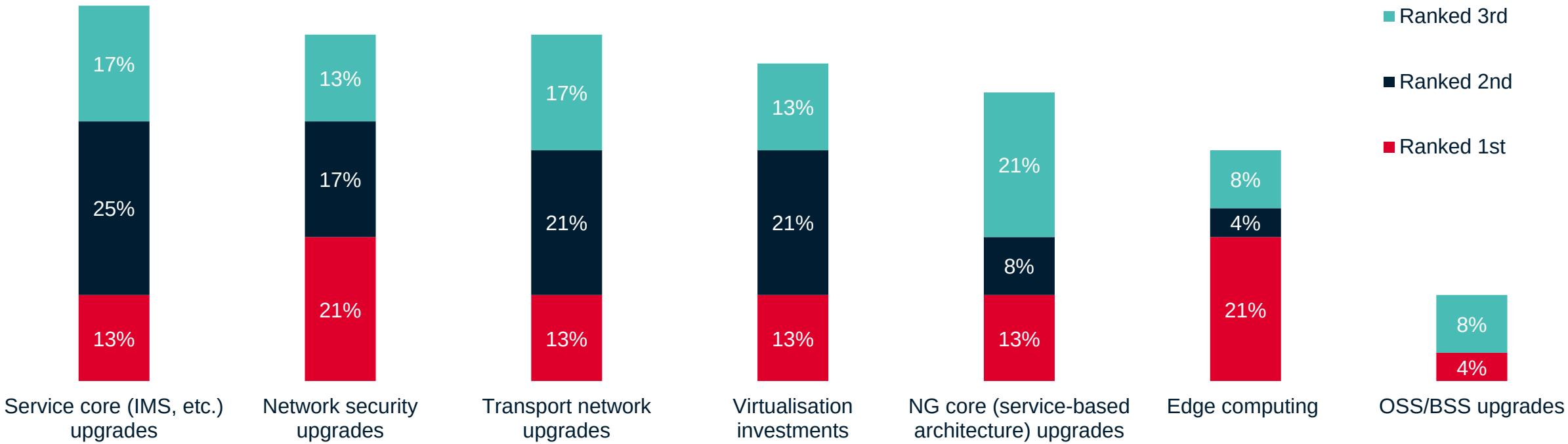

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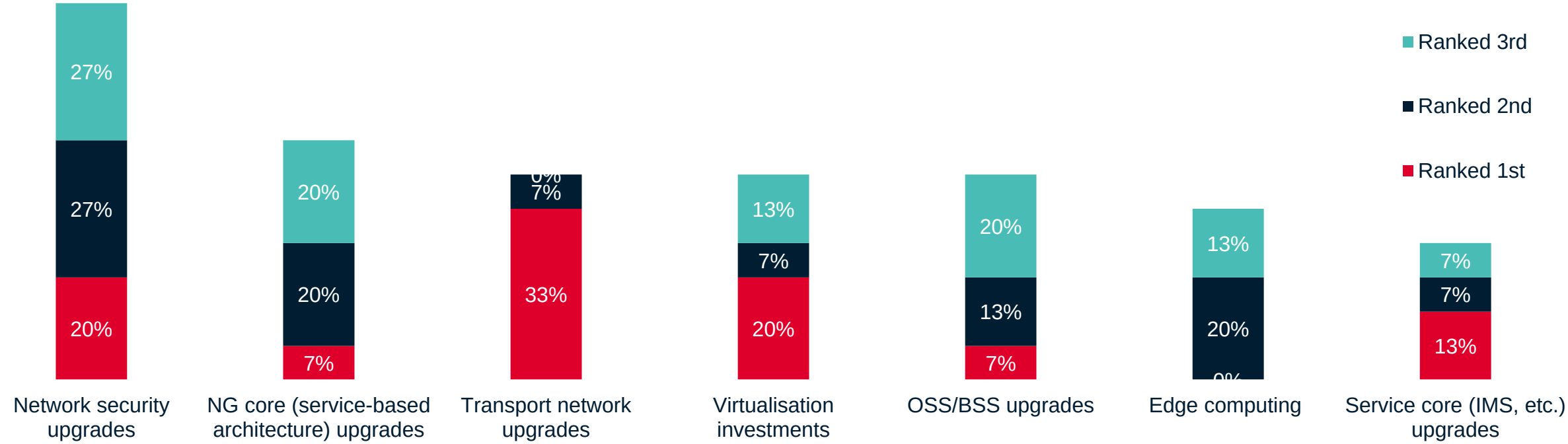
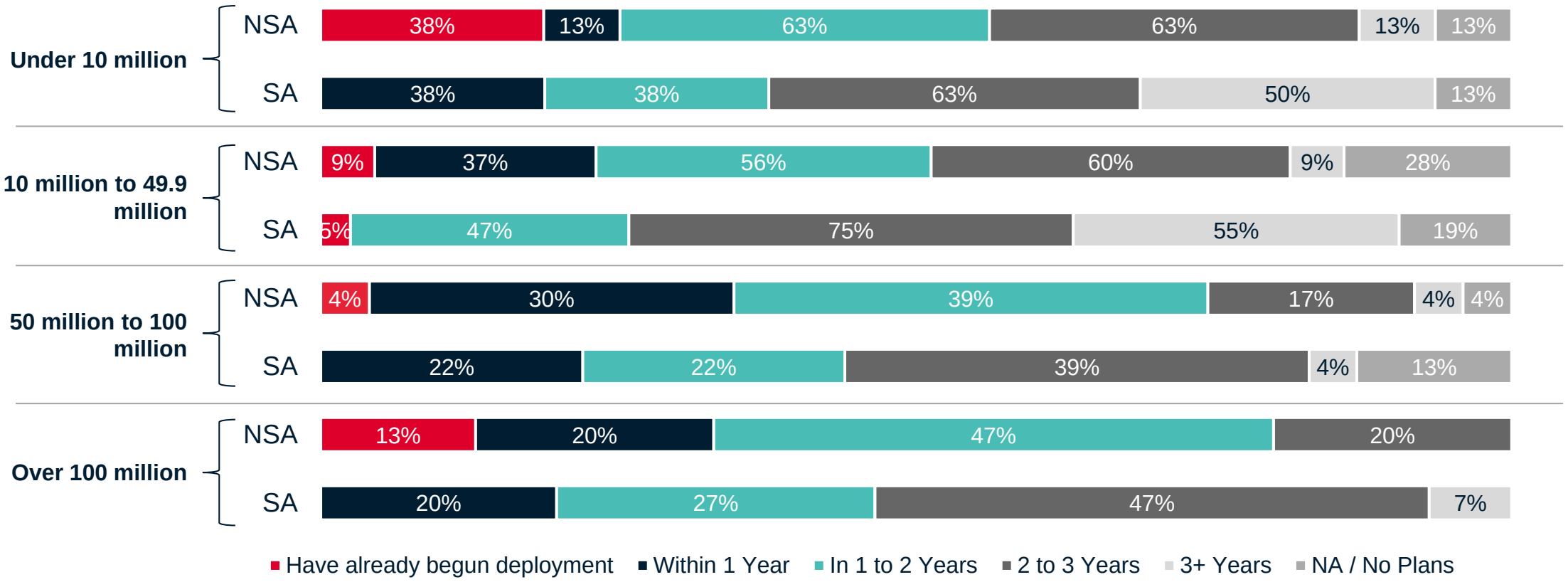


Standalone versus non-standalone

Results by operator size (by number of connections)

Considering your 5G network assets and strategy, when do you plan to deploy standalone and non-standalone 5G?

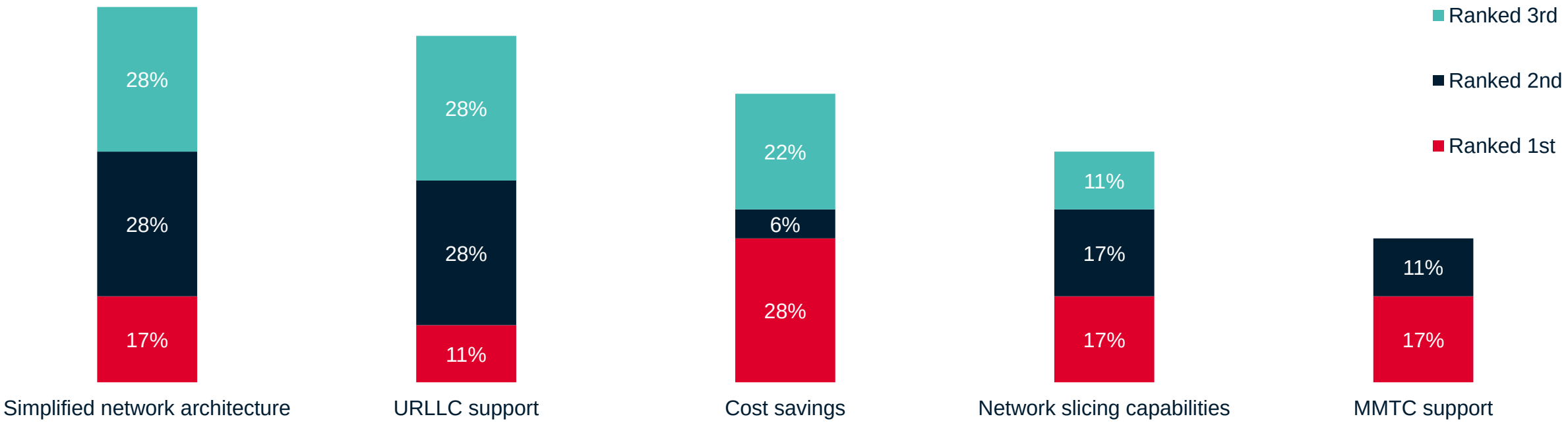


Standalone 5G benefits

Results by operator size (by number of connections)

Rank the following benefits of deploying standalone 5G in your network (top three choices)

Under 10 million

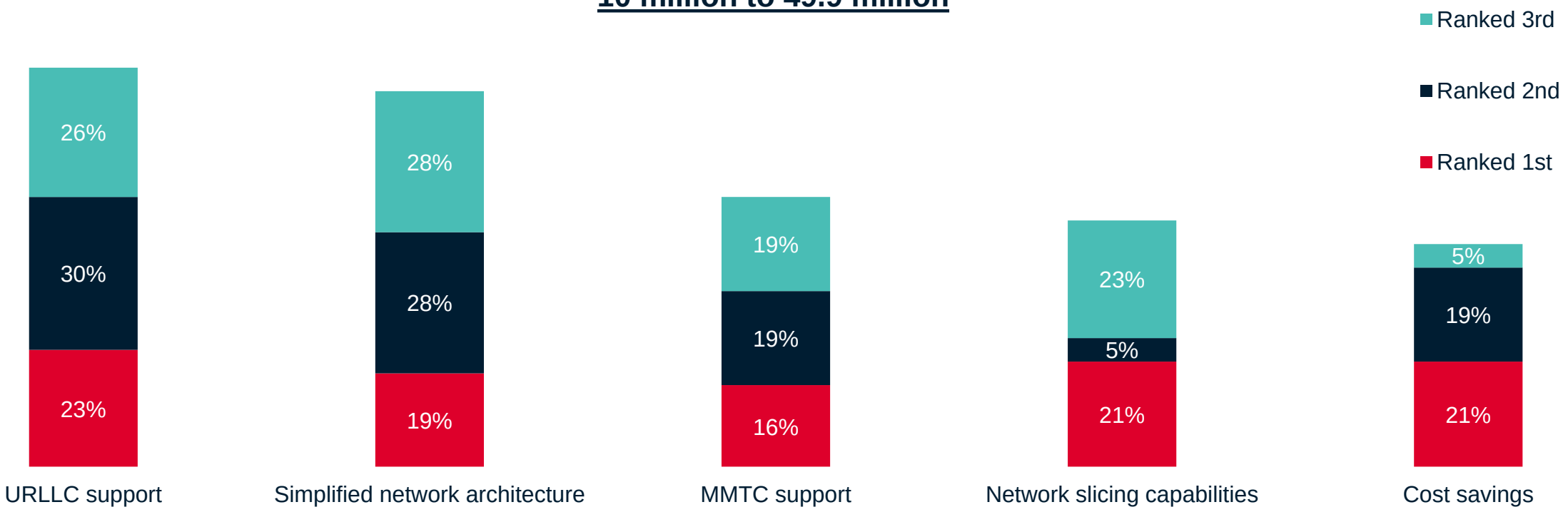


Standalone 5G benefits

Results by operator size (by number of connections)

Rank the following benefits of deploying standalone 5G in your network (top three choices)

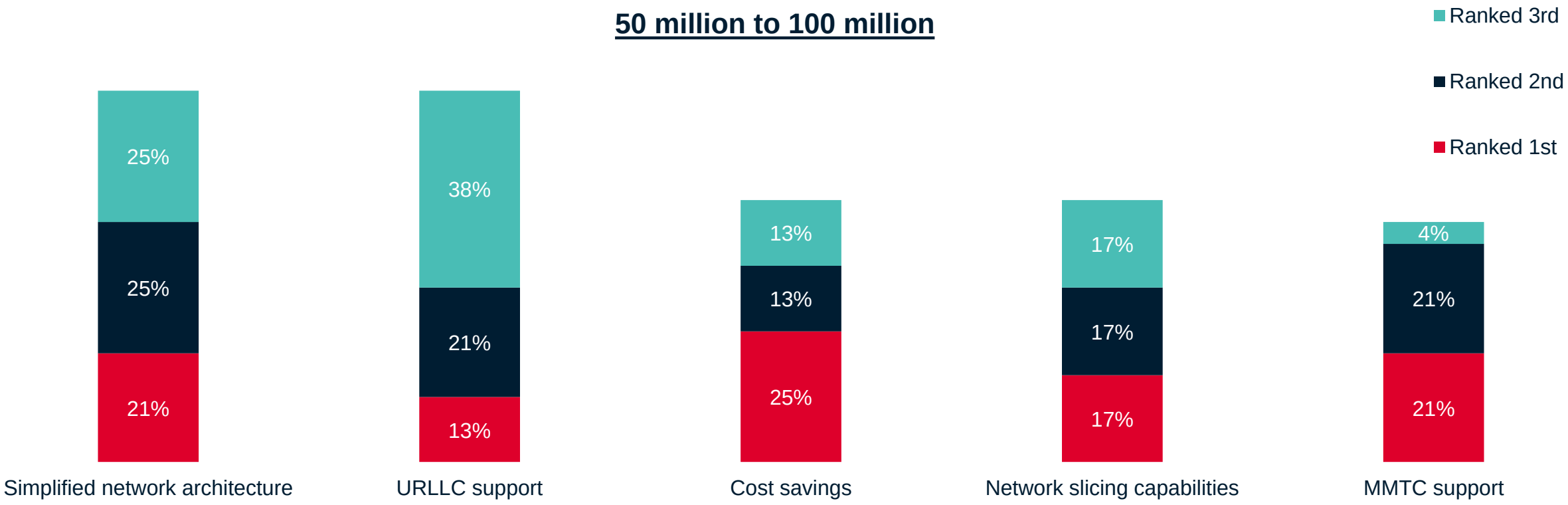
10 million to 49.9 million



Standalone 5G benefits

Results by operator size (by number of connections)

Rank the following benefits of deploying standalone 5G in your network (top three choices)

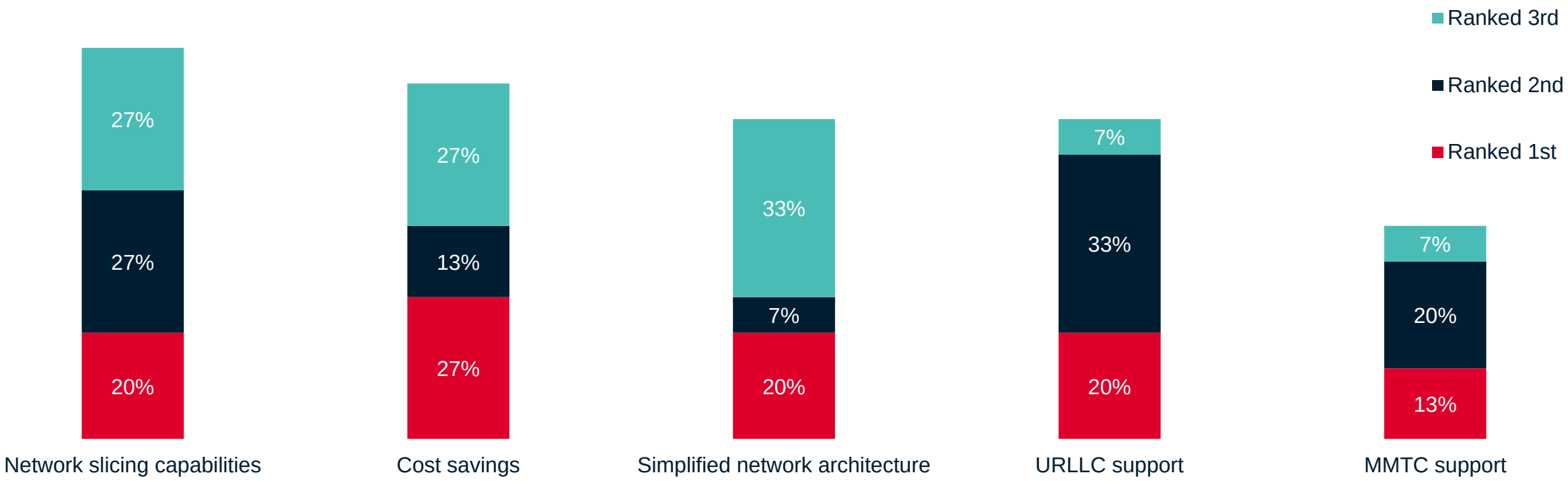


Standalone 5G benefits

Results by operator size (by number of connections)

Rank the following benefits of deploying standalone 5G in your network (top three choices)

Over 100 million

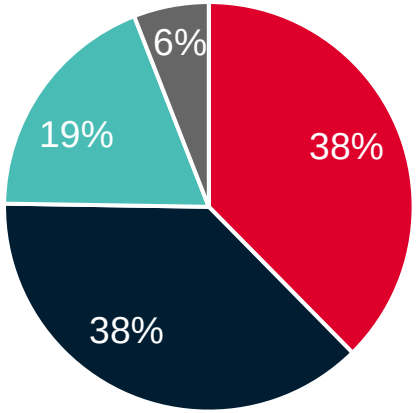


5G and new network suppliers

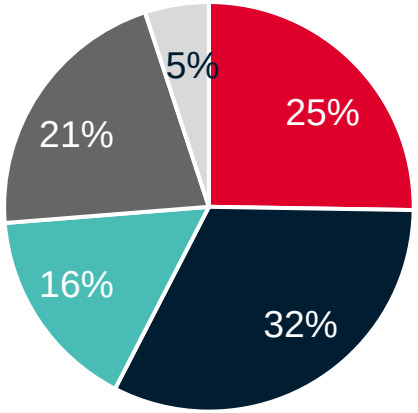
Results by operator size

How likely are you to use 5G to introduce new vendors into your network?

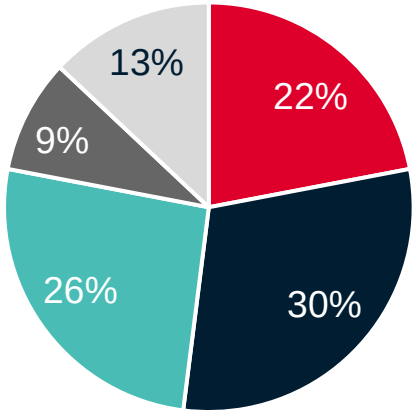
Under 10 million



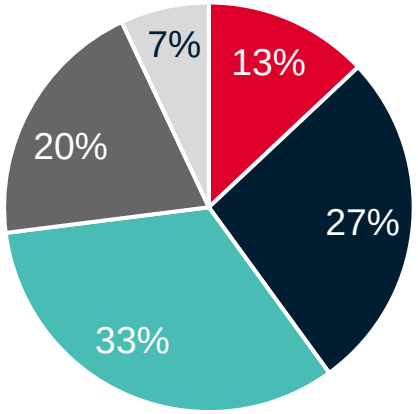
10 million to 49.9 million



50 million to 100 million



Over 100 million

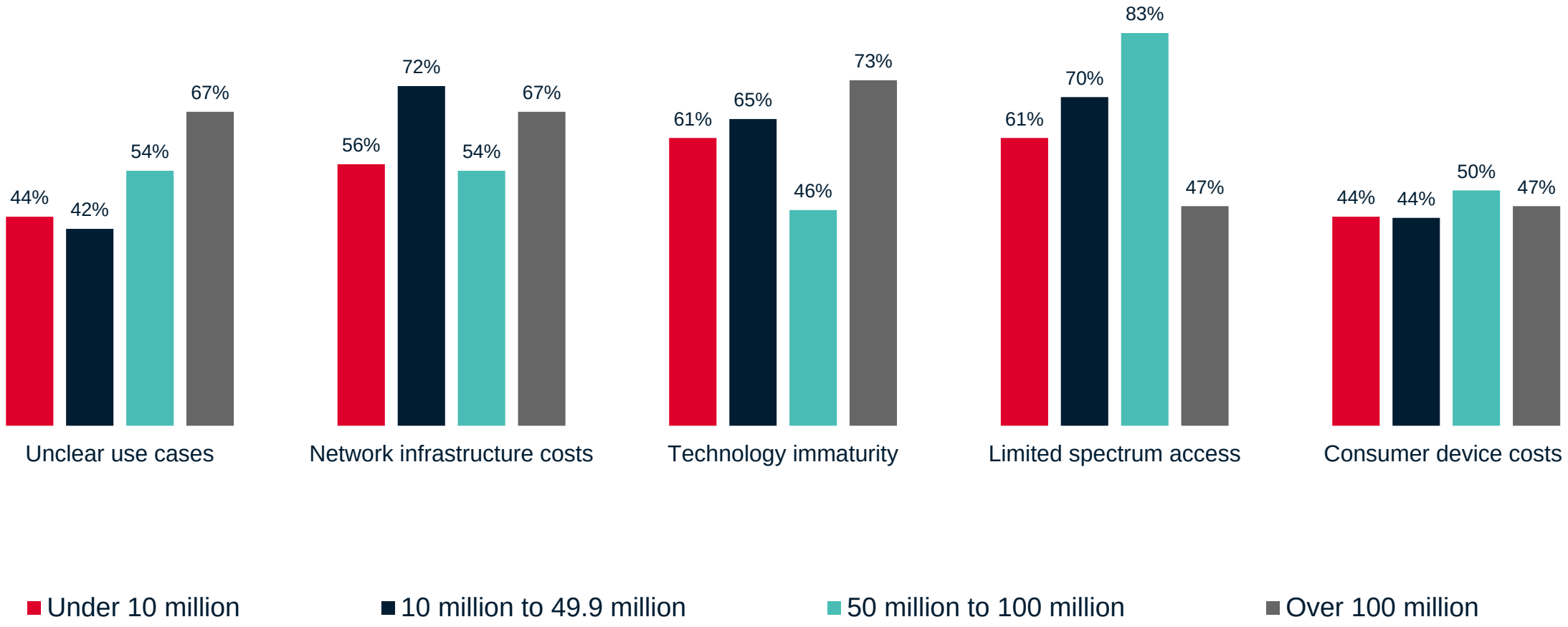


- Very likely
- Somewhat likely
- Neither likely nor unlikely
- Somewhat unlikely
- Very unlikely

5G network investment barriers

Results by operator size

What is the greatest barrier to increasing your planned network investment in 5G?



Multiple responses accepted; chart total adds up to more than 100%

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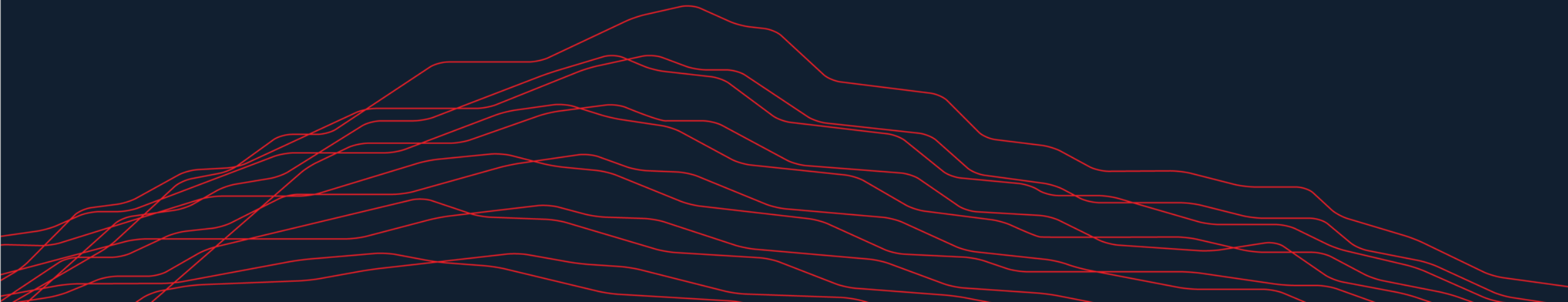

Although open networking through Virtualization and Service-Based Architecture is not a silver bullet, it does represent a path to organically bring new vendors into the ecosystem while increasing the competitiveness of existing trusted players globally.

Virtual and Open RAN technology is still in its nascent stages, but represents an opportunity to increase supply chain flexibility and reduce Total Cost of Ownership (TCO). Open interfaces can help diversify and reinvigorate the supply chain with a "plug and play" components model that allows operators to use multiple vendors.

While many companies including GSMA have banded together to develop this technology further, the transition to such technology will not be immediate. The desire to diversify suppliers does not diminish the importance of existing relationships or the work and innovations of some of the trusted larger players today. Smaller players lack the scale to deliver for massive deployments and large suppliers are u nder financial pressure to keep up the pace. As 5G coexists and interoperates with 4G and LTE networks, so must open network technology integrate into current networks. Current suppliers will necessarily be an important part of the transition.

56% operators indicate that it is important for them to integrate open source and open networking technologies into their network. However, only a quarter of operators say they are commercially deploying open networking technology. Internal expertise gaps are an impediment to deployment and operators with fewer than 50 million connections are much more likely to have no virtual RAN plans.

In addition to these questions, GSMA asked this group of operators about their vendor strategies, including what they are looking for from vendors and how likely they are to engage new vendors going forward. 57% of operators think they are likely to introduce new network

suppliers into their 5G network deployments, with only six % reporting they are very unlikely to introduce new vendors as part of their 5G deployment.

Without public support, this technology's success will ultimately depend on internal factors, such as business prioritization and capital expenditures, as well as external considerations including vendor availability. Recent actions by Congress - such as the Secure and Trusted Communications Networks Act or the recently proposed Creating Helpful Incentives to Produce Semiconductors (CHIPS) for America Act[6] – highlight growing recognition of the need for external funding to achieve the administration's goals for 5G. Public support such as tax credits and R&D funding will be critical to this technology's success.

Are there stakeholder-driven approaches that the U.S. Government should consider to promote adoption of policies, requirements, guidelines, and procurement strategies necessary to establish secure, effective, and reliable 5G infrastructure?

Maintaining the integrity, availability and security of wireless network while preserving global interoperability is important to U.S. and global businesses and economies. The U.S. members of GSMA are dedicated to protecting their networks from security weaknesses, bad actors and providing consumers with a secure and reliable experience and services.

Any security scheme should ensure that operators are able to continue to identify and share problems as they arise and work together for secure, reliable networks across borders. Efforts such as the Criteria for Security and Trust in Telecommunications Networks and Services from the Center for Strategic & International Studies (CSIS) show great promise and complement both the Prague Proposals and the European Union's 5G Toolbox[7].

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[6] *See* D. Palmer and Sabrina Rodriguez, "Lawmakers unveil bill to boost semiconductor production", Politico (June 11, 2020), available at https://www.politico.com/newsletters/morning-trade/2020/06/11/lawmakers-unveil-bill-to-boost-semiconductor-production-788432

[7] *See* Center for Strategic & International Studies (CSIS), CISS Working Group on Trust and Security in 5G Networks (May 13, 2020), available at https://www.csis.org/analysis/criteria-security-and-trust-telecommunications-networks-and-services

There is no single measure, framework or control point that can successfully eliminate all security risks. Multiple and varied approaches are needed to identify and mitigate risks. Continued collaboration with global standardization work such as security subgroups within 3GPP is critical to identifying and preparing control measures. Such groups help manage security threats on a global scale with the wider IT world to counter cyberattacks.

How can the U.S. Government best lead the responsible international development and deployment of 5G technology and promote the availability of secure and reliable equipment and services in the market?

Transformative advanced communications services are the result of global innovation particularly inside standards development organizations (SDOs), where the U.S. has always been a leader. The GSMA applauds Commerce and BIS' recent decision to encourage U.S. industry's contribution and collaboration to standards-development activities[8]. As highlighted in our March 2020 comments to Commerce, the work that happens within standard setting bodies is vital to ensuring interoperability and economies of scale. These recognized international bodies provide the building blocks for emergent technology and enable the design and production of products that are critical to U.S. competitiveness.

As with previous technological generations, global standards need collaborative input from U.S. industry leaders. Their continued participation makes our technology better. As we move to virtualized and open network architectures, such technical specifications will be a critical piece of the world's future connectivity.

[8] U.S. Department of Commerce, Bureau of Industry and Security, *Release of "Technology" to Certain Entities on the Entity List in the Context of Standards Organizations*, Interim final rule, request for public comments, 85 Fed. Reg. 36719 (June 18, 2020).