World Class Regulatory Information Management Whitepaper; Connections to Supply Release, Product Change and QMS

2018 Fall Edition - Based on our 2018 World Class RIM Study (n = 69)

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Introduction

Regulatory Information Management (RIM) is clearly transitioning to an enterprise capability with growing connections to other critical functional areas while some potential "game changing" technologies emerge. Our 2016 World Class RIM baseline has now moved to an industry standard based on our 2018 research results and input from 31 contributing companies in our design sessions.

This white paper provides our strategic insights along with a clear industry status highlighting the current state, key trends, priorities, investment focus, projected change and a comprehensive update on the software and service provider landscape. Based on our 2018 survey results from 69 companies, we see these as the most interesting results and will be explored in-depth:

1) There is significant focus in the next three years to improve and start automating the RIM connection to clinical, product change control, supply release and QMS.
2) Certain organizational structures do make a difference for overall RIM performance.
3) On average, efficiency levels of the 18 RIM capabilities (see appendix) and data quality levels did not improve from 2016 to 2018; unlike the significant improvement found from 2014 – 2016.
4) The RIM provider landscape shift is accelerating - 74% of companies are investigating and may potentially adopt an end to end (E2E) RIM platform over the next 4 years.
5) Most regulatory organizations are getting more sophisticated in their business cases for major regulatory capability transformation as the requested investment has risen substantially.

The information and graphs in this paper are primarily based on the results of our 2018 World Class RIM Study, coupled with key learnings from participant debrief sessions, client work and our professional insights. This paper is structured as follows:

- Executive Summary – Study Key Findings
- Industry Status: World Class RIM and Strong Performance Benchmark Results
- RIM Connection to Supply Release, Product Change Control and QMS
- Contrasting RIM for Medicinal and Device Companies
- Shifting RIM Architecture Strategy
- Regulatory Intelligence Trending
- Regulatory Outsourcing Update: Trends and Supplier Status
- Software Vendor Landscape: Key Trends and Provider Update

We hope you find this information insightful and valuable. Please contact us with any questions.


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Executive Summary

Survey Demographics and Design Strategy

A record 69 companies participated in this year's survey with a balanced representation of large, mid-tier and smaller organizations (see Figure 1). These categories were determined by revenue size through the annual Pharmaceutical Executive Top 50 publication. We were pleased with the growing number of medical device participants and a substantial jump in smaller organizations giving us a much better understanding of their RIM status, strategy and investment direction. We analyzed the data to uncover unique insights and trends by company size, medicinal vs device comparison, and by product portfolio complexity defined as number of products, diversity of product types, and geographic reach (number of affiliate locations).

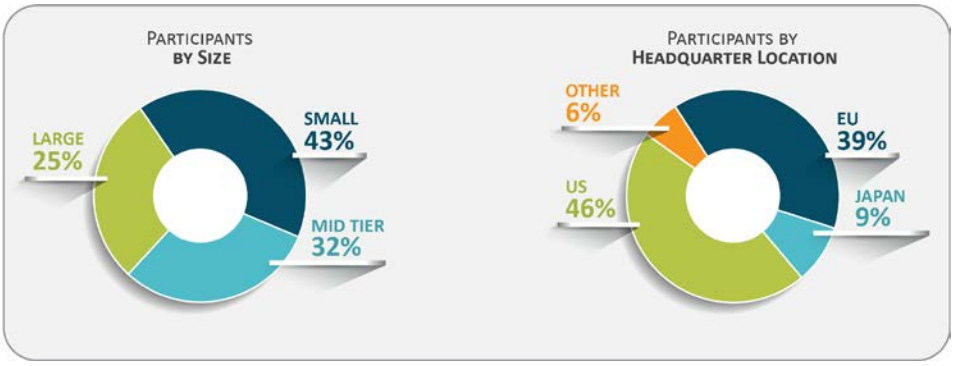


Figure 1: 2018 Survey Demographics

We expanded our successful survey review process of design sessions from four in 2016 to seven in 2018. We had 50 participants representing 31 companies. Design sessions were held in Basel (Switzerland), Boston (Massachusetts), Leiden (Netherlands), Chicago (Illinois), Lambertville (New Jersey), a "device only" session in Minneapolis (Minnesota) and one virtual session for several other companies. These sessions were used to review and debate the survey design, and identify suggested modifications, additions, and deletions. We continued the "what is world class RIM and how to measure it" conversation from our 2015 design sessions and expanded it to include "what is strong performance" to set an industry standard. The other critical design conversation focused on our new section featuring the RIM connection to product change control, supply release and quality management systems (QMS). A special thanks to individuals who participated in the design sessions for their time and knowledge, along with the four industry companies that opened their doors to host some of these sessions.

Investment Priority and Benefit Realization

We noted regulatory investment was increasing starting in 2013 and this continues in 2018. We believe we are half way through a 10-year regulatory transformation cycle with many mid-tier and large multi-national companies starting the execution phase of these transformations. The investment goals vary by size of the company, however there are some consistent themes as our clients prepare and build their business cases for major RIM investments:

- Compliance is assumed. Greater value must be expressed in efficiency, productivity, speed, and resource re-allocation, along with a clear timeline for benefit realization.
- Business cases require a thorough economic analysis and clear benefit evidence, as the required investment amounts have grown substantially and may compete with other critical investments - such as a clinical trial.
- RIM is being viewed as an Enterprise Asset and RIM systems must be able to exchange information with other critical enterprise capabilities (e.g. ERP) real time.

During the design sessions, we decided to modify the business benefit scale to include "partial benefit achieved", and it is clear in Figure 2 that industry is gaining partial benefits (green) from the growing RIM investments. The most notable areas improved were health authority (HA) inspections, real-time information access, HA interactions (Q&A and correspondence management processes) and increase in user productivity. While progress is being made, there is a significant expectation (light blue) over the next two years in most benefit categories. The highest expectation for improvement is in information exchange with manufacturing and supply release (64%), better integration of business processes (55%), reduce level of complexity (54%), better resource planning (54%), better submission planning and forecasting (52%), and the reduction of data remediation cost (52%).

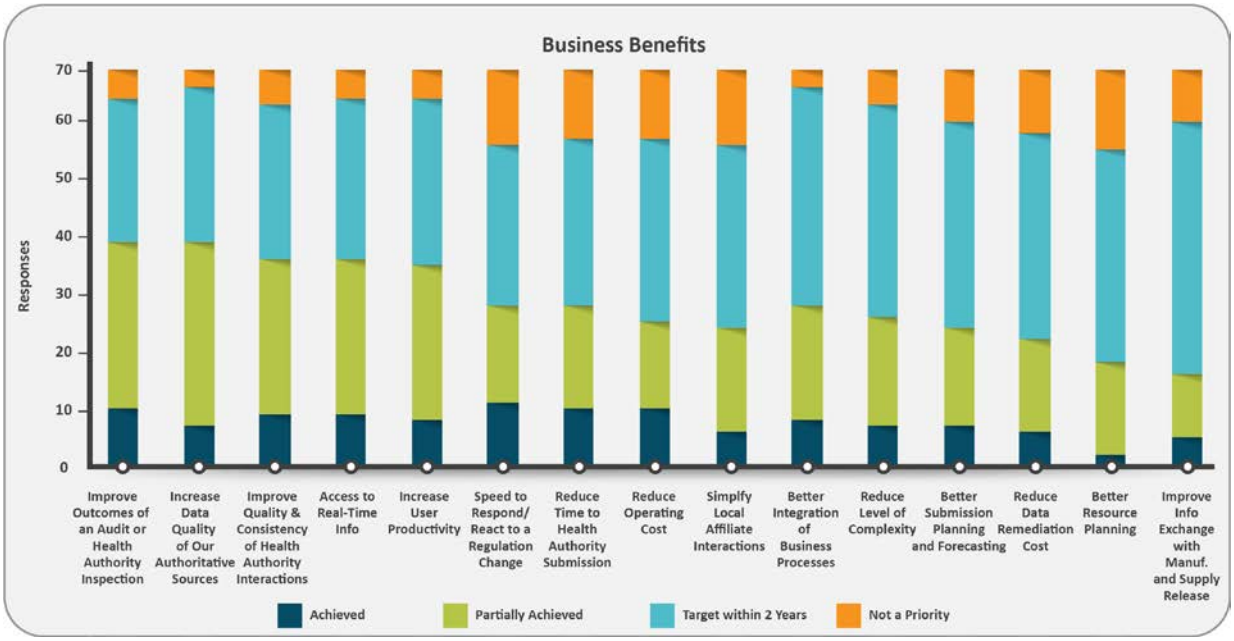


Figure 2: Business Benefit Realization

Investment priorities differ by size of company (see Figure 3). However, in the 2019 – 2020 period, all tiers consider improving data management / standards and connections to other functional areas a major priority (red text). We see a reemergence of investment in regulatory intelligence (75%) for the large tier; a clear driver for E2E RIM platform strategy (76%) in the mid-tier; and product registration (50%) continues to be a critical investment for the small tier.

Investment Period	Large (n = 17)	Mid-Tier (n = 22)	Small (n = 30)
Changing now or starting in 2018	1) Data Management / Information Standards (65%) 2) Safety Reporting (54%) 3) Dossier Management and Product Registration (53%)	1) Dossier Management (50%) 2) Submission Doc. Management (45%) 3) Submission Forecast and Plan (43%)	1) Safety Reporting (48%) 2) Labeling (44%) 3) Submission Doc. Management (41%)
Changing in 2019 - 2022	1) Regulatory Intelligence (75%) 2) Reporting & Analytics (59%) 3) Connection with QMS (57%) 4) Connection with Supply (50%) 5) Design History File (50%)	1) E2E RIM Capability (76%) 2) Connection with Clinical (67%) 3) Data Management / Information Standards (64%) 4) Regulatory Archive (57%) 5) Health Authority Interactions (55%)	1) Data Management / Information Standards (71%) 2) Connection with Product Supply (59%) 3) Connection with QMS (52%) 4) Connection with Product Change (50%) 5) Connection with Clinical (50%) 6) Product Registration (50%)

Figure 3: Priority Investments by Tier

Capability Efficiency and Data Quality Status

The only finding from this year's research that surprised us was that efficiency and data quality levels remained the same as 2016. We took the efficiency average of the 18 RIM capabilities of the 69 companies and compared it to the previous two surveys (see Figure 4), and found generally the same efficiency levels as 2016. There were some exceptions: increases in submission forecasting, labeling, and reporting /analytics; and decreases in health authority interactions, data management / information standards, and connection to supply release. See the appendix for 2016/18 efficiency comparison detail.

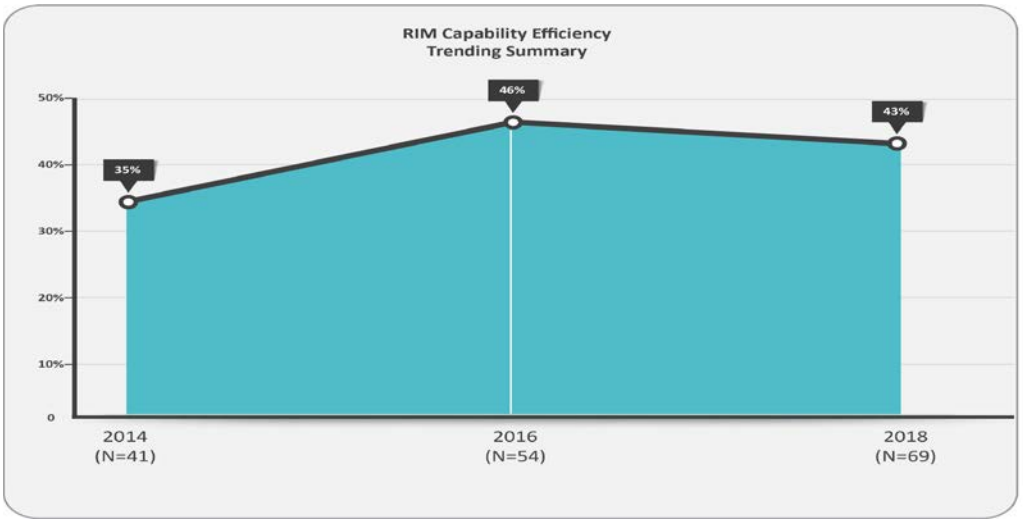


Figure 4: RIM Capability Efficiency Trending Summary

All other RIM capability efficiency was unchanged. First and foremost, the vast majority of organizations still struggle with "disconnected" information with most companies having 4 or 5 five software providers (publishing, document management, registration, labeling, submission planning etc.). These multiple systems typically are not connected (except for submission document management and publishing). Many companies are inefficient due to this operating environment. This is one reason why 74% of the surveyed companies are looking to investigate and potentially adopt an E2E RIM platform strategy, with the highest interest coming from the mid-tier where business scalability is a priority.

The other clear challenge for most regulatory organizations is having a mature and disciplined continuous improvement program that is driven by performance metrics. In our World Class RIM work, we compiled performance metrics (see appendix) that should be common in all regulatory organizations; although there are some exceptions based on the size and type of the product portfolio. We see a clear correlation between quality and cycle time metrics, and an organization's efficiency rating. While all organizations have major system and process change initiatives every 5 to 7 years, having a constant flow of small changes guided by data (metrics) should bring steady annual efficiency improvement.

The more concerning area is data quality confidence levels. The keyword here is "confidence". When confidence is low or moderate, regulatory organizations spend considerable amount of time "verifying" information with other sources or with the local affiliate office which greatly impacts productivity. Some information areas are better than others (see Figure 5). In three previous client studies that encompassed 85 countries, we found, on average, between 6 – 9 % of weekly local affiliate regulatory activity time was spent verifying or providing information to be verified.

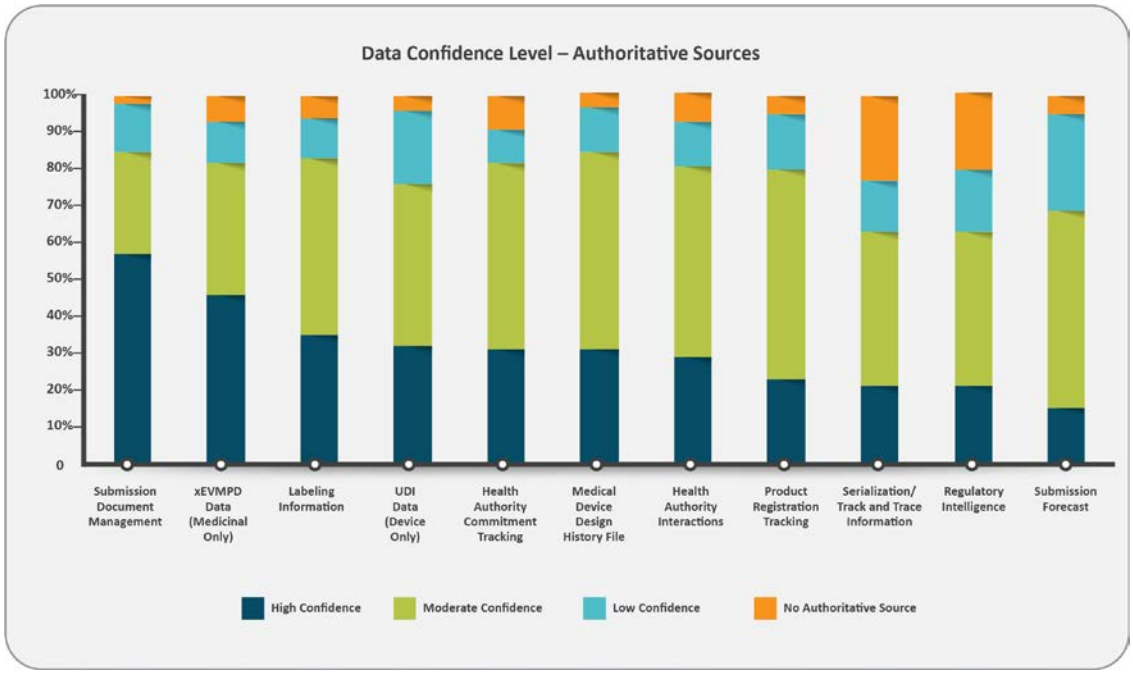


Figure 5: Data Confidence Levels

The product registration high confidence level dropped significantly from 41% in 2016 to 23% in 2018. We believe anecdotally this drop resulted from IDMP impact assessments conducted between 2015 and 2017 that identified the need for additional data quality work.

We also examined data quality methods for the first time in this year survey. These methods include dedicated resources for monthly/quarterly reviews, formal audits, a central data entry model, and verification against the source at data entry. From our consulting work, we see more organizations justify data stewards or data scientists that aid in data quality standards and execution. Finally, data quality levels must continue to improve if companies want to realize the benefits of planned RIM connections to other functional areas and leverage more sophisticated analytics and supportive emerging technologies.

Organizational Strategies Do Make a Difference

The 2018 survey was our first to collect detailed organization data that provided us with total regulatory headcount, and its distribution in central, regional, design center (device), and local affiliate offices. We also collected the local affiliate reporting relationship data to the central regulatory group, information on dedicated RIM groups, and collected information to better understand different operating models (central, local, hybrid etc.) for several regulatory activities.

Figure 6 depicts the difference in the affiliate reporting relationship to the central office by company size. Both the large and small tier tend to have a solid line reporting relationship into the central office while the percentage for mid-tier is almost balanced. We assume "non-regulatory" reporting means the commercial organization. We also know that United States based organizations have a higher rate of solid line reporting into the central regulatory group compared to European and Japanese counterparts.

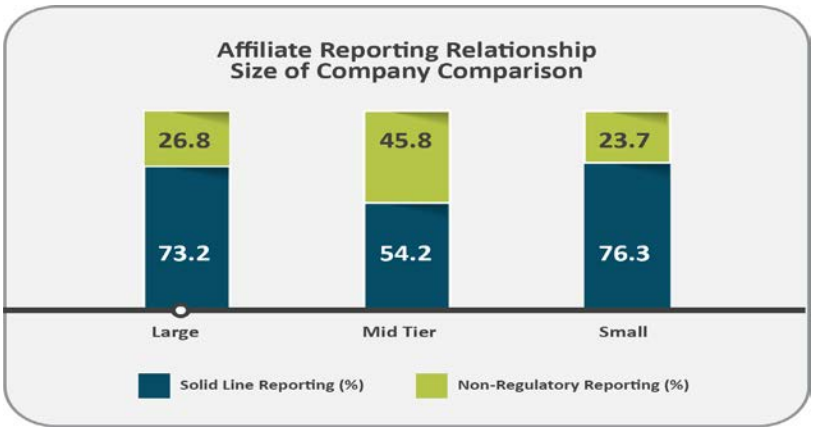


Figure 6: Affiliate Reporting Relationship

We found those with a solid line affiliate reporting relationship to the central regulatory group enjoyed slightly better efficiency (12%) and time to report information (10%), however there was a substantial

positive difference in business benefits achieved (24%), most notably being faster time to health authority submission and faster adoption of regulation changes.

The other organization strategy we tested was the benefit of having a dedicated RIM group (see Figure 7). For 2018, 61% (42 companies) have this structure. We compared the efficiency, data quality, and benefit realization data of companies with a dedicated RIM group to companies without one. Overall RIM capability efficiency levels were better for those with a dedicated RIM group, but more significant was higher benefit realization. Companies with a RIM group had reduced data remediation cost, improved submission forecasting, reduced operating cost, and simplified affiliate interactions. Our starting hypothesis was that a solid line reporting relationship and dedicated RIM group would find better data quality ratings. This turned out to be false, there was no difference. We conclude that data quality is probably more influenced by culture or organizational mindset.

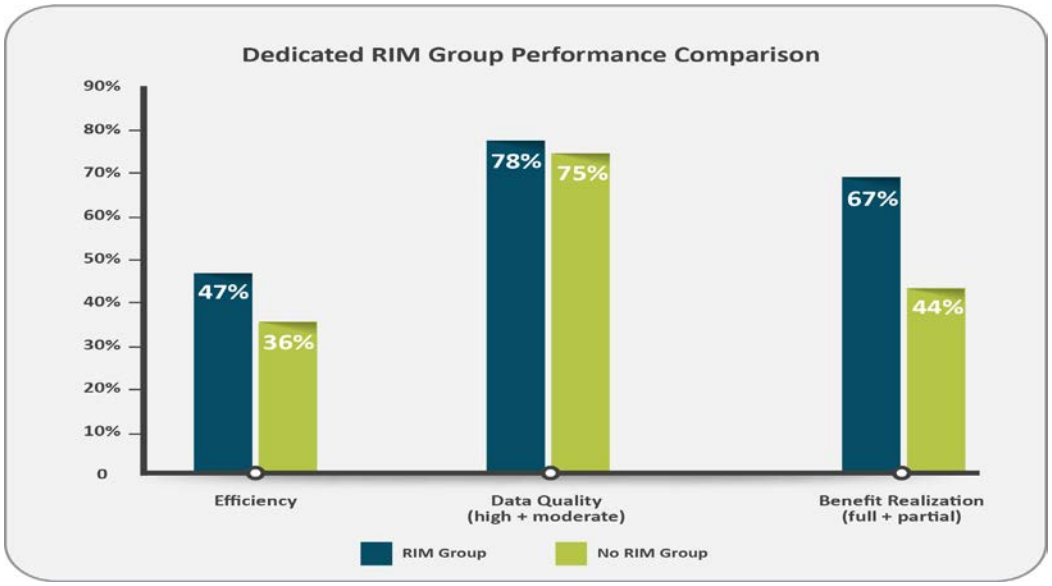


Figure 7: Dedicate RIM Group Performance Results

Finally, the other clear benefit to a dedicated RIM group was an increased prevalence of global system deployment. For example, Product Registration (68% - dedicated RIM group vs. 5% - no RIM group), HA interactions (59% vs. 9%), HA commitment tracking (54% vs. 14%), Design History File (53% vs. 0%), and labeling (60% vs. 27%) were most notable. This is very significant as many companies find deploying and maintaining global systems takes more time and effort than originally expected.

Performance Metrics and Continuous Improvement

We expanded our World Class Performance metrics in the 2017 design sessions (see appendix) and added a metrics characteristics question to gauge the level and maturity of continuous improvement in regulatory organizations. We learned metric programs continue to be immature, however there is significant opportunity for increased organizational performance. Figure 8 depicts the status of metric characteristics. We focused on how metrics are used to identify compliance risk, efficiency and

productivity opportunities; and also, on metrics used for service provider performance and internal employee goal and objectives (specifically tying registration data quality to individual performance objectives for those that contribute to the registration data). The other key metric area is transparency of metric results or "our reports /dashboards are widely available to the organization". Metric risk/benefit identification, employee / provider performance, and metric transparency are all key elements to a sound continuous improvement program.

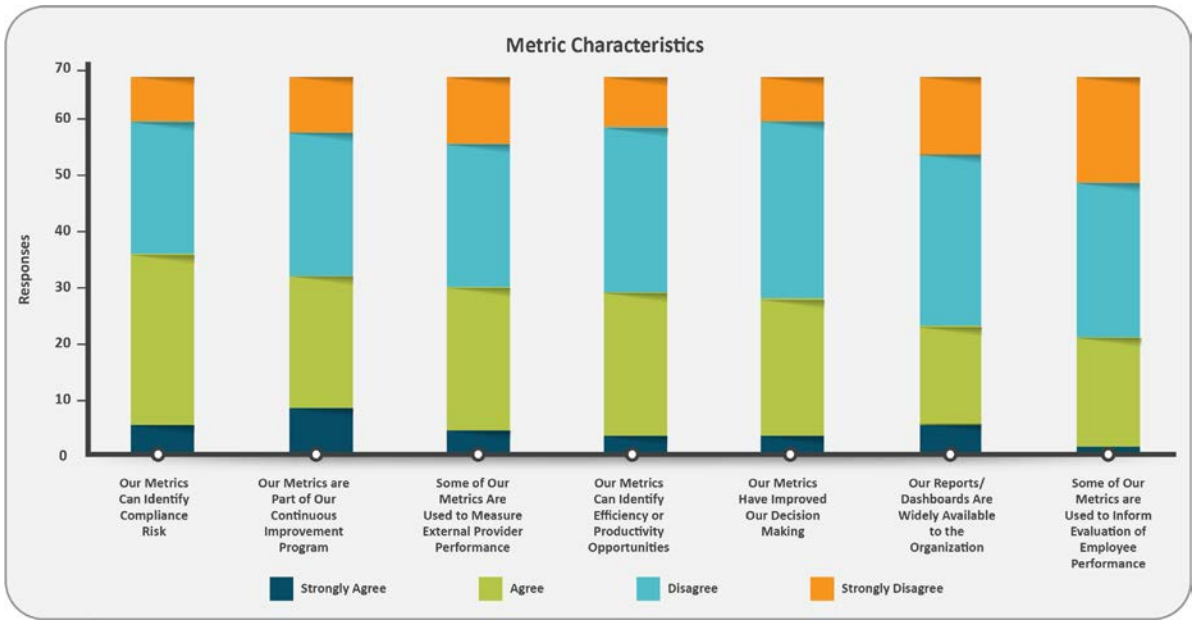


Figure 8: Metric Characteristic Results

World Class RIM and Strong Performance Industry Status

During a keynote presentation of our World Class RIM work in the summer of 2016, we got a great question: "What if we don't want to be world class? Maybe we can't afford it. What would be considered "strong performance?". We continued our world class dialogue with industry (31 companies in 7 design sessions) in the fall of 2017 to modify how we measure world class RIM and introduced this "strong performance" band.

Figure 9: World Class RIM Categories

World Class RIM – Five Elements, Ten Questions

Our core World Class model (see Figure 9) did not change. However, we did expand the number of data points considered; primarily in the performance metric section. The following are the five categories with the number of data points (in parenthesis) used for this industry benchmark.

1) **Data Quality Confidence (11**) - It's one thing to have an authoritative source, but what is your confidence in the quality of the data in your authoritative source? This category is heavily weighted in our world class algorithm and is foundational to RIM performance.
2) **Business Benefit Realization (37) –** Comprises of business benefit realization status, performance metrics usage, continuous improvement program status, and operating cost understanding.
3) **Global Reach: Global System Deployment Status (7) -** World Class means the "world" can access and utilize the core RIM capabilities in at least 75% of the affiliate offices (we account for the agent/distributor network).
4) **Level of Efficiency (18)** - Evaluates the effective utilization of resources, repeatability of process, and low error rates to achieve regulatory goals of the 18 RIM capabilities (see appendix for listing). We use a four-point scale so those participants who are unsure must decide whether they are leaning toward efficient or not efficient.
5) **Time to Report Information: Provide Accurate Reporting to Common Regulatory Questions (9)** – This is a very telling measure with a clear correlation to data quality confidence levels. We have nine common regulatory questions; for example, what products are registered in what countries. Participants indicate if they can answer each question in real-time, within a day, multiple days or a week or more.

Figure 10 depicts the placement of the 69 companies and their relationship to their tier average, the strong performance band and the world class level. Two companies are very close to the world class level and we had several companies enter the strong performance band when compared to 2016. The green shading for 11 companies represents those who are farthest along in the RIM to other functional area connection. Another starting hypothesis was the requirement of having a strong foundation before attempting to extend RIM programs with other functional groups which was confirmed by the results.

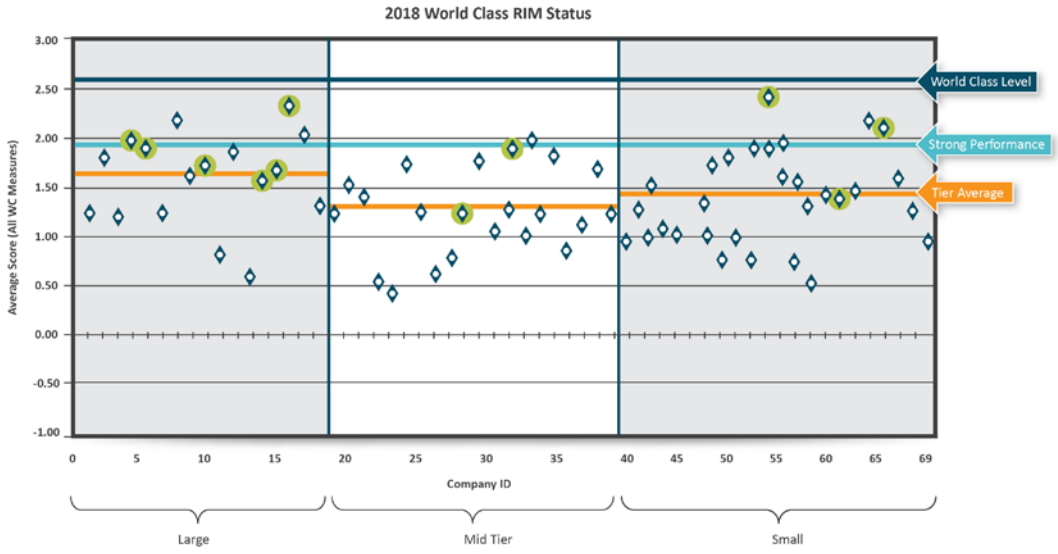


Figure 10: World Class RIM Benchmark Results

RIM Connection to Clinical, Supply Release, Product Change Control and QMS

During the summer of 2017, eight companies were approached (regulars in our survey series) to determine if detailed research to the critical connection points with clinical, product change, supply release and QMS were a priority. We already had a view that RIM is an enterprise asset and information throughput is a growing area that may add value by connecting and automating activities that are either manual or compliance risk to the business. All eight company responses had a consistent theme of "interesting you mention this as we are planning and allocated budget to review the value potential of these critical connections in the coming years". The data and insight in this section are very clear. We expect that RIM 2022 should see these connection points as the "new norm" along with the combination of an E2E RIM platform, tools based on artificial intelligence (AI), predictive analytics, business process management, and end to end process work.

One of our underlying hypotheses was that as regulatory organizations mature their RIM capabilities (data quality, metrics, process efficiency), connecting them to other enterprise assets will be possible and valuable.

Figure 11 summarizes the significant focus of clinical (65%), product supply release and change control (51% respectively) and QMS (44%) over the next three years. Many other companies (shown in green) will be working on these areas longer term (>2020). When we cut the data by size of company, all tiers had a similar priority and investment focus. Our consulting works tells us the large multi-nationals are more driven by complexity reduction, compliance risk and cost. Most mid-tiers are busy scaling their operations while the small tiers want to "lay the foundation" correctly the first time.

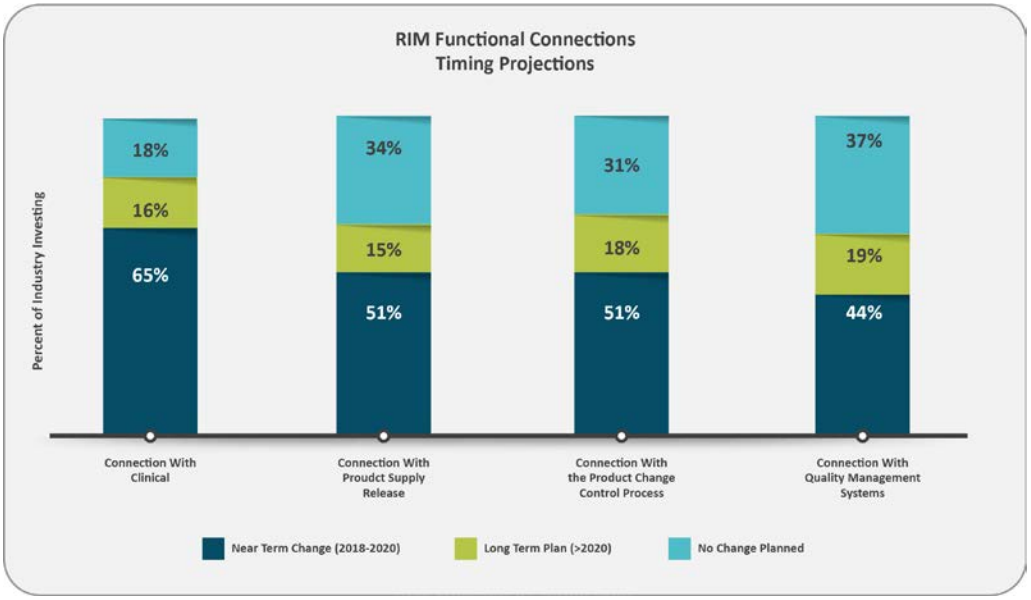


Figure 11: Cross Functional RIM Connection Timelines

Our survey questions explored the RIM connection points with supply release and product change control along with the inter-relationship with QMS. Figure 12 depicts the capabilities we tested for the RIM to Manufacturing connection.

RIM to Manufacturing Connect Point	Implemented Today	Funded Implementation Objective	Exploring	Total
RIM Capability alerts Manufacturing that a regulatory status has been changed in a particular country	21%	23%	39%	83%
Regulatory Product Registration and ERP systems are connected and have information transparency	11%	28%	40%	79%
RIM Capability notifies all regulatory parties in impacted markets to prepare for a Regulatory Impact Assessment for a potential product change	11%	18%	44%	73%
Artificial intelligence or automation to suggest what countries require a submission for a proposed product change	8%	5%	32%	45%
ERP system links to a regulatory system to understand any significant label change that could delay a manufacturing run	3%	12%	51%	66%

Figure 12: RIM to Manufacturing Connection Summary

Figure 13 depicts the capabilities we tested for the RIM to Supply Release connection

RIM to Supply Release Connect Point	Implemented Today	Funded Implementation Objective	Exploring	Total
Regulatory approval: RIM capability triggers product release for marketed products	30%	22%	32%	84%
Using product registration data during product recall	23%	13%	37%	73%
Registration Change to "not approved by HA" in RIM system halts product batch release	19%	12%	44%	75%
Regulatory approval: RIM capability triggers product release for clinical development	18%	12%	39%	69%
Use the RIM Registration system to determine product recalls for specific markets	12%	16%	34%	62%
Registration expiration date in RIM system halts product planned batch runs or release	10%	15%	37%	62%
Ability to correlate warning letters to registered manufacturers	16%	5%	40%	61%

Figure 13: RIM to Supply Release Connection Summary

We found several interesting things with the RIM and QMS inter-relationship research. First, medical device companies have more of a RIM/QMS inter-relationship than medicinal companies and may have a different definition too. Based on our survey design sessions, medical device companies were more likely to define QMS as an overarching set of policies and procedures for the organization. In contrast,

medicinal companies were more likely to define QMS as an IT capability. Most likely because of this difference, survey results show device companies were more likely to view RIM as part of the QMS than their medicinal counterparts. Secondly, just about 50% of companies stated that RIM was effective in supporting internal audits and external inspections. Finally, these four areas were viewed as not effective (%) and currently industry is working to improve:

1) Regulatory Performance Metrics (63%) – a common theme in our research – most regulatory organizations lack a disciplined and data driven approach to continuous improvement
2) Standards Management (59%)
3) CAPAs (Corrective Action/Preventive Actions) that impact Regulatory Processes (57%)
4) Data and content quality audits on regulatory owned systems (48%)

Another area of research focus was the regulatory impact assessment (RIA) for proposed product changes (manufacturing or quality). We found 94% of survey participants are currently evolving or improving their RIA today or within the next two years as depicted in Figure 14.

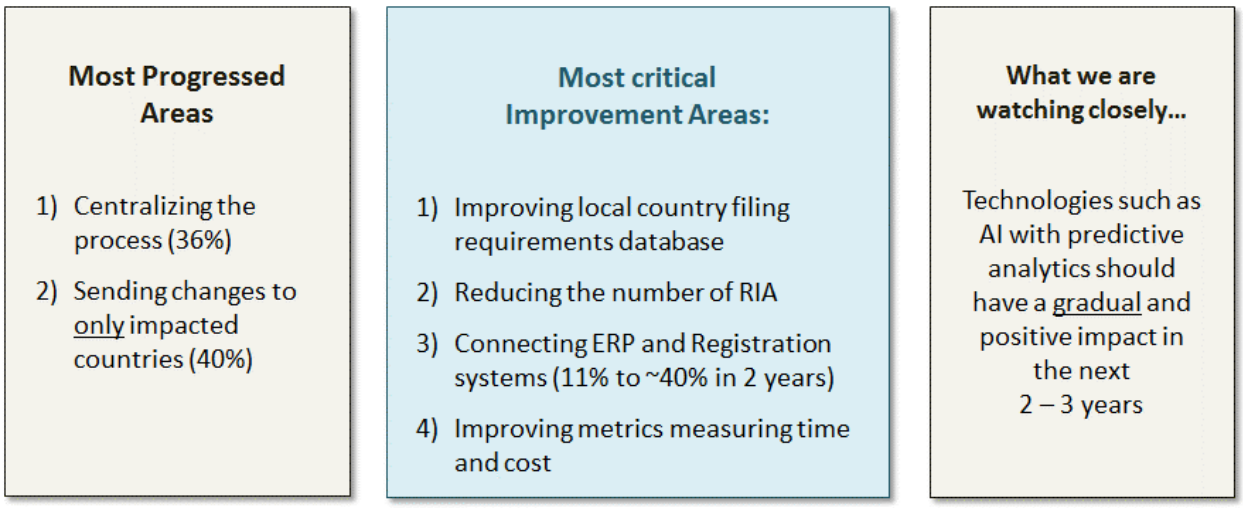


Figure 14: Regulatory Impact Assessment Status

Contrasting RIM for Medicinal and Device Companies

The medical device sector is generally years behind the medicinal product sector in electronic submission of regulatory information. We believe this is due to the technical complexity and variability of medical device products, and a lack of electronic submission standards for medical devices among the world health authorities. The medicinal product sector completed significant submission harmonization work with the agencies 10 – 15 years ago that resulted in significant investments in document management, publishing, third party collaboration technologies, and document authoring workflow. This was driven by the need to improve operational efficiency and reduce the time and cost of submissions that were growing in size, volume, and complexity.

Because of these differences, we suspected the RIM survey data would show some notable differences between medical device and medicinal product companies. We compared survey data from 10 device companies with data from 33 survey respondents who had only medicinal products. The remaining 26 survey participants had multiple product types (e.g. combination products). Several key differences emerged from this comparison.

First, although efficiency in a few areas (notably submission production, regulatory archiving, and safety reporting) were very similar between medical device and medicinal product companies; device companies were significantly less efficient in other areas. Figure 15 shows a comparison of self-reported efficiency ratings for RIM areas where a significant difference exists between the device and medicinal RIM efficiency.

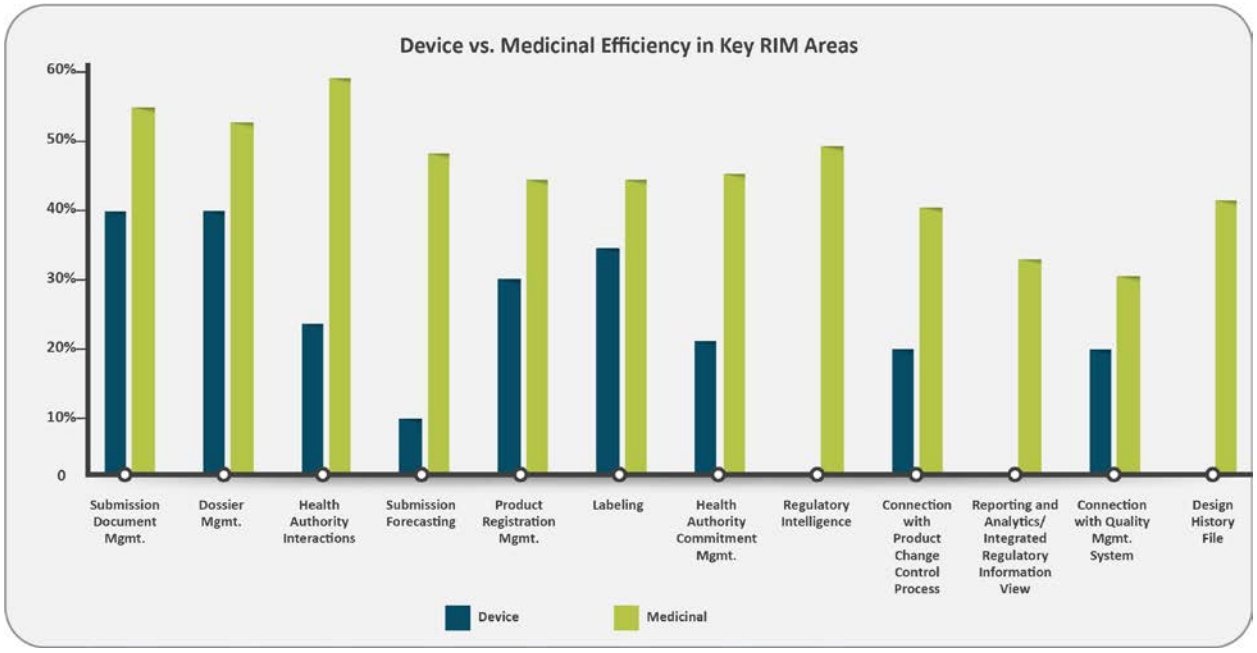


Figure 15: Device / Medicinal Efficiency Comparison

In addition to efficiency differences, device companies also require significantly more time to report key regulatory information. On average, 68% of pure medicinal companies in the survey could accurately report key regulatory information real time or within a day. This is a sharp contrast to only 36% of device responding companies who could do the same.

There were also key differences in the regulatory organizational structure of responding device companies as compared to the medicinal companies. Based on our experience, we believe organizational differences are a key factor in the lower efficiency and increased reporting time. Those differences include divisional vs central regulatory organizations, the extent to which RIM related activities are managed centrally, and the prevalence of a Regulatory Operations role.

Device companies are commonly organized into individual business divisions or design centers, each of which is typically focused on a type of product or therapy. The regulatory organization often mirrors this structure. Device survey responses indicate that 20% of regulatory staff on average are in business divisions, while pure medicinal companies show only 1% of regulatory staff are in business divisions.

The divisional organization also means that operational regulatory work is more often done in a decentralized way for device companies, as opposed to a more centralized approach on the medicinal side. Figure 16 shows differences in where work is managed for device companies as compared to medicinal. Note that the chart excludes business management of RIM systems, since this is most often performed centrally for both device and medicinal companies[1].

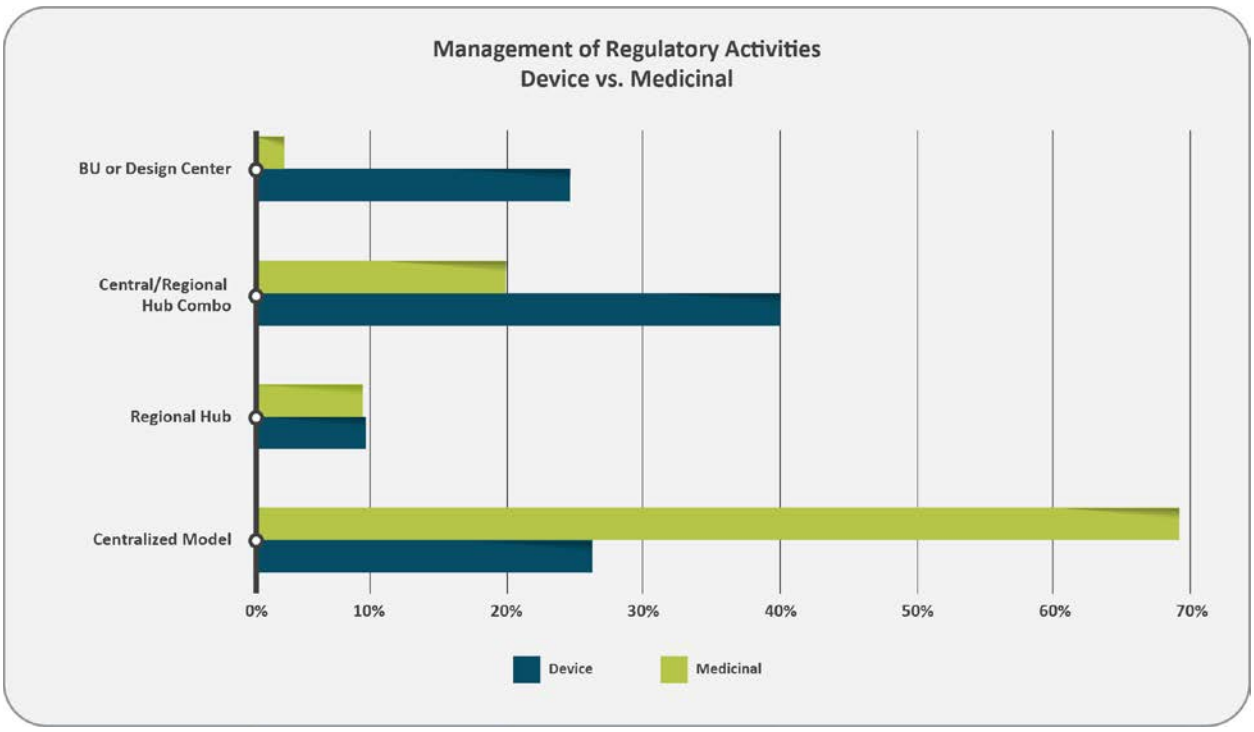


Figure 16: Device/Medicinal Organizational Comparison

Another key difference is the extent to which a Regulatory Operations role exists. The pure medicinal companies responding to the survey had a greater percentage of their staff devoted to a Regulatory Operations role than the pure device companies. In our experience, it is also common for device companies to not have a Regulatory Operations role within their organizations – though we did not see this reflected in the small group of pure device companies participating in the survey.

We hypothesize that decentralized management of RIM activities, combined with the variability in processes across divisions / design centers, and lack of Regulatory Operations staff specializing in RIM

[1] 90% of device, and 87% of medicinal companies perform business management of RIM systems centrally.

activities make it significantly more challenging for device companies to achieve RIM efficiencies and to quickly retrieve key regulatory information.

The medical device sector is just starting on this digital journey. They tend to have a more decentralized business model that segments companies into independent divisions. Often the regional and local affiliate level is also a highly distributed regulatory operation. Pricing pressures and regulatory complexity at the regional level are causing many medical device organizations to rethink this decentralized model of regulatory information management and invest in standards and technology. We were not surprised that device participants scored in the lower region of the world class plot for the second survey in a row. The good news is there are many common practices to leverage from the medicinal product side. The solution providers are investing in areas where there are small but meaningful differences such as the registration management process, product release, and data standards (UDI compared to IDMP) between device and medicinal product divisions.

Shifting RIM Architecture Strategy

We have been discussing and anticipating the promise of emerging technology to improve Regulatory Information Management (RIM) systems for the last few years. The game changer is the emergence of an end to end (E2E) RIM platform approach; which will be discussed in detail in the provider section and is represented in the blue section of Figure 17. The green area named “value added tools” combines both traditional technologies (data visualization, business intelligence, and collaborations tools) with emerging technologies such as AI, predictive analytics, and voice-based assistant.

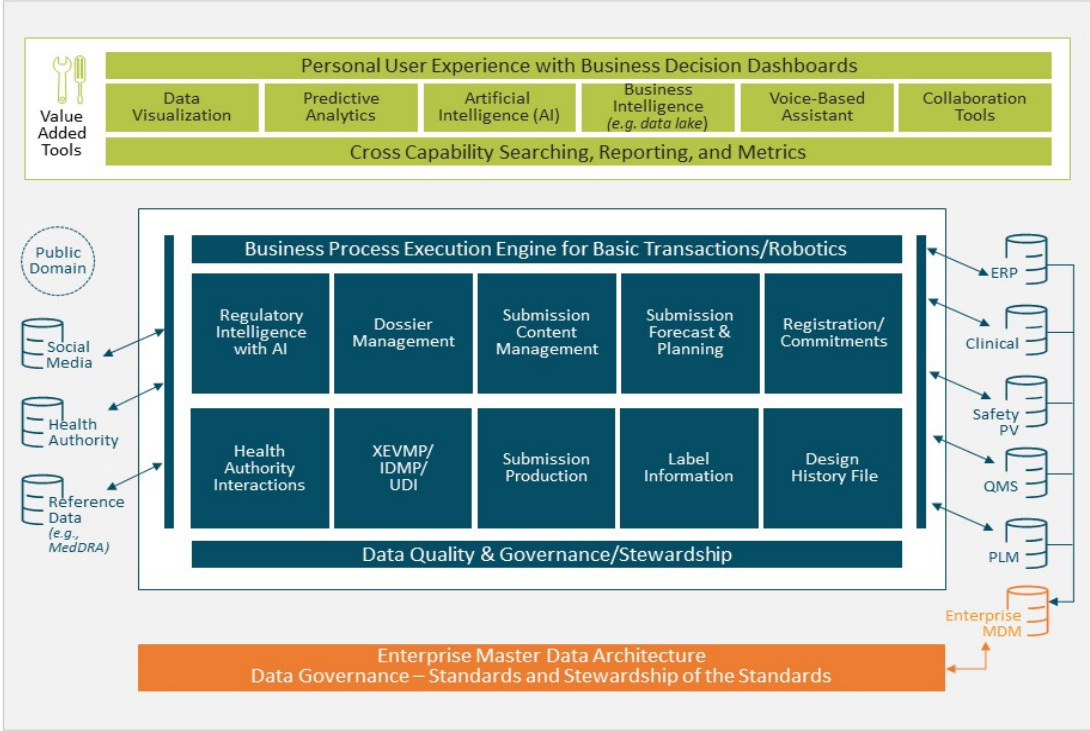


Figure 17: 2018 RIM Architecture Viewpoint

Value Added Tool Priorities

We tested fifteen technologies (see appendix) companies are using or trying to use in an innovative or disruptive manner. The top five technologies or tools "in production today or being implemented currently" are collaboration (48%), mobile apps (33%), visualization (30%), master data management (29%), and business intelligence (22%). The larger the company size, the more value-added tools that are utilized most likely due to high data volumes and broad geographic diversity.

We asked participants to identify if they are: 1) investigating or in proof of concept or 2) monitoring for educational purposes. Sorting the data in this manner or "what's next", we find the following priorities:

1. Automate data extraction from unstructured date (e.g. for IDMP, serialization)
2. Structured component authoring / structured content management (making a reemergence)
3. Artificial intelligence techniques (e.g. natural language processing)

Over the past few years, several IDMP data source and data quality analyses conclude that at least 50% of the data needed to meet the current IDMP reporting requirement is in unstructured documents and reports. Some of this data is unique to the source and some is potentially duplicative or conflicts with other sources. A key emerging requirement is to efficiently and effectively locate the specific data in unstructured sources especially for those companies that have many products. The data must then be extracted or, at minimum, highlighted for evaluation. It was no surprise that the top "what's next" priority is automated data extraction.

While there is much discussion and "hype" over blockchain and robotics, we don't see any near-term application of these technologies; most discussions of them are "conceptual" in nature and not practical. Although voice based assistant technology was not a high priority, we believe as data quality levels increase, especially in the product registration / health authority commitment tracking capability, this technology will see rapid adoption. Finally, we believe the combination of Artificial Intelligence and Predictive Analytics has the highest amount of potential use cases and value promise.

Off Premise vs On Premise Trending

We continue to track the interest and adoption of off-premise solutions for regulatory capabilities. For 2018, we simplified the question regarding adoption of a "cloud" or Software-as-a-Service (SaaS) solution for regulatory capabilities to just "off-premise".

As in previous years, there continues to be strong interest in adopting an off-premise solution, however most companies have still not implemented off-premise solutions for most regulatory information management capabilities except for advertising / promotional material and safety system reporting. For other RIM capabilities, 39% of participants are planning to be off-premise within two years for at least some RIM capabilities.

As the market shifts to more of an E2E RIM platform strategy, off-premise adoption should increase. Since many RIM modules are interconnected, it is difficult to have some capabilities on-premise while others are off-premise. The survey results find 67% of those investigating an E2E RIM solution will prefer an off-premise model. We view this as an indicator of the synergy between E2E solutions and off-premise RIM.

In Figure 18, we see that the number of companies with an off-premise solution increased from 16 (2016) to 27 (2018), and adopters of off-premise solutions for at least one RIM capability continue to see very positive technical benefits. The overall trend is toward a higher percentage of companies reporting "Better than Internal" across most measures. The one area with a notable decrease in "Better than Internal" is "Access and Security". We have no clear understanding of this reduction.

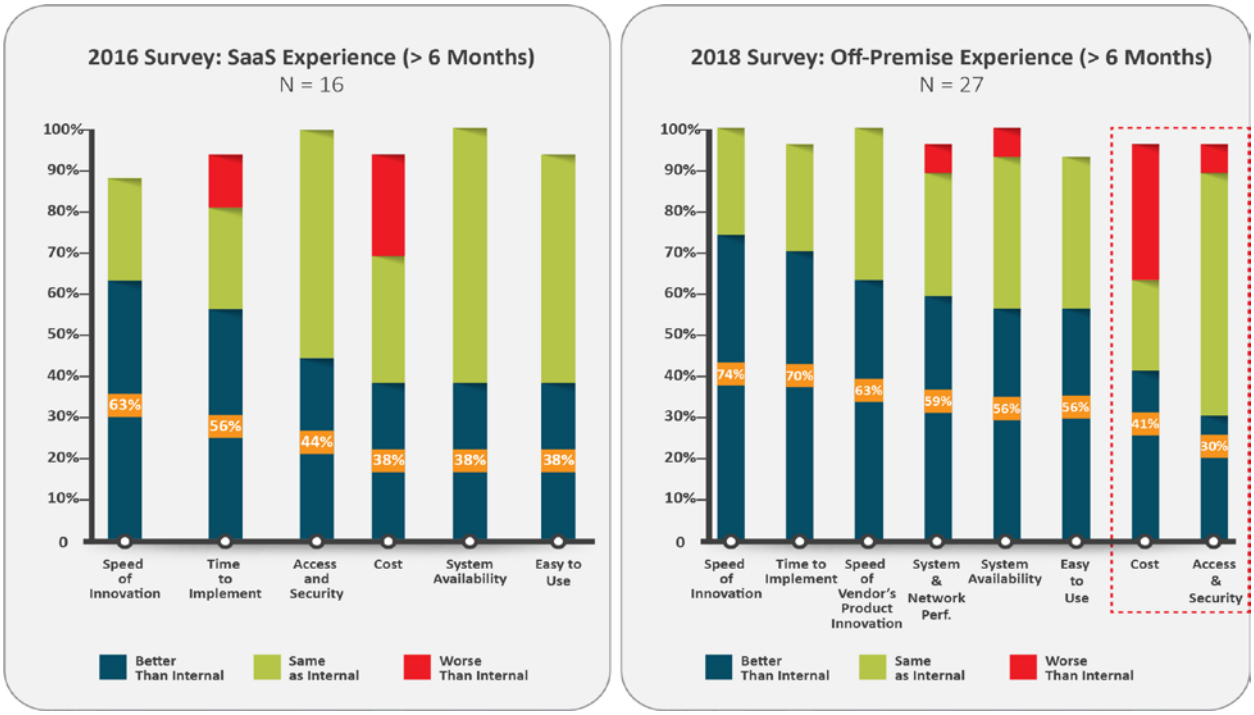


Figure 18 - Experience with Off-Premise Solutions

Interestingly, when comparing the 2016 and 2018 results for off-premise "Cost", 2018 results show an increase in the number of companies reporting both "Better" and "Worse". This indicates a widening disparity of experience in this area.

Increased speed of validation and faster time to implement off-premise solutions where reported by 70% or more of the participants; supporting the often-cited idea that improvement in these two areas are benefits of off-premise solutions.

This data and lessons from other industries and other functional areas in life sciences show that off-premise solutions can be implemented faster, made globally accessible and can often be operated at less overall cost than internally provisioned solutions.

Regulatory Intelligence Trending

We consider regulatory intelligence (RI) to be an important regulatory information management (RIM) capability. In our view, the regulatory intelligence capability includes country filing requirements, each medicinal or medical device company's knowledge of global Health Authority's policies, internal company policies / procedures, and lessons learned from previous submissions and interactions with Health Authorities. Also included in RI capability are company processes and tools for gathering, assessing, using and distributing regulatory intelligence.

In this year's survey, the 8 data points related to regulatory intelligence are shown in Figure 19.

2018 Research Area	Regulatory Intelligence Aspect	2018 Survey Headline
Plans for RIM Capability Change	Regulatory intelligence	58% of the companies plan to change their RI capability
Innovative / disruptive use of technology	Web crawling for regulatory intelligence	30% of companies are in production or investigating
Efficiency	Regulatory intelligence	Only 36% report "efficient" (including only 1 "very efficient" response)
Affiliates using a global RIM capability	Regulatory intelligence	26% "use today" with another 51% expected within 2 years (Note: projected usage at affiliates has been historically inaccurate i.e. overly optimistic)
Data confidence level	Regulatory intelligence	At 21% "high confidence", RI is the second lowest in terms or high confidence of all of the survey's authoritative sources
Data quality methods	Regulatory intelligence	49% of have no formal data quality checks for RI information (highest of all information in the survey)
Off-premise (SaaS) technology model	Regulatory intelligence	22% are off-premise today
Outsourced roles, functions or activities	Regulatory intelligence analyst role	21% outsource today or are considering outsourcing the role Large = 2 of 17; Mid Tier = 7 of 22; Small = 6 of 30

Figure 19 2018 Survey Data Points

These data points show a significant amount (58%) of change planned, a low efficiency rating (38% consider it efficient) and low confidence in the information provided by the current RI capability. 75% of large companies had RI as a 2019/20 priority which is a substantial increase when compared to 2016.

Given the low confidence in RI capability, it is not surprising that there is very low usage of the RI capability across the company - especially at affiliates. Less than 25% of the companies have deployed the corporate capability to affiliates, despite a steadily increasing number of "planned" deployments since 2014, see Figure 20.

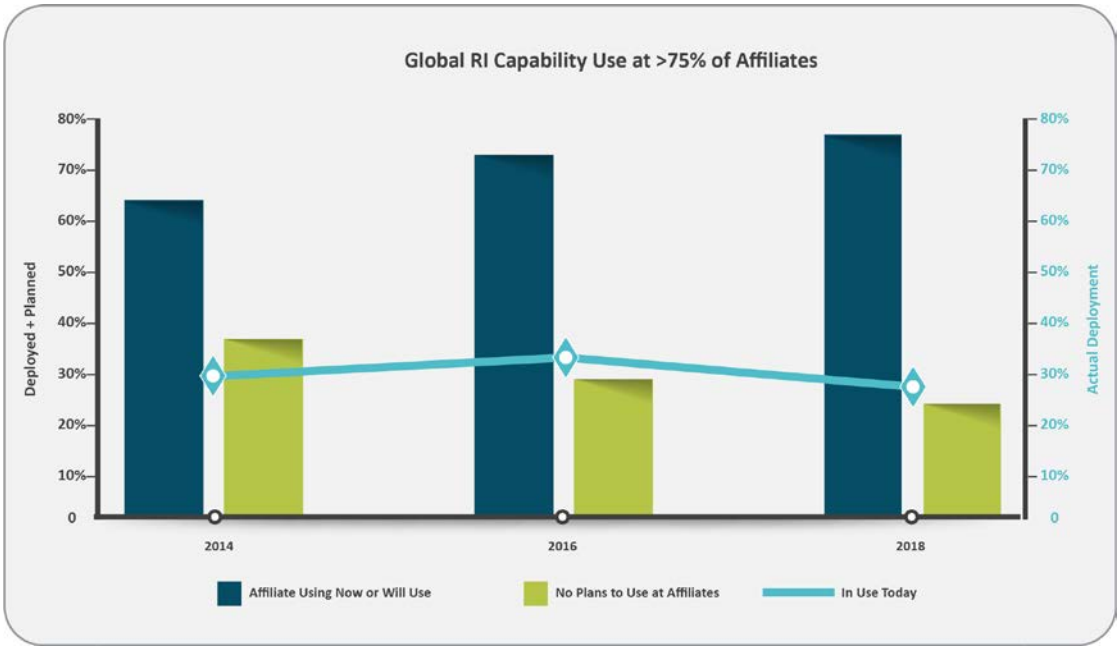


Figure 20 - RI Deployment to Affiliates

The limited usefulness of RI information is also evident in our work with clients. In formal and informal analyses and interviews, regulatory intelligence capability is often described as a "pain point" with low satisfaction ratings, but with potentially high strategic and operational value. RI programs are typically under staffed or do not exist as a formal internal service. In our experience, we find formal RI groups have great variation in their remits along with general dissatisfaction with off the shelf RI tools and services.

We conclude that regulatory intelligence is increasingly seen as a critical resource at several points in typical regulatory affairs processes; including regulatory impact assessments, planning global submission strategies, and ensuring submission compliance for regional and local Health Authorities. RI is a pain point, partly due to its high value but low satisfaction, and there has been a relatively low investment in providing an improved and comprehensive RI capability beyond the purchase of commercial RI data services along with internal customized SharePoint and portals.

Regulatory Outsourcing Update

We have tracked dossier outsourcing since the inception of our industry benchmarks in 2007 (see Figure 21). Since 2014, outsourcing has been considered a common practice with many qualified suppliers having positive satisfaction ratings. There are a variety of viable outsourcing models ranging from individual application types to full function outsourcing.

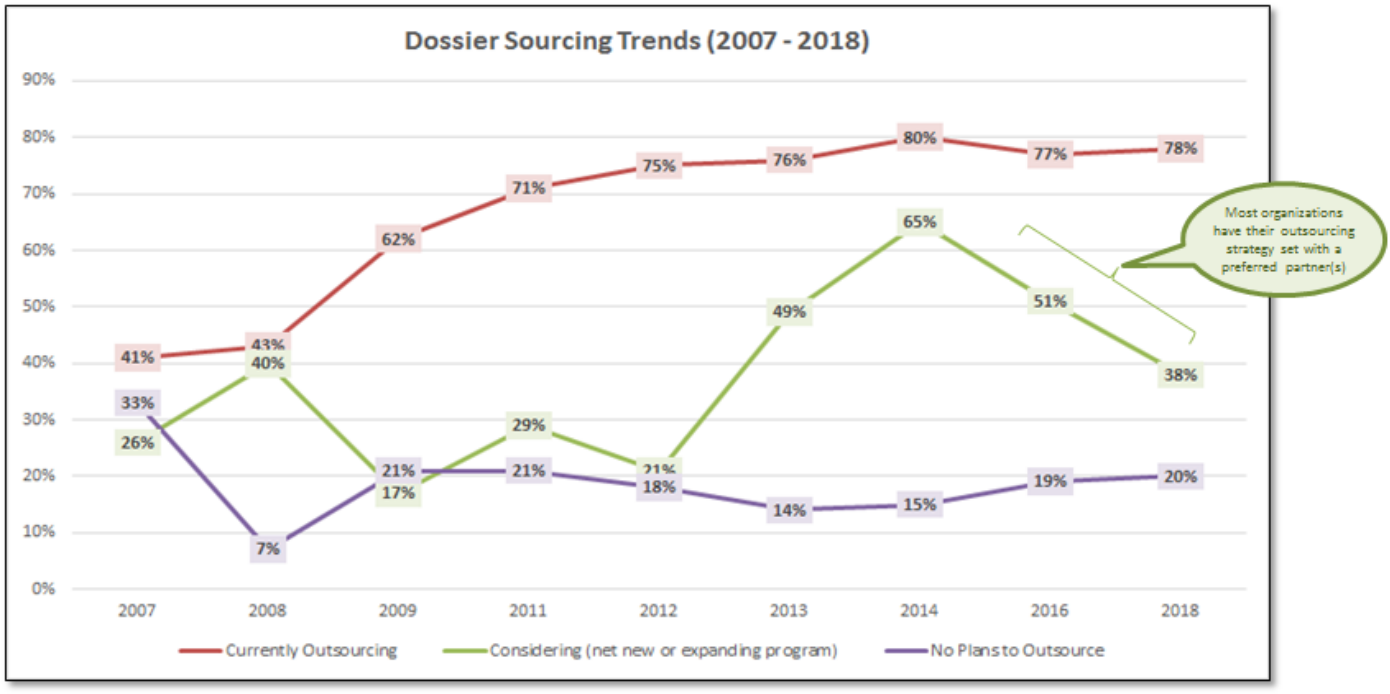


Figure 21: Dossier Outsourcing Trending Summary

In the early years of outsourcing, most companies used cost reduction as a primary driver to leverage publishing resources in low cost regions (e.g. China and India). While this remains an important factor, the market has stabilized and the top 3 drivers for outsourcing remain unchanged from out 2016 survey (organizational flexibility, increased efficiency, reduced cost). One difference from the 2016 survey is that the percentage of companies outsourcing to supplement missing skillsets in their internal personnel decreased from 57% (2016) to 42% (2018).

For 2018, we did separate primary and secondary / emerging markets for the new marketing application and life cycle management to determine where the outsourcing actual takes place. The most commonly outsourced activities are investigational application (initial and maintenance), marketing application maintenance, and safety reporting. The two biggest potential growth areas are related to initial marketing applications and maintenance submissions in secondary and emerging markets (see Figure 22).

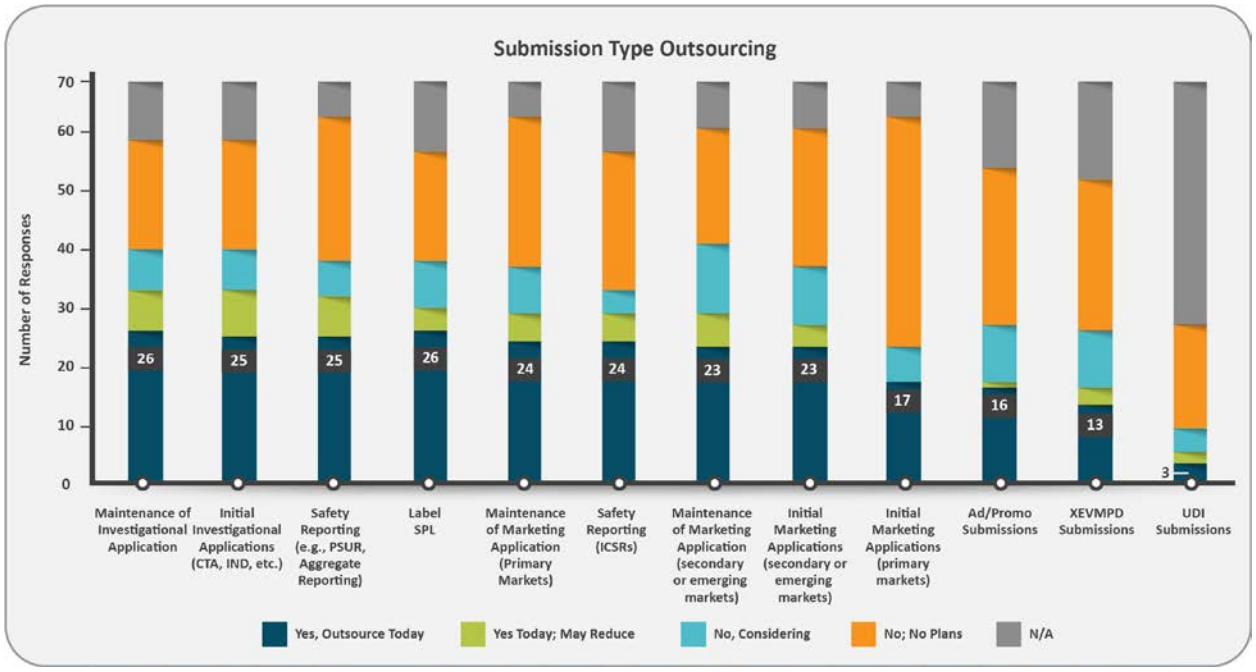


Figure 22: Submission Type Outsourcing Summary

Which activities are outsourced can vary by size of company. Figure 23 details the most common outsourcing activities, most likely to outsource tier comparison and highest growth activity by tier.

Company Tier	Most Common Activity Outsourced Today (>35% of companies)	Activity Most Likely to Outsource Today Compared to Other Tiers (More than 10% difference)	Highest Growth Potential (more than 15% companies considering)
Large	■ Investigational Applications (initial and maintenance) ■ Maintenance of Marketing Applications (primary markets) ■ Safety Reporting ■ Ad/Promo Submissions ■ Label SPL	■ Investigational Applications (initial and maintenance) ■ Maintenance of Marketing Applications (primary markets) ■ AD/Promo Submissions	■ Label SPL ■ Maintenance of Marketing Applications (secondary markets) ■ XEVMPD Submissions
Mid	■ Safety Reporting ■ Investigational Applications (maintenance) ■ Label SPL ■ Maintenance of Marketing Applications (primary & secondary markets)	■ Maintenance of Investigational Applications ■ Label SPL ■ Safety Reporting ■ XEVMPD Submissions	■ Maintenance of Marketing Applications (primary markets) ■ Initial Marketing Applications & Maintenance (secondary markets) ■ AD/Promo Submissions ■ Label SPL
Small	■ New Marketing Application (secondary markets) ■ Label SPL	■ No more likely than other tiers to outsource any activity	■ No growth areas over 15%

Figure 23: Outsourcing Activities by Tier

We expanded our list of outsourcing providers to 30 in our 2018 survey and included the labeling providers for the first time. Twenty-four vendors were used by respondents to support initial applications or maintenance support activities; and 18 vendors support data intensive outsourcing activities such as product registration maintenance, UDI, XEVMPD, or Label Operations.

Many vendors providing initial application and lifecycle submission support had fewer than 4 respondents that used their services. We will be watching these smaller vendors in our future surveys to see if their market share increases. Of the remaining vendors, PAREXEL was the leading provider of submission outsourcing services with 32% of respondents using their services. It appears that companies are using fewer vendors for submission services indicating a strong preference for preferred provider relationships.

For data intensive outsourcing services, only 2 of the 18 vendors had 4 or more respondents that used their services, Reed Technology and PAREXEL. Reed Technology was the market leader with over 48% of respondents using their services (e.g. SPL) and all have a positive satisfaction rating.

Software Vendor Landscape: Key Trends and Provider Update

Since we started our benchmarks in 2007, we have witnessed gradual changes in the provider landscape up until 2014 when the rate of change started to increase. We wrote about significant change in the submission document management solution set in 2016 along with anticipated IDMP investments.

2018 marks a significant transition point for both the traditional solution sets and emerging technology applications. The following capabilities have the highest anticipated change over the next two years:

- Submission Planning and Forecasting (47%)
- Registration Tracking (46%)
- Submission Content Management (41%)
- Label Compliance Tracking (39%)
- Heath Authority Interactions (Q&A/Correspondence Management) – 39%
- Label Content Management (35%)
- Regulatory Intelligence (35%)
- Publishing (34%)
- Label Artwork Management (31%)

What is very significant about these projections is that most capabilities have a five to seven-year lifecycle. The fact that change continues to be high is expected given the priority focus on enhancing regulatory systems and process. What is significant is the potential change of technology strategy given the emergence of a true end to end (E2E) RIM platform by several providers. Recall the lack of improvement from 2016 to 2018 in the efficiency and data quality levels which we see as a structural issue – having multiple providers with disconnected information. The starting hypothesis of E2E RIM is increased efficiency, simpler ways of working, better data control / quality, and reduced cost. It is important to note that while E2E solutions are the latest focus, we believe a 2 – 3 year maturing process is required to improve certain modules such as label management and publishing. Figure 23 demonstrates the interest and potential adoption of this new strategy. The timing of this move for most organizations is between 2020 and 2022, which we believe is a solid transition point allowing the providers to improve less mature modules.

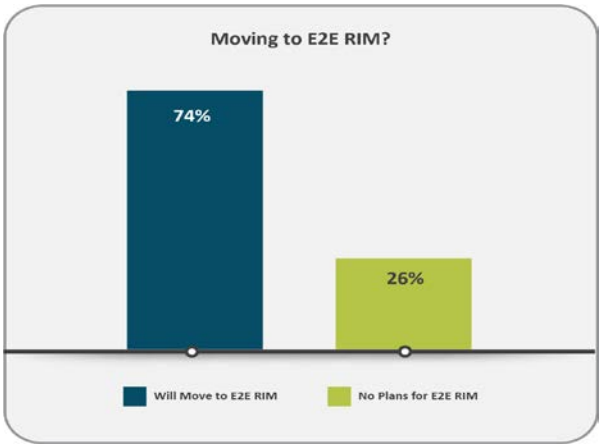


Figure 23: E2E RIM Strategy Forecast

We continue to see good news regarding provider satisfaction ratings with Figure 24 showing positive trending. This is the result of turnover of some of the traditional providers whose market share and satisfaction ratings are on the decline along with several newer providers that have increasing market share and much higher than average satisfaction ratings. Additionally, providers with a single E2E RIM platform approach have higher innovation scores compared to most of the best of breed providers

Figure 24: Software Provider Satisfaction Trending

In past years we provided graphs by solution set of the latest market share, projected provider change, and the associated provider satisfaction ratings. We expect the current market share by tier (see Figure 25) to change dramatically over the next 2- 3 years. While the current market share primarily represents

traditional "best of breed" providers, we are finding several emerging E2E RIM providers in the market share, especially in the small and mid-tier. What we find most interesting in our client work is when we combine the individual provider satisfaction rating and innovation index score, it gives a more predictive view of provider health and trending than the market share data.

Solution Type	Large Tier	Mid Tier	Small Tier
Submission Content Management	1) OpenText/Documentum 2) DXC FirstDoc 3) Generis Cara	1) DXC FirstDoc 2) Veeva 3) SharePoint	1) Veeva 2) OpenText/Documentum
Publishing	1) PAREXEL 2) DXC eCTDExpress 3) Lorenz	1) DXC eCTDExpress 2) PAREXEL 3) Lorenz	1) Lorenz 2) Extedo 3) Acuta
Product Registration	1) PAREXEL 2) Custom 3) ArisGlobal	1) PAREXEL 2) Custom 3) Sparta Systems or Excel	1) Excel 2) Veeva
Submission Forecasting and Planning	1) PAREXEL or Custom 2) Excel	1) SharePoint 2) Excel	1) Excel 2) Veeva
Label Tracking	1) Custom 2) Intagras or PAREXEL	1) PAREXEL or Custom	1) Custom 2) Veeva or Sparta
HA Interactions	1) PAREXEL 2) OpenText/Documentum or SharePoint or Custom	1) Custom 2) DXC or Excel or SharePoint or Veeva	1) Excel 2) Veeva

Figure 25: Current Market Leaders by Size of Company Summary

Provider Economic Impact

We stated earlier in this paper that 74% of the 69 companies are investigating and potentially adopting an E2E RIM Platform. If 50% of these companies move to an E2E Platform in the projected 2020 – 2022 timeframe, the economic impact to several current "niche providers" could be substantial. For example, if you're a publishing or label compliance only provider, you may be replaced by a platform provider and not another "niche" provider, resulting in reduced market-share and annual license revenue. This would place stress on the organization as funding to keep relevant would be challenged.

We also conducted several 5-year total cost of ownership studies with our larger clients and found a positive economic benefit to moving to an E2E RIM platform instead of remaining in a "best of breed" model. These studies accounted for annual business and information resource cost (internal FTE and external contractors), projected minor and major upgrade cost, data center allocation cost, and provider cost (licensing or subscription). In most cases, there was a reduction in the overall run-rate.

Total Addressable Market Summary

We updated our total addressable market (TAM) data and had to modify several of our solution algorithms based on the move to off-premise in a subscription-based model and the potential shift to E2E RIM platforms. The addressable market of regulatory services and software is estimated at ~$8.02 billion (see figure 26) over a five-year period for top 500 companies (by revenue).

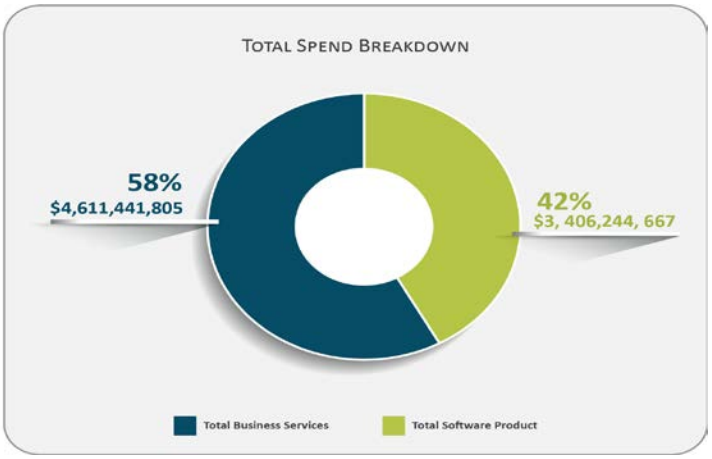


Figure 26: Five-year Total Addressable Market Summary

The TAM is broken down by type and tier (top 15, mid-tier, small, very small) in our detailed TAM briefing report with the following categories:

1) Regulatory Service

a) Major Marketing Application Dossier Publishing
b) Investigational Application Dossier Publishing
c) Life Cycle Submission Publishing
d) Regulatory Advisory Consulting (strategy, intelligence, CMC, label)
e) Product Registration Data Maintenance (XEVMPD, UDI)
f) Data Standards / Stewardship (IDMP, EUMDR, Falsified Medicine, UDI, Data Quality Methods)
g) RIM Consulting Services – Strategy
h) RIM Consulting Services – Execution and Maintenance

2) Regulatory Software

a) Submission Content Management / Health Authority Correspondence
b) Product Registration and Commitment Management
c) Submission Forecasting and Planning
d) eCTD / Dossier Publishing
e) Label Compliance Tracking

f) Regulatory Intelligence

g) Reporting and Analytics

h) End to End RIM Platform

Provider Market Dynamic Summary

The provider market share and innovation perceptions started shifting in 2014 and are accelerating. We recognize three RIM solution provider categories today and will limit our comments to those providers we are currently tracking. We realize not all providers can be reviewed in this section and omission of a provider does not signal a positive, neutral, or negative interpretation by the research team. This is particularly true for those providers who serve the medical device community as our design history file and UDI data samples are fairly new.

The Emerging E2E RIM Platform Players

We define an E2E RIM platform as having the following 10 RIM capabilities with the exception of Label Artwork. We realize some providers are stronger than others in these modules and have different architectural strategies.

1. Dossier Management (content plan, distribution, archive)
2. Health Authority Interactions (Q&A, Correspondence)
3. Health Authority Commitments
4. Labeling (core data sheet, eIFU, compliance tracking, artwork)
5. Product Registration Management
6. Regulatory Archive
7. Reporting and Analytics / Integrated Regulatory Information View
8. Submission Forecasting (demand for next 12 months)
9. Submission Document Management
10. Submission Production (assemble, publish, QC, dispatch)

Amplexor has most of these capabilities today in an “Integral” framework and are working to develop their labeling module. They offer both an on-premise and off-premise architecture option and do well in our satisfaction ratings and innovation index. Amplexor has a leading language services division which makes a future translation automation capability interesting from a regulatory operations standpoint.

Cunesoft has extended their offering from an IDMP solution innovator to aggressively adopting an E2E RIM platform model and is rated high in our innovation index. They have realized some initial client success with their E2E RIM offering this year and 2019 could be a breakout year for them within the small and mid-tier. They too need to develop the label management module.

Ennov appears to have most modules and also extends into other non-regulatory areas, however they primarily reside in the very small and small tier with a strong base in Europe, but expanding into other regions aggressively. They are investing to grow their organization to be able to support larger customers. Our Ennov customer sample size was small, but their customers report a very favorable experience and innovation views.

Veeva is progressing their E2E platform "unified and connected" approach from a strong content management base, but still has to bring important functionality to their label management and publishing modules. Veeva has an off-premise subscription-based model only and does well in our satisfaction ratings and innovation index. Veeva is strong in eTMF (all tiers) and advancing their platform to other functional areas. Figure 25 demonstrates their strength in the small tier and we see their market share building in the mid-tier and large companies.

To round out the field, we have two providers that accomplish E2E RIM via partnerships or acquisitions. This scenario brings several "best of breed" providers together to form an alternative offering that may be very attractive to the market. One example is companies with a long-term commitment to Documentum who do not see a Veeva / Documentum integration as practical or efficient. This scenario is playing out with several of our clients.

PAREXEL (formerly Liquent) was first to market with a "platform" approach, but only supported the data side of regulatory. They are market leaders in registration management and have market leadership in publishing. They realized several years ago that a major investment was required to modernize / re-tool their RIM capability for usability, predictive analytics, intelligent workflow assistant, and cloud offering. This critical investment is being supported through their Microsoft partnership. They are moving aggressively with their Perceptive® Cloud offering to bring the best of the PAREXEL, Documentum, and Microsoft partnerships to the market. We believe PAREXEL will make this transition and continue to be strong and relevant unlike some other traditional market leaders who did not have the foresight that major, not incremental investment is required, even when you're a market leader.

IQVIA has purchased many solid regulatory product and service providers (Acuta, Wingspan, Pilgrim, Highpoint) and also has access to advanced analytics capability through IMS Health. These acquisitions are fairly new and we will understand their market status better in 12 – 18 months.

The Traditional RIM Providers with multiple RIM Capabilities

This cohort has strengths in a much smaller subset of what we consider E2E RIM and may be impacted with the projected E2E RIM adoption trend in the 2020 – 2022 timeframe. They consist of **ArisGlobal** who has a strong history in product registration management and is very strong in safety management. They too are modernizing their registration capability and have recently announced a publishing capability under their LifeSphere® Regulatory Solution framework in an off-premise environment.

DXC Technology (formally CSC – FCG/ISI) was a clear market leader in content management and publishing solutions and has seen significant decline in both areas over the past three years. While they have stabilized in our innovation index, our data suggest further market share decline in the near-term.

Lorenz has consistently high satisfaction ratings over the past 10 years and does well in our innovation index. We are starting to see them in the product registration market share in 2018 and they continue to do well in the publishing space. The next several years will determine if they participate in many of the E2E RIM opportunities or are just seen as a dependable partner for the subset of industry (~26%) who are not interested in a true E2E RIM platform approach.

The Niche Providers

This cohort could be most impacted with the E2E RIM platform trend and we are watching these providers closely for different reasons.

Extedo is a traditional publishing provider that has not expanded their RIM platform which puts them at risk long term in the regulatory solution space. They have emerged in the safety space with very small and small tier customers and also have built a small regulatory publishing services division. We believe this diversification will be critical to Extedo long-term.

Like Lorenz, **Generis** is a long-standing player with strong satisfaction ratings and does well in our innovation index. They have grown in recent years with customers that remain with Documentum and require a strong regulatory interface with common industry practices provided “out of the box”. While other small content management providers are trending down, Generis is trending up.

Intagras is a label compliance tracking capability built to support a critical compliance challenge with most mid-tier and large companies. Their market share has grown, but has not been able to “breakout” to market leadership based on the 2018 data of 69 companies. They may be at risk long term if the E2E RIM platform players are able to satisfy core label content management and label compliance tracking requirements.

We continue to see **Planisware** in the submission forecasting capability as there is not one provider from a publishing or registration tracking orientation that does this well. They too are at risk if the long term E2E RIM trend materializes.

Sparta Systems is a strong QMS provider that has had mixed results with their registration management and label tracking capability based on our customer satisfaction and innovation index data. There strength is QMS which is one important RIM connection point, but their market share has declined since 2016 and our 2018 data suggest further decline.

Cabeus is emerging in the Regulatory Intelligence (RI) solution area which has been underinvested by the regulatory providers even with RI being a major industry pain point. We are watching them closely to see if 2019 becomes a break-out year as the increased spend by industry is very clear in the “what are your plans to change” 2019/2020 data.

Finally, several of the "traditional" and "niche" providers are teaming up to provide a common user interface over their combined products and a "one-stop" process for procurement; a different approach that may be attractive to certain parts of the market.

RIM Solution Providers and Value-Added Tool Dynamic

We'll keep this simple, there are many software and service providers who are advancing predicative analytics, artificial intelligence, business process management, and robotics tools that pull data from the transactional systems (RIM solution providers). The key question is this, *how far can the E2E RIM providers take the predictive analytics, AI, and BPM offerings or will the need for other value-added tool providers be required tactically (3 – 5 years) or long-term?*

Study Conclusion

Figure 27 resonated in many of our participant debrief and industry speaking sessions this year. It provides the past, present, and future RIM journey for most companies. Much of the original RIM program work was getting scattered information into "authoritative sources". This has transitioned to where most companies are today, improving data quality confidence, processes, and metric programs. It is clear from the survey data that RIM is an enterprise asset with connection points to other functional areas being a top priority in the next 3 years. We see this goal as achievable for those companies with a strong RIM foundation, however others may find a 5 – 7 year time horizon is a more realistic goal given the work still needed on the base RIM capabilities. As companies connect to other functional areas and apply artificial intelligence and predictive analytics methods, we should witness growing strategic value, operating efficiency and reduced compliance risk as a natural outcome.

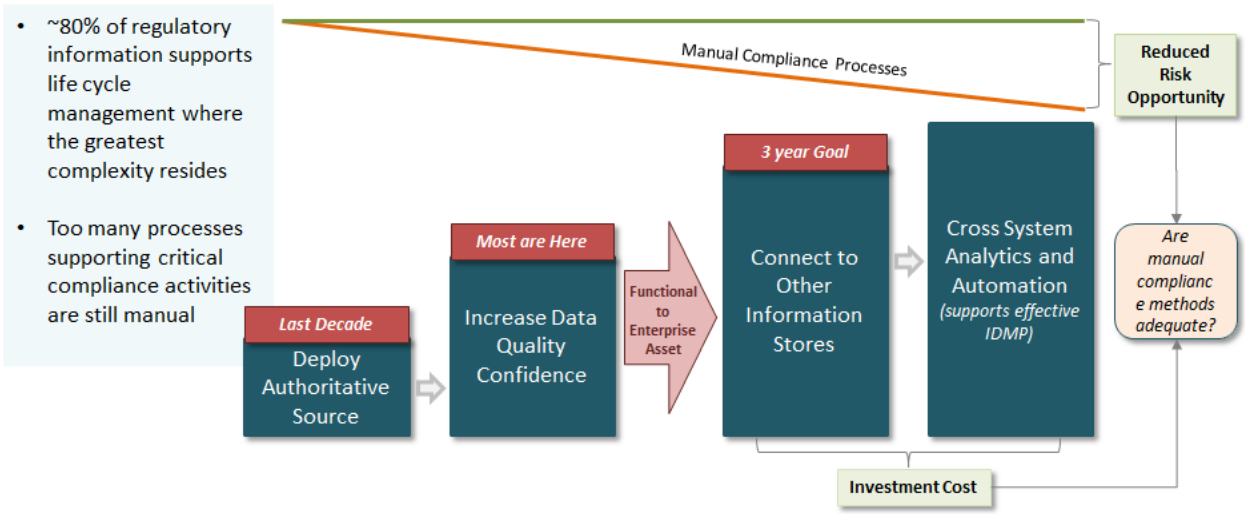


Figure 27: RIM Past, Present, and Future

White Paper Authors

Steve Gens is the survey co-founder with the first industry survey conducted in 2007. The 2018 World Class RIM follow-up will be the 33rd survey conducted under Steve's leadership. He has over 30 years of business experience with the majority in the biopharmaceutical and healthcare industries. His early career was spent at Johnson and Johnson and then moved into consulting where he managed several healthcare consulting practices for Booz Allen Hamilton and First Consulting Group.

Steve has deep experience in strategy formulation and implementation, organization development and performance, industry benchmarking, information management strategy, and facilitating strategic change. He consults for many large global biopharmaceutical companies and with small high growth organizations. He has a Master of Science in Organization Development from American University with distinction for his field work and a BS in Business Computer Science. Steve is a frequent speaker and was named to the 2017 PharmaVoice 100 entrepreneur category for his contributions to industry. You can reach him at sgens@gens-associates.com

Karin Sailor of SRO Inc. (new to the research team) is an independent consultant specializing in RIM, electronic submissions and regulatory operations solutions for medical devices. She has is a global regulatory professional with 23 years of experience in the medical device

Greg Brolund (survey team since 2009) is a Global Pharma management and technology consultant with extensive experience in business processes and supporting IT for product labeling, submission publishing, global Health Authority interactions, and pharmacovigilance programs. He served as the Rapporteur of the ICH M2 Working Group Rapporteur from 1998 through 2002 for the development of the initial production version of the eCTD and the implementation of the E2B ICSR electronic submission. He has 25 years of experience with the FDA leading development of FDA's internal IT systems in support of the CDER and CBER submission review process. After leaving the FDA, he served as the US HHS CTO and was a pharmaceutical industry consultant with Booz Allen Hamilton. He holds a Masters of Chemistry degree from the American University in Washington DC.

Sarah Powell (survey team since 2015) is the President of Powell Regulatory Services. Sarah has over 30 years of experience in the life sciences industry (Clinical, Quality Control, Regulatory Affairs and Regulatory Operations). In the past 16 years as a consultant, she has assisted clients with regulatory process improvements, standards development, defining filing strategies and writing and review of submission content. She has extensive experience with projects related to design and implementation of regulatory solutions including document management, submission planning, publishing, and registration management. Sarah is a past executive at Chiron, First Consulting Group and Parexel. She holds a Bachelor's of Science degree in Nutrition Science from the University of California, Davis, is

industry; 17 of those years with Medtronic. She has experience in both regulatory affairs and regulatory operations.

Through SRO Inc., Karin Sailor helps companies develop and implement strategies for regulatory processes and systems that support medical devices. Her efforts include work with industry, vendors and regulators. Key areas of focus include the impact of new regulatory requirements (such as UDI, EU MDR and electronic submissions) on data and document management; and increased efficiency through regulatory systems and cross-functional collaboration.

Special thanks to other contributors…

Gordon Workman – General Survey Analysis and Analytical Support

Steve Scribner – Survey Design and Results Review. Steve and I did many surveys that focused on enterprise content management and collaboration from 2007 – 2011.

Kelly Hnat – Provided critical review of the RIM connection to Functional Areas section with her detailed domain knowledge and industry experience

Regulatory Affairs Certified in the US and EU; and a RAPS Fellow.

Hans van Bruggen of Qdossier / eCTDconsultancy/ Qdoor (new to the World Class RIM research team). He has an MSc in Pharmaceutical Medicine from the University of Surrey (UK) and has worked within and for the pharmaceutical industry for more than 30 years. He and his teams have gained a wealth of experience and a comprehensive view on what information is needed to evaluate the benefit/risk ratio of drugs for patients (and healthy volunteers). Using that scientific background, he approaches interdisciplinary and international processes, resulting into lean data, document- and dossier management (including structured content management and an intuitive eCTD viewer, NEES viewer and any other regulatory dossier viewer (www.dossplorer.com).
Once proper processes and well-implemented tools are embraced within the company, commercial profits will come as a bonus, rather than a goal. Proper data-, document- and dossier management saves time and money for the pharmaceutical industry and agency, leaving them to focus on their core business; namely: Public Health.

Appendix

18 RIM Categories

1. Dossier Management (content plan, distribution, archive)
2. Health Authority Interactions (Q&A, Correspondence)
3. Health Authority Commitments
4. Labeling (core data sheet, eIFU, compliance tracking, artwork)
5. Product Registration Management
6. Regulatory Archive
7. Reporting and Analytics / Integrated Regulatory Information View
8. Submission Forecasting (demand for next 12 months)
9. Submission Document Management
10. Submission Production (assemble, publish, QC, dispatch)
11. Design History File – Medical Device (NEW)
12. Data Management and Information Standards (IDMP, UDI, EUMDR etc.)
13. Regulatory Intelligence
14. Safety Reporting
15. Connection Point: Manufacturing Product Change Control
16. Connection Point: Product Supply Release
17. Connection Point: Clinical
18. Connection Point: QMS (New)

Providers in Innovation Rating (sorted alphabetically)

1. Acuta
2. Amplexor
3. ArisGlobal
4. Author It
5. Cabeus
6. Cunesoft
7. Dita Exchange
8. DXC Technology (CSC - includes former ISI / FCG)
9. Ennov
10. Extedo
11. Generis
12. Glemser
13. Globalvision
14. I4i
15. Identifica
16. Instem
17. Intagras
18. Lorenz
19. Microsoft
20. Microsystems
21. OpenText (Documentum)
22. Oracle
23. Quintiles IMS (now IQVIA)
24. Qumas
25. PAREXEL (includes former Liquent)
26. Planisware
27. Please Review
28. PTC
29. SAP
30. Schema
31. Schlafender Has (TVT)
32. Sparta
33. Veeva

World Class and Other Key Performance Metric Details

The following list are the metrics we track in our benchmarks or other industry pulse surveys. Importance to industry is calculated by the number of companies that currently measure the metric or plan to measure it within two years (by 2020).

Class / Type of Metric	Metric Name	Importance to Industry
Time to Report Key RIM Information (Real-Time, Same Day, Days, Weeks)	Listing of Market Authorization Holders	High
	What products are marketed in which countries	High
	Listing of product approval, renewal, and expiration dates per country	High
	Status of Open Health Authority Commitments	High
	Which excipient is used in which finished product in which country	High
	Number of submissions globally by application type	High
	Regulatory Status for Supply Chain release	High
	Regulatory status of products at a specific manufacturing site	High
	Status of Label Changes at the local Affiliate Office	High
Cycle Time	Time from Health Authority Submission to HA Approval	High
	Time from instance of deviation to closing a Regulatory related CAPA	High
	Time from receipt of agency question(s) to submission of response	High
	Time from delivery of 'core" dossier to affiliate/partner to submission to Health Authority	High
	Time from a significant safety event to an approved label change	High
	Time from last document received in submission operations to dossier submission	Low
	Time to conduct a Regulatory Impact Assessment	Moderate
	Time of approved label change to release to market (date to market)	High
	Time for first market submission to last market submission	Moderate
Volume / Service Level	Number of annual New Product Submission by type	High
	Number of annual Life Cycle Management Submissions by type	High
	Number and status of open Health Authority Commitments	High
	Service Level: Time from Regulatory Event to updated status in Registration System	High
	Number of question from Health Authorities by product / therapeutic area	High
	Number of annual unplanned submissions	Moderate
Quality	Accuracy of our central submission schedule for New Products	High
	Quality of our Product Registration Data	High
	Right First Time: Submission Technical Validation	Moderate
	Accuracy of our central submission schedule for Post Approval Life Cycle Management	Moderate
	Right First Time: Quality of submission document readiness from authoring community	Moderate
	Accuracy of the local affiliate office submission schedule for New Products	High
	Accuracy of the local affiliate office submission schedule for Post Approval Life Cycle Management	High
	Quality of submission content based on the number and type of questions received from Health Authorities	Moderate
	Right First Time: Affiliate receives the right documents for their regulatory submission	Moderate
	Accuracy of ERP vs. RIM data	High

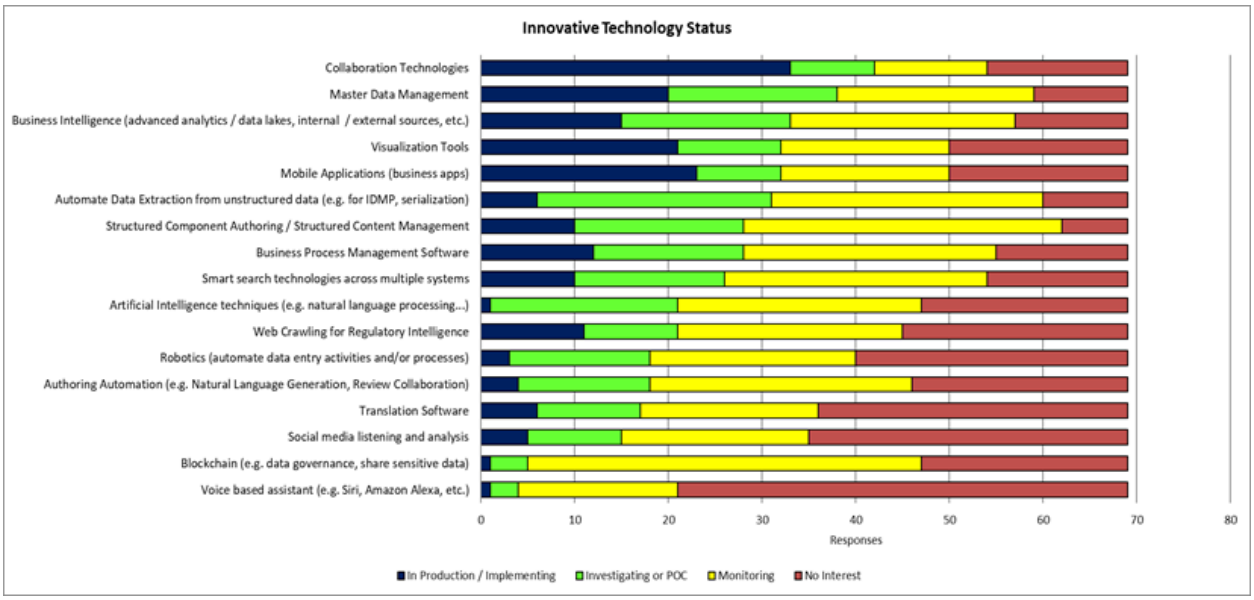
Volume / Service Level	Metric Name	Importance to Industry
Confidence in RIM Data	Submission Document Management	High
	xEVMPD Data (Medicinal Only)	High
	Labeling Information	High
	UDI Data (Device Only)	High
	Health Authority Commitment Tracking	High
	Medical Device Design History File	High
	Health Authority Interactions	High
	Product Registration Tracking	High
	Serialization / Track and Trace Information	High
	Regulatory Intelligence	High
	Submission Forecast	High
Cost	Submission Content Management System Cost	Moderate
	Product Registration Management System Cost	Moderate
Regulatory Outsourcing	% who outsource new marketing application	High
	% who outsource investigational application	High
	% who outsource life cycle management or obligations dossiers	High
	% who outsource roles (publishing, data stewards, dossier managers regulatory intelligence analyst, submission readiness, archiving, regulatory IT support)	High
	% who outsource safety Reporting	High
	% who outsource SPL	High
	% who outsource Ad/Promo submissions	High
	% who outsource XEVMPD maintenance	High
Other	% of companies having true global deployment of regulatory systems (submission content management, registration, commitments, HA interactions, submission planning, regulatory intelligence, Label Tracking)	High
	% of companies having RIM/ERP integration	High
	Business Benefit Achieved (full or partial) from RIM Investments	High
	Data Quality Practices (who is using what method and correlation to DQ levels)	Moderate
Efficiency (survey participant self rating on 4 point scale)	Data Management and Information Standards	High
	Design History File	High
	Dossier Management	High
	Health Authority Commitment Management	High
	Health Authority Interactions	High
	Labeling	High
	Product Registration Management	High
	Regulatory Archive	High
	Regulatory Intelligence	High
	Reporting and Analytics /Integrated Regulatory Information View	High
	Submission Document Management	High
	Submission Forecasting	High
	Submission Production	High
	Connection with Clinical	Moderate
	Connection with Product Change Control Process	Moderate
	Connection with Product Supply Release	Moderate
	Connection with Quality Management System	Moderate
	Safety Reporting	Moderate

2016 to 2018 RIM Capability Efficiency Comparison

We compared the 2016 efficiency ratings (16 capabilities) to the 2018 data with highlights representing a significant different. We use a 4-point scale (very efficient, efficient, inefficient, and very inefficient) as companies needed to decide if they were closer to efficient or inefficient if they were undecided.

RIM Capability	2016 (Efficient + Very Efficient)	2018 (Efficient + Very Efficient)
Submission Production	78%	78%
Safety Reporting	71%	78%
Submission Document Management	67%	64%
Dossier Management	54%	54%
Regulatory Archive	53%	53%
Health Authority Interactions	57%	48%
Submission Forecasting	35%	45%
Product Registration Management	50%	44%
Labeling	48%	44%
Health Authority Commitment Management	43%	42%
Regulatory Intelligence	36%	36%
Data Management and Information Standards	40%	33%
Connection with Product Change Control Process	37%	33%
Connection with Product Supply Release	34%	27%
Connection with Clinical	26%	27%
Reporting and Analytics /Integrated Regulatory Information View	18%	26%
Connection with Quality Management System	n/a	22%
Design History File	n/a	21%

15 Technologies Tested for Status and Priority



GENS AND ASSOCIATES INC. BENCHMARK HISTORY

1) **2007 *eCTD/Electronic Document Management Survey,* (with ILSS)**
2) 2007 *Promotional Material Process Metric*
3) 2007 *Labeling Pulse Survey*
4) 2008 *eCTD and Organizational Implications*
5) 2008 *Labeling Best Practices Survey*
6) 2008 *Regulatory Core Dossier Submission Strategy*
7) **2009 *Electronic Document Management/Collaboration* (with ILSS)**
8) 2009 *Industry Engagement*
9) 2009 *Regulatory Submission Management and Production Planning*
10) 2010 *Global Pharmaceutical Regulatory Affiliate Strategy*
11) 2010 *Regulatory Information Management & Health Authority Trends*
12) 2010 *Vendor Market Share Update*
13) **2011 *Collaboration and Content Management Trends* (with ILSS)**
14) 2011 *Regulatory Futures*
15) 2011 *Publishing and Dossier Management (organization and outsourcing)*
16) 2011 *Labeling and Promotional Material Organization Strategy*
17) 2012 *Regulatory Information Management Trends*
18) 2012 *Vendor Market Share Update*
19) **2013 *Managing Regulatory Information as a Corporate Asset (n = 37)***
20) 2013 *Regulatory Operations Pulse*
21) 2013 *CTA Pulse*
22) 2013 *EDMS and Digital Archive: One in the same?*
23) 2014 *Regulatory IT Resource Pulse*
24) **2014 *Next Generation RIM and Regulatory Intelligence: Strategy, Investments, and Status (n = 41)***
25) 2015 *Product Registration Investment Pulse*
26) 2015 *Next Generation Content Management (n = 21)*
27) 2015 *Addressable Market update (solution and services)*
28) 2015 *Legacy Product Outsourcing Pulse Survey*
29) **2016 *Pursuing World Class RIM: Strategy, Measures, and Priorities (n = 54)***
30) 2016 *Enterprise Content Management Governance Structure Pulse Survey*
31) 2017 *Safety Systems Trends: Innovation, Operating Model and Growing TCO Pulse (n = 17)*
32) 2017 *Regulatory Services and Software Addressable Market Analysis Update (top 500)*
33) **2018 *Pursuing World Class RIM: Connections to QMS, Supply Release and Product Change (n = 69)***
34) 2018 *Submission Content Management Capability Change Investment Pulse (n = 10) – Top 30*