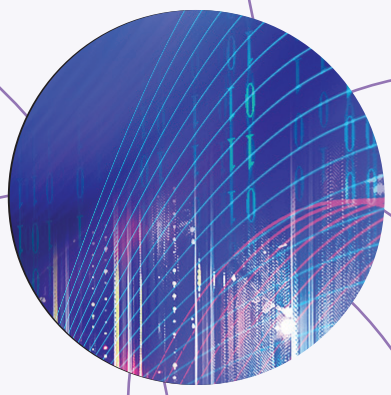
Vendor Analysis

Vendor Analysis: TCS

GRC Solutions, 2021



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About Chartis

Chartis Research is the leading provider of research and analysis on the global market for risk technology. It is part of Infopro Digital, which owns market-leading brands such as Risk and WatersTechnology. Chartis' goal is to support enterprises as they drive business performance through improved risk management, corporate governance and compliance, and to help clients make informed technology and business decisions by providing in-depth analysis and actionable advice on virtually all aspects of risk technology. Areas of expertise include:

- Credit risk.
- Operational risk and governance, risk and compliance (GRC).
- Market risk.
- Asset and liability management (ALM) and liquidity risk.
- Energy and commodity trading risk.
- Financial crime including trader surveillance, anti-fraud and anti-money laundering.
- Cyber risk management.
- Insurance risk.
- Regulatory requirements.
- Wealth advisory.
- Asset management.

Chartis focuses on risk and compliance technology, giving it a significant advantage over generic market analysts.

The firm has brought together a leading team of analysts and advisors from the risk management and financial services industries. This team has hands-on experience of implementing and developing risk management systems and programs for Fortune 500 companies and leading consulting firms.

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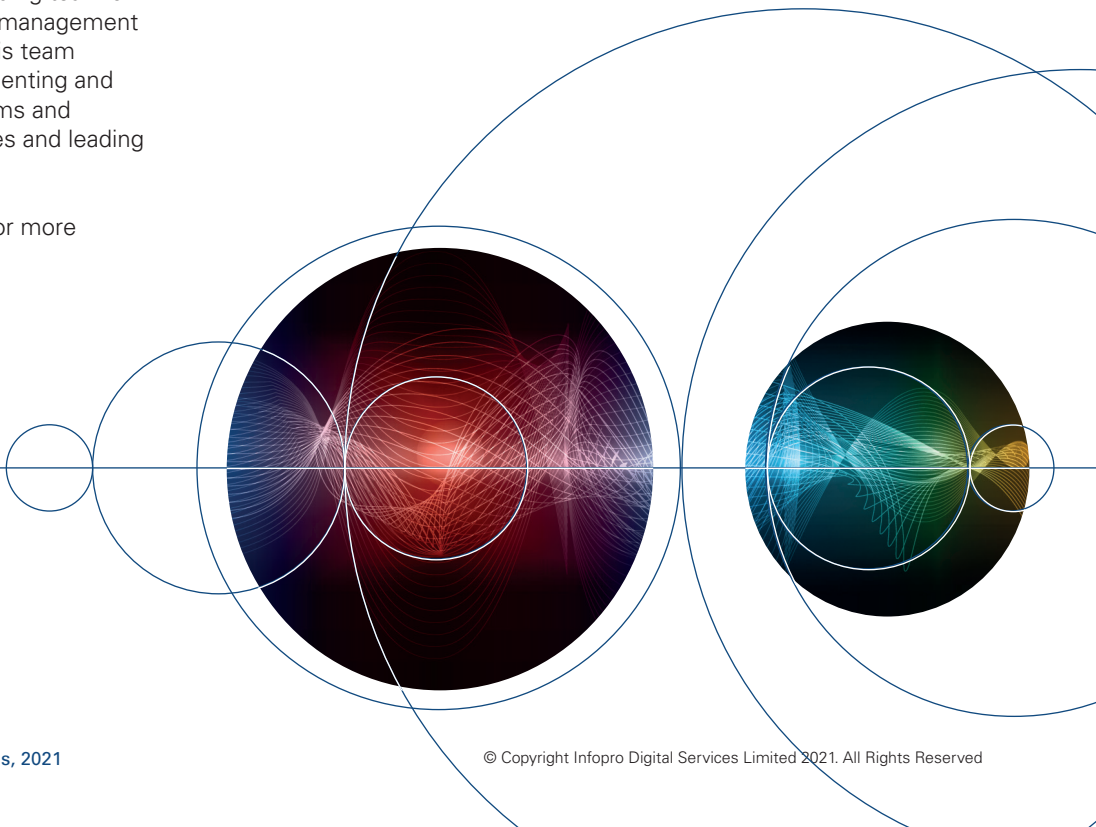
Join our global online community at **www.risktech-forum.com**.



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1. Report context

This Vendor Analysis is based on the Chartis quadrant report *GRC Solutions, 2021: Market Update and Vendor Landscape* (published in May 2021). This section summarizes the key theses in that report; subsequent sections take a detailed look at TCS's quadrant positioning and scoring, and Chartis' underlying opinion and analysis.

Key thesis

GRC: an increasingly diverse and sophisticated arena

In the world of risk technology, GRC is a vast sector that now covers a diverse range of sub-segments that have all become fixtures of financial institutions' risk management frameworks. Defining GRC's evolution has been its continued steady growth, and the specialization and growing sophistication of its constituent parts.

What began as an audit-focused discipline with several sub-segments has now broadened to encompass distinct areas that are risk disciplines in their own right. The rapid growth of GRC as a discipline has occurred because of increasing integration, a heightened focus on technology and operational issues, and the growing involvement of the front office.

Chartis identifies the main segments of GRC as (see Figure 1):

- Enterprise GRC (EGRC)
- Operational risk
- Conduct risk and controls
- Model risk management (MRM)
- Internal audit management
- Third-party risk management (3PRM)
- IT risk management (ITRM)
- GRC analytics

While the processes in these segments overlap significantly and feed into one another, their technology and methodologies continue to diverge (in terms of processing rules, domain-specific content, modeling methodologies and tailored technology, etc.) Chartis' view of the GRC market and the corresponding vendor landscape is segmented according to these areas, but several overarching trends are also noteworthy.

Figure 1: The segments of the GRC solutions landscape

Source: Chartis Research

These include the drive for greater automation, digitalization and scenario analysis, and the employment of data-driven technologies such as machine learning (ML) and natural language processing (NLP). GRC analytics continue to sweep the market, and financial institutions' budget allocation for GRC reflects their focus on investing in technology to help maintain margins and manage risk beyond regulatory compliance. EGRC is now a discrete category that consists of workflow and control platforms that manage enterprise risk. In addition, operational and conduct risk have now evolved into separate disciplines, reflecting the growing markets for specified and tailored solutions in these spaces, and increasing regulatory differentiation between the categories.

Demand-side takeaways

The GRC space has been shifting and expanding rapidly, with especially fast growth in the areas of MRM, 3PRM and ITRM. While Chartis has noted a large increase in spending on GRC solutions recently, institutions are not necessarily spending in traditional GRC areas. The widespread and diverse challenges introduced by the COVID-19

pandemic have put pressure on several GRC systems, largely due to the sudden onset of distributed operating environments. Firms have been forced to adapt quickly, accelerating existing technology and business trends across the GRC lifecycle.

Notably, the perception of GRC as an important investment and a topical business concern has been intensifying for some time and, notwithstanding regulatory pressures, institutions have been looking to roll out 'modernization' projects driven by GRC incentives. Digitalization projects, for instance, support wider and more diverse control frameworks across institutions and, as regulatory scrutiny on the front office intensifies, we are seeing increased demand for these initiatives and implementations.

The pandemic has accelerated many modernization projects, or at least highlighted the pressing need for them. The sudden shift to distributed operating environments, and the accompanying security concerns, data governance issues and strain on infrastructure, illuminated issues that financial firms had been grappling with for some time. The pandemic changed the usual order of events whereby regulations, standards or industry trends reveal gaps in operations and technology infrastructures, and firms have time to evaluate and invest in solutions. As the pandemic hit, those without adequate systems that could be modified and mobilized to help them transition to distributed operating environments faced serious disruption to their business.

Finally, Chartis believes that GRC as a whole is now a far more analytical discipline. Not only are analytics leveraged to design, manage and optimize business processes and control risk, they are often embedded into workflows and controls, sometimes even in real time.

Conduct risk and controls

Following the financial crisis of 2008, regulators across the world investigated how conduct risk was defined and policed. Conduct risk has since emerged as a distinct discipline, driven by cultural pressures and advances in control and management analytics. However, predictions that conduct risk would become highly quantifiable have not quite been fulfilled, as there is still a lack of clarity around the exact mechanisms that firms should use when monitoring activity and policing misconduct. While several regulators made a concerted push to define conduct risk and outline rules after the financial crisis, these efforts have been applied inconsistently across jurisdictions, and are not prescriptive at a detailed level.

Beyond box-ticking

Under more recent regulatory initiatives (such as the Financial Conduct Authority's [FCA's] conduct risk framework), firms have been working to monitor employee behavior, customer interaction and product sales, and have set out rules for defining and monitoring behavior, as well as defined escalation processes.

Aside from monitoring behavior, effective ways to assess conduct risk include examining commission structures, payment patterns and product design. In the US, many conduct risk tools are built into loan-processing capabilities and core banking and operational systems.

However, these measures can only go so far, and financial institutions continue to receive significant fines for misconduct. Although scandals and enforcements can drive cultural and structural shifts across industries, a failure to operationalize conduct risk is a major barrier to effective risk management. Recently, however, more development of conduct control 'libraries' and conduct risk frameworks has offered a potential tool for operationalizing conduct risk. Chartis believes that appropriate conduct risk management is only effective if well-defined, actionable control libraries exist. In our view, well-structured conduct risk programs are synonymous with effective, well-designed and executable control libraries and frameworks.

Model risk management

More models, more complexity, more challenges

As a business practice, MRM first emerged from the world of derivatives modeling and, to a lesser extent, loan credit risk. The publication of the Supervisory Guidance on Model Risk Management (SR 11-7) by the US Federal Reserve System solidified MRM's position as its own unique discipline. Since that watershed, regulation has continued to indirectly and directly shape MRM and the relevant demands that firms must meet. Model risk is becoming more specialized: a single solution does not cut across all areas of a firm, and 'one size fits all' solutions are sparse.

Against this background, financial institutions globally have been accelerating their model development and implementation. Models are becoming increasingly pertinent, and firms are

relying more on them across business lines. Scenario analysis, stress testing and sensitivity testing are all measures that organizations can implement to assess a model's performance under different conditions, and to pinpoint influential factors. Models have their limitations, however, and robust MRM practices call for institutions to assess how their models perform under extreme conditions, and how these conditions affect modeling accuracy. The COVID-19 pandemic, in particular, has shed a harsh light on the challenges that extreme market conditions can create for model performance.

A statistical understanding

Firms outsourcing MRM and planning to extend their market presence must confront the challenges and complexities of this approach by ensuring that their MRM solution includes the following core components: performance monitoring, risk thresholds, model inventories, reporting, data governance and document workflow. But the key to providing an effective third-party MRM solution in these new markets is understanding the quantitative methods that underlie the models in the space, as each industry sector uses a vastly different modeling technology. While the quantitative component of MRM is a cog in an overarching mechanism, its importance should not be underestimated.

GRC analytics

As GRC has evolved, the integration of analytical components has served to increase available analytical tools, often from other areas of risk. This merging of analytical tools from other areas enables deeper GRC analytics.

Chartis views GRC analytics as a broad category that is constantly shifting and evolving. From our standpoint, GRC analytics as a category subsumes operational risk analytics, and comprises two main elements, quantification and risk analytics, as well as embedded analytics in workflow, data management, visualization and controls.

Over the last five years, there has been an explosion of new analytical techniques, which have experienced very rapid adoption. In virtually all disciplines (and sub-disciplines) of GRC, diverse, sometimes ad-hoc, frameworks and analytics have proliferated. This has been true across business contexts and institution types, including investment banks, commercial banks, retail banks and broker/dealers. We have observed the same phenomenon across a broad range of non-financial firms as well, including energy and logistics companies.

Key to the recent growth in GRC analytics has been an expansion in the suite of underlying tools employed. Many processes that GRC analytics address are fundamentally non-quantitative, including governance, workflow and operational activities. With digitalization these functions have been quantified, creating usable structured data series. Techniques for this vary and include NLP, automatic data mapping, ML, text analysis, and non-linear, non-standard models for mapping workflow to risk. Graph analytics can also be useful, enabling financial institutions to analyze workflow more effectively by converting it into statistical data in a way that previously was not possible.

Supply-side takeaways

For many firms, GRC is now a salient business concern that is well worth investing in, and the pandemic has highlighted this strengthening trend. Consequently, the vendor market has enjoyed substantial growth as it strives to tap into demand. To excel in the GRC space and its separate market segments, however, vendors must have a coherent market strategy. GRC has evolved well beyond its audit and workflow origins, and even within its sub-segments, catering to different geographies, institution types and market areas can be challenging. Synthesizing and integrating disparate technology tools to provide marketable solutions can present difficulties as well.

An increase in the number of featured vendors in our 2021 GRC quadrants highlights the rapid growth across the industry in general. At the level of individual sub-segments, the quadrant dynamics reflect the unique vendor landscapes, which have become progressively more differentiated as specialization in the respective segments increases and functionality deepens.

Although the distribution of vendors in each quadrant varies considerably, at a high level the quadrants indicate the relative maturity of vendors in the GRC space, with many featuring as category leaders or best-of-breed providers.

2. Quadrant context

Introducing the Chartis RiskTech Quadrant®

This section of the report contains:

- The Chartis RiskTech Quadrants® for conduct and control, MRM and GRC analytics solutions, 2021.
- An examination of TCS's positioning and its scores as part of Chartis' analysis.
- A consideration of how the quadrants reflect the respective broader vendor landscapes.

Summary information

What does the Chartis quadrant show?

The RiskTech Quadrant® uses a comprehensive methodology that comprises in-depth independent research and a clear scoring system to explain which technology solutions meet an organization's needs. The RiskTech Quadrant® does not simply describe one technology option as the best solution; rather it has a sophisticated ranking methodology to explain which solutions are best for specific buyers, depending on their implementation strategies.

The RiskTech Quadrant® is a proprietary methodology developed specifically for the risk technology marketplace. It takes into account vendors' product, technology and organizational capabilities. Section 4 of this report sets out the generic methodology and criteria used for the RiskTech Quadrant®.

How are quadrants used by technology buyers?

Chartis' RiskTech and FinTech quadrants provide a view of the vendor landscape in a specific area of risk, financial and/or regulatory technology. We monitor the market to identify the strengths and weaknesses of different solutions and track the post-sales performance of companies selling and implementing these systems. Users and buyers can consult the quadrants as part of their wider research when considering the most appropriate solution for their needs.

Note, however, that Chartis does not endorse any vendor, product or service depicted in its research publications, and does not advise technology users to select only those vendors with the highest ratings or other designations. Chartis' publications consist of the opinions of its research analysts and should not be construed as statements of fact.

How are quadrants used by technology vendors?

Technology vendors can use Chartis' quadrants to achieve several goals:

- Gain an independent analysis and view of the provider landscape in a specific area of risk, financial and/or regulatory technology.
- Assess their capabilities and market positioning against their competitors and other players in the space.
- Enhance their positioning with actual and potential clients and develop their go-to-market strategies.

In addition, Chartis' Vendor Analysis reports, like this one, offer detailed insight into specific vendors and their capabilities, with further analysis of their quadrant positioning and scoring.

Chartis Research RiskTech Quadrant® for conduct and control solutions, 2021

Figure 2 illustrates Chartis' view of the conduct and control vendor landscape, highlighting TCS's position.

Quadrant dynamics

General quadrant takeaways

Players in the conduct and control space are entering the market with a variety of capabilities. While firms are likely to specialize in conduct and control functionality, developing control frameworks in code for every possible situation is virtually impossible. Developing automated controls is also difficult because specific content and dynamics must be taken into account. Consequently, the breadth and depth of controls that firms develop from a client's particular viewpoint are key indicators of success.

Figure 2: RiskTech Quadrant® for conduct and control solutions, 2021

Source: Chartis Research

Strong control frameworks go beyond the recording of situational information and written controls and can be operationalized and implemented with built-in automation. While some vendors have constructed control libraries, they have yet to industrialize them and construct the surrounding implementation frameworks.

Chartis' conduct and control analysis (which was previously incorporated into our OpRisk quadrant) now represents the emerging independent conduct and control marketplace. The precise mechanisms around how conduct risk should be managed still lack clarity, and mature quantification capabilities are still some way off. The quadrant includes a spectrum of vendors that, to varying degrees, supply the tools by which firms manage and secure controls within the organization. The featured vendors encompass a broad range of capabilities that center on control frameworks. Most firms appear in the relative mid-range for market potential and completeness of offering, achieving either best-of-breed or category leader status.

The few that appear in the top right of the category leader space have such distinguishing features as flexibility, integration and scalability. Vendors in this cluster have successfully moved to operationalize and industrialize their conduct and control offerings. From a client perspective, the breadth and depth of controls a firm is capable of supplying are key factors in vendor selection.

Vendor positioning in context – completeness of offering

By focusing on core GRC technology (including NLP and ML), TCS has been able to simplify and manage the wide array of GRC processes and procedures now apparent in financial firms. Its use of open source technology supports ease of integration and data exchange with existing enterprise systems, while the advanced analytical components of its control framework help to facilitate the automation of controls in a broad range of contexts and organizational dynamics.

While TCS provides robust and extensive coverage of control libraries, its ability to operationalize controls beyond the library is a marker of its sophistication in this space. The organization's high scores for extensibility, depth, ease of integration and scalability/enterprise readiness reflect its ability to implement its conduct and control offering to align with custom client frameworks. TCS's GRC libraries, which include schemas for organizational data, metadata, and risk and control registers, provide a reliable foundation for operational and technology controls that are embedded in middle- and back-office systems. These controls extend through sub-components that address workflow, alerts and entitlement frameworks.

Table 1 shows Chartis' rankings for TCS's coverage against each of the completeness of offering criteria.

Vendor positioning in context – market potential

TCS received high scores across the market potential criteria for conduct and controls. It scored particularly well for its business model and growth strategies, which reflect the strength of its technology foundation in GRC. TCS's investment in core technology has been a key part of its business model, affording it the flexibility and configurability required to compete in the conduct controls market at scale. In addition, TCS's expertise in the GRC and regulatory space, fostered by its broad range of solutions and services, reinforces its business model and growth strategies.

Table 2 shows Chartis' rankings for TCS's coverage against each of the market potential criteria.

Table 1: Completeness of offering – TCS (conduct and control solutions, 2021)

Completeness of offering criterion	Coverage
Control library coverage	High
Extensibility	High
Depth	High
Ease of integration	High
Scalability/enterprise readiness	High

Source: Chartis Research

Table 2: Market potential – TCS (conduct and control solutions, 2021)

Market potential criterion	Coverage
Business model	High
Growth strategy	High
Market penetration	High
Financial strength	High

Source: Chartis Research

Chartis Research RiskTech Quadrant® for MRM solutions, 2021

Figure 3 illustrates Chartis' view of the MRM vendor landscape, highlighting TCS's position.

Quadrant dynamics

General quadrant takeaways

The MRM quadrant is populated with a variety of specialist providers of model risk services, many of which have entered the market from their respective niche areas of strength. The quadrant is more densely populated in the category leader segment, with a few standout leaders. Vendors toward the top right are differentiated by their market presence and robust offerings, which integrate model governance with broad model coverage and the quantitative elements of MRM.

The breadth of model coverage on offer, in fact, is one key distinguishing factor among vendors that feature in the top right of the quadrant. A vendor

Figure 3: RiskTech Quadrant® for MRM solutions, 2021

Source: Chartis Research

seeking to extend its MRM services outside a particular niche can find it particularly challenging in terms of model validation and, to some extent, governance. Despite the rise in demand for model risk functionality, challenges remain for vendors in providing strong governance across a wide variety of asset classes. In our analysis, the spread of firms along the x axis of the quadrant reflects the variation in the type and level of functionality offered by vendors in this space.

Finally, as MRM technology spend has increased as a result of regulatory pressures, shifting market standards and technology transformation, so has the number of emerging players. The historical separation of validation and governance services is waning, as the automation of validation activities reduces the level of differentiation between the two.

Vendor positioning in context – completeness of offering

TCS's MRM offering includes sophisticated validation techniques that can be leveraged for a broad spectrum of models across different business lines, and its high scores for model coverage and inventory management reflect this comprehensive coverage. The MRM offering is part of a wider network of GRC offerings and integrates with TCS's 'GRC analytics' suite. This includes cognitive controls, cognitive validation and compliance systems, and features significant automation of key processes. TCS also harnesses

advanced analytics to drive the validation and data integrity components of its MRM suite.

TCS's MRM solution includes model performance tracking and intervention alerts. One key aspect is its data management capability, which includes data integrity monitoring. The company's strength in regulatory intelligence and compliance also enables alignment with statutory governance requirements.

Table 3 shows Chartis' rankings for TCS's coverage against the completeness of offering criteria.

Vendor positioning in context – market potential

TCS received strong scores for business model, growth strategy and financial strength relative to its MRM offering. The vendor's high score for business model is due in part to its sophisticated validation techniques, which it leverages alongside governance processes that are informed by regulatory intelligence.

Table 4 shows Chartis' rankings for TCS's coverage against each of the market potential criteria.

Chartis Research RiskTech Quadrant® for GRC analytics, 2021

Figure 4 illustrates Chartis' view of the GRC analytics vendor landscape, highlighting TCS's position.

Quadrant dynamics

General quadrant takeaways

Change is ongoing and significant in this sub-segment, and the scope of GRC analytics is expected to shift naturally over time, as formerly advanced analytics become core system features and new analytics are introduced. Chartis' current view is that the term 'GRC analytics' refers to a broad set of operational analytics that address a range of GRC processes, including quantification and process automation. This year, we have included regulatory intelligence capabilities, which increasingly employ such advanced analytical tools as NLP and ML.

Nevertheless, the GRC analytics category will always tend to encompass disparate processes.

Table 3: Completeness of offering – TCS (MRM solutions, 2021)

Completeness of offering criterion	Coverage
Model coverage	High
Governance	High
Data management	High
Model inventory management	High
Dashboarding	High
Visualization	High

Source: Chartis Research

Table 4: Market potential – TCS (MRM solutions, 2021)

Market potential criterion	Coverage
Business model	High
Growth strategy	High
Market penetration	Medium
Financial strength	High

Source: Chartis Research

While this makes evaluating the GRC analytics category a challenge, the leaders in the space are generally firms with good breadth of coverage that incorporates multiple implementations for different processes. The tools to develop new analytics are becoming widely available, and the space is experiencing strong growth that is likely to continue.

Since the GRC analytics category is so diverse, vendors in the space often operate in somewhat different fields and have varied backgrounds. As financial firms increasingly seek to obtain value from their GRC solutions, GRC analytics capabilities are becoming more highly sought after, as they often provide a way to reduce operational costs. Chartis foresees continued growth in the GRC analytics space, as techniques to enable the development and adoption of new analytics become more widely established and supported.

The quadrant for GRC analytics is well-populated, reflecting the breadth of coverage in this category. While many vendors in this space are strong in a particular analytical process (or group of related analytical processes), the leaders tend to be firms

Figure 4: RiskTech Quadrant® for GRC analytics, 2021

Source: Chartis Research

that have powerful capabilities in multiple disparate areas of GRC analytics.

Vendor positioning in context – completeness of offering

TCS scored well for its breadth of coverage, as it offers advanced analytical solutions over a diverse set of operational processes. TCS's ignio™ suite of software offerings contains six standalone products that use ML and other AI techniques to improve the efficiency of IT and operational processes. These modules provide different applications of analytics and can cover IT systems, ERP process management, procurement spending, and software assurance.

TCS also received a high score for its depth of coverage. Although each of its GRC analytics offerings is distinct, many share similar concepts, including identifying and analyzing systems and context, automating alert management, and incident management (incident triage, recommending actions and automated resolution of incidents).

TCS's strong data management is reflected in its scoring. Its solutions can analyze historical data, if required, and can also generate a significant volume of data from an initial contextual analysis and the day-to-day process management that follows. TCS's overall strong platform for data management enables users to integrate and

interpret data from a variety of internal and external sources.

Finally, when applying advanced analytical processes – especially those that include automation – reporting and visualization are vitally important, as recommendations and alerts that are flagged for review by staff are critical and occur often (as do justifications for any automated actions a firm carries out). Scoring well in this category, TCS's GRC analytics offerings have particularly strong reporting, applications of AI and analytics across the GRC value chain, and visualization in situations where manual intervention is needed, enabling rapid resolution of issues.

Table 5 shows Chartis' rankings for TCS's coverage against each of the completeness of offering criteria.

Vendor positioning in context – market potential

TCS received high scores for market potential, given its strong presence in the GRC analytics space. With several distinct offerings across multiple areas, TCS has been able to achieve a wider range of implementations, including multi-component implementations. TCS's score for business model is boosted by its integration capabilities, which enable the organization to apply capabilities from other areas of strength, including data management, to its GRC analytics offerings.

Chartis views GRC analytics as an area with strong growth potential, and TCS's offerings for varied use cases ensure the company is well-positioned to take advantage of this. TCS's strong score for growth strategy is due largely to its continued investment in emerging technologies applied to GRC processes, which is creating considerable potential in this space going forward.

Table 6 shows Chartis' rankings for TCS's coverage against each of the market potential criteria.

Table 5: Completeness of offering – TCS (GRC analytics, 2021)

Completeness of offering criterion	Coverage
Breadth of coverage	High
Depth of coverage	High
Performance	High
Data management	High
Reporting and visualization	High

Source: Chartis Research

Table 6: Market potential – TCS (GRC analytics, 2021)

Market potential criterion	Coverage
Business model	High
Growth strategy	High
Market penetration	High
Financials	High

Source: Chartis Research

3. Vendor context

Overview of relevant solutions/ capabilities

Table 7 reviews TCS and its GRC solutions.

Vendor leading practices

TCS's conduct and controls, MRM and GRC analytics solutions comprise a suite of GRC offerings within the company's broader portfolio of risk solutions. The solutions are designed to enable analytic interventions across the GRC value chain (see Figure 5).

Powered by a portfolio of analytics solutions, domain expertise, global partnerships and a robust ecosystem, TCS's GRC Analytics-in-a-Box provides a wide-ranging services and solutions offering to help financial institutions via several areas of innovation and development:

- **Transformation advisory** services across the GRC domain.
- **GRC analytics hub**: a suite of solutions and an innovation lab.
- **Comprehensive GRC service portfolio**: enterprise to enterprise services across the GRC value chain ('GRC as a service').
- **Ecosystem**: partnerships with an ecosystem of start-ups.

TCS's conduct and controls offering: core components

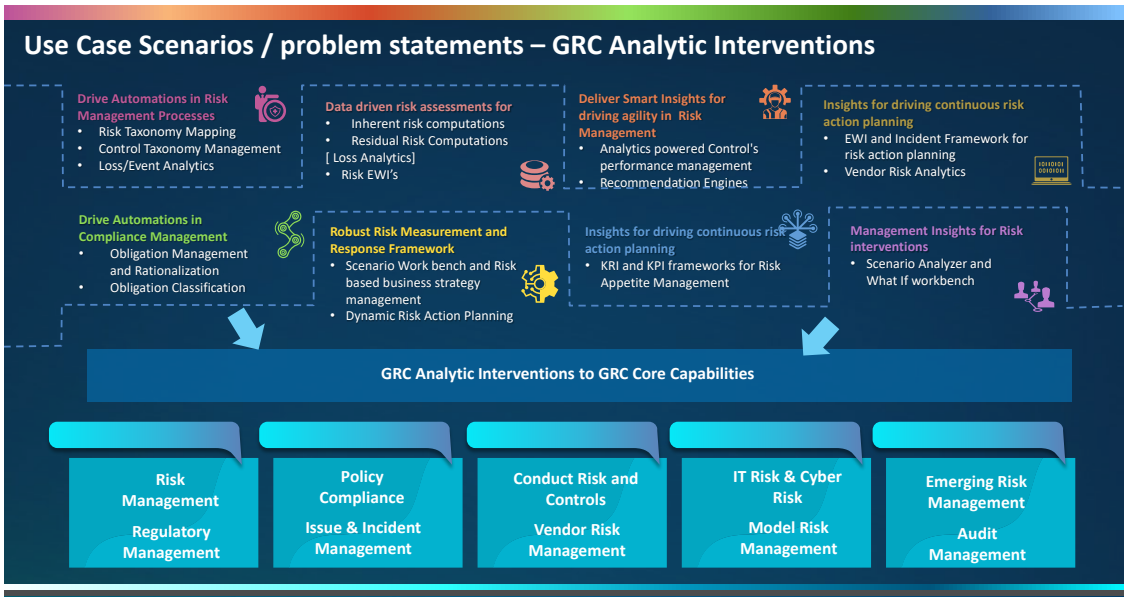
The digitally scalable Cognitive Controls solution helps institutions transform their operating

Table 7: TCS – company information

Company	Tata Consultancy Services
Headquarters	Mumbai, India
Other offices	Presence across 46 countries
Description	Tata Consultancy Services is an IT services, consulting and business solutions organization that has been partnering with many of the world's largest businesses in their transformation journeys for more than 50 years. TCS offers an integrated portfolio of business, technology and engineering services and solutions through its Location Independent Agile delivery model.
Solution	TCS's Risk and Compliance Unit partners with global financial institutions, offering GRC domain expertise and end-to-end solutions and services. Its portfolio of financial risk offerings includes risk advisory, risk decision systems and frameworks to help customers in the areas of credit, market and liquidity risk capabilities. TCS's GRC Analytics-in-a-Box offering helps customers manage GRC, operational risk, cyber risk, compliance risk and emerging risks (such as conduct, AI risks and control frameworks). Its Compliance RegTech framework and a suite of RegTech solutions enable 'human-guided' automation in the core compliance value chain, while the company's regulatory remediation offerings, enabled by advisory and remediation toolkits, support regulatory remediations and help to accelerate compliance.

Source: TCS

Figure 5: GRC solutions: key analytic interventions



Source: TCS

models in the risk assurance and internal control environment functions, which can be suboptimal, sampling-based and judgmental. TCS's offering helps to enhance cognitive automations of control identification, execution and assurance, and offers AI-based insights for the implementation and remediation of controls. Core components include:

- Advanced deep learning AI models to enable intelligent control identification and design, including control taxonomies.
- Advanced data solution and automation framework to facilitate automation in controls execution and validation.
- Self-service orchestration layer to facilitate greater agility in the automation of control execution.
- Metadata-based evidence management framework to facilitate greater agility in control testing and evidence onboarding.
- Insights into control performance for timely management interventions in risk remediation.
- Cloud-enabled solution to drive a 'controls as a service' proposition to offer more scalability to the enterprise.
- Application programming interface (API) framework to deliver higher interoperability and to offer plug-and-play inputs to customer ecosystems and external marketplaces.

TCS's MRM offering: core components

TCS's Cognitive Model Validation solution uses AI-based model testing and validation, and provides a metadata-based framework for model validation to determine overall model predictability based on relevant data.

- Metadata-based framework for monitoring strength, stability and data integrity.
- Configurable automation framework for measurement and monitoring of feature drift, feature importance and feature sensitivity.
- Intuitive insights for navigating model performance and identifying and addressing hotspots.

TCS's GRC analytics offering: core components

TCS's GRC analytics suite of solutions is designed to drive insights and automations across the GRC value chain. The solutions provide coverage across compliance management, risk and control self-assessment (RCSA) analytics, control assurance and dynamic risk action management. Key features of the solution include:

Analytic framework services

- Data ingestion framework: structured and unstructured.
- Deep learning-powered named entity recognition (NER) and classification models.
- Knowledge graph services.
- Visualization framework, service layer, workflow services, entitlement services.

Cognitive automation

- GRC model services: RCSA taxonomy model analytics, risk classifier.
- GRC integrated analytics: strategic MI and dashboards, correlation analysis.

Cognitive insights

- Cognitive controls: control analytics and automation.
- Smart compliance: obligation analytics and intelligence.
- Smart key risk indicator (KRI) solution: KRI computes, KRI monitoring.
- Smart val. cognitive model monitoring solution.

Cognitive inference

- Risk decision services: simulations and recommendations.
- EWI systems for GRC: conduct, compliance.

4. Methodology

Overview

Chartis is a research and advisory firm that provides technology and business advice to the global financial services industry. Chartis provides independent market intelligence regarding market dynamics, regulatory trends, technology trends, best practices, competitive landscapes, market sizes, expenditure priorities, and mergers and acquisitions. Chartis' RiskTech and FinTech Quadrant™ reports are written by experienced analysts with hands-on experience of selecting, developing and implementing financial technology solutions for a variety of international companies in a range of industries including banking, insurance and capital markets. The findings and analyses in our quadrant reports reflect our analysts' considered opinions, along with research into market trends, participants, expenditure patterns, and best practices.

Chartis seeks to include RiskTech and FinTech vendors that have a significant presence in a given target market. The significance may be due to market penetration (e.g., a large client base) or innovative solutions. Chartis uses detailed 'vendor evaluation forms' and briefing sessions to collect information about each vendor. If a vendor chooses not to respond to a Chartis request for information, Chartis may still include the vendor in the report. Should this happen, Chartis will base its opinion on direct data collated from technology buyers and users, and from publicly available sources.

Chartis' research clients include leading financial services firms and Fortune 500 companies, leading consulting firms and financial technology vendors. The vendors evaluated in our quadrant reports can be Chartis clients or firms with whom Chartis has no relationship.

Chartis evaluates all vendors using consistent and objective criteria, regardless of whether or not they are Chartis clients. Chartis does not give preference to its own clients and does not request compensation for inclusion in a quadrant report, nor can vendors influence Chartis' opinion.

Selection criteria

Chartis' assessment of **control** functionality covers the quality, flexibility, application and sophistication of controls. Another important aspect of a solution's functionality is its ease of integration with existing systems, and how readily it enables control frameworks to be spread across the organization. API-driven control frameworks that can be broadly applied across a range of areas score more highly.

Despite the rise in demand for **model risk** functionality, vendors still face considerable challenges in providing strong governance across a wide variety of asset classes, and the spread of firms in our analysis reflects the variation in functionality offered by vendors – existing and emerging – in this space.

In our analysis, the category **GRC analytics** features vendors that have advanced analytical capabilities (including applications of AI, ML, automation, etc.) that have been applied to GRC use cases. These often serve to increase operational efficiency, reduce workload on operations-focused employees, reduce errors in manual tasks or provide continuous monitoring of systems. Vendors that provide strong GRC analytics offerings will vary because of the breadth of the category but will tend to cover multiple use cases, which may include advanced analytics for IT system management, operational process management, workflow management, regulatory intelligence monitoring and process quantification.

Briefing process

Chartis conducted face-to-face and/or web-based briefings with each vendor1. During these sessions, Chartis experts asked in-depth, challenging questions to establish the real strengths and weaknesses of each vendor. Vendors provided Chartis with:

- A business update – an overview of solution sales and client satisfaction.
- A product update – an overview of relevant solutions and R&D roadmaps.
- A product demonstration – key differentiators of their solutions relative to those of their competitors.

[1] *Note that vendors do not always respond to requests for briefings; they may also choose not to participate in the briefings for a particular report.*

In addition to briefings, Chartis used other third-party sources of data, such as conferences, academic and regulatory studies, and publicly available information.

Evaluation criteria

Chartis develops specific evaluation criteria for each piece of quadrant research from a broad range of overarching criteria, outlined below. By using domain-specific criteria relevant to each individual risk, we can ensure transparency in our methodology, and allow readers to fully appreciate the rationale for our analysis. The specific criteria used for conduct and control, MRM and GRC analytics solutions are shown in Table 8.

Completeness of offering

- **Depth of functionality**. The level of sophistication and detailed features in the software product (e.g., advanced risk models, detailed and flexible workflow, domain-specific content). Aspects assessed include: innovative functionality, practical relevance of features,

Table 8: Evaluation criteria for Chartis' analysis of conduct and control, MRM and GRC analytics solutions

Completeness of offering	Market potential
Conduct and controls	• Market penetration
• Control library coverage	• Growth strategy
• Extensibility	• Financials
• Depth	• Business model
• Ease of integration	
• Scalability/enterprise readiness	
MRM	
• Model coverage	
• Governance	
• Data management	
• Model inventory management	
• Dashboarding	
• Visualization	
GRC analytics	
• Breadth of coverage	
• Depth of coverage	
• Performance	
• Data management	
• Reporting and visualization	

Source: Chartis Research

user-friendliness, flexibility and embedded intellectual property. High scores are given to those firms that achieve an appropriate balance between sophistication and user-friendliness. In addition, functionality linking risk to performance is given a positive score.

- **Breadth of functionality**. The spectrum of requirements covered as part of an enterprise risk management system. This will vary for each subject area, but special attention will be given to functionality covering regulatory requirements, multiple risk classes, multiple asset classes, multiple business lines and multiple user types (e.g., risk analyst, business manager, CRO, CFO, Compliance Officer). Functionality within risk management systems and integration between front-office (customer-facing) and middle/back office (compliance, supervisory and governance) risk management systems are also considered.

- **Data management and technology infrastructure**. The ability of risk management systems to interact with other systems and handle large volumes of data is considered very important. Data quality is often cited as a critical success factor and ease of data access, data integration, data storage and data movement capabilities are all important factors. Particular attention is given to the use of modern data management technologies, architectures and delivery methods relevant to risk management (e.g., in-memory databases, complex event processing, component-based architectures, cloud technology and software as a service). Performance, scalability, security and data governance are also important factors.

- **Risk analytics**. The computational power of the core system, the ability to analyze large amounts of complex data in a timely manner (where relevant in real time), and the ability to improve analytical performance are all important factors. Particular attention is given to the difference between 'risk' analytics and standard 'business' analytics. Risk analysis requires such capabilities as non-linear calculations, predictive modeling, simulations, scenario analysis, etc.

- **Reporting and presentation layer**. The ability to present information in a timely manner, the quality and flexibility of reporting tools, and ease of use are important for all risk management systems. Particular attention is given to the ability to do ad hoc 'on-the-fly' queries (e.g., 'what-if' analysis), as well as the range of 'out of the box' risk reports and dashboards.

Market potential

- **Business model**. Includes implementation and support and innovation (product, business model and organizational). Important factors include size and quality of implementation team, approach to software implementation, and post-sales support and training. Particular attention is given to 'rapid' implementation methodologies and 'packaged' services offerings. Also evaluated are new ideas, functionality and technologies to solve specific risk management problems. Speed to market, positioning and translation into incremental revenues are also important success factors in launching new products.

- **Market penetration**. Volume (i.e., number of customers) and value (i.e., average deal size) are considered important. Rates of growth relative to sector growth rates are also evaluated. Also covers brand awareness, reputation, and the ability to leverage current market position to expand horizontally (with new offerings) or vertically (into new sectors).

- **Financials**. Revenue growth, profitability, sustainability and financial backing (e.g., the ratio of license to consulting revenues) are considered key to scalability of the business model for risk technology vendors.

- **Customer satisfaction**. Feedback from customers is evaluated, regarding after-sales support and service (e.g., training and ease of implementation), value for money (e.g., price to functionality ratio) and product updates (e.g., speed and process for keeping up to date with regulatory changes).

- **Growth strategy**. Recent performance is evaluated, including financial performance, new product releases, quantity and quality of contract wins, and market expansion moves. Also considered are the size and quality of the sales force, sales distribution channels, global presence, focus on risk management, messaging and positioning. Finally, business insight and understanding, new thinking, formulation and execution of best practices, and intellectual rigor are considered important.

Quadrant construction process

Chartis constructs its quadrants after assigning scores to vendors for each component of the completeness of offering and market potential criteria. By aggregating these values, we produce

total scores for each vendor on both axes, which are used to place the vendor on the quadrant.

Definition of quadrant boxes

Chartis' quadrant reports do not simply describe one technology option as the best solution in a particular area. Our ranking methodology is designed to highlight which solutions are best for specific buyers, depending on the technology they need and the implementation strategy they plan to adopt. Vendors that appear in each quadrant have characteristics and strengths that make them especially suited to that particular category, and by extension to particular users' needs.

Point solutions

- Point solutions providers focus on a small number of component technology capabilities, meeting a critical need in the risk technology market by solving specific risk management problems with domain-specific software applications and technologies.
- They are often strong engines for innovation, as their deep focus on a relatively narrow area generates thought leadership and intellectual capital.
- By growing their enterprise functionality and utilizing integrated data management, analytics and business intelligence (BI) capabilities, vendors in the point solutions category can expand their completeness of offering, market potential and market share.

Best-of-breed

- Best-of-breed providers have best-in-class point solutions and the ability to capture significant market share in their chosen markets.
- They are often distinguished by a growing client base, superior sales and marketing execution, and a clear strategy for sustainable, profitable growth. High performers also have a demonstrable track record of R&D investment, together with specific product or 'go-to-market' capabilities needed to deliver a competitive advantage.
- Because of their focused functionality, best-of-breed solutions will often be packaged together as part of a comprehensive enterprise risk technology architecture, co-existing with other solutions.

Enterprise solutions

- Enterprise solution providers typically offer risk management technology platforms, combining functionally rich risk applications with comprehensive data management, analytics and BI.
- A key differentiator in this category is the openness and flexibility of the technology architecture and a 'toolkit' approach to risk analytics and reporting, which attracts larger clients.
- Enterprise solutions are typically supported with comprehensive infrastructure and service capabilities, and best-in-class technology delivery. They also combine risk management content, data and software to provide an integrated 'one stop shop' for buyers.

Category leaders

- Category leaders combine depth and breadth of functionality, technology and content with the required organizational characteristics to capture significant share in their market.
- They demonstrate a clear strategy for sustainable, profitable growth, matched with best-in-class solutions and the range and diversity of offerings, sector coverage and financial strength to absorb demand volatility in specific industry sectors or geographic regions.
- They will typically benefit from strong brand awareness, a global reach, and strong alliance strategies with leading consulting firms and systems integrators.

5. How to use research and services from Chartis

In addition to our industry reports, Chartis offers customized information and consulting services. Our in-depth knowledge of the risk technology market and best practice allows us to provide high-quality and cost-effective advice to our clients. If you found this report informative and useful, you may be interested in the following services from Chartis.

Advisory services

Advisory services and tailored research provide a powerful way for Chartis clients to leverage our independent thinking to create and enhance their market positioning in critical areas.

Our offering is grounded in our market-leading research, which focuses on the industry and regulatory issues and drivers, critical risk technologies and leading market practices impacting our sector. We use our deep insight and expertise to provide our clients with targeted market and industry analysis, tailoring content to assess the impact and potential of relevant regulatory and business issues, and highlighting potential solutions and approaches.

Chartis' advisory services include:

Market dynamics

The markets that our clients – vendors, institutions and consultants – address are changing at an ever-increasing pace. Understanding the market dynamics is a critical component of success, and Chartis uses its deep industry and technical knowledge to provide customized analysis of the specific issues and concerns our clients are facing.

Market positioning

In today's highly competitive market, it is no longer enough simply to have a leading product or solution. Buyers must be able to appreciate the differentiating capabilities of your brand and solutions, and understand your ability to help them solve their issues.

Working with our clients, we generate compelling, independent co-branded research, targeting critical business issues. This helps our clients to position their solutions effectively, 'own' key issues, and stand out from the crowd.

Collaborating closely with our clients, we develop pragmatic, resonant thought-leadership papers with immediate industry relevance and impact.

Our offering includes:

- **Co-branded research** on key market topics to provide a unique and compelling point of view that addresses a key industry driver and highlights the relevant issues. Reports can be tailored to varying levels of depth and can be powered by quantitative survey fieldwork, qualitative industry interviews, our deep domain expertise, or a blend of all three.
- **Chairing roundtables and/or facilitating events and workshops**, to support clients in hosting compelling events that put them at the heart of the discussion.
- **Targeted marketing through our sister brands**, leveraging the power of our parent group – Infopro Digital – to reach across leading brands such as Risk.net, WatersTechnology, FX Week and Central Banking.

Competitor analysis

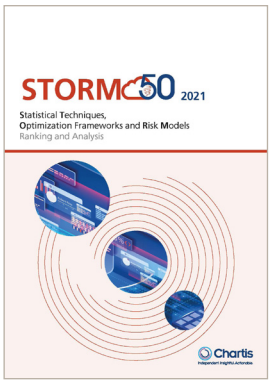
Our unique focus on risk technology gives us unrivalled knowledge of the institutions and vendors in the sector, as well as those looking to enter it. Through our industry experts, Chartis clients can tap our insights to gain a much deeper understanding of their competitors and the strategies they should pursue to better position themselves for success.

Regulatory impact analysis

The analysis and assessment of regulatory change and implementation is one of Chartis' core strengths. We can apply our insights to assess the impact of change on the market – both as it applies to vendors and the institutions they serve, or on a client's specific product and customer base. We can also provide insights to guide product strategy and associated go-to-market activities, which we can execute for internal use to drive our clients' strategy, or as a co-branded positioning paper to raise market awareness and 'noise' around a particular issue.

6. Further reading

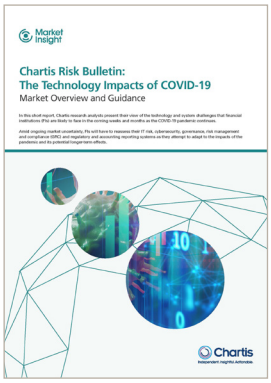
Enterprise GRC Solutions, 2019: Market Update and Vendor Landscape



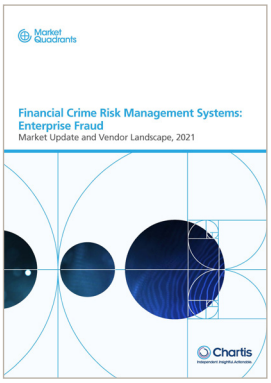
STORM50 2021

Big Bets 2021

RiskTech100® 2021



Chartis Risk Bulletin: The Technology Impacts of COVID-19



Financial Crime Risk Management Systems: Enterprise Fraud; Market Update and Vendor Landscape, 2021

For all these reports, see **www.chartis-research.com**