

How Contract
Development and
Manufacturing
Organizations (CDMOs)
are leading innovation
for pharmaceutical
partners



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How pharmaceutical CDMOs use their technological know-how to enter the center stage of manufacturing

Contract Development and Manufacturing Organizations (CDMOs) are flexible third-party manufacturing partners for pharmaceutical companies — but can they also become leaders of innovation?

The report at a glance: CDMOs as emerging technology leaders

CDMOs play a central role in the production of medicines today. As flexible and well-trusted third-party service providers, CDMOs support pharmaceutical companies at all stages of the process of making medicines: from providing services in the research and development stages of new medicines, and offering support in manufacturing these drugs, to providing formulation and finishing processes. CDMOs have been on the rise in the last decade, and in our previous EY-Parthenon analysis and publication of the market in 2017, we found that a predominant driver in mergers and acquisition (M&A) was consolidation¹. In this publication, we are now updating our view on the CDMO M&A landscape with a perspective on the transactions of the last five years. Spanning the time from 2017 until 2021, our current report

comprises 244 publicly announced M&A transactions that involved CDMO companies. The EY-Parthenon analysis was complemented by the review of 92 publicly announced internal investments of 15 selected global CDMO companies. Thereby we integrated the perspective on the internal activities of leading CDMO players with our global CDMO M&A landscape EY-Parthenon analysis. In line with our previous findings, we observed a continuous consolidation of the market. However, we identified new developments that are poised to continuously change the position of CDMOs in the market. To summarize our findings, CDMOs are setting a clear course towards technology leadership, and thus are expected to become even more important over the next decade.

CDMOs are shifting their business model in response to a changing environment

In response to the changing demands of their customers, CDMOs have been adjusting their business model, both through internal investments and by strategic M&A initiatives. Historically, the business model of CDMOs predominantly focused on serving as external service providers for the manufacturing of mature pharmaceutical products. This model included (and still does so today) the addition of capacity through the acquisition of manufacturing facilities owned by pharmaceutical companies, but which these no longer require. Nowadays, in addition to this, CDMOs are increasingly becoming leaders of innovation. Pharma service providers are progressively covering all areas of the pharmaceutical business, not only manufacturing; adding additional revenue streams in this altered business model. Through acquisitions, CDMOs can rapidly expand their capabilities and, thus, are able to deliver technically

advanced services at scale. This change of focus in the business model is accompanied by a change in the M&A landscape of the industry. For example, the rise of novel modalities and innovative vaccines in recent years required a sudden and unprecedented investment in new additional manufacturing capabilities for viral vectors, cell manipulation, as well as nucleic acids and lipid-based formulations. Well-positioned CDMOs were able to flexibly and efficiently change their production lines to meet the increasing demand of smaller, more diverse projects. They have been further investing in enhancing their production capabilities since then. New partnerships arose, which further enabled CDMO players to fuel the rapid growth of capacities and capabilities, helping the industry to succeed in ramping up e.g., vaccine production.

¹The pharmaceutical CDMO industry is consolidating, EY, 2017 EYGM Limited., EYG no. 04551-172GBL



CDMOs are on the rise, trailblazing with new manufacturing capabilities

A major learning of our EY-Parthenon analysis relates to the requirement of mastering technology. Today, it is not only important for CDMOs to be a trusted partner for well-known mature pharma products, but it is also essential for them to contribute specialty knowledge and relevant know-how to maintain a competitive capability edge in innovative products. This holds especially true in view of novel modalities (Figure 1). Of the 244 M&A transactions

that we analyzed, one-third was related to novel modalities such as cell and gene therapies as well as novel nucleic acid therapies. More specifically: while deals including some capabilities in the novel modalities space contributed to only 29% of the M&A transactions in 2017, this type of deals has been steadily increasing since then to up to 40% in 2021.

	Small molecules	Biologics		Novel modalities				
Manu- facturing categories	Chemical synthesis	Microbial fermentation	Mammalian cell culture	Chemical synthesis	Enzymatical production	Microbial fermentation	Mammalian cell culture	Cell manipulation
Products (selected examples)	Small molecules	Peptides	mAbs	Antisense oligos, RNAi	mRNA	Plasmids	Viral vector	CAR-T, stem cells
Typical lot size	~t	~g-kg	~g-kg	~kg	~g (COVID-19: kg)	~g (to kg)	Viral titer, # of doses ²	Cell #, # of doses
Typical facility scale	<ul style="list-style-type: none"> ▶ Often large scale chemical API plants ▶ Up to several 100k L capacity 	<ul style="list-style-type: none"> ▶ Medium to Large-Scale production ▶ Up to several 10k L capacity 	<ul style="list-style-type: none"> ▶ Medium to Large-Scale production ▶ Up to several 10k L capacity 	<ul style="list-style-type: none"> ▶ Medium scale currently, but upscaling possible 	<ul style="list-style-type: none"> ▶ Large-scale production in progress (COVID-19) 	<ul style="list-style-type: none"> ▶ Currently still in medium scale, providers are working on commoditizing kg scale 	<ul style="list-style-type: none"> ▶ Large-scale production in progress (large investments in recent years) 	<ul style="list-style-type: none"> ▶ Medium-scale production in progress (large investments in recent years)
Industrial mfg. maturity								
	Still the most important segment in terms of volume and value	Important for biotechnology production intermediates	Segment with large growth in past decades, further growth expected	Growing importance rising with number of advanced products in pipeline	Jump in maturity due to COVID-19 vaccines	Relevant as used as precursor for e.g., mRNA and gene therapies	Major component of ex- and in-vivo gene therapies	Current volumes rel. low due to mainly autologous nature of products

Source: EY-Parthenon analysis

Figure 1: Schematic segmentation of modalities and underlying manufacturing categories



²Amount depends e.g., for viral vectors on target tissue and type of virus



The CDMO value chain is moving towards a “one-stop-shop” service portfolio

We also observed another major trend: partnering pharma or biotech companies increasingly expect CDMOs to expand from having specialty knowledge towards providing expertise along the entire manufacturing processes up to and including commercial launch. This trend is strengthened by the fact that the customer base of CDMOs experiences a shift from primarily “big pharma” companies towards including more and more smaller biotech companies. The latter naturally have a sole focus on developing their drug pipeline without having vast experience in manufacturing, let alone a manufacturing site. They require an early integration of their operations with partnering CDMOs in the drug developmental

and manufacturing process³. A more recent example for a further expansion of the value chain is the combination of the existing integrated manufacturing services for clinical stage products with clinical trial services. These were previously a separate domain for classical clinical research organizations (CROs⁴). Thus, CDMOs enlarge their service offering and are now also delivering to patients, not only to their pharma partners. In summary, via the further integration up- and downstream of core capabilities along the value chain, CDMOs are striving to meet changing customer needs.

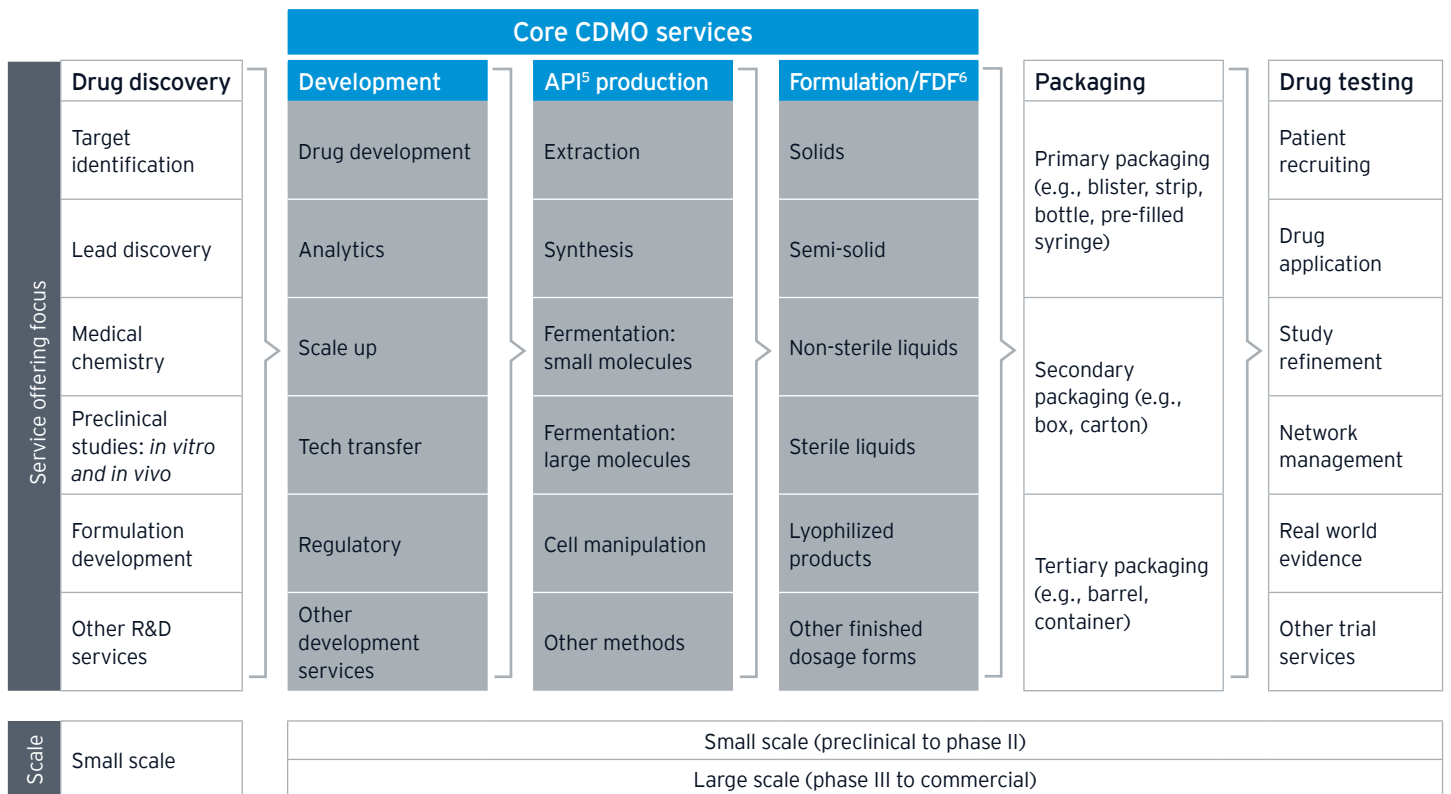
The CDMO value chain is becoming broader

These recent developments indicate the need for an adjustment of the current value chain model that is expanding from drug development to clinical trials. In view of the observed M&A activities, we expect an extended service value chain to better reflect the changing CDMO business landscape (Figure 2) including, e.g., cell manipulation as an additional active pharmaceutical ingredient production step that is gaining importance in pharmaceutical manufacturing.

Furthermore, we noticed several examples of CDMOs expanding at the “edges” of the value chain, becoming active in clinical trial services as well as increasing their focus on the preclinical research stage by selected acquisitions of contract research organizations. For this reason, we included drug testing as an adjacent category in the value chain overview.

³Weathering the Storm Together – Part 1 and 2, published 27.10.2021 on the Medicine Maker; Roundtable: How CDMOs Handled the Pandemic (amproject.org) and How have Pharma CDMOs Responded to the COVID-19 Pandemic? (themedicinemaker.com); accessed 16.11.2021

⁴In this case not to confuse with contract research organizations, often also abbreviated as CRO.



Source: EY-Parthenon analysis

Figure 2: CDMO value chain overview (schematic)

⁵Active Pharmaceutical Ingredient

⁶Finished Dosage Forms



Players at scale, extenders and complementors as emerging CDMO business models

To summarize the observed M&A movements, we would like to point out to three major CDMO strategies by classifying three types of players (Figure 3): Players at scale, extenders, and complementors. Players at scale have the purchasing power to move into new areas quickly and decisively, broadly extending their business model that is typically already vastly integrated. Extenders are investing in selected segments along adjacent growth trajectories, for example, to extend

their manufacturing service capabilities by adding fill and finish capabilities. Lastly, complementors are careful expanders that are typically small and highly specialized, and that invest in complementing areas. An example for this model would be the case of an antibody drug conjugate specialist that acquires a specialist of relevant conjugation technologies.

	Players at scale	Extenders	Complementors
Company archetype	Very large companies/conglomerates (>US\$5b annual revenue), with wide range of products and services	Large companies (US\$0.5b-US\$5b in yearly revenue) with existing CDMO services and broad offering	Smaller scale CDMOs with more limited product and services offering focused on few modalities/value chain elements
CDMO M&A activity	Conducting multiple deals to leverage economies of scale by broadening their range of services	Purchasing selected assets to add capabilities in a strategic way	Acquisition of companies active in adjacent spaces connected to the buyer's core business
Growth trajectories	Universal expansion: horizontal + vertical	Directed expansion: horizontal or vertical	Surgical investment
	← Modalities →	Modalities	Modalities
	← Value chain/technologies →	← Value chain/technologies →	Value chain/technologies
	← Product/service combinations →	Product/service combinations	Product/service combinations
	← Customer types (early/late stage) →	Customer types (early/late stage)	Customer types (early/late stage)
← Geographies →	Geographies	↔ Geographies	

Source: EY-Parthenon analysis

Figure 3: Schematic illustrative overview of typical types of CDMO movements observed on the market

In the following sections, we are going to explore how the M&A landscape has moved the market in the recent years.



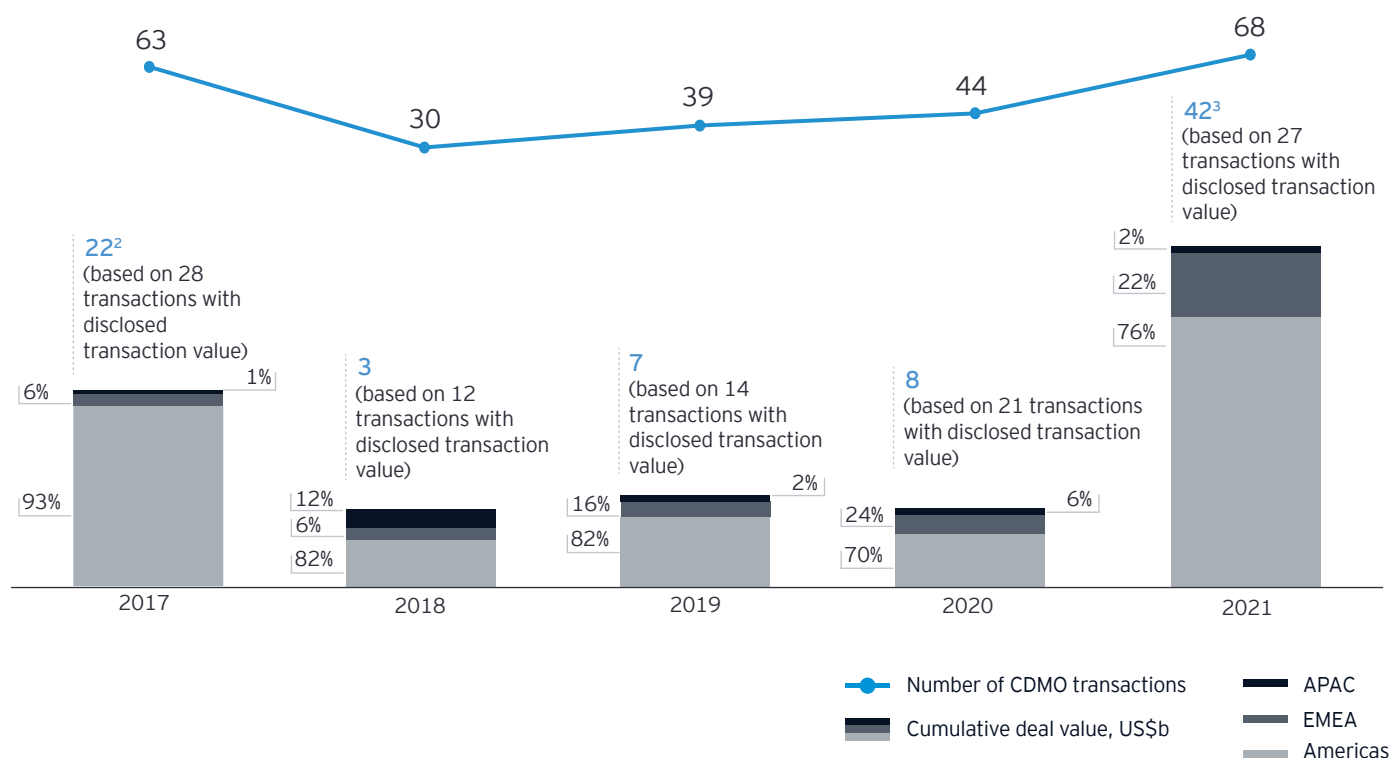
The majority of transactions have targets in North America

North America is the center of gravity for CDMO transactions

The M&A transaction landscape is highly volatile and dominated in value by a few large deals

In the EY-Parthenon M&A landscape analysis, we reviewed transactions conducted between 2017 and 2021¹ (Figure 4). The absolute total deal volume has been highly variable due to a few major multibillion deals in 2017 and 2021 with a mean of US\$7b. The average deal volume showed a more than 6-fold increase compared to our 2017 publication (US\$131m and US\$811m, respectively). The deal number per year in the currently investigated time frame spanned from the least busy year, 2018 with 30 deals, to 2021 as a transaction-rich year with 68 analyzed deals and nearly US\$42.4b in transaction volume.

When analyzing the geographic footprint of M&A deals in more detail, three major regions were considered: The Americas (North, Middle and South America), EMEA (Europe, Middle East, and Africa) and APAC (Asia Pacific region).



Source: EY-Parthenon analysis, S&P Capital IQ, secondary research

Note: Numbers are rounded

Figure 4: Overview of CDMO-related M&A volume and value per year between 2017 and 2021. Regions: Americas refers to North, Middle and South America; APAC refers to Asia Pacific; EMEA refers to Europe, Middle East, and Africa

¹Of note: not all transactions publicly reveal financial conditions. Information was available for 102 of the 244 M&A transactions investigated herein.

²In 2017, 4 megadeals (>US\$1b) make up for ~US\$18.8b of the reported transaction values

³In 2021, 4 megadeals (>US\$1b) make up for ~US\$37.9b of the reported transaction values



Intra-regional transactions increased in the Americas

A large portion of the deals in the observed timeframe occurred within North America (Table 1). This included several megadeals in 2017 as well as in 2021. More specifically, around one-third of the analyzed M&A transactions were related to deals where both business

partners had their headquarters in the US. While in the previous reporting period the deal value or total target enterprise value (EV) of such US internal investments was less than half of the total US deal volume, the portion increased to 73% in the current EY-Parthenon analysis.

EMEA investments flow into North America

The opposite trend has been observed in Europe, Middle East, and Africa (EMEA). Here, both the number of deals and deal values of cross-regional deals are higher than the respective figures for deals within the EMEA region. This was also reflected by a strong investment focus of EMEA

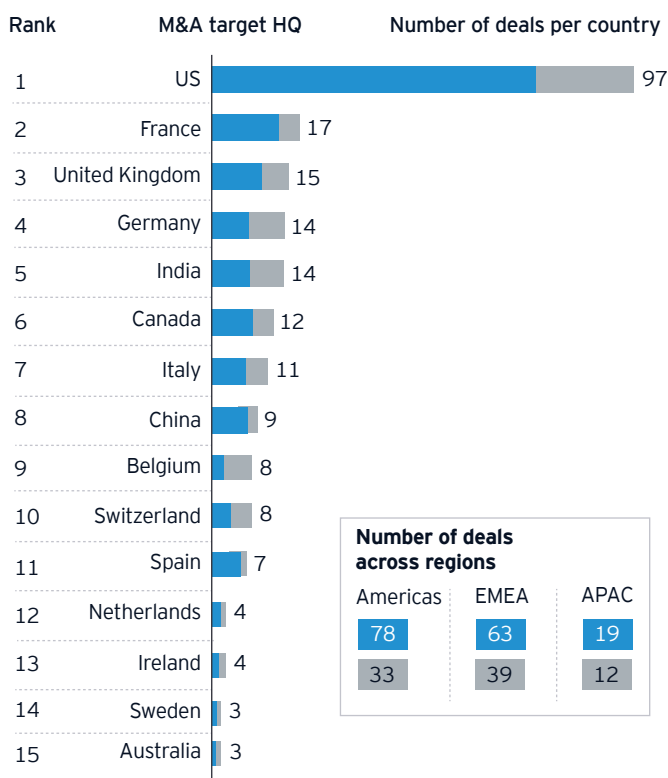
headquartered companies on targets in the US. While North America remained the main source of investments (US\$49b), European companies ranked higher than in the last report regarding the number of deals and deal values.

North America remained the main source of investments with
US\$49b

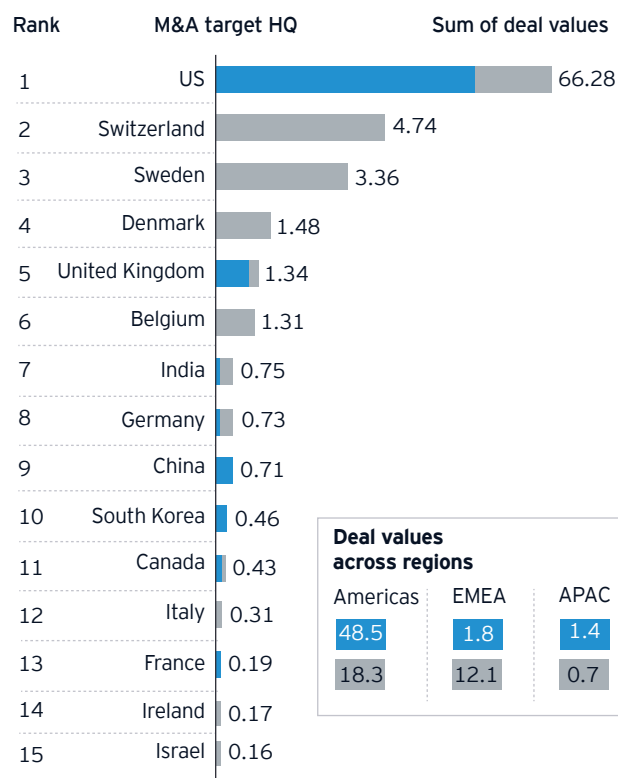


Table 1: Top target countries for CDMO M&A transactions based on number of deals and transaction volume in deals between 2017 and 2021, sorted by the region of the headquarters of the target company.

Number of deals (2017-2021)⁴



Sum of deal values (US\$b, 2017-2021)⁵



— Internal — Cross-border

Source: EY-Parthenon analysis, S&P Capital IQ, secondary research

Note: Graphic representation is not exhaustive

⁴Number of deals EY-Parthenon analyzed based on 244 transactions

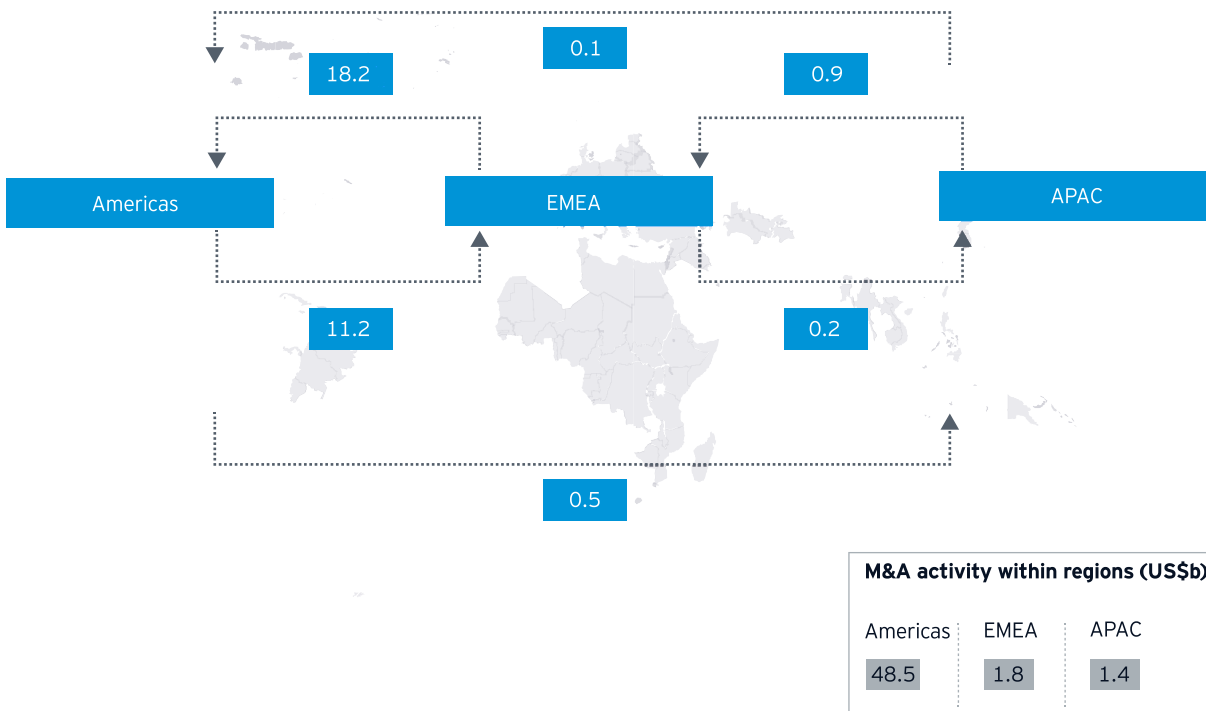
⁵Out of 244 analyzed transactions, transaction values were available for 102



Intra-regional transactions in the Americas outdo global cross-regional transactions in number and volume

Reviewing the flows of funds (Figure 5), the primary stream of transaction values across regional borders was from EMEA to the Americas with approx. US\$18b, followed by transactions with investments from the Americas to EMEA with approx. US\$11b, and the investments from the

APAC region (including India) to EMEA with US\$1b. Notably, all observed cross-regional deals were much smaller than the transaction value of the deals within the Americas (almost US\$49b).



Source: EY-Parthenon analysis, S&P Capital IQ, secondary research

Figure 5: CDMO investment flows (deal values in US\$b) of investigated M&A deals between 2017 and 2021. Arrows originate in the region of the acquirer; arrowheads point towards the region of the target



The CDMO landscape is further consolidating

The 10 companies with the highest numbers of deals within the analyzed timeframe contain several major CDMO players (Table 2). The 10 most active companies conducted an average of 7 transactions per player between 2017 and

2021. About one quarter (27%) of M&A deal activities between 2017 and 2021 originated from these 10 players, indicating that the market consolidation we observed already in our previous report has continued.

Table 2: List of top 10 companies active in M&As, ranked by numbers of deals (2017 to 2021)

Company (ultimate parent ⁶)	HQ	Ownership	Revenue (US\$b, 2021) ⁷	Acquisitions	Sum of transaction values (only publicly available, US\$m) ⁸
Catalent, Inc.		Public Company	\$4b	12	\$2,881m
Charles River Laboratories International, Inc.		Public Company	\$2.9b ⁹	9	\$1,818m
Thermo Fisher Scientific, Inc.		Public Company	\$39.2b	8	\$23,766m
Lonza Group AG		Public Company	\$5.5b	8	\$3,731m
WuXi Apptech Biopharmaceuticals, Ltd.		Public Company	\$3.3b	7	\$425m
Eurofins Scientific SE		Public Company	\$5.4b ⁹	6	\$194m
Delpharm Holding		Private Company	\$0.1b	5	\$1m
Evotec SE		Public Company	\$0.5b ⁹	4	\$90m
Danaher Corp.		Public Company	\$29.5b	3	\$11,563m
Piramal Enterprises Ltd.		Public Company	\$1.7b	3	\$123m

Source: EY-Parthenon analysis, S&P Capital IQ, secondary research

⁶S&P Capital IQ

⁷Annual reports

⁸Based on transaction values that are publicly available, not exhaustive

⁹Based on 2020 revenue

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How a drive towards technology leadership is shaping the CDMO market

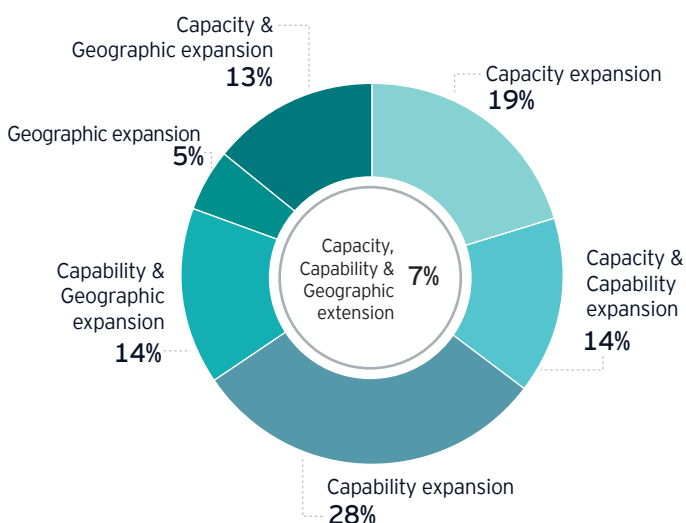
Capability expansions in biologics and novel modalities seem to be major drivers behind M&A activities and internal investment decisions in the CDMO sector

M&A activity differed strongly across the modalities

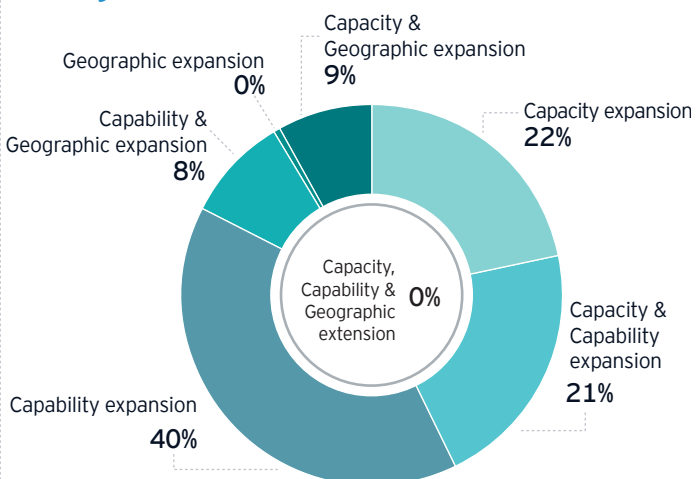
We extended our M&A EY-Parthenon analysis in view of a further dissection of modalities involved and value chain steps included in the transferred assets. More specifically, we categorized the investigated M&A deals based on two criteria: Firstly, the modalities that the target companies are active in, and secondly, what seems to be the most likely

deal rationale (“deal focus”) behind the transaction (i.e., geographic expansion, capacity expansion, or capability expansion) (Figure 6).

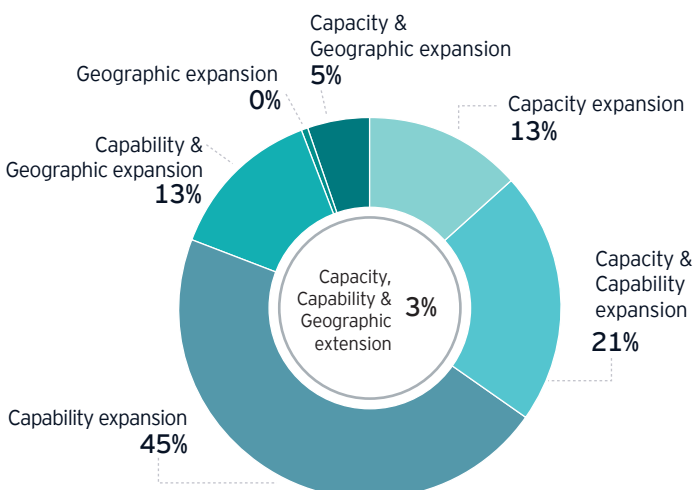
Small molecules



Biologics



Novel modalities



Source: EY-Parthenon analysis, S&P Capital IQ, secondary research

Figure 6: Capacity vs. capability vs. geography (based on sum of transaction value in US\$b; 2017 to 2021)



Small molecule transactions focused mostly on geographic expansion and capacity, while deals including biologics and novel modalities mostly included the acquisition of new capabilities

There were remarkable differences between the focus areas of the deals per modality. Transactions including players (as buyers or targets) active in small molecules, revealed the strongest “balance” between the three deal rationales: geography, capacity, and capability. Both, capacity increase and geographic footprint expansion seem to be important factors in the deal rationale. This stands in contrast with the deal rationale of transactions that included companies with a focus on the development or manufacturing of biologics and novel modalities. In these deals that focused on newer types of medicines, capability expansion seems to be much more important as a deal rationale. In the cell and gene therapies (CGT) area the movement towards viral vectors and plasmid manufacturing capabilities has been a main field of interest

for several major CDMO players. The companies that occupy a niche with their capabilities were the main acquisition targets. Overall, the differences in deal rationale between the modalities indicate that the small molecule manufacturing market is a more mature market that grows through incremental improvement of existing offerings, whereas new capabilities are the most important factor for deals in the areas of manufacturing services in biologics and CGT.

Internal investments also indicate a clear drive for technology leadership of CDMOs

Our EY-Parthenon analysis of internal investments demonstrates a general focus on newer modalities – biologics and novel modalities represented 43% and 35% of internal investments, respectively. Of the internal capacity investments (62% of all internal activities), about half of the moves were made in upscaling of biologics, and equally about a quarter for both small molecules and novel modalities. In

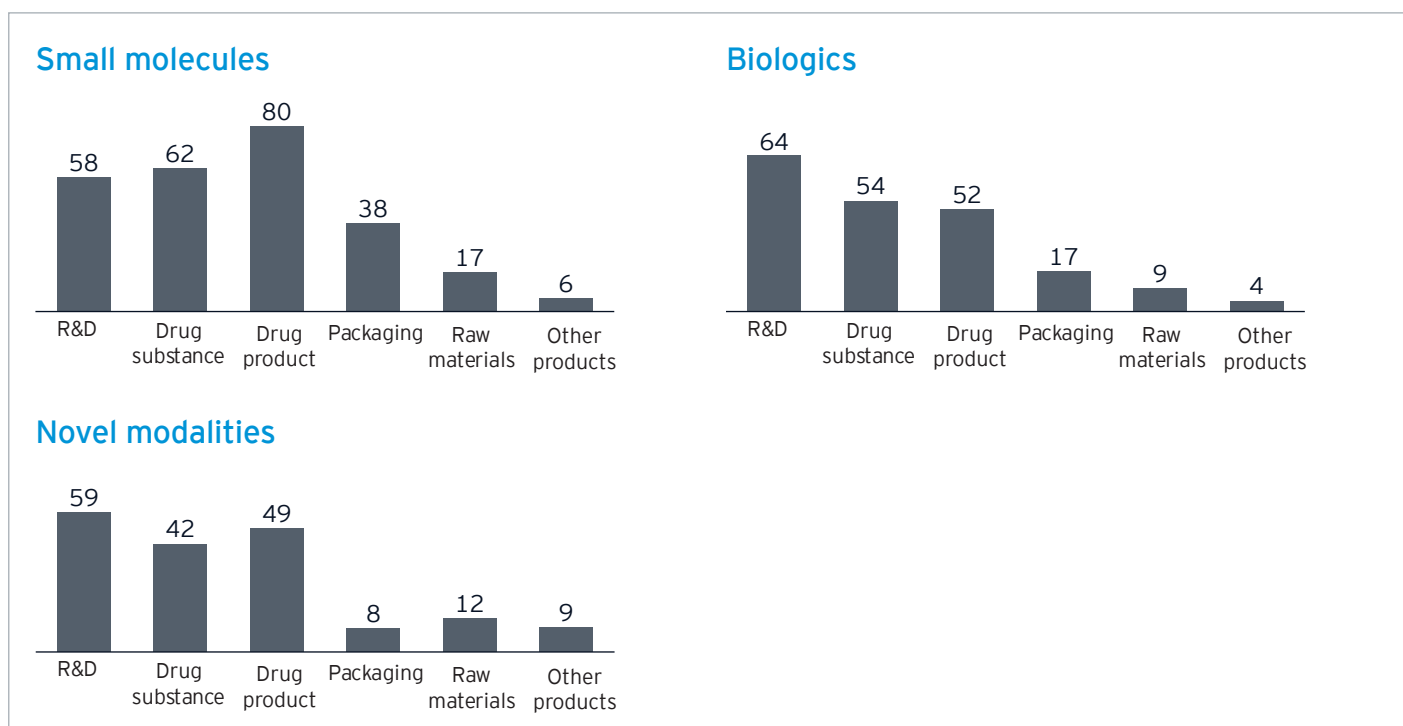
contrast, the investments in capabilities (18% of all internal activities) were mostly directed towards novel modalities (53%), indicating that CDMO players are still seeing the largest gap in reaching technological maturity in these modalities, mirroring the movements on the M&A landscape.



Drug product capabilities were the major area of interest along the value chain for M&A deals involving small molecule CDMO services

Lastly, we also investigated the steps along the value chain that the companies in the analyzed M&A deals were focusing on (Figure 7). Investments were mainly equally distributed between the value chain steps of research and development services, drug substance manufacturing and drug product manufacturing, while packaging and other business were represented less. Deals including small molecule capabilities

stood out with a larger number of transactions, involving companies that include drug product manufacturing. For biologics and novel modalities, transactions involving research and development capabilities were the most prominent. This may also reflect the larger need for developmental services in new and faster growing markets, in which technology has not yet reached maturity.



Source: EY-Parthenon analysis, S&P Capital IQ, secondary research

Figure 7: Value chain focus based on number of deals within the CDMO M&A transactions, 2017 to 2021¹

¹Investments including multiple modalities and value chain steps counted multiple times.

CDMOs are increasingly moving into the clinical research organization business

A new trend that has been emerging recently is the investment of CDMOs in traditional CRO companies, which are focused on clinical trials. Several big movers in 2021 shook the business, especially the North American market. A major deal in this regard has been the acquisition of the CRO PPD by the CDMO Thermo Fisher Scientific for US\$17.4b. Other examples include the acquisitions of

the CDMOs Cognate BioServices and Vigene Biosciences by the CRO Charles River Laboratories for US\$875m and US\$293m, respectively. From a pure value chain perspective, these M&A activities display the shift from traditional developmental and manufacturing services that rarely involve patients directly, to directly interacting with patients.

A major deal in this regard has been the acquisition of the CRO PPD by the CDMO Thermo Fisher Scientific for US\$17.4b²

CDMOs have been actively looking for growth through technology leadership

In summary, we have seen a large interest in technology, indicating that many CDMO players strongly believe that not only low costs and large capacities are going to be key criteria for pharma customers, but also advanced technical capabilities are going to be essential for their partners. Furthermore, as indicated by the large number of transactions and the transaction volume, we observe that

biologics as well as cell and gene therapies are still a hot topic in the CDMO industry. The focus of these transactions seems to be mainly capability expansion, while players in the small molecule world have been focusing more on drug product services and geographical and capacity expansions, in addition to capability expansions.

²Source: Thermo Fisher Scientific Inc. Thermo Fisher Scientific Completes Acquisition of PPD, Inc.





Main drivers of M&A transactions are CDMOs, but investment companies are gaining interest

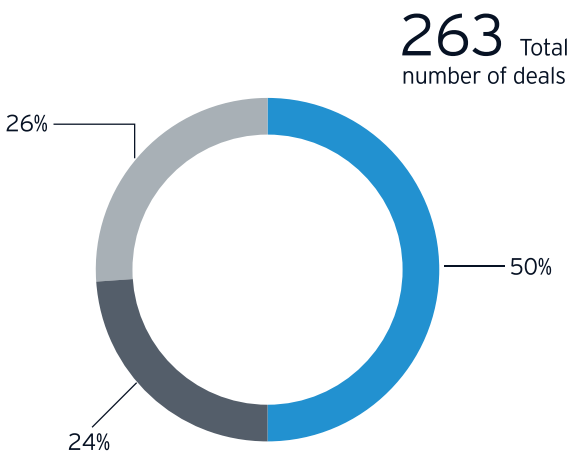
Investment companies are increasing their activities in the M&A space, which is still dominated by CDMOs

Majority of CDMO transactions are driven by strategic CDMO players

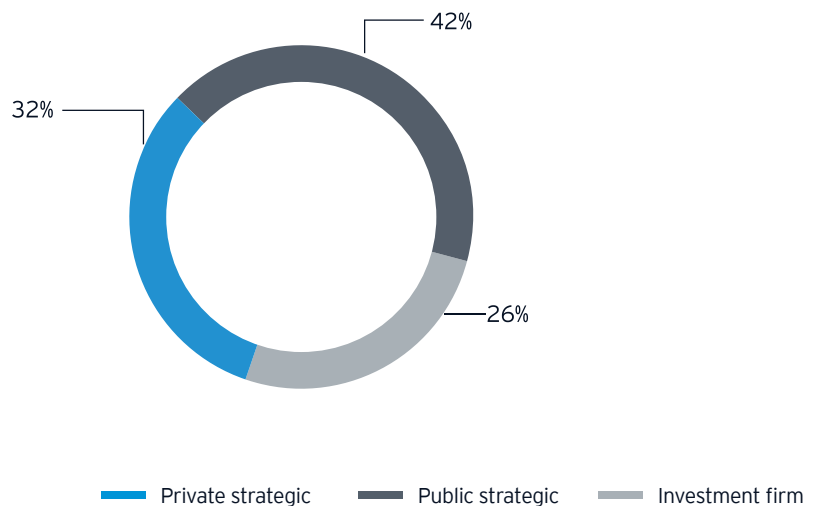
In an additional EY-Parthenon analysis we investigated the ownership status of target and buyer companies in the M&A deals between 2017 and August 2022 (Figure 8). We differentiated between private and public strategic companies (CDMOs or companies with related product or service offering) and investment firms¹

While targets of M&A deals were largely private companies, the buyer side was more balanced, still mainly driven by public strategic companies.

Target ownership



Buyer ownership



Source: EY-Parthenon analysis, S&P Capital IQ, secondary research

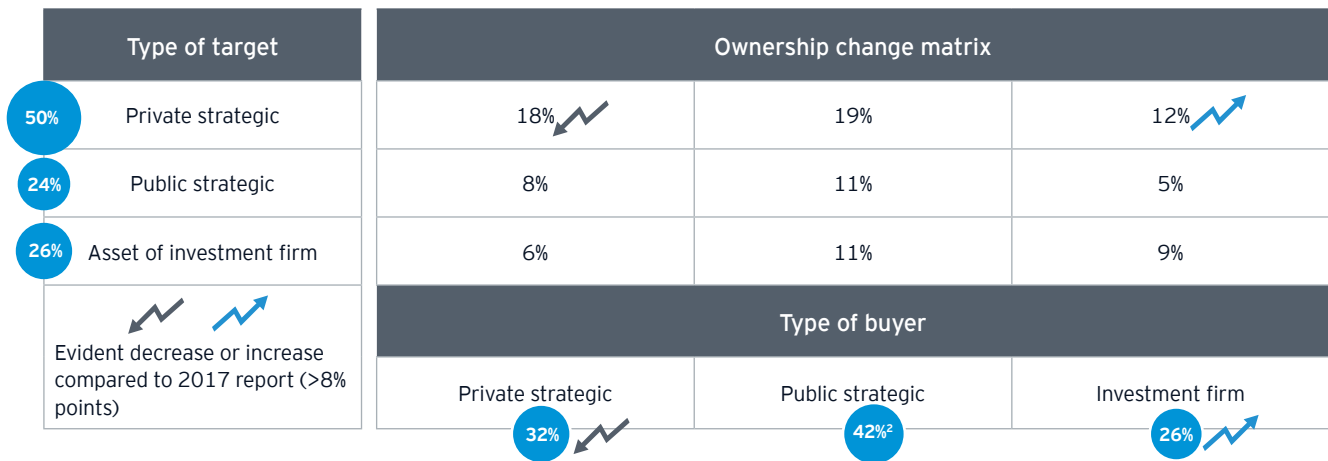
Figure 8: Ownership status of target and buyer companies

¹The S&P Capital IQ classification of investor type was used as basis to label investment firms (incl. Financial investor, PE, VC, Hedge Fund, Investment bank or firm).

Assets owned by investment firms were acquired mostly by publicly held companies, followed by other investment firms

Our updated target-buyer's matrix compares the results in this study to our previous findings in the CDMO M&A landscape (Figure 9). Considering the global ultimate parent of companies involved in transactions, targets owned by investment firms were mainly acquired by public strategic players, closely followed by acquisitions through investment firms. Comparing our findings to our 2017 report, a remarkable increase could be seen for investment firms acquiring private companies. While not as strong, the acquisition of public targets by public strategic companies

and acquisition of assets of investment firms by other investment firms has increased as well. We can observe an increase in the overall number of deals involving investment firms as buyers. At the same time, the number of deals involving private companies, either as buyer or as target, decreased. We can conclude that while M&A deals within the private sector remain high, there is an emerging role of investment firms in the M&A landscape, indicating a growing interest in this area of the life science business.



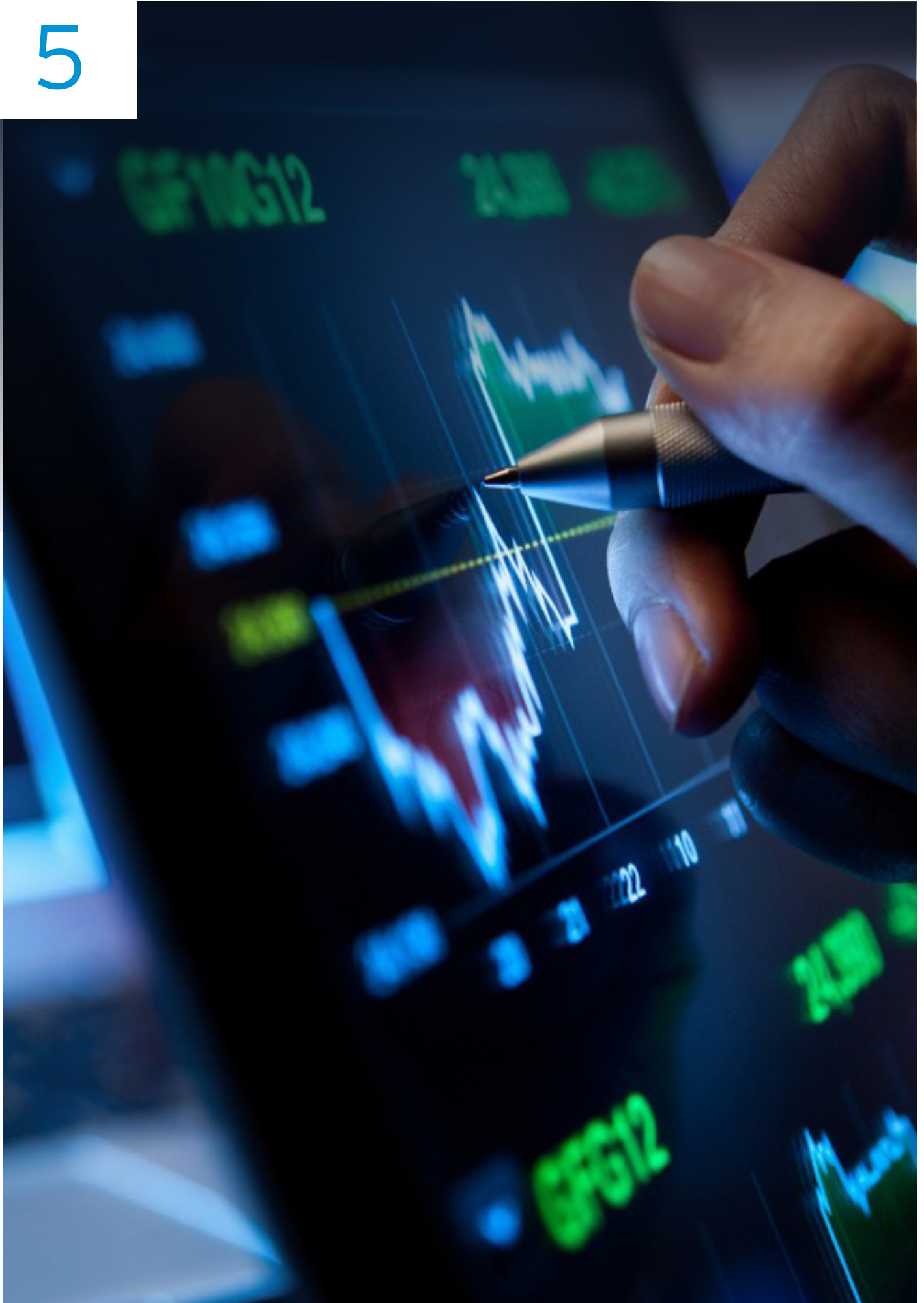
Source: : S&P Capital IQ; EY-Parthenon analysis

Figure 9: Ownership change matrix based on M&A deals between 2017 and August 2022. Segments that saw a pronounced change (>8% points) vs. our EY-Parthenon analysis in the 2017 report are indicated by arrow signs.

²Table shows rounded numbers. Thus, Public strategic firms reflect total of 42% as type of buyer, while column sum is 41%. The apparent difference comes from rounding up two numbers (11% instead of 11,5%)



5



How the CDMO market is poised for growth

Are continuous outsourcing trends, ever more complex manufacturing networks and new technologies positioning the CDMO sector for success?

To summarize, this report analyzed the M&A landscape in the CDMO industry between 2017 and 2021, and compared insights with results from our previous report covering the time frame from 2012 to 2016. The updated EY-Parthenon analysis this time also includes the assumed strategic rationale behind the analyzed deals. Our results reveal an ongoing consolidation trend within the CDMO market and unravel the companies' special investment focus on technology and capabilities.

Integration of the company network is happening along three main axes: Extension of the capabilities along value chains within a modality, extension to new modalities and, in select cases, an extension from a product offering focus towards offering additional service categories (such as clinical trial services). Especially the rise of new technologies offers potential to revolutionize therapies and supply chains. We expect these trends to persist throughout the next years. Compared to our initial CDMO M&A EY-Parthenon analysis in 2017, investment firms appear to gain appetite to become more active players in the field, and we expect this trend to continue. CDMOs present an interesting option to enter life sciences and pharmaceutical markets by investing in continuous service revenues, while still benefitting from high growth rates in novel therapy areas.

In novel modalities, we expect an increasing shift towards capacity expansion by existing players. The need to be able to swiftly allot manufacturing capacity to enable higher speed to market and secure long-term capacities for assets will become key requirements for CDMOs active in that space. Both requirements are also driven by having sufficient reserves in capacity.

More broadly, we also expect CDMOs to foster their new role as technology innovators. Major players increasingly incorporate smaller startups and technology leaders. Looking across modalities, we also anticipate that product companies will continue to move towards the CDMO service market, while CDMOs will increasingly move towards extended product offering, especially in the novel modalities space. In addition, integration of clinical trial services could be a new trend for CDMOs to enter high value, low volume segments. For example, the field of personalized medicine. However, a respective business model would be quite different from a more traditional "volume first" business model.

Distilling the essence of the market movers of the past five years, CDMOs are expected to become additional strong contributors to innovation in the pharmaceutical industry. Overall, we anticipate that CDMOs will remain important partners for pharmaceutical companies and are expected to gain further relevance through their increasing technological expertise and know-how along the value chain.



Appendix: Methodology

The sources used for the EY-Parthenon transaction analysis were S&P Capital IQ, company websites and press releases. For the EY-Parthenon analysis of M&A transactions, transaction data was accessed from S&P Capital IQ on January 10th, 2022, and was extended to reflect data until August 15th 2022 in our ownership matrix. M&A transactions were considered in this study if a CDMO participated as buyer, seller or target (or any combination thereof) in the transaction; CDMOs were classified by our analyst team as such if the companies publicly offer CDMO services (CDMO services include the research, development, manufacturing of pharmaceuticals, including API manufacturing); only transactions in which more than 50% of the target companies were acquired were included (according to S&P Capital IQ data). The time frame for the inclusion of deals was a completion date within 01.01.2017 to 31.12.2021. EVs were calculated by dividing total transaction values by respective shares acquired in the transaction. Ratios of EV/target revenue were based on values reported for the last twelve months from transaction date, transaction year, or latest available values. Transactions involving multiple modalities were counted for each modality, respectively.

The ownership matrix which analyzes target and buyer companies includes transaction data until 15.08.2022 and considers the level of global ultimate parent of the sellers and buyers. Global ultimate parents of seller and buyer companies were identified manually at the date of transaction based on S&P Capital IQ data. Targets were classified as asset of investment firm if the ultimate parent company was considered an investment firm based on classification from S&P Capital IQ. Otherwise, targets were classified according to their ultimate parent company type assigned by S&P Capital IQ as private or public company. Buyer companies were classified as investment firm if S&P Capital IQ assigned their ultimate parent as investor type (except corporate investors). Otherwise, buyers were classified according to their ultimate parent company type as assigned by S&P Capital IQ. Corporate investors were classified according to their ultimate parent company type.

For the EY-Parthenon analysis of internal investments, 15 global CDMOs were selected based on ranking their respective revenues in 2020 as obtained from either annual reports or D&B Hoovers. The following 15 companies were analyzed for internal investments: Thermo Fisher Scientific Inc, Lonza Group Ltd, Catalent, Inc., Delpharm, Samsung Biologics Co., Ltd., Recipharm AB, Vetter Pharma-Fertigung GmbH & Co. KG, WuXi AppTec Co., Ltd., FUJIFILM Holdings Corporation, Aenova Holding, Boehringer Ingelheim Pharmaceuticals, Inc., Curia, Inc., Fareva, Divis Labs, Jubilant Pharmova Limited. Internal investments per company were obtained by gathering S&P Capital IQ entries, press releases, news articles, and annual report extracts, and extracting the type of investment, modality affected, and transaction value of the investment.

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