Profile of the Costa Rican offer specialized in 4.0 technologies

2019-2021

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Executive Summary

It is estimated that the companies specializing in technologies linked to the **Fourth Industrial Revolution** represented in 2021 the **22% of Costa Rica's ICT business park** (wich is estimated in 450 companies). These offer the services of Cloud Computing (20% of the companies), 4.0 Industry Integration (19%), Internet of Things (13%), Robotics process automation10%), Big Data (9%) and others, among ten specialization categories. Cloud and Integration have been the most developed since 2019.

According to number of employees, the **large** companies are more associated to Cloud, Big Data, Integration, RPA & IoT, while the **smaller** ones to Cybersecurity, X-Reality, A.I., 3D Printing & Blockchain. For approximately 60% of the sector, 4.0 technologies sales represent over 80% of their total sales, these particularly associated to the A.I., X-Reality, Cybersecurity & Blockchain offer; namely, for the smallest ones according to number of employees.

About their customers, 77% indicate having large companies as customers (+200 employees) and 67% having services companies. According to **goods verticals**, 42% of the offer has customers in the food sector, followed by medical devices (39%), pharmaceutical (28%) and agricultural (26%); while in **services verticals** other ICT companies (54%), business services (54%), banking-finances (49%) and other emergent ones like **health**, security, retail and logistics. On the other hand, around 7 of each 10 companies monetize their services with payments for regular or occasional maintenance.

The export profile shows that **78% of this sector exports**, representing 37% of their total sales, while the remaining sales are channeled in local linkages. by destination, 30% of exporters markets 4.0 technologies in North America, followed by Central America (27%), South America (27%) and Europe (7%), among others. Compared to 2019, Colombia was positioned as the main destination in 2021 , displacing USA to third position and leaving Mexico in second place. By specialization, exporting companies specialize in Cloud, IoT, 4.0 Integration, Big Data and RPA.

During 2019-2021, and despite the complex economic context of this period, this sector shows a stable performance, with no evident substantial changes, although a greater sales concentration at local level, of 53% to 63%. In addition, 78% of the sector developed or upgraded a technological solution in response to the needs generated by the pandemic, in areas of: **i)** teleworking or communication; **ii)** products traceability; **iii)** digital means of payment; **iv)** transport; **v)** agriculture and **vi)** solutions for the health sector. Finally, it is important to mention the **dynamism** shown among customers in sector such as health, medical devices and pharmaceutical, as well as the generation of **MedTech** solutions, demonstrates the sector's capacity to adapt and explore new opportunities of added value derived from post-pandemic markets.

Main Objective

Understand the experience of the Costa Rican offer of 4.0 technologies services segment in order to specify the potential of international scalability and linkages of its business model

Specific Objectives

1. **Determine the current characteristics of the Costa Rican 4.0 technologies offer in terms of its services portfolio, companies' size , business models, exports, destinations and other variables.**

2. **Identify the technological solutions developed by this sector or readjusted in the context of the pandemic (2020-2021) in response to the needs posed by the pandemic's context.**

Methodology

1. **Identification of Costa Rican ICT companies whose offer of services is based on technologies linked to 4.0 Industry**

2. **Design and apply a statistical survey to this group of companies:**

   - Participants: 69 companies
   - Profile of the interviewed: CEOs / CTOs / other managerial

3. **Data Processing and Modeling**

4. **Development of the final report**

2019 Edition	2021 Edition
Sample (n)= 48 companies	Sample (n)= 69 companies
• **Recurrence:** 16 companies surveyed on 2019 repeat on 2021 (23% of current sample) • 30 surveyed in 2019 did not participate in 2021 • 53 new companies participated on current edition	

Content

Backgrounds

2019

Characterization of the Information Technologies and Communication (ICTs) sector in Costa Rica

Download document

2019

Profile of the Costa Rican Offer specializing in 4.0 Technologies

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In 2019, PROCOMER developed two investigations based on the information technologies sector. First, a general characterization of this business park, en which was identified within the sector's offer, the existence of some differentiated technologies related to the Fourth Industrial Revolution . This led to a subsequent development of a mapping centered on this group of companies, where its characteristics were profiled, services and export experiences.

The present investigation, developed in January of 2022, is a follow-up of the analysis performed in 2019 about the 4.0 technologies offer and shows an update on its characteristics, largely motivated by understanding the influence of the challenging socio-economic context driven by the Covid-19 pandemic during 2020-2021.

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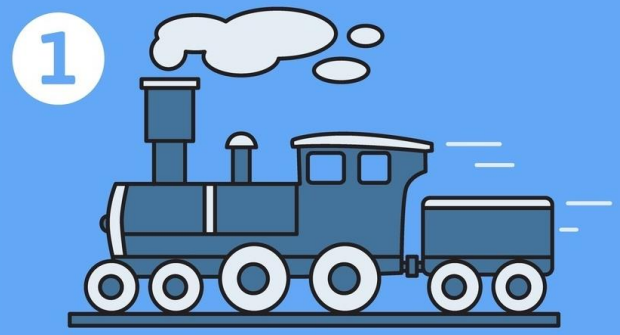
What is the Fourth Industrial Revolution?

What is the Fourth Industrial Revolution ?

The world is living a rapid transformation where a group of new technologies based on ICT's is radically changing the ways we produce, consume, market and work. This process of socio-economic changes is known as the Fourth Industrial Revolution or 4.0 Industry



The first Industrial Revolution (1760's-1840's)

Development of manufacture mechanization, steam engines and industrial tools

The Technological Revolution (1870's-1930's)

Industrialization, electrification and production of goods in assembly lines

The Digital Revolution (1970-today)

Digital electronic automation, internet, mass telecommunications, digital social systems

The Fourth Industrial Revolution (today)

Interaction of digital technologies, cyber-physical systems, Internet of Things , cloud networks

Source: World Economic Forum

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Which are the technological categories identified for this investigation?

For this investigation, the followin are the technological categories with most added value and economic potential, relevant for this analysis and its connection to Costa Rica, considering 4.0 Industry, in this case, from the perspective of the offer and application of these platforms.

Technological categories identified for this analysis:

Robotic Automation of Processes (RPA)	Big Data & Analytics	Blockchain & cryptographic systems	Cybersecurity	Cloud Computing
3D Printing	Artificial Intelligence	Internet of Things	4.0 Industry Integration	X-Reality

Source: World Economic Forum

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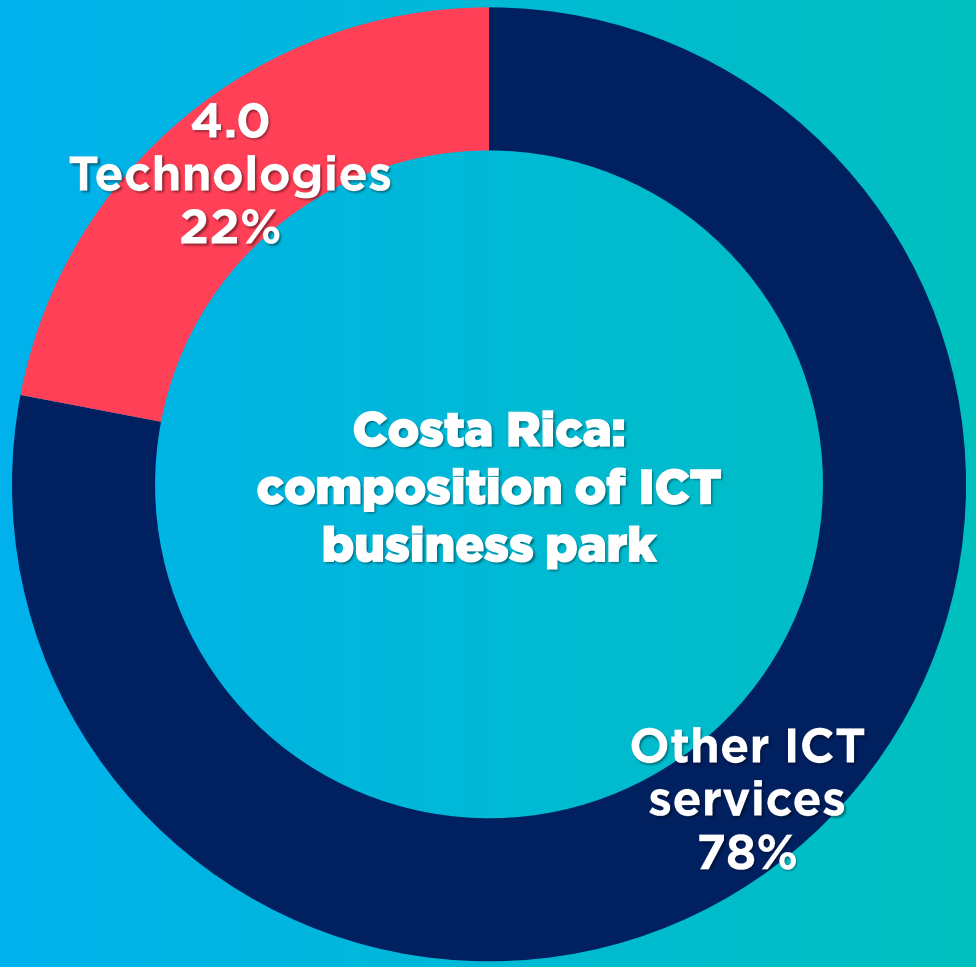
What is the estimated size of the segment of companies offering 4.0 technologies in Costa Rica?



The Information technologies and communication (ICT) sector is estimated as being integrated by a total of 450 companies.

Of this total, at least 22% of the business park, approximately 99 companies, are estimated offer technologies related to the Fourth Industrial Revolution (2021)

Source: PROCOMER

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CHAPTER 1

Profile of the Costa Rican 4.0 technologies' offer

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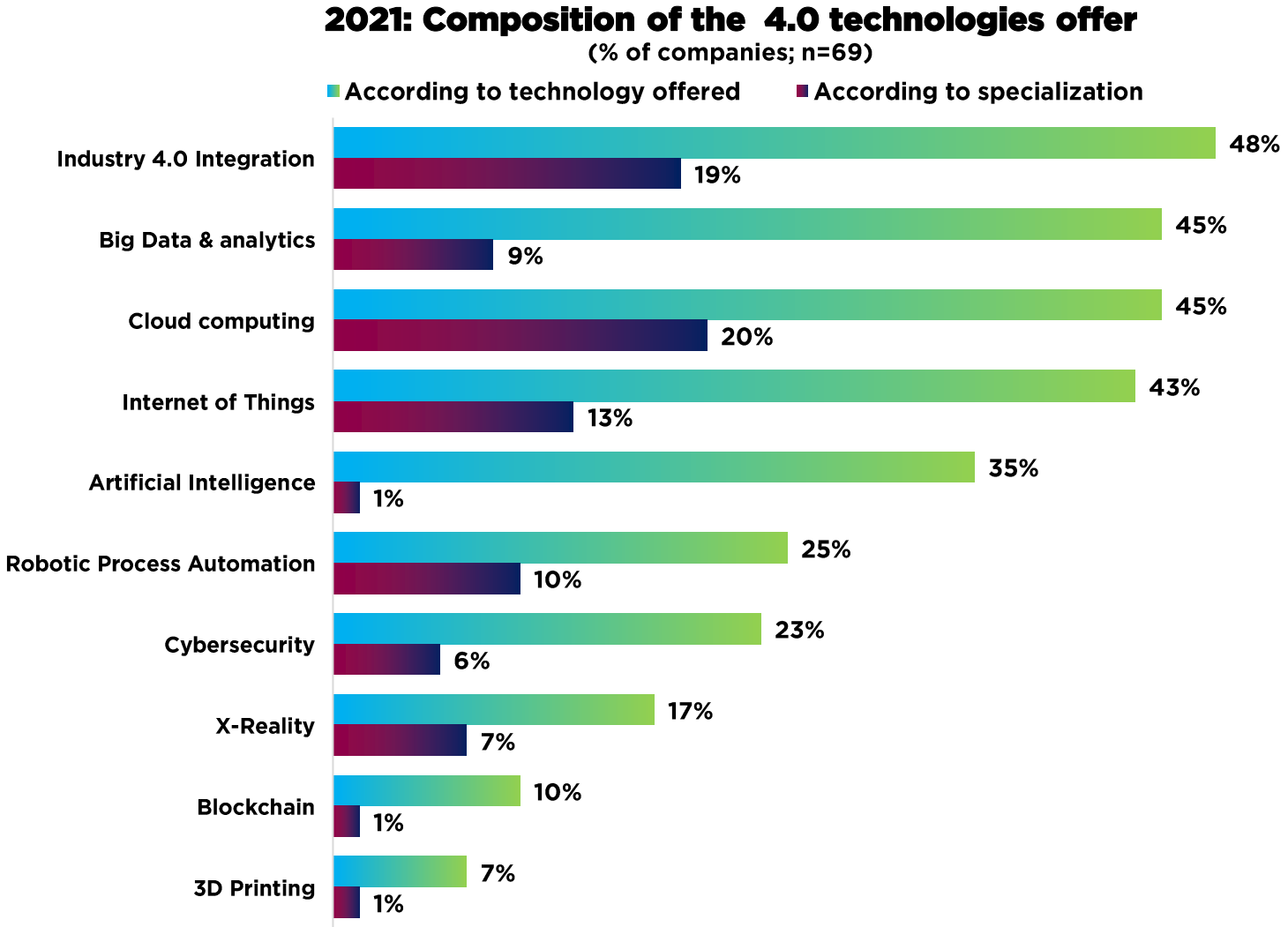
Portfolio of 4.0 technologies offered by the sector

1. Composition of the 4.0 technologies offer by category

The sector shows a diverse technological portfolio, with presence of the 10 main categories identified for this investigation. **By offer**, 4.0 Industry Integration is the category more offered, with 48% of total companies, while Internet of Things, Big Data & Cloud Computing follow closely. **By specialization**, there are more companies concentrating on Cloud Computing (20%), Integration (19%) & Internet of Things (13%), which jointly represent 52% of the total companies.



By specialization:
Shows the number of surveyed companies indicating specialization in a specific technological category

By technology offer:
Shows the number of companies developing one or several technologies as part of their portfolio of services. In average, each surveyed company offers 3 categories

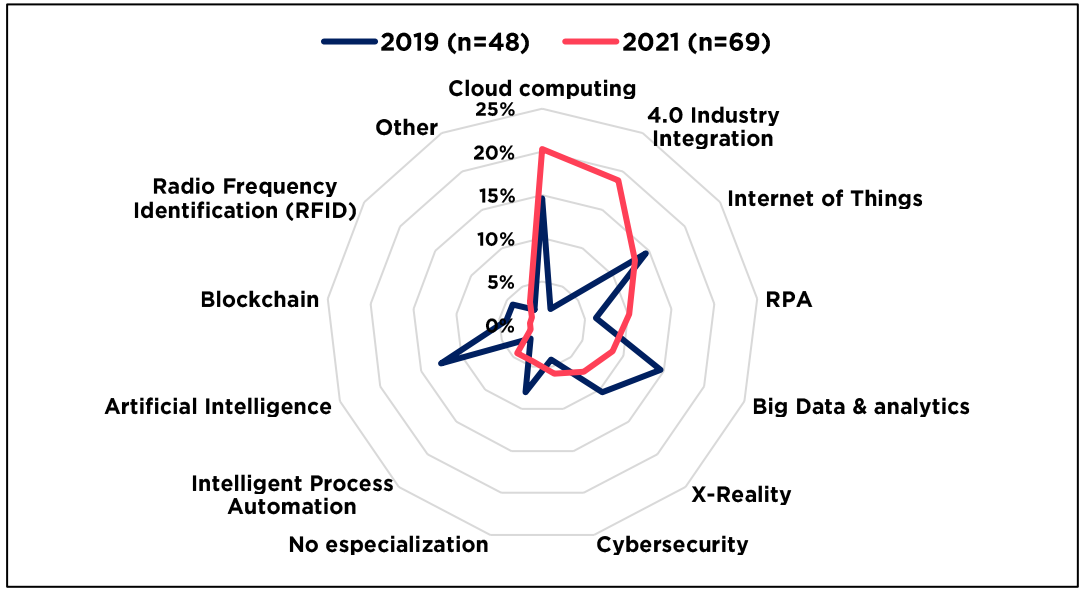
In addition, some companies state complementing their offer with other services that may be linked to their specialization or else be independent. Among the identified services, are:

- Intelligent Process Automation (7%)
- Sensors & hardware for IoT (4%)
- Videogames (1%)
- APPs, ecommerce & web (3%)
- RFID Technology; ERPs (1%)

2. Evolution in specialization and portfolio of services, 2019-2021

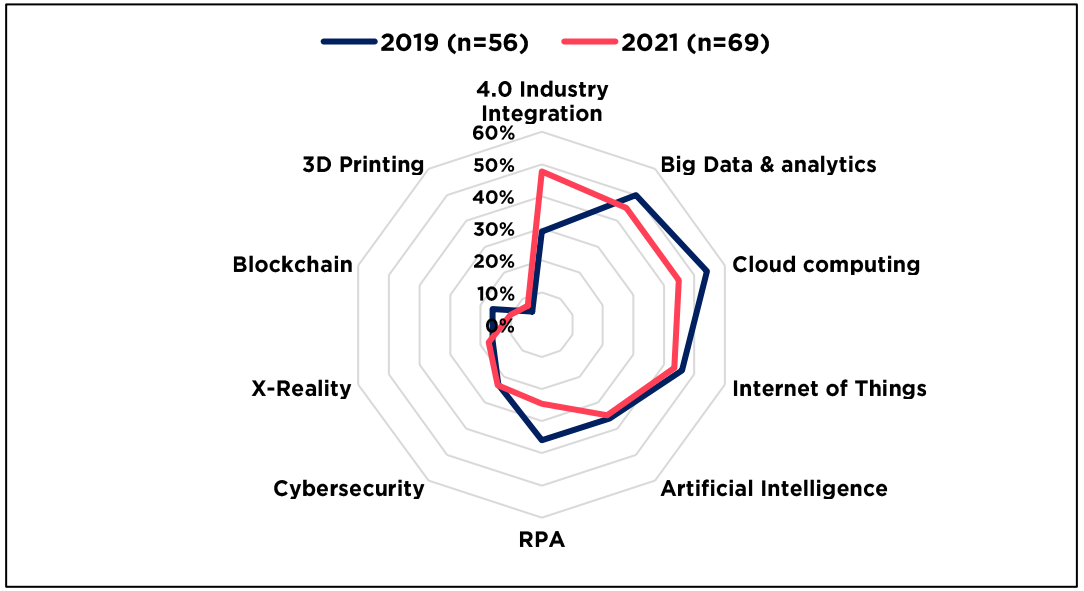
During this period, Cloud Computing reflects an important expansion and is consolidated as category with most specialized companies, 20% of the sector. On the other hand, 4.0 Industry Integration is the technology recording greater expansion in this period, both in the number of specialized companies (2% to 19%) as in the total of those developing them (29% to 48%). IoT & Cybersecurity are highlighted as stable technologies, with light changes.

2019-2021: specialization category
(% of companies)



Specialization	2019 (n=48)	2021 (n=69)
Cloud computing	15%	20%
4.0 Industry Integration	2%	19%
Internet of Things	15%	13%
RPA	6%	10%
Big Data & analytics	15%	9%
X Reality	10%	7%
Cybersecurity	4%	6%
No specialization	8%	4%
Intelligent Process Automation	2%	4%
Artificial Intelligence	13%	1%
Other	10%	5%

2019-2021: portfolio of services offered
(% of companies)



Technology offered	2019 (n=48)	2021 (n=69)
4.0 Industry Integration	29%	48%
Big Data & Analytics	50%	45%
Cloud computing	54%	45%
Internet of Things	46%	43%
Artificial Intelligence	36%	35%
RPA	36%	25%
Cybersecurity	23%	23%
X Reality	16%	17%
Blockchain	16%	10%
3D Printing	5%	7%

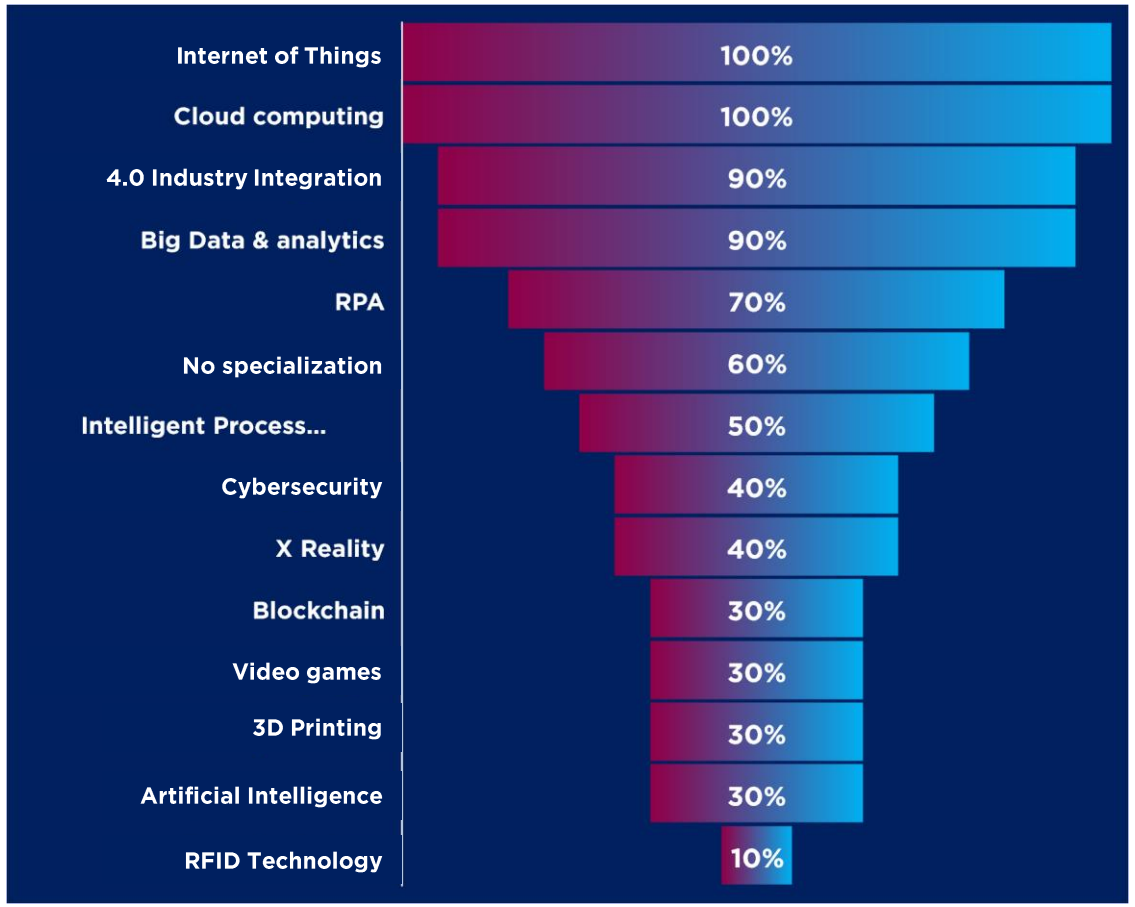
Source: own elaboration from survey's data

3. Diversification of the portfolio of services, by specialization

IoT & Cloud Computing are the specializations showing the most varied offer of services, with a total of 10 categories developed, where its specialization is the main participation within the portfolio. For example, the specialization Big Data complements its offer with a total of 8 other technologies, being the Big Data services the most offered within their portfolio. This consistency is key underling that the know-how of the companies is reflected in the services articulated at business level.

2021: number of categories offered for each specialization

(among a total of 10 categories)



2021: composition of portfolio of services by specialization

(% of companies)

Internet of Things

	Technology:	Participation In portfolio
1	**Internet of Things**	**26%**
2	4.0 Industry Integration	15%
3	Big Data & analytics	12%
4	Cloud computing	12%
5	X Reality	9%
6	Artificial Intelligence	9%
7	Cybersecurity	6%
8	RPA	6%
9	3D Printing	3%
10	Blockchain	3%

4.0 Industry Integration

	Technology :	Participation In portfolio
1	**Sistemas de Integration**	**28%**
2	Internet of Things	15%
3	Artificial Intelligence	13%
4	Big Data & analytics	13%
5	Cloud computing	10%
6	RPA	8%
7	Cybersecurity	8%
8	Blockchain	5%
9	X Reality	3%

Cloud

	Technology:	Participation In portfolio
1	**Cloud computing**	**31%**
2	Big Data & analytics	17%
3	4.0 Industry Integration	14%
4	Cybersecurity	10%
5	Artificial Intelligence	10%
6	Internet of Things	7%
7	RPA	5%
8	X Reality	2%
9	Blockchain	2%
10	3D Printing	2%

Big data & analytics

	Technology :	Participation In portfolio
1	**Big Data & analytics**	**25%**
2	Artificial Intelligence	17%
3	Cloud computing	17%
4	4.0 Industry Integration	13%
5	Internet of Things	8%
6	RPA	8%
7	Blockchain	4%
8	Cybersecurity	4%
9	3D Printing	4%

Source: own elaboration from survey's data

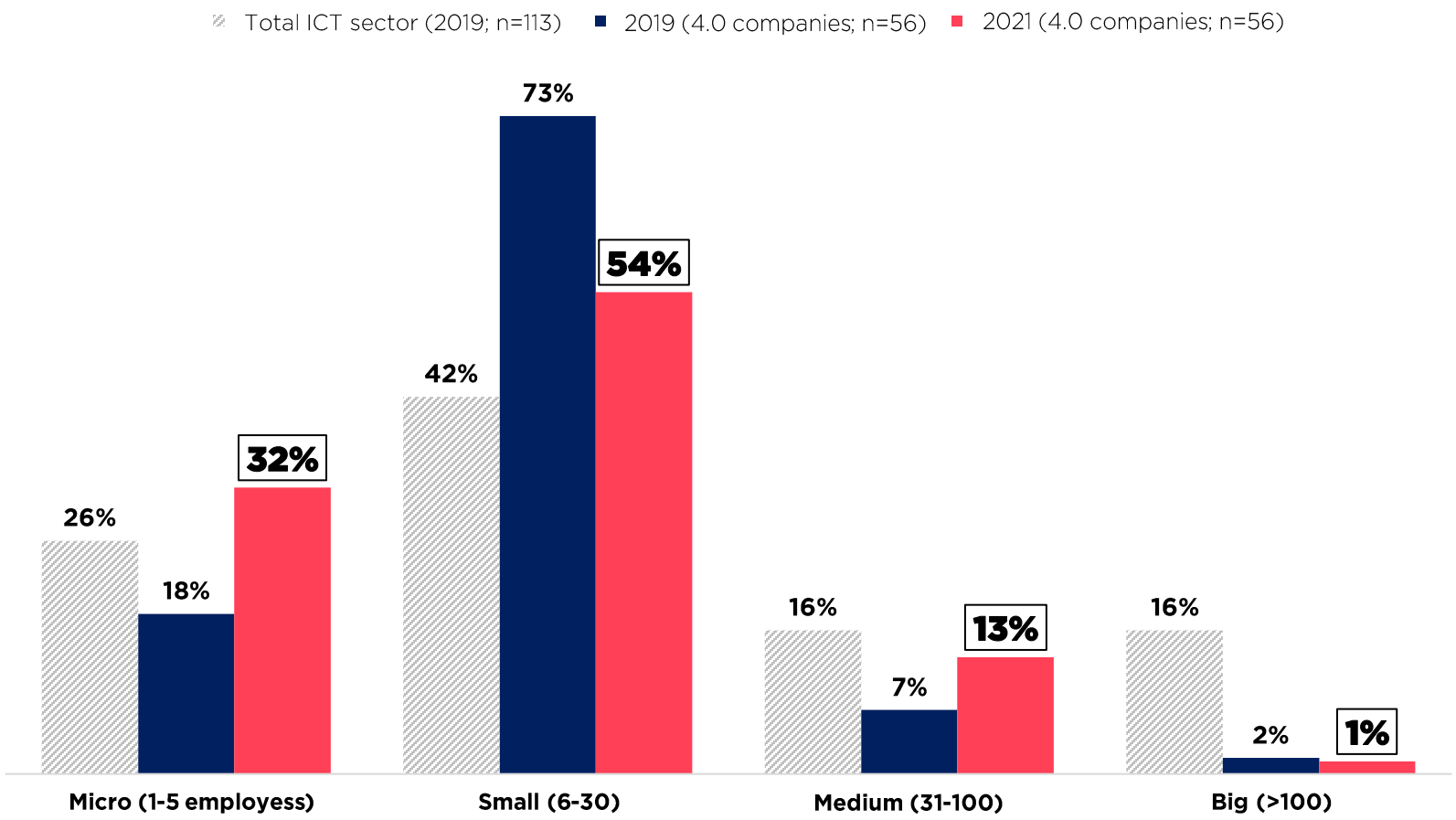
Size of companies & employment

4. Composition of the sector as per companies' size

In 2021, the sector was characterized by a predominance of Small-size companies (54%) & Micro (32%), namely, in a range between 1 to 30 employees; this behaviour is consistent with the profile of the entire ICT sector in Costa Rica, but with a significantly smaller participation of Large companies. In terms of employment, the sector recorded a total of **1,090 jobs**, an expansion of 120 positions regarding 2019. In general, these sizes allow the sector to have certain flexibility in the development of their operations, not to mention that some of their services may have experimental or exploratory character.

Composition of the sector according to companies' size

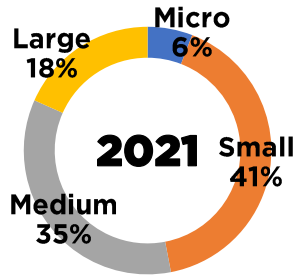
(% of companies)



Compared to 2019: the sector shows a decrease in Small companies, which could mean a displacement towards Micro (by loss of employments) or Medium (by increase). Even if Micro earned more percentual points, it was medium and large with more job positions during the period.

Employment Distribution

(% of total)



Size	Employment 2019	Employment 2021
Micro	36	64
Small	592	448
Medium	212	378
Large	130	200
Total general	**970**	**1090**

Source: own elaboration from survey's data / Characterization of the ICT sector in Costa Rica, PROCOMER (2019)

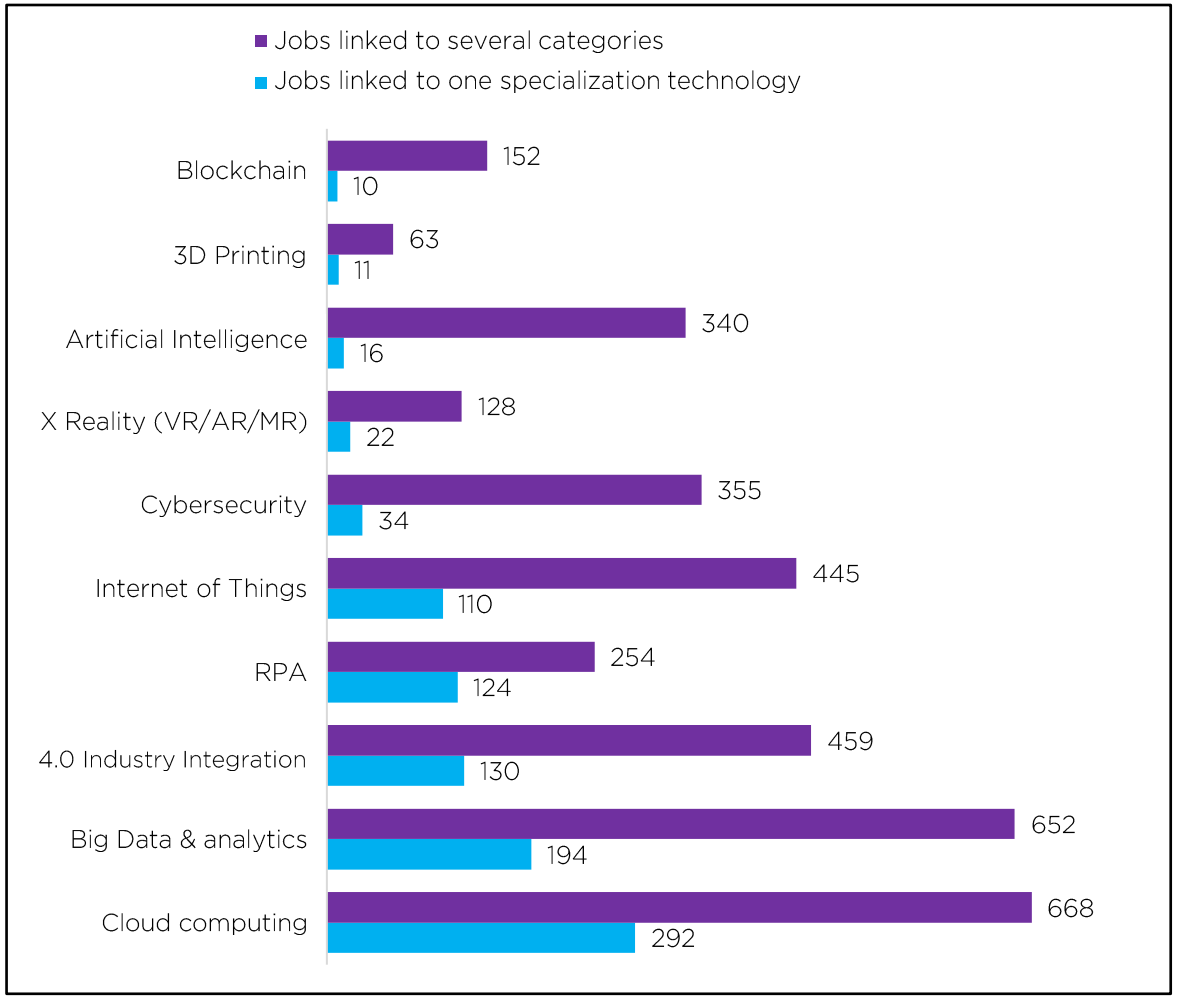
5. Distribution of employment by technological category

Surveyed companies were consulted of their technological specialization (single option), as well as for their portfolio total in 4.0 technologies offer. By specialization, Cloud is the category concentrating more employment, followed by Big Data; together representing almost half of the work positions (45%). As per **categories offered**, 61% of employment positions develop Cloud among their services. On the contrary, 3D Printing is the technology showing less jobs.

Key facts	2019 (Jobs)	2021 (Jobs)
Total employment:	**970**	**1,090**
Average per company:	17	16
Company with most collaborators:	130	200
Company with less colaborators:	2	1

2021: Employment by technological category
(n=1090)

Specialization	Jobs linked to a technology of specialization	%Part.	Jobs linked to various categories	%Part.
Cloud computing	292	27%	668	61%
Big Data & analytics	194	18%	652	60%
4.0 Integration Industry	130	12%	459	42%
RPA	124	11%	254	23%
Internet of Things	110	10%	445	41%
Cybersecurity	34	3%	355	33%
X Reality (VR/AR/MR)	22	2%	128	12%
Artificial Intelligence	16	1%	340	31%
3D Printing	11	1%	63	6%
Blockchain	10	1%	152	14%
Other	147	13%	-	-
Total general	**1.090**	**100%**	-	-

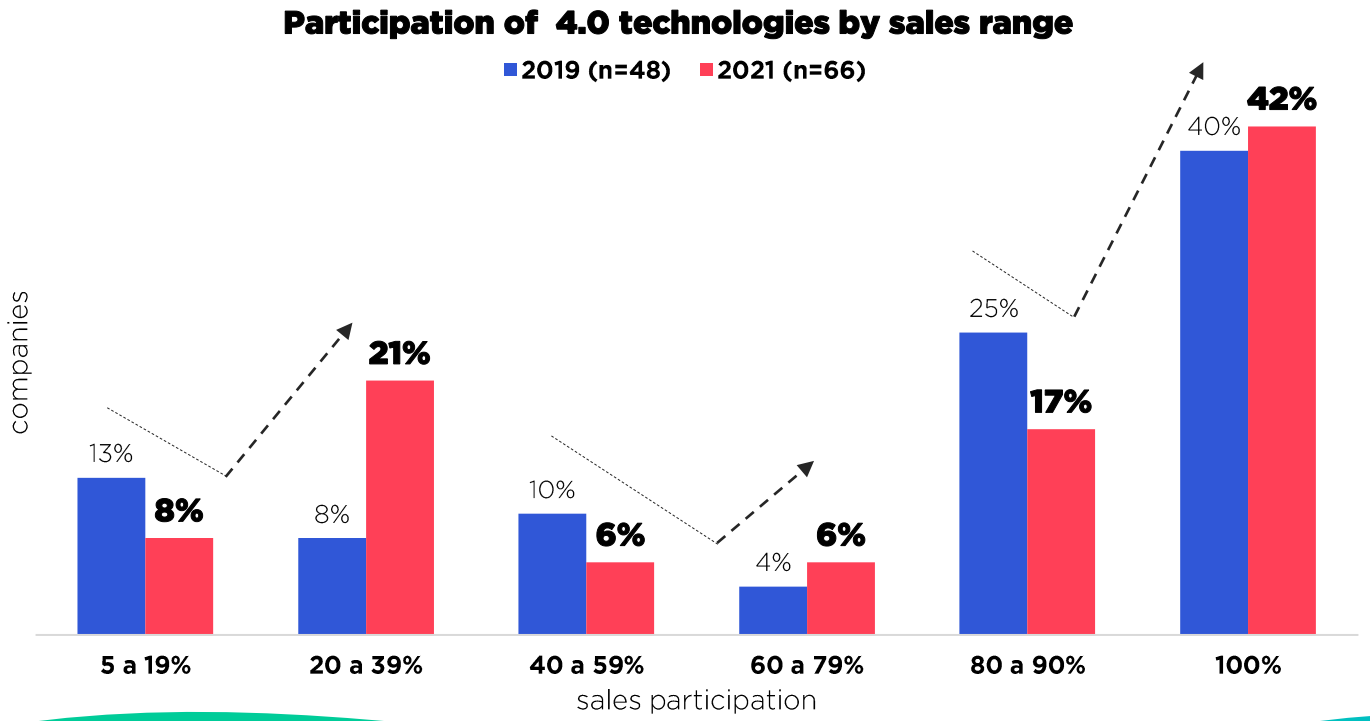


Source: own elaboration from survey's data

Composition of 4.0 technologies sales

7. Participation of 4.0 technologies in the total sales of the sector

In average (2021), 70% of the sales of this sector is product of 4.0 technologies, showing that these companies are effective in translating their knowledge specialized in business returns to the market. Compared to 2019, this participation lightly decreased, as minus three percentual points, which could equally be considered a positive outcome, because of the economic crisis produced by the pandemic, particularly in 2020, affecting the sector to some extent.



For approximately 60% of the companies, 4.0 technologies sales represent over 80% of their income, showing a widely specialized commercial activity.

These data reflect that the sector's offer of services (at qualitative level, know-how, specialization, portfolio diversification) is in line and also substantiated by its sales level.

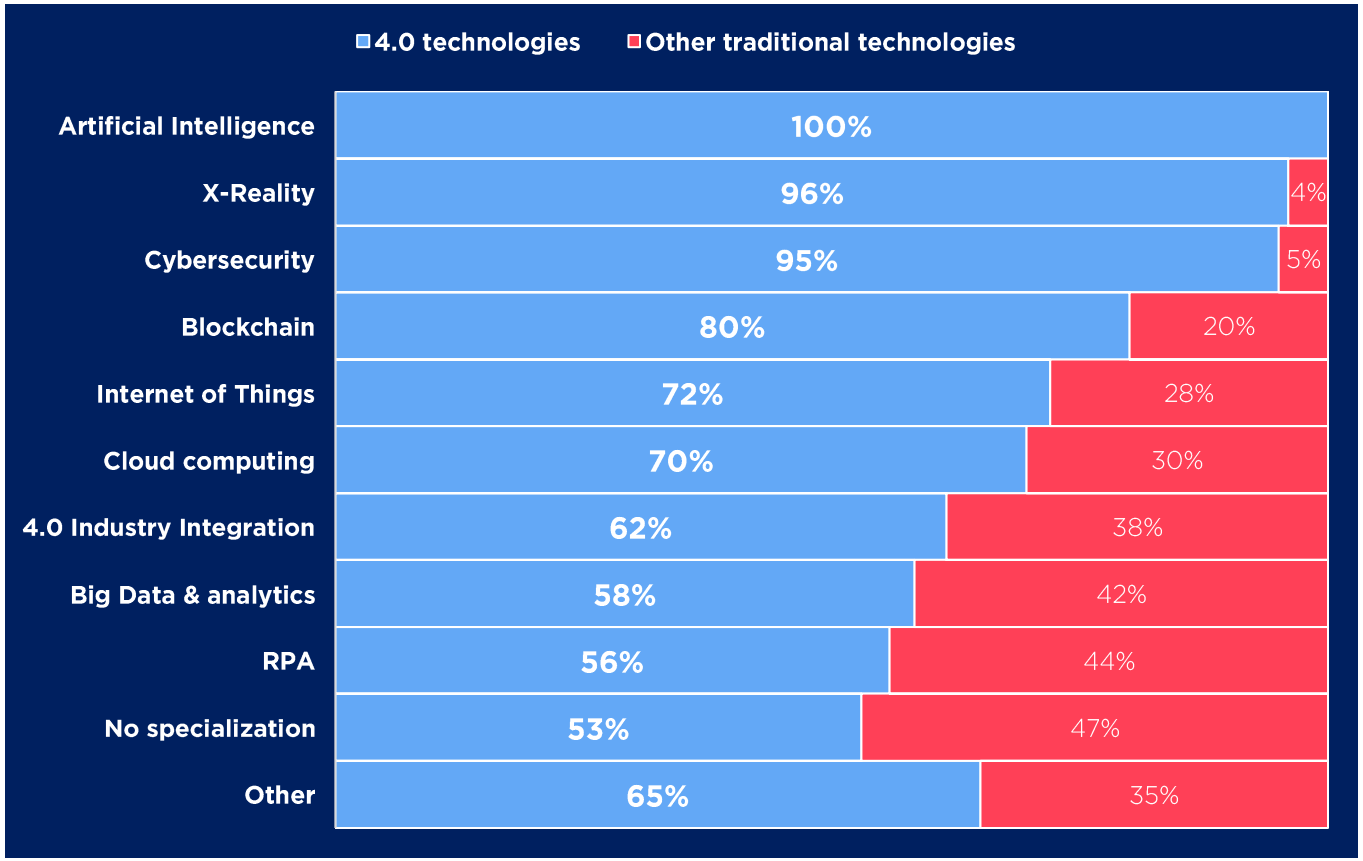
When the period's performance is analysed, it is possible to note there was a displacement of sales participation from the bottom ranks toward other higher.

Source: own elaboration from survey's data

8. Sales participation of 4.0 technologies, by category

By specialization, **Artificial Intelligence** is the only category whose total sales is product of 4.0 technologies. In addition, X-Reality, Cybersecurity & Blockchain are above the average rate (76%). On the other hand, observe that companies without specialization are the least effective in their 4.0 sales, which shows that business performance may be related to the capacity of the companies to contribute specialized added value; for example. in aspects of experience, differentiation and understand their customers' vertical, as well as and specially of their business models and digital transformation.

Participation of 4.0 technologies in sales, by specialization
(2021; % of the total sales)



A larger participation of 4.0 services on total sales shows profiles which have gone further in their specialization activities; in the opposite case, categories are shown which should still complement their sales with traditional style services, not related to 4.0 Industry.

Notice that **4.0 Industry Integration** was positioned in 2021 as the most offered technology by the sector (48% of the companies), however, it should be complemented in 38% by other not specialized ones.

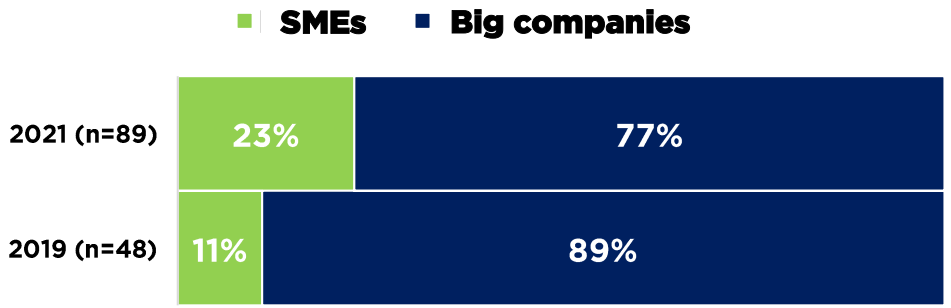
	% companies	
Specialization	**2019 (n=48)**	**2021 (n=66)**
Artificial Intelligence	88%	100%
RFID Technology	90%	100%
X-Reality	73%	96%
Cybersecurity	100%	95%
Blockchain	50%	80%
Internet of Things	75%	72%
Cloud Computing	68%	70%
4.0 Industry Integration	50%	62%
Big Data & analytics	79%	58%
RPA	82%	56%
No specialization	-	53%
Other	38%	65%

Source: own elaboration from survey's data

Profile of the sector's customers

9. 4.0 Technology sales according to customers' profile

By size, customers of the sector are characterized mainly by large companies (77% of the total), but with participation of small and medium companies growing up to 23% in 2021 (vs 11% in 2019). Given that 63% of the sales of this sector are done in the local market (vs 56% in 2019) which could reflect a greater penetration and acceptance of 4.0 technologies among smaller size companies, normally not close to digital transformation processes. **By vertical**, customers with activities in services remain as the main consumer, with 67% of the total sales (vs 65% in 2019).



SMEs customers
(% of companies)

Specialization	2019	2021	
X Reality	5%	**40%**	Above average (2021)
Cloud computing	53%	**30%**	
4.0 Industry Integration	9%	**27%**	
Cybersecurity	22%	**26%**	
Blockchain	20%	**25%**	
Internet of Things	15%	**23%**	
Big Data & analytics	7%	15%	
RPA	11%	11%	
W/o specialization	-	8%	
3D Printing	0%	5%	
Videogames	0%	0%	
Artificial Intelligence	4%	0%	

As per vertical where its customers are located:

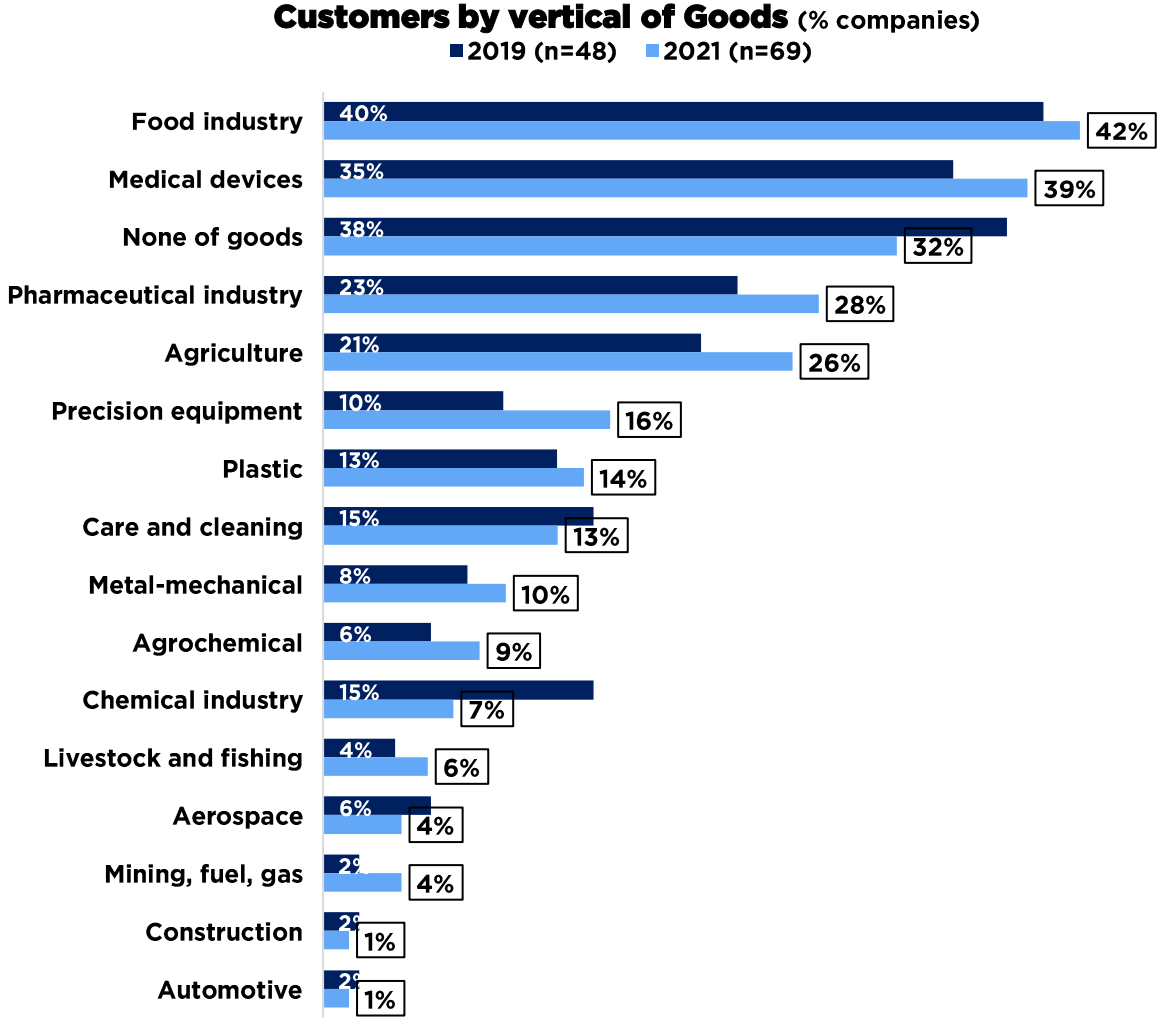
Customers by vertical
(2021; % of companies)

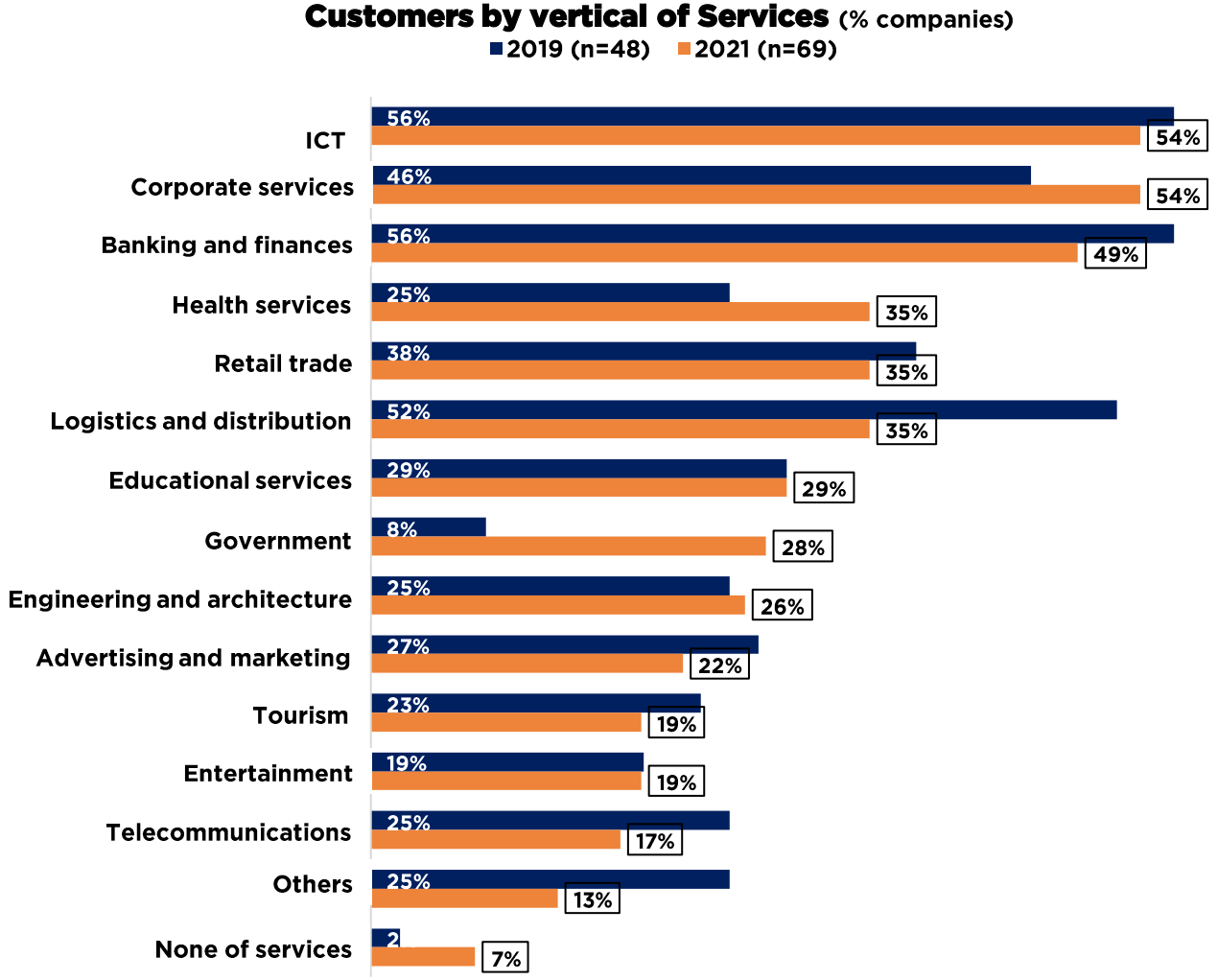
Specialization	Average customers in services		Average customers in goods	
Blockchain	**100%**	Above average (2021)	0%	
Artificial Intelligence	**100%**		0%	
Int. Process Automation	**88%**		13%	
RFID Technology	**80%**		20%	
Videogames	**80%**		20%	
W/o specialization	**75%**		25%	
Cybersecurity	**69%**		31%	
X Reality	65%		**35%**	Above average (2021)
4.0 Industry Integration	65%		**35%**	
Cloud computing	62%		**38%**	
Big Data & analytics	53%		**48%**	
Internet of Things	39%		**61%**	
3D Printing	30%		**70%**	
RPA	26%		**74%**	

Source: own elaboration from survey's data

10. 4.0 technology sales by vertical of its customers

In goods, food prevails as the main demanding, with 42% of the companies with customers in that sector. In general, 10 out of 16 verticals of Goods increased participation versus 2019, with greater percentage expansion in the case of precision equipment, agricultural, pharmaceutical and medical devices; which could be related to the general needs generated by the pandemic context in health areas. **In services**, ICTs displaced banking as main consumer, while **health** recorded the greatest percentage growth (+10 p.p), only surpassed by Government (+20 p.p.), both possibly related to the context.





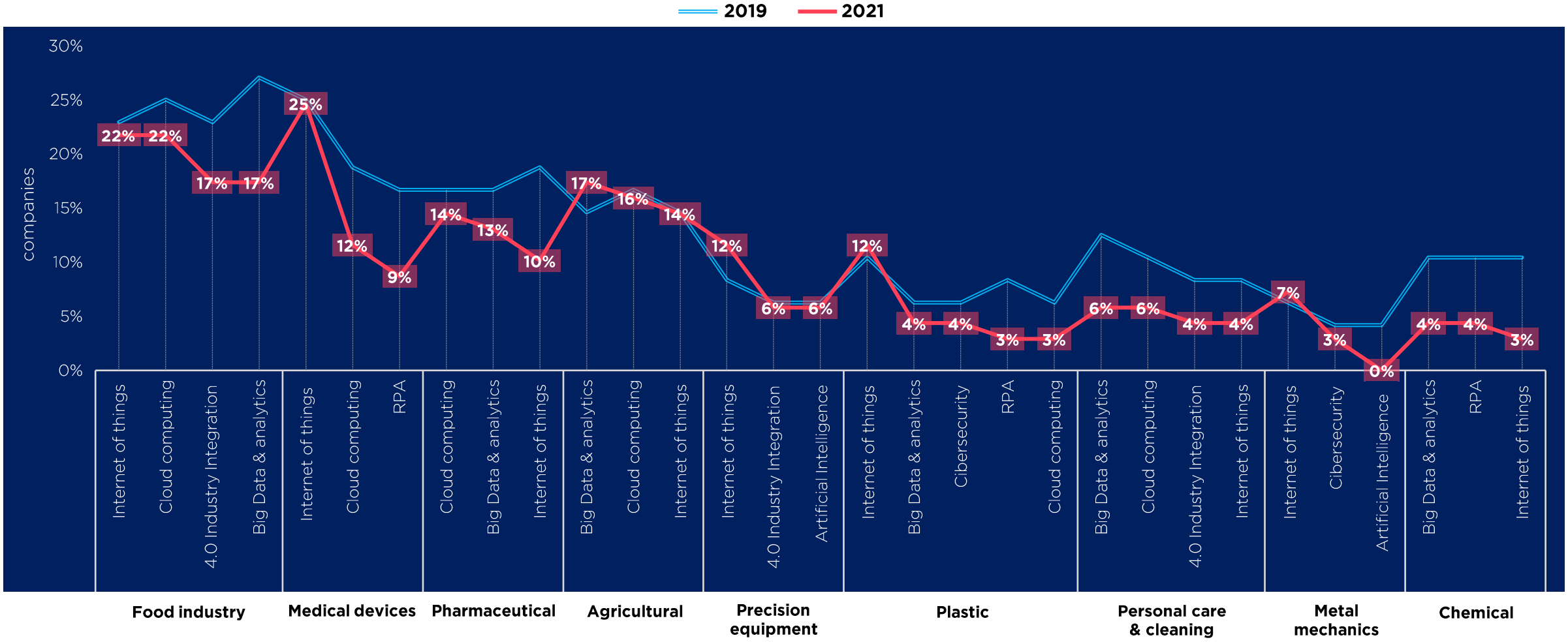
Source: own elaboration from survey's data

11. Goods: sales by vertical of its customers

Among the verticals of **goods**, Internet of Things , Big Data & Cloud Computing indicate being the most recurring technologies offered by the sector, among others. On the other hand, Cybersecurity shows it is positioned in plastic and metal-mechanics customers.

Incidence of technologies commercialized among its customers, by vertical of goods

(% companies; top technologies in each vertical)



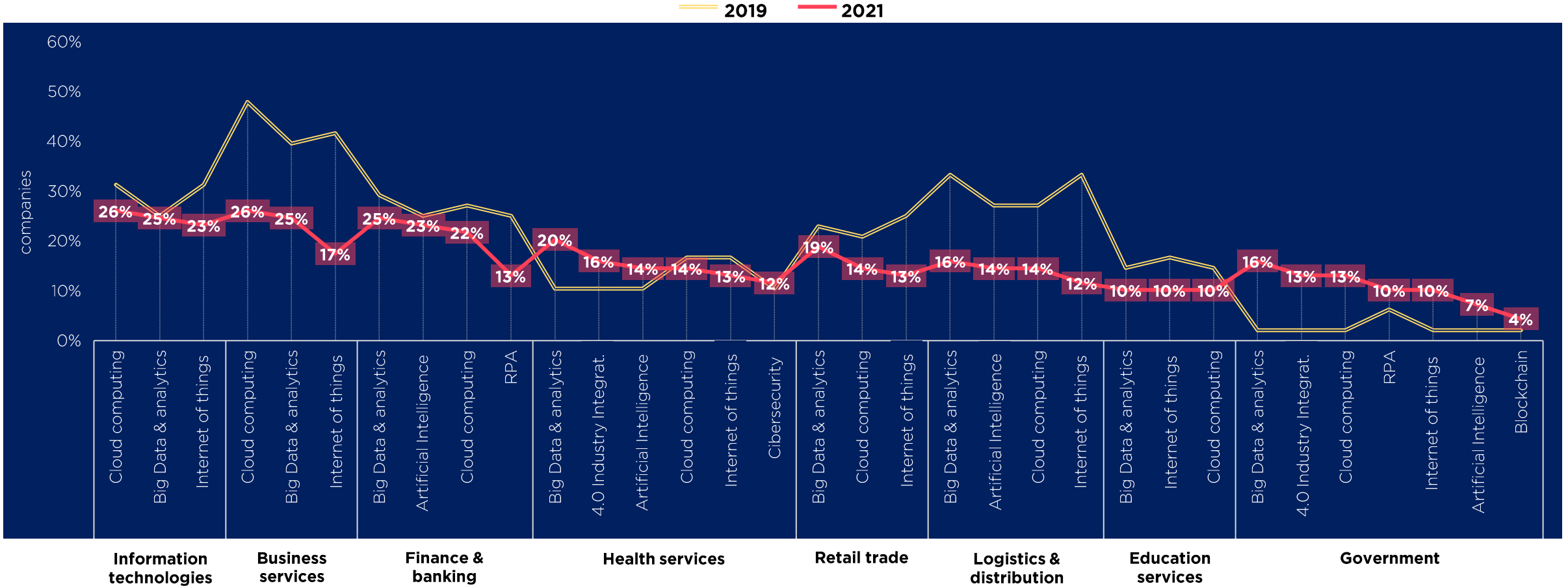
Source: own elaboration from survey's data

12. Services: sales by vertical of its customers

Big Data is the most offered category among the services' verticals, consistent with the needs of these customers, mostly working with data for decision-making or process optimization. The **health** sector, vertical with greatest growth in 2021 (excluding Government), also has Big Data as main category, followed by Integration, Artificial Intelligence, Cloud & Cybersecurity. In the context of the pandemic, the health sector has shown opportunities at global level to deepen in solutions of, for example, smart records, Cybersecurity, telemedicine, identification of patterns for epidemiology, traceability of patients/assets, artificial for identification of new formulas, among others.

Incidence of technologies commercialized among their customers, by Services vertical

(% companies; top of technologies in each vertical)



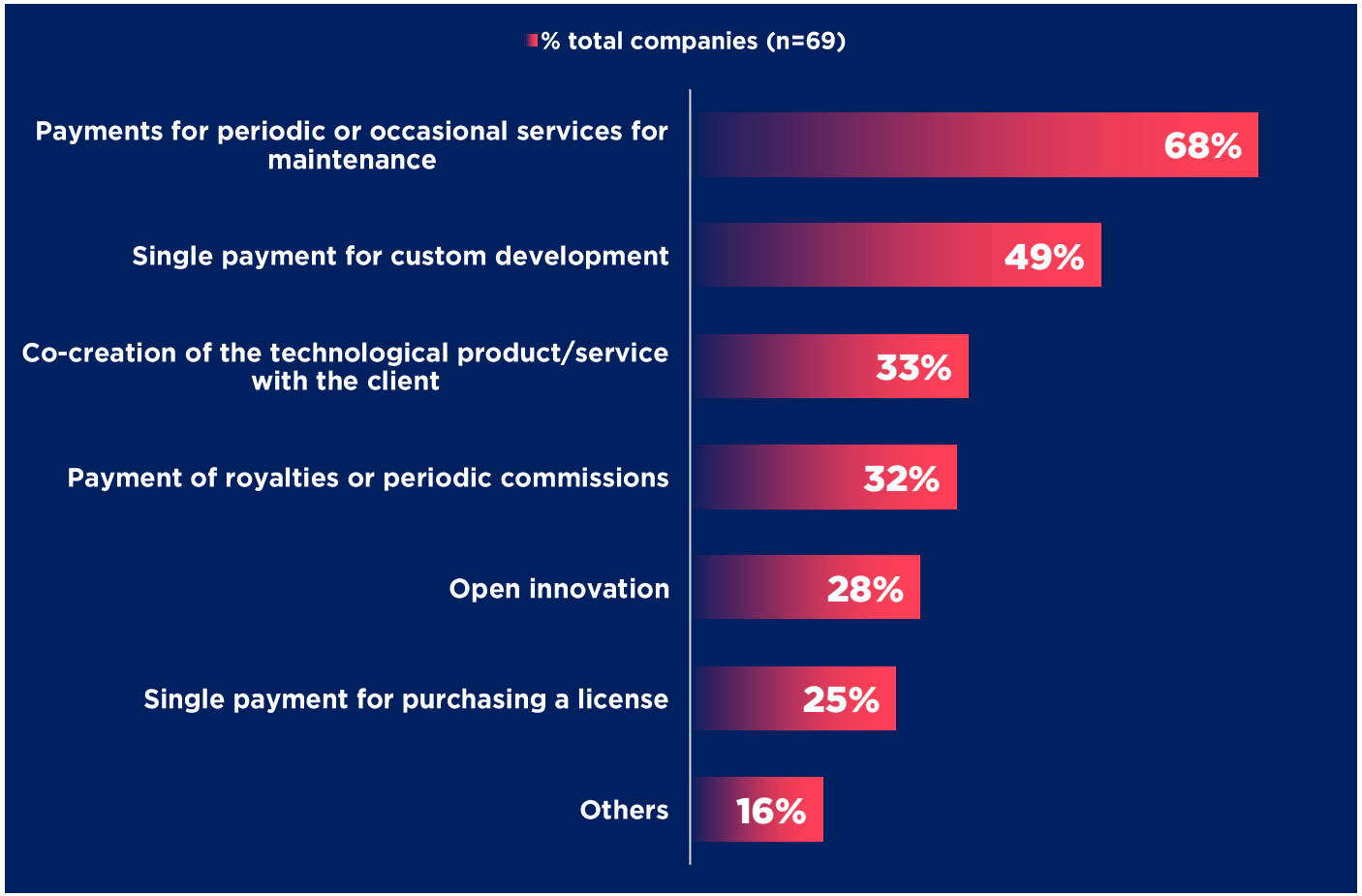
Source: own elaboration from survey's data

Main models of service or monetization

13. Main business models developed by the sector

About 7 out of each 10 companies monetizes for maintenance services of technological solutions, showing follow-up to their customers and a linkage which might go beyond the original purchase-sale. Around one third of the sector develops co-creation models of the technological product and open innovation, showing closeness to their customers to understand their needs and generate products in line with these. The diversity of business models is normally one of the most highlighted added value differentials by international customers for Costa Rica's ICT offer.

Business models identified (2021)



Other models detected:

Outsourced Services for security tests

Payment of licences for use of the platforms or Services

Payments for individual services

Revenue sharing

Software as a Service

Instalment for use of licences and processing capacity

Annual contracts with invoicing with monthly contributions

Sale and/or renting of sensors as complement

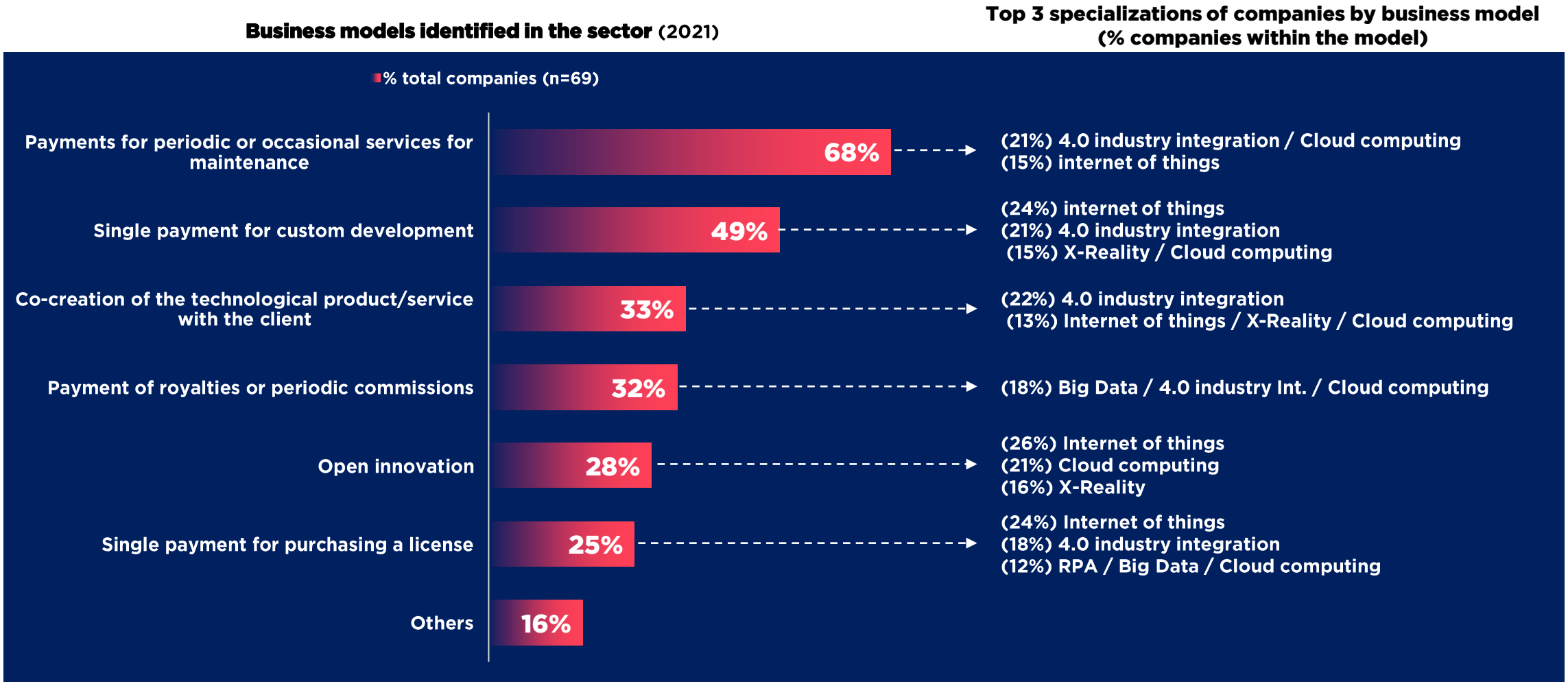
Training and capacity-building

Single payment for training services

Source: own elaboration from survey's data

14. Main business models developed by the sector

About 7 out of each 10 companies monetizes for maintenance services for technological solutions, showing a follow-up of their customers and a linkage which might go beyond original purchase-sale. Around one third of the sector develops co-creation models of the technological product and open innovation, showing closeness to their customers to understand their needs and generate products in line with these. The diversity of business models is normally one of the most highlighted added value differentials by international customers for Costa Rica's ICT offer.



Source: own elaboration from survey's data

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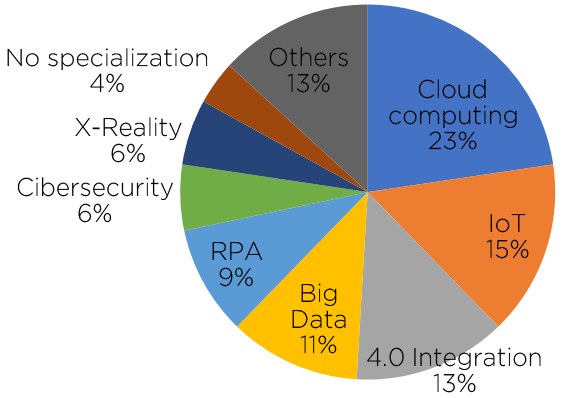
Export Profile of 4.0 technologies

15. Export profile of the 4.0 technologies

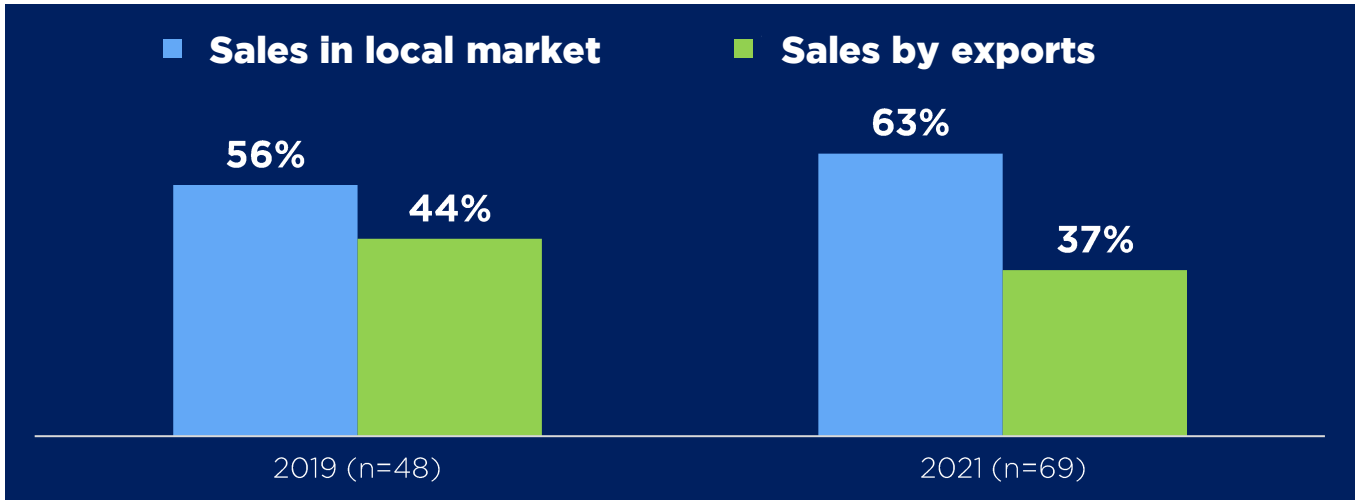
The sector shows ample exporting experience, since 78% of the companies commercializes its services on international markets. Even when showing some impairment during this period, probably because of the pandemic, the decrease in this rate was only 2 percentage points in relation to 2019, leading to companies selling more services in the local market, passing from 56% to 63% in 2021. By technology, Cloud is the specialization with more exporters (23%).

Year	Exports	No exports
2021	54 companies	15 companies
2019	38 companies	10 companies

2021: Exporters by specialization (n=54)



Specialization	% of companies within exporting specialization (2021)	
Big Data & analytics	**100%**	Above average (78%)
Artificial intelligence	**100%**	
Blockchain	**100%**	
Internet of things	**89%**	
Cloud computing	**86%**	
Other	**83%**	
Cybersecurity	75%	
RPA	71%	
No specialization	67%	
X-Reality	60%	
4.0 industry integration	54%	



Source: own elaboration from survey's data

16. Value of exports of 4.0 technologies

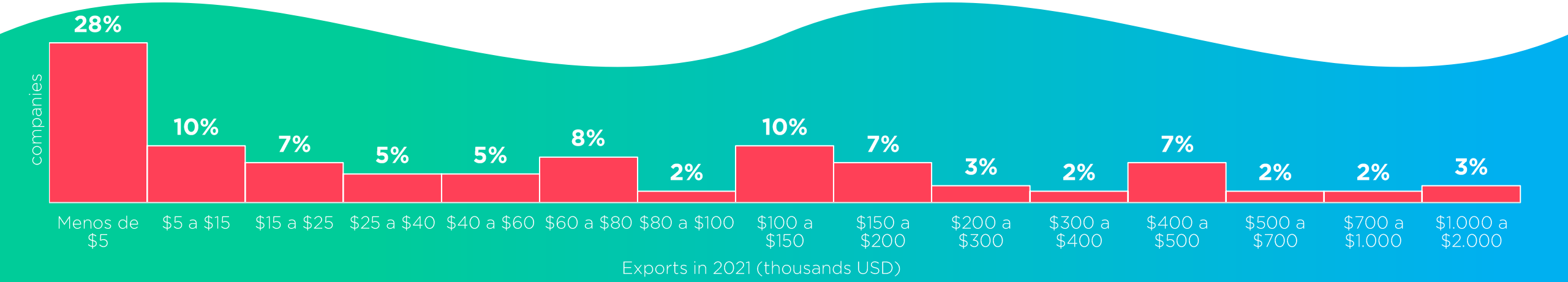
In 2021, surveyed companies generated sales of 4.0 categories 4.0 for $31 million USD, where 37% had international markets as destination, namely, around $11,5 million USD. **By specialization**, Cloud is the category with more invoicing both in local as international markets (28% of total exports); however, it is Videogames or Blockchain whose export value contributes more in total sales. Integration, the technology with most offer by sector, shows its market is mostly local.

4.0 Technology sales by market (in 2021; thousand USD; n=69)

Destination	Thousands USD	Part. in sales
International	**$11 475**	**37%**
Local Market	$19 539	63%
Total sales	**$31 013 514**	**100%**

4.0 technologies sales by specialization (in 2021; thousands USD; n=54)

Specialization	Exports	Part. of exports in total sales of the specialization	Part. in total exports	Sales in local market	Total general
Cloud computing	**$3 200**	28%	28%	**$8 066**	$11 266
Videogames	**$2 000**	**90%**	17%	**$232**	$2 232
Intelligent Process Autom.	**$1 165**	**61%**	10%	**$731**	$1 896
Big Data & analytics	**$1 130**	**53%**	10%	**$985**	$2 115
Internet of Things	**$965**	**44%**	8%	**$1 236**	$2 201
Blockchain	**$700**	**69%**	6%	**$310**	$1 010
4.0 industry integration	**$615**	22%	5%	**$2 179**	$2 794
Cybersecurity	**$530**	29%	5%	**$1 308**	$1 838
RFID Technology	**$500**	**68%**	4%	**$232**	$732
X-Reality	**$310**	19%	3%	**$1 331**	$1 641
No specialization	**$210**	9%	2%	**$2 122**	$2 332
RPA	**$125**	18%	2%	**$570**	$695
Artificial Intelligence	**$25**	10%	0%	**$235**	$260
Total general	**$11 475**	**37%**	**100%**	**$19 539**	**$31 014**

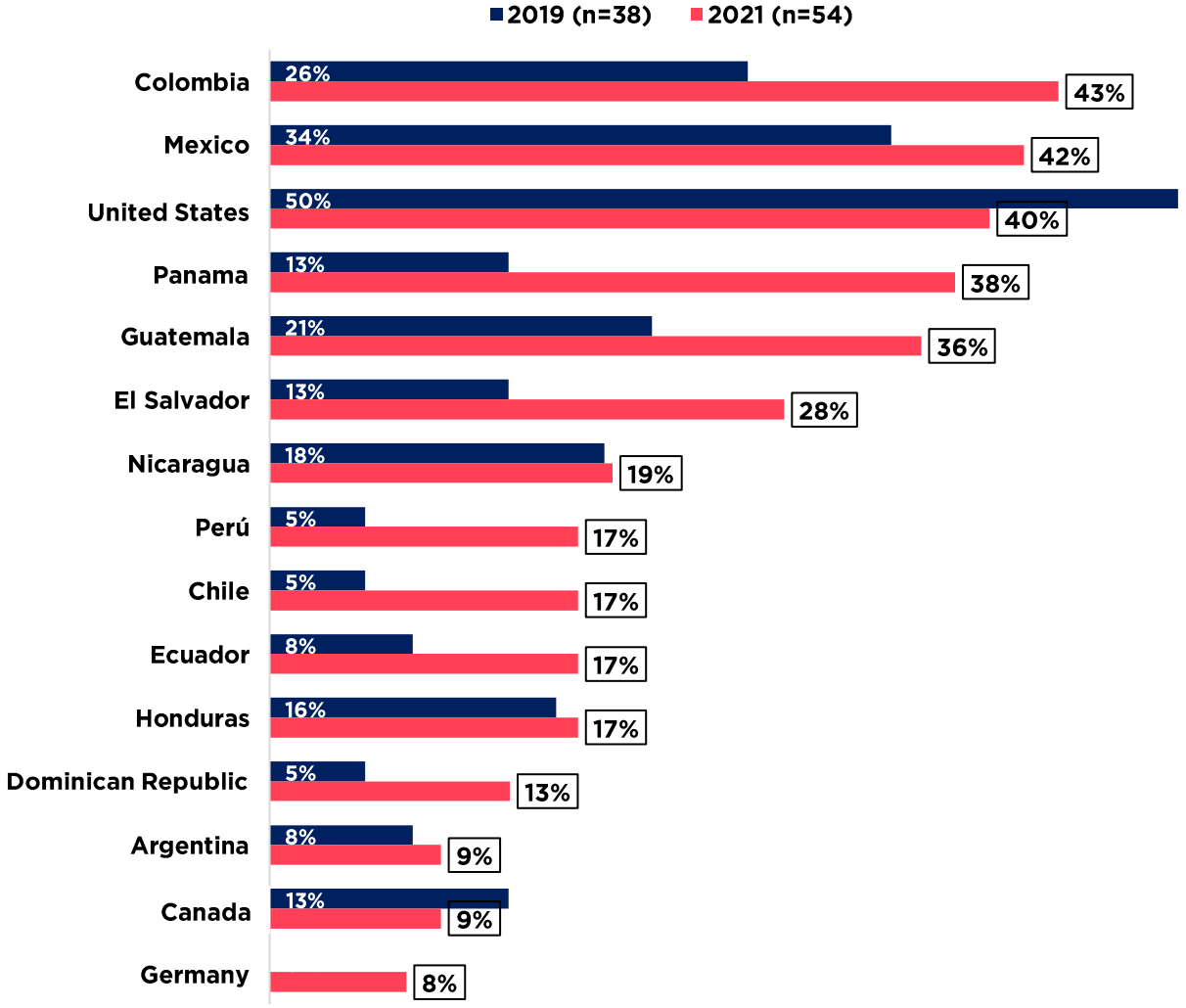


Source: own elaboration from survey's data / Total exports of 4.0 Technology may be higher tan the here estimated since there may be more exporting companies not having participated of this analysis

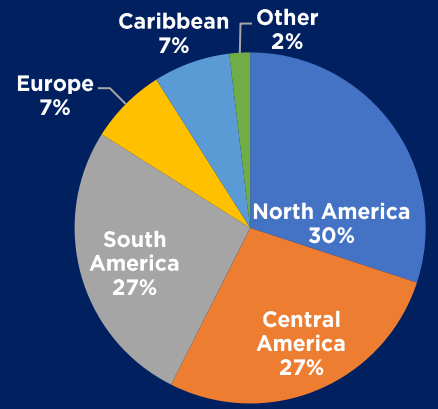
17. Destinations of 4.0 technology exports

In 2021, 30% of exporters commercialized 4.0 technologies in North America, followed by Central America (27%), South America (27%) and Europe (7%), among others. Compared to 2019, Colombia was positioned as main destination, displacing USA to third position and Mexico staying in second place, these three with over 40% of exporters participating. This adjustment shows a greater focus on regional markets, but not neglecting more distant destinations like Europe, with Germany or Spain as reference.

Main 15 export destinations (% exporters)



2021: Exports by region
(% exporters; n=54)



2021: Other export destinations
(% exporters: n=54)

Pos.	Market	2019 (n=38)	2021 (n=54)
16	Spain	4%	6%
17	Uruguay	0%	6%
18	Venezuela	2%	4%
19	Paraguay	0%	2%
20	Brazil	2%	2%
21	Poland	0%	2%
22	Bolivia	0%	2%
23	Israel	0%	2%
24	Italy	0%	2%
25	Puerto Rico	2%	2%

Pos.	Market	2019 (n=38)	2021 (n=54)
26	United Kingdom	4%	2%
27	South Korea	0%	2%
28	Barbados	0%	2%
29	Netherlands	2%	2%
30	France	4%	2%
31	Portugal	2%	0%
32	Jamaica	2%	0%
33	Finland	2%	0%
34	Ireland	2%	0%

Source: own elaboration from survey's data

18. Specializations required in the main destinations (Top 3)

Cloud Computing is the specialization most companies have among those exporting to the main three destinations of the sector. On the other hand, Colombia and Mexico are interesting markets, since both have a diversified technological offer, competing with Costa Rica in certain destinations, but at the same time showing a generation of needs which Costa Rican companies benefit from, and could also be treated as associativity or co-production models.

#1 Colombia (2021)

Pos.	Specializations exporting to this destination	% exporters to this destination
1.	**Cloud computing**	**22%**
2.	**Internet of Things**	**17%**
3.	**RPA**	**17%**
4.	X Reality	13%
5.	Cybersecurity	9%
6.	4.0 Industry Integration	9%
7.	Big Data & analytics	9%
8.	Other	4%

#2 Mexico (2021)

Pos.	Specializations exporting to this destination	% exporters to this destination
1.	**Cloud computing**	**27%**
2.	**Internet of Things**	**23%**
3.	**X Reality**	**18%**
4.	Big Data & analytics	9%
5.	RPA	9%
6.	Cybersecurity	5%
7.	Int. Process Autom.	5%
8.	Artificial Intelligence	5%

#3 United States (2021)

Pos.	Specializations exporting to this destination	% exporters to this destination
1.	**Cloud computing**	**38%**
2.	**Cybersecurity**	**14%**
3.	**Internet of Things**	**10%**
4.	X Reality	5%
5.	Technology RFID	5%
6.	Integration Systems	5%
7.	Intell. Process Autom.	5%
8.	Videogames	5%
9.	Big Data & analytics	5%
10.	Blockchain	5%
11.	W/o specialization	5%

Source: own elaboration from survey's data

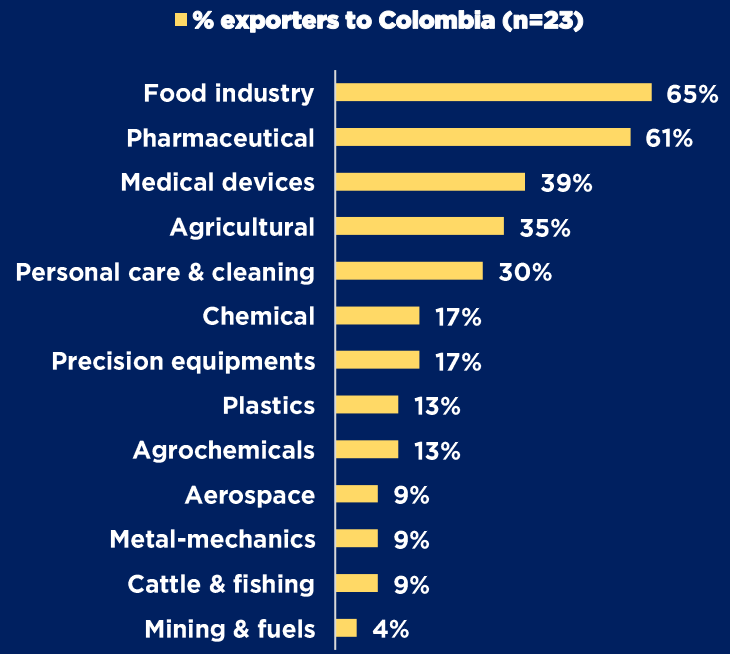
19. Customers of companies that export to these markets (goods)

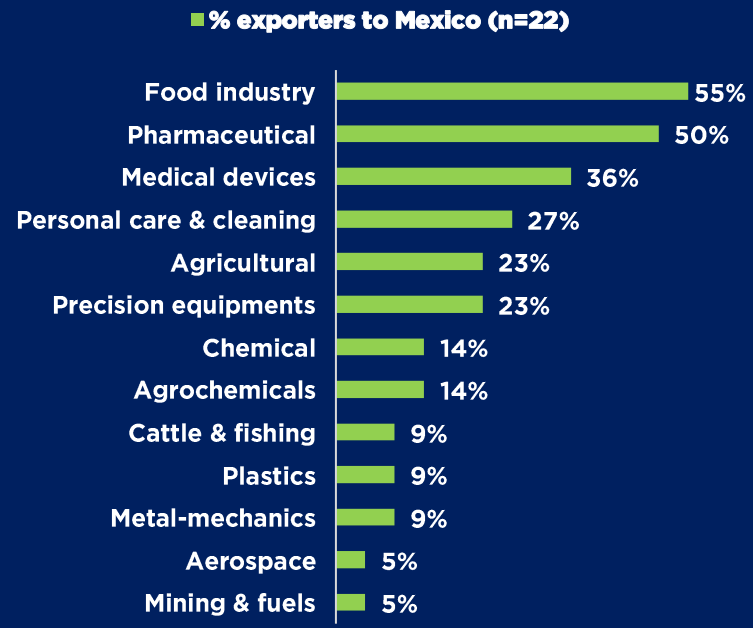
The food industry is the most important sector of goods among the customers of the companies exporting to Colombia, Mexico and United States; together with others as pharmaceutical & medical devices. With less participation, but also recurrently among these countries, the agricultural and personal care-cleaning sector stand out.

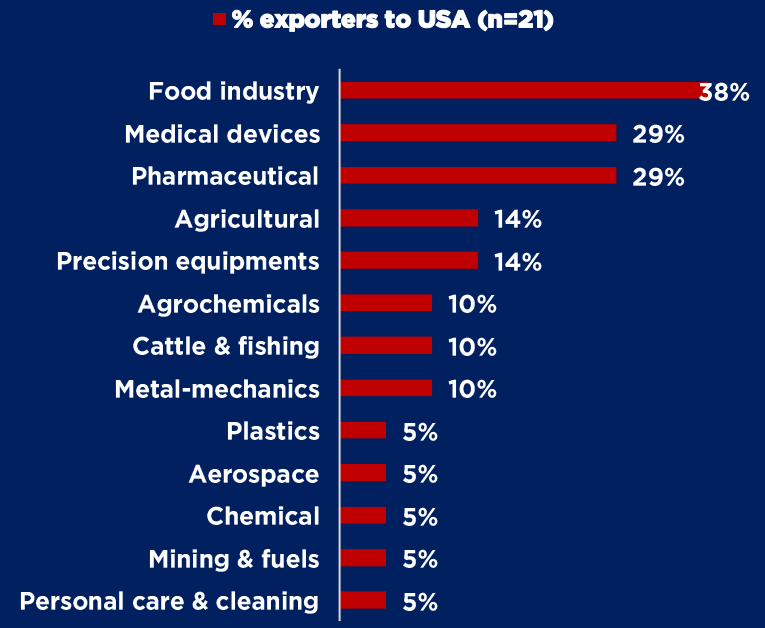
#1 Colombia (2021)

#2 Mexico (2021)

#3 United States (2021)







Source: own elaboration from survey's data

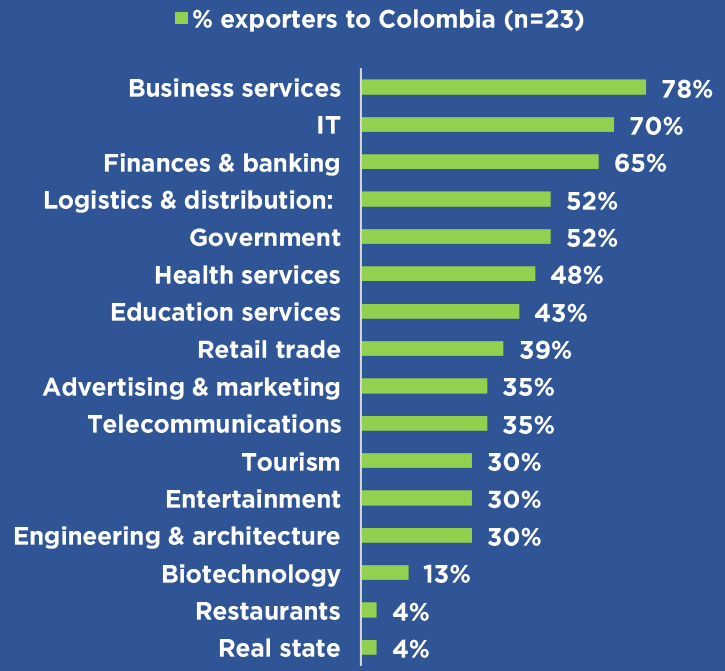
20. Customers of companies that export to these markets (services)

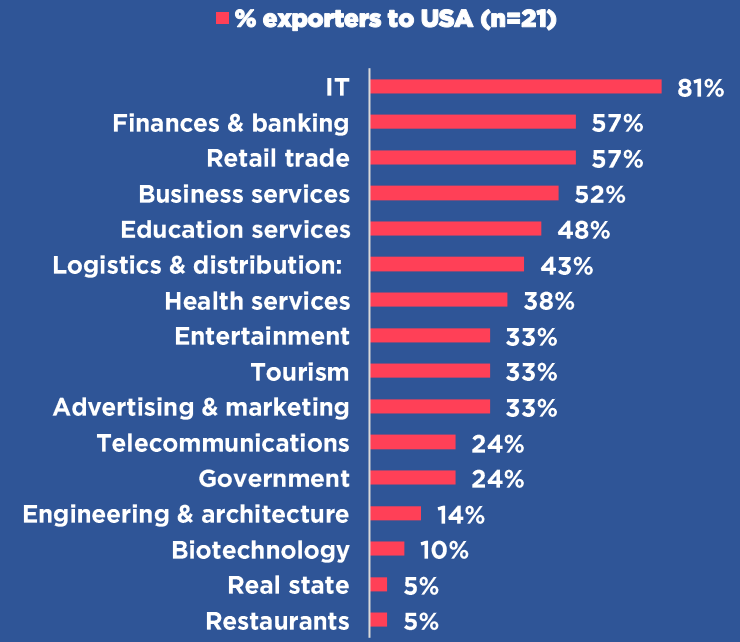
Information technologies and business services are the main sectors where customers in verticals of Services are located for companies exporting to these three main destinations, with a greater participation in the case of Colombia and Mexico. As complement, finances-banking is also a relevant sector, more related in this case to the United States.

#1 Colombia (2021)

#2 Mexico (2021)

#3 United States (2021)





Source: own elaboration from survey's data

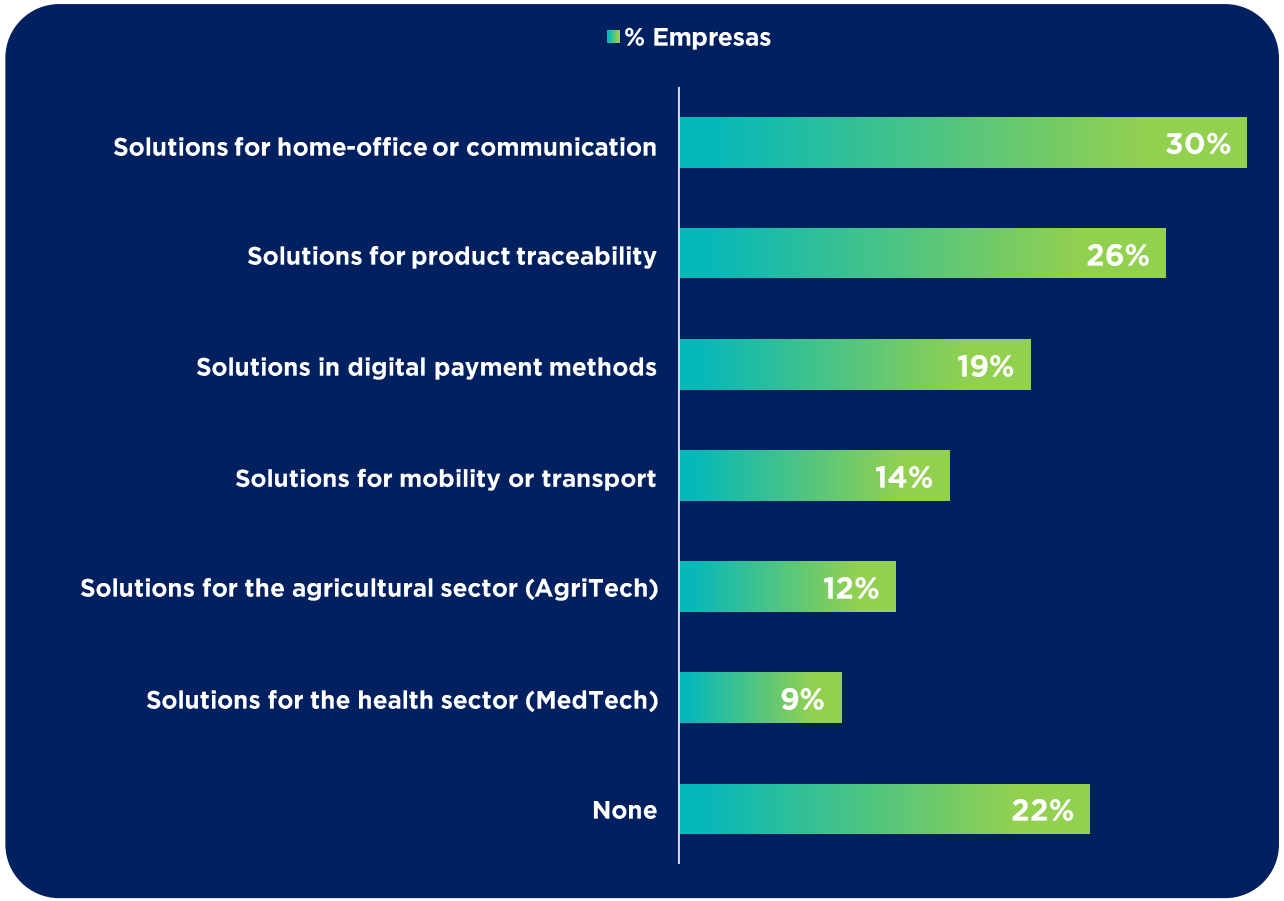
CHAPTER 2

Technological solutions developed or readjusted as response to the needs generated by the pandemic (2019-2021)

21. Technological solutions in the pandemic context (2020-2021)

Surveyed companies were consulted about new technological products developed or else readjusted from previously existing solutions and having been focused in response to new needs or opportunities generated by the pandemic. In total, 78% of the sector offers some service or development in this line, showing their capacity to react and adjust to the market's variable conditions, especially based on differentiated technologies which could add value to this context.

Technological solutions developed during the pandemic (2020-2021 period)



Other solutions generated by the sector	Company specialization
Solutions for virtual education	Cloud Computing
Systems for quality management systems	4.0 Industry Integration
Monitoring of environmental variables in closed environments	IoT
Solutions for optimization of machines, processes & costs	IoT
End-to-end solutions for retail banking by A.I.	Artificial Intelligence
Solutions for eCommerce	Cybersecurity
Solutions for remote attention of the industry	Intelligent Process Autom.
Solutions for energy optimization and efficiency	IoT
Solutions for human talent management	Cloud Computing
Cyber-defence Solutions	Cybersecurity

Source: own elaboration from survey's data

22. Solutions for teleworking or communication

Following the comments provided by companies regarding their solutions in this category are shown:

Solutions for teleworking or virtual communication	Company specialization
Replacement of traditional models of Call Center with self-management, sales channel with app & web from a program integrated to custmer's systems.	RPA
Tele-maintenance systems.	
Remote connectivity.	Cloud computing
Control of times geolocation from smartphones / autograph subscriptions for documents' acceptance reception and reading / Record of attendance with geolocation.	
Development of an application for follow-up of remote work.	
Systems for control of distancing, control of teleworking, systems for control of intelligent agricultural systems / specialized software for analysis, audit and administration of assets.	Internet of Things
Virtualization of work spaces.	
Immersive platforms with WebVR enabling interaction of persons in virtual environments with no need of a virtual reality device.	X Reality
Augmented reality solutions enabling automatization of equipment's maintenance so any person may repair an equipment without knowledge of the same, using pre-determined guides in augmented reality.	
Ecosystem called based on IoT obtaining hardware, software and cloud storage. The hardware consists of embedded systems used to collect and send data to the cloud. Cloud software and storage are in charge of storing data and tools to analyse and obtain the knowledge to optimize the processes generating those data.	4.0 Integration

Source: own elaboration from survey's data

23. Solutions for the traceability of products and means of payment

Following the comments provided by companies regarding their solutions in this category are shown:

Solutions in traceability	Company specialization
Solutions in restaurants' training and management.	Cloud computing
There is a great need in the industry and public services to acquire data of their processes and industrial machinery and unify these data in a single model of data to determine efficiencies, improvement opportunities and intercommunicate industrial and company systems.	Internet of Things
Standardized platform with application in Smart Cities.	Internet of Things
Integrated chain of supply and reforestation plans for the agricultural industry.	4.0 Integration
Traceability of finished product, de of platforms, heavy machinery for the oil, mining and forestry industry.	RFID Technology

Solutions in digital means of payment	Company specialization
Transactional core enabling multiple payments of Services, connecting different devices and means of payments, as well as different integrated systems.	4.0 Integration
Fintech of payments in commerce.	Big Data & analytics
E-commerce platform so that companies may have processing of payments with all security rules.	Cybersecurity
Fintech platforms of digital factoring, confirming and negotiable electronic invoicing.	Cloud computing
System of payments for education institutions to reduce presence for payments.	
E-commerce B2B, Support Ticketing System, E-commerce B2C.	w/o specialization

Source: own elaboration from survey's data

Key aspects

1. **Fourth Industrial Revolution: Fo**r Costa Rica, from the perspective of its offer, this is a space for work which has allowed technological diversification and the generation of added-value solutions. In this market the real constant is transformation, forcing companies to persist in permanent specialization processes, of experimentation and adaption; these attributes are shown on the findings for the sector. Currently, global **macrotrends** draw attention towards segments based on, for example, the metaverse, cryptocurrencies, bio-technology genetics and advanced bionics, which may be some potential markets local companies might also look into.

2. **Portfolio of 4.0 technologies:** By specialization, offer shows a high participation in Cloud Computing (20% of companies), 4.0 Industry Integration (19%), Internet of Things (13%), Robotics process automation (10%), Big Data (9%) and others , among the 10 main categories. Cloud and Integration are the two most developed categories since 2019; their sales, however are mostly local, reflecting opportunities to better develop their exports.

3. **Sales Profile:** the local market is still the main consumer of 4.0 technologies for this sector, representing 63% of total sales in 2021, and increasing this participation from 56% in 2019. this might show a greater openness by local consumers to integrate digital transformation processes; besides that, the economic context produced by the crisis may have also stimulated this. taking into account the findings of the 2019 investigation, where it was shown one of the **deal-breakers** fora generating local business is lack of knowledge of demand concerning potential 4.0 solutions offered by this sector; so it is clear there is an important margin to develop more local linkages, more sales and a greater development on relations among both parties.

4. **2019-2021:** considering the generalized affectation to the business park, product of the pandemic on this period, there is no evidence of a significant alteration on performance, structure or composition of the sector. Should there have been, probably in 2020, it then also shows enough recovery by the end of 2021. These findings show the capacities and resilience of theses companies, also consistent with the performance of all the ICT sector of C.R., achieving growth rates of 5% in exports in 2020 and +11% to the III Quarter of 2021 vs the same period of the previous year.

Profile of the Costa Rican offer specialized in 4.0 technologies

2019-2021

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February 2022