

IT SERVICES VENDOR PROFILE OF:

Infosys – Digital Testing

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1. Background

Infosys is the third-largest of the Indian-centric IT services and BPS vendors, and the eleventh largest globally by revenues. In FY17 (the period ending March 31, 2017), it had revenues of \$10.2bn, and in calendar year (CY) 2016 it had revenues of \$10.1bn. Its headcount at the end of Q4 FY17 was 200k.

The company primarily provides software testing services through its Infosys Validation Solutions (IVS) unit, which was founded in 2001. It initially serviced websites and e-commerce applications as an independent service (from ADM activities), focusing on TCoEs. IVS is a horizontal service line with ownership on P&L and delivery, as well as on pre-sales, centers of expertise, and portfolio management.

IVS is a large practice within Infosys and has 22.5k career testers (at the end of FY17). This headcount does not include an additional 2k career testers working in other Infosys units. IVS therefore represents ~11% of Infosys' total headcount.

Major IVS clients include tier one organizations: Kraft Heinz, Honda, Prime Therapeutics, And Arizona Public Service. IVS has a track record in gaining very large standalone testing contracts, with TCVs of ~\$100m and a regular flow of contracts in the \$10m-\$50m range.

In the past five years, IVS has expanded its focus on independent services and TCoEs towards bundling testing services with ADM as part of agile engagements, and driving coordination and collaboration across ADM and testing teams. Meanwhile, it continues to sell independent and TCoEs services for its clients using waterfall.

Looking forward, IVS is focusing on IoT, AI/ML, DevOps, big data, and device testing. It is shifting its approach to helping clients move from a TCoE model to a more decentralized delivery structure, more aligned with development teams. IVS is also helping clients to fine-tune their agile organization structure and maintain their cost centricity, while increasing go-to-market.

Another key priority for IVS is to help organizations industrialize their delivery; it continues to create testing services offerings that are backed up by an accelerator or a platform, relying on testing software standardization and self-service.

2. Revenue Summary

Infosys reported that its business assurance segment revenues for FY17 were \$929m, up 8%. Its CY 2016 revenues were \$918m, up 11%. In FY17, Infosys experienced momentum in Europe across sectors, thanks to financial services, retail and logistics, and manufacturing. Legacy systems and compliance are driving spending in banks.

NelsonHall estimates the breakdown of IVS' FY17 revenues by geography to be:

- Americas: 64%
- Europe: 20%
- Rest of the World: 16%.

NelsonHall estimates the breakdown of IVS' FY17 revenues by vertical as:

- Financial services, cards, and payments: 48%
- Insurance, healthcare, and life science: 15%
- Retail, CPG, and logistics: 14%
- Energy, utilities, communications, and services: 14%
- Manufacturing: 9%.

NelsonHall estimates IVS' digital testing (excluding agile testing) revenues for CY 2016 to be ~15% of its total revenues, representing ~\$140m.

3. Key Offerings

3.1 Infosys Quality Assurance Platform

IVS made a major step change in FY17, and unveiled its Infosys Quality Assurance Platform (IQAP). IQAP aims to automate the full SDLC and therefore goes beyond digital testing activities. It is a platform and aims to systematically integrate IVS' accelerators, with open source software, and testing COTS.

IQAP has a wide functionality range with several features related to digital testing:

- Omnichannel automation: including functional automation (both scripted and scriptless), API testing, non-functional and data testing, integration with CI/CD software
- User experience validation: including accessibility, compatibility, security, device performance, usability, sentiment analysis, and customer experience index
- Package testing: including SAP and Oracle.

In conjunction with its Infosys Quality Assurance Platform, IVS also offers test support services such as:

- Access to a device lab, through Perfecto Mobile
- Test environment provisioning
- Crowdttesting.

In addition, IVS is deploying analytics around:

- Test optimization
- Failure prediction
- Code guidance
- Sentiment analysis
- Traceability
- Application hot spots.

IVS has also used KM software to store repositories of business processes, bugs, reference test data, and test scenarios.

IVS provides Infosys Quality Assurance Platform on a subscription basis, based on the number of users. IVS has ~30 clients for Infosys Quality Assurance Platform.

3.2 Digital Testing

IVS' priority, in recent quarters, has been to further invest in its digital testing capabilities and accelerators, particularly around UX testing.

Mobile Website and App Testing

Services provided include:

- Usability testing: verification of text visibility in the selected language, and navigation between screens
- Compatibility testing: validation of apps on different devices, OS and releases, screen size and resolution; and for technical purposes, e.g. app isolation with other apps
- Interface testing: validation of each screen, button, text input, and of navigation flow into external apps
- Low-level resource testing: checking for overuse of memory, cleaning of app temporary files, size of local database, and garbage generation
- Performance testing: checks on server connection changes from 2G or 3G to Wi-Fi, application response time; and code optimization for CPU, battery consumption, memory leakage
- Operational testing: checking of necessary information back-up when mobile is running out of battery, and checking that no data is lost in app upgrades
- Security testing: testing encryption of data communications, blockage of malicious content, and checks for access of files saved in the app by unintended users.

Infosys has shared mobile labs in Pune, Trivandrum, and Chennai. These labs are used by Infosys for its R&D needs, and also by IVS. They provide access to ~2k devices. IVS has set up client-dedicated mobile labs, located in the offshore development centers. Existing client-dedicated centers are located in Pune, Chennai, Hyderabad, and Mangalore. Finally, IVS has partnerships with Perfecto Mobile, Experitest, Mobile Labs, and Device Anywhere for accessing remote mobile devices on the cloud.

IVS has developed several IPs for its mobility testing offering, the most widely used of which is Infosys Network Impact Testing Suite, a network variability testing tool. Other tools include:

- Infosys Mobile automation framework
- Infosys Web Automation Framework for omni-channel testing
- Infosys Mobile Load Testing Solution: a mobile performance tool
- Infosys Mobile Security Platform: a security framework
- Infosys App Certification: a tool which validates that an app follows Google Play's guidelines.

UX Testing

IVS has developed two main UX testing accelerators: Customer Experience Index, and Customer Sentiment Analytics.

Customer Experience Index (CEI) provides metrics around six parameters (performance, omnichannel, accessibility, social engagement, usability, and omni-channel integration) through a web portal. For these parameters, CEI provides a score based on assessing attributes either automatically (e.g. number of comments, scoring for mobile apps) or through manual data input (look and feel). Examples of attributes for omni-channel include mobile integration, customer service integration, and social engagement. Customer Experience Index has been live since Q1 2017 and is now used in most digital engagements.

Customer Sentiment Analytics (CSA) tracks attributes such as analysis of app combability, functionality, sentiment, and performance across Google Play, Apple app store, and social media (Facebook and Twitter). CSA is essentially a reporting portal, tracking volumes of comments, classifying comments into categories (functional, compatibility, security and privacy, and performance), identifying sentiment (positive vs. negative), and identifying keywords. IVS provides Customer Experience Analytics with a license fee, which is based on the number of reports.

IVS conducts workshops based on data collected by CEI and CSA and drives design thinking to improve UX and app store scoring

Crowdtesting

IVS has conducted a pilot for a client, with crowdtesters coming from Infosys' available personnel. IVS will also supplement its crowdtester pool through partners, when required.

Crowdtesting services provided include UAT, usability, and security testing from clients in the retail, CPG, and energy and utilities industries. Infosys also provides test management including test priorities, access control, defect management, and validation processes (to assess the quality of defects logs).

Infosys rewards crowdtesters through a gamification approach, relying on vouchers and similar incentives.

Infosys has a partnership with Preenos Crowd Technologies for using its 99tests.com technology. Note that Preenos Crowd Technologies was partially funded by Infosys co-founder, Kris Gopalakrishnan.

Another client is an Australian financial services firm, for which it conducted usability and accessibility exploratory testing of the client's portal static content, and made recommendations on enhancing the UX. The project involved 2k crowdtesters for two weeks, and helped identify 4k defects and make 800 suggestions.

Omni-Channel Experience

Infosys uses its Omni-Channel Experience tool for conducting business process testing.

The purpose of Omni-Channel Experience is to test business processes involving several customer touch points (e.g. mobile, browser, branches, customer services, devices, and ATMs), while conducting back-end systems (ERP and CRM) testing and banking-specific systems/external services (e.g. online and mobile payment, stock markets, insurance, and international transfers).

Omni-Channel Experience includes a reference architecture and several services/accelerators including:

- Mobile testing with access to the device labs of Perfecto Mobile
- Multi-channel testing
- API testing through its Infosys API testing accelerator
- Functional and non-functional, including Infosys performance testing suite
- Service virtualization
- Test scenario repositories.

3.3 DevOps and Agile

Consulting Services

IVS has a unit specializing in test consulting, which has a headcount of 80. It has rebalanced its service portfolio towards agile and DevOps, around:

- Testing processes: and helping clients to move from waterfall to agile. IVS has an agile maturity model with five levels, based on 45 parameters
- Testing tool selection: assessing existing testing software and making recommendations on which testing software tools to standardize on. The service offering is backed by a checklist on Microsoft Excel
- Automation at the enterprise level: through assessing the level of test automation going beyond functional test execution to automation of the full SDLC, and looking at test support services (e.g. enterprise test data management, test environment)
- Reskilling of manual testers: IVS is offering re-skilling services for both client organizations and its own delivery (see Delivery Capability and Partnerships section)
- Applying ML.

The agile and DevOps consulting services last from three to six months.

DevOps

Infosys (overall, not just IVS) has developed its Infosys DevOps Platform, which relies on the integration of open source software, COTS, and Infosys' proprietary accelerators.

Features of the Infosys DevOps Platform include:

- Unit testing: using JUnit
- Functional testing: Selenium, HPE UFT, IBM RFT, SoapUI, and MonkeyTalk
- Non-functional: e.g. JMeter
- CI-CD: e.g. Jenkins
- Release automation: with IBM UrbanCode
- Static code analysis: using SonarQube

- Compliance checks: including free and open source software compliance
- Security analysis
- Test support services: including environment provisioning, test coverage, and service virtualization. Infosys has two main accelerators:
 - Infosys Test Data Accelerator: a workflow tool to accelerate the creation of test data, reserve test data, manage federated data relationships, and generate secondary extracts
 - QA Environment Assessment Engine: this tool will assess testing environments in terms of needs, capacity, and utilization, and will recommend optimization methods, e.g. virtualization.

Early adopters of Infosys DevOps Platform include:

- A U.S. BFSI unit: to reduce time to market from three to six months to two to four weeks
- A Northern European bank: to reduce execution cycles by 87% through continuous testing, and reduce cost by up to 35%.

In addition, IVS is collecting data from several data sources including production logs, defect management software, and ITSM software, for analysis with ML techniques.

Infosys has its Infosys API Test Automation tool for validating the flow of information running through interfaces and middleware tools, in an automated manner. The tool is also used for SOA based applications. It is web based and is also scriptless.

3.4 AI

Infosys has been working on analytics and AI/machine learning and defining different testing use cases, largely across these three main topics and unveiled its “Infosys AI-led QA platform” (IAIQ). IAIQ has several use cases:

- Defect and log analysis
- Sentiment analysis
- Test case optimization
- Defect analysis and visualization
- Defect prediction
- Traceability.

Sentiment Analysis/UX

Sentiment analysis has become a common offering and Infosys is able to extract trends and analysis based on data extracted from social media (Facebook and Twitter), app stores (Apple Store and Google Play), and (based on client requirements) from consumer websites (e.g. a retailer). Why does this fit into testing? Largely, because consumer feedback is taken into account in improving UX in websites and mobile apps; it helps to identify application issues from a UX perspective. Infosys says that it is starting to see testing departments be at least partially assessed on sentiment analysis trends and consumer satisfaction.

Test Case Optimization

This is based on capturing details on test cases (from different sources, including HP ALM as well as from test case repositories), and clustering them into groups based on natural language processing algorithms across test case descriptions. It uses its Infosys AI-led QA platform to analyze and visualize clusters to identify correlated test cases; and uses other test case optimization techniques such as pair wise and CBT, from a statistical approach.

This approach has several purposes, all related to reducing test execution effort: first, identifying redundant test cases; second, only executing a few correlated test cases (i.e. test cases which are not identical but which share similarities and have the same test pass/fail patterns). Thirdly, creating test scripts that can accommodate relatively similar test cases.

Defect Analysis and Visualization

In a more traditional approach, Infosys is providing a data visualization tool for identifying defects and correlating them across applications, domains, teams to drive root cause analysis. The tool is based on the Pareto approach (which assumes, from a testing perspective, that 80% of defects are caused by 20% of applications/teams/technologies).

It also provides insights into correlated application areas and helps identify application hotspots based on defect data.

Defect Prediction (For Agile Projects)

The approach is specific to agile projects. Based on historical data on pass/fail performance of test cases for one given sprint, Infosys helps to predict a test pass/fail for a specific sprint. Infosys uses up to eight parameters (e.g. application complexity, degree of change in the application, past history defects, identity of developers working on the application) in order to make predictions.

Again, the benefit of this approach is to reduce the test workload by avoiding testing what does not need to be tested. This approach is especially relevant when test cases have not been scripted or need to be enhanced. Infosys currently uses its own IP based on open source algorithms.

3.5 Other Digital Testing: Data Testing

Data Testing

Data testing is IVS' BI and data warehousing testing offering. It includes:

- ETL testing (for validating source and target data)
- BI reporting
- Migration testing for the migration of ETL systems, databases, and upgrades; this includes audit and control testing
- Big data testing around Apache Hadoop, NoSQL/MongoDB, Informatica, and IBM software products
- Database migration from RDBMS to Apache Hadoop and Spark.

IVS has a data warehousing software test automation tool that is typically used in cases of regulatory reporting, M&A, BI reporting, and data migration. The tool is a web based workbench that provides data quality analysis according to several parameters including metadata, statistics, relationships, patterns, and business rules. It supports several (unnamed) relational databases, and is designed for use by power users rather than career testers.

IoT Testing

NelsonHall has published an assessment of Infosys' IoT capabilities. This analysis is available [here](#).

3.6 Engineering Services Testing

Through its Engineering Services business, Infosys services technology vendors whose activities include enterprise and consumer software, media and entertainment products, storage products, computing, software middleware, and communication equipment.

Of these client segments, ISVs (enterprise and consumer software) are the largest. NelsonHall estimates that ISVs represent two-thirds of revenues within technology vendors (~\$40m out of a total of ~\$60m).

Services provided by Infosys to its technology vendor clients include:

- Product testing: globalization and localization development and testing
- User acceptance services in the form of business process validation
- Compatibility and interoperability testing services.

4. Delivery Capability and Partnerships

IVS uses its ten delivery centers in India for the provision of testing services. Each of these centers is large enough to deliver the full range of testing services, from functional testing to specialized offerings. Infosys has ~22.5k career testers located in India or in onsite assignments.

IVS has, as part of Infosys' overall expansion strategy, added some nearshore presence (~1k) in select locations:

- Milwaukee, WI (U.S.): this center has a NelsonHall estimated headcount of less than 50:
 - Infosys has recently (May 2017) signaled its intention to hire 10k personnel in the U.S. over the next two years, with its first hub in Indiana to open in August 2017 (and plans to reach a headcount of 2k positions by 2021); and another in North Carolina (also aiming for 2k positions by 2021). It is yet not clear if the local centers will provide testing services
- Shanghai (China): acts as both a nearshore and local center, servicing the operations of U.S. clients in China as well as local clients, providing language skills. The center is intended to service Japanese clients in future. It has <500 career testers

- Monterrey (Mexico): services clients in Central and South America as well as North America. The center has ~200 career testers
- Brno (Czech Republic): provides nearshore services to European clients, including ADM, service desk, and testing. In testing, the primary purpose of this center is to handle (together with India based teams) different languages for services such as test planning, test project management, and test design. The center does not focus on test execution and has ~50 career testers.

IVS estimates that a third of its personnel (~7k) now lies in specialized services which include testing activities around mobile devices and apps/websites, big data, ERP IoT, performance engineering and testing. Of these specialized services, big data is the largest activity around ETL testing and master data management.

NelsonHall estimates that IVS has 3.5k personnel working on agile and digital projects.

Reskilling

IVS is involved in the reskilling of manual testers (whether internal testers or those of clients), relying on a skill assessment and on training, taking a role based approach (executive, project manager, and practitioners) both in the classroom or using online modules. The duration of training is up to six to eight weeks, outside of working hours. Approximately 2k testers have gone through reskilling.

IVS estimates that it has the following employee numbers with specialized skills (numbers do not add up, as a number of career testers have several specializations):

- Manual testers: ~10.8k (IVS estimates that ~60% of its manual testers also have automation skills)
- Mobile testing: ~1.1k
- Test automation: ~8.5k
- Non-functional (performance and security): ~2k
- Testers working on agile projects: ~4.1k.

5. Strategy

5.1 Personnel Specialization

IVS is driving the specialization of its workforce towards:

- Further training and specialization in testing services such as digital, non-functional, and automation
- Further enforcing the usage of its IPs and partners' software products, through training
- Further investing in key offerings (e.g. SAP offerings) and related IPs and data testing, middleware testing, IT infrastructure testing, and security testing.

IVS' strategy continues to rely on several main initiatives:

- Service portfolio: a continued focus on digital assurance, ERP testing, analytics assurance, IT infrastructure, big data (including IoT), and managed testing services, as well as RPA, chatbots, and blockchain;
- Favoring consulting based selling by increasing coordination between delivery, consultants, and account managers
- Investing further in automation and IPs
- Driving innovation
- Further specialization
- New pricing models with a reliance on test unit pricing.

5.2 Innovation Program

IVS is emphasizing its innovation program, which has several elements:

- A top-down approach with specialized groups and labs (a combined 200 personnel), looking at the latest technology trends, deciding on relevance to IVS, and prioritizing investments. Examples include crowdtesting, further testing automation (through machine learning/AI, robotics, and IoT), and using technology hosted on the cloud and IaaS, as much as possible
- In terms of robotics, Infosys is currently involved with one Australian banking client to automate the client's PoS so it runs without human intervention, e.g. cash, counting, scanning, and printing of bank statements. To do this, Infosys has used a robotic arm to mimic human gestures. It has also built its own robotic arm to perform activities such as operating a smart device and performing an ATM transaction. Infosys IVS is involved in the testing activities, while the robot project is conducted by Infosys' Product Engineering Service practice.

6. Strengths and Challenges

6.1 Strengths

- Overall, Infosys has a solid offering in digital and Agile/DevOps testing
- Focus on automation (through acquisitions and continued focus on IPs), and on introducing innovation to clients, as well as a wealth of accelerators and two main platforms: Infosys Quality Assurance Platform (for automating the full SDLC) and Infosys DevOps Platform
- Scale: Infosys has the scale to maintain its effort in proprietary automation and further deepen its service portfolio, as well as developing its delivery network onshore for agile testing needs.

6.2 Challenges

- Digital testing: Infosys has a collection of accelerators and IP (e.g. in UX testing, Customer Experience Index and Customer Sentiment Analytics), rather than a comprehensive digital platform. Infosys says that these accelerators are part of its Infosys Quality Assurance Platform which has some digital capabilities
- UX testing specifically: NelsonHall would like Infosys to invest further in its service portfolio towards analytics to more activities around workshops, focus groups, crowdtesting, and integration with its UX consulting units.

7. Outlook

In 2017/2018, NelsonHall is expecting Infosys to:

- Maintain its investment in proprietary automation; digital, and in particular UX testing, is a priority
- Continue to invest in communication tools and methodologies and help clients roll out distributed agile projects (in the context of digital)
- Invest in re-skilling, both in terms of external services to organizations and internally as part of managed testing contracts.



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