Automation of Knowledge-Based Shared Services and Centers of Expertise

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Abstract. Automation of Knowledge-Based services is the natural evolution of Robotic Process Automation (RPA), fueled by new technologies, often categorized as Cognitive Automation (CA). The purposes of this research are to (1) explore the Expertise Shared Services and Centers of Expertise functions where automation of knowledge-based processes is most suitable and (2) understand the value drivers and primary tactical challenges in adopting a strategy for automating Knowledge-Based expertise services. In addition to a literature review conducted, we conducted in-depth interviews with selected executives and experts. We developed case studies to better understand how Software Bots can be deployed for automating Knowledge-Based Expertise Services in organizations when they transition to automation of knowledge-driven processes. Results of our research indicate that the majority of executives and experts are aware of the need for automating Knowledge-Based Expertise Services but most remain unclear regarding its value or how to invest in adoption of this new trend.

Keywords: Expertise Shared Services · Centers of Expertise (COE) · Knowledge process automation · Cognitive Automation (CA) · Artificial Intelligence (AI) · Intelligent Automation (IA) · Intelligent Process Automation (IPA) · Robotic Process Automation (RPA) · Software Bots · Big data · Unstructured data

1 Introduction

Automation of Knowledge-Based processes is the natural evolution of Robotic Process Automation (RPA), fueled by technologies often categorized as Cognitive Automation (CA). The CA tools are considered cognitive, in that they 'think', however not necessarily in the same way as a human, but rather leveraging more advanced algorithms that are self-learning in nature. As such, where RPA is a tool that is deterministic (i.e. using pre-defined actions), CA has the ability to render an outcome based on probabilistic evidence. The inherent ability of CA that enables automation of knowledge-based

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Expertise Services is the ability to understand context, much like an expert would as a reliable source of advice, having extensive knowledge or ability beyond that of an average person based on experience, occupation or research.

Knowledge Processes concentrate on the identification, acquisition, dissemination and preservation of knowledge in order to drive efficiencies, garner competitive advantage and enhance company value. In general, there are four Knowledge Processes: (a) generating knowledge, (b) sharing knowledge, (c) storing knowledge, and (d) applying knowledge. In today's competitive environment, organizations must have the ability to effectively incorporate all four of these Knowledge Processes into their business.

Using a combination of literature review, in-depth interviews, process classification frameworks and case studies, we address the following research questions:

1. What cognitive tasks are implied in the workflows across common Shared Services functions?
2. What workflows currently are being automated?
3. What is the extent of incremental business value brought by automation of knowledge-based processes?

The number of terms used to describe software tools designed to automate services can be very confusing. These software products are aimed at automating or supplementing different types of human tasks and include Machine Learning (ML), Robotic Process Automation (RPA), Cognitive Automation (CA), Artificial Intelligence (AI) and Intelligent Process Automation (IPA). To develop a common understanding of these terms, we offer the following definitions including those from the IEEE Guide for Terms and Concepts in Intelligent Process Automation [1]:

Machine Learning (ML) - Detection, correlation, and pattern recognition generated through machine-based observation of human operation of software systems along with ongoing self-informing regression algorithms for machine-based determination of successful operation leading to useful predictive analytics or prescriptive analytics capability.

Robotic Process Automation (RPA) - A preconfigured software instance that uses business rules and predefined activity choreography to complete the autonomous execution of a combination of processes, activities, transactions, and tasks in one or more unrelated software systems to deliver a result or service with human exception management.

Cognitive Automation (CA) - The identification, assessment, and application of available machine learning algorithms for the purpose of leveraging domain knowledge and reasoning to further automate the machine learning already present in a manner that may be thought of as cognitive. With cognitive automation, the system performs corrective actions driven by knowledge of the underlying analytics tool itself, iterates its own automation approaches and algorithms for more expansive or more thorough analysis, and is thereby able to fulfill its purpose.

Artificial Intelligence (AI) - The combination of cognitive automation, machine learning, reasoning, hypothesis generation and analysis, natural language processing, and intentional algorithm mutation producing insights and analytics at or above human capability.

Intelligent Process Automation (IPA) - A preconfigured software instance that combines business rules, experience-based context determination logic, and decision criteria to initiate and execute multiple interrelated human and automated processes in a dynamic context. The goal is to complete the execution of a combination of processes, activities, and tasks in one or more unrelated software systems that deliver a result or service with minimal or no human intervention.

Big Data - Big data is data sets that are so voluminous and complex that traditional data-processing application software are inadequate to deal with them. Big data challenges include capturing data, data storage, data analysis, search, sharing, transfer, visualization, querying, updating, information privacy and data source. The term big data tends to refer to the use of predictive analytics, user behavior analytics, or certain other advanced data analytics methods that extract value from data, and seldom to a particular size of data set.

Center of Expertise - A center of expertise or a center of excellence (COE) is a corporate group or team that leads other employees and the organization as a whole in some particular area of focus such as a technology, skill or discipline. It is also known as a competency center or a capability center and is a shared facility or an entity that provides leadership, best practices, research, support and/or training for a focus area. The focus area might be a technology (e.g. SAP), a business concept (e.g. BPM), a skill (e.g. negotiation) or a broad area of study (e.g. knowledge management).

This paper is organized in following sections: Sect. 1 has just provided an introduction to Knowledge Processes and automation terminologies and has set the stage for our study. Section 2 provides a summary of our literature review related to RPA, CA, AI and IPA. Section 3 presents data collection methods. Section 4 provides findings and analysis of data collected and Sect. 5 outlines the conclusions and future research.

2 Literature Review

The business disruption caused by AI and related technologies is already here and more business disruption is on the way. In 1999, the big business disruption was the use of offshoring to create labor arbitrage. The new disruptor is automation arbitrage, a term Gartner is using to describe the recalibration of the amount of human labor that should be used to drive business outcomes. The initial low-hanging fruit in this arena is RPA. It is relatively low cost, quick to implement and unobtrusive; thus, it starts what will likely be one of the most important conversations in the next five years regarding how automation will change the value proposition in all organizations [2].

For more than 130 years, managers have, in effect, been attempting to get humans to act like robots by structuring, routinizing, and measuring work - all under the guise of organizational efficiency. The automation software that is being developed today

enables a reversal of this process. We are now able to use software robots to amplify and augment distinctive human strengths, enabling large economic gains and more satisfying work. However, given the widespread skepticism and fears about how many types of employment will fare in the future, managers are in a difficult position. Media headlines such as "Rise of the Robots: Technology and the Threat of a Jobless Future" and "A World without Work" only serve to fuel the anxiety. The plethora of software tools and terms used to describe software designed to automate services can be very confusing. To help make sense of the service automation landscape, it is suggested to avoid the jargon and instead focus on the service characteristics that the tools are designed to help automate. Two broad classes of service automation tools which can be considered are: Robotic Process Automation (RPA) and Cognitive Automation (CA). Each class of tools is designed to deal with specific types of data and processes. A vocabulary needs to be developed for communicating the meaning of various automation approaches. Figure 1 shows how to communicate automation to stakeholders [3]:

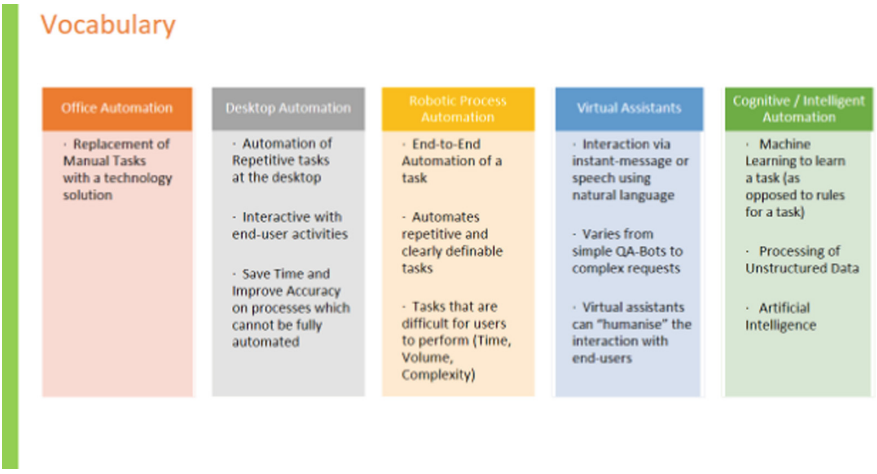

Fig. 1. How to communicate automation to stakeholders [3]

In order to adopt RPA into a stable model for an enterprise, the recommendation is taking a three-stage approach. This focuses on a range of applicable RPA features from the most linear features that deliver the greatest ROI to the most cutting-edge technology that is not yet completely defined. The first is Structured RPA, which can easily automate swivel chair processes, where data currently is manually entered into one system and then the same data is entered into another system; this requires interaction with many applications in order to complete a business process. The next level of automation is Intelligent/Enhanced RPA. With Intelligent/Enhanced RPA (also known as Intelligent Automation (IA) or Intelligent Process Automation (IPA)) intelligent tools use machine learning to build a process related knowledge base in order to automate processes. The last is Cognitive RPA (also known as CA), which provides

greater business value by automating processes with the use of advanced machine intelligence, natural language processing, Big Data, and real time analytics. Figure 2 shows a comparison of RPA and Intelligent Automation [4].

RPA vs. Intelligent Automation

	Robotic Process Automation	Intelligent Automation
Automates tasks that are...	Routine: Methodical, repetitive, rules-based	Non-routine: Requiring a thoughtful consideration
Able to...	Follow instructions	Come to conclusions
Application is...	Broader: Can automate any suitable process	Narrower: Application should be targeted to deliver meaningful, insightful outputs
Market offerings are...	Maturing	Emerging
Implementation and ongoing costs are typically...	Lower	Higher
Implementation timeframe are typically of the order of...	Weeks	Months

Fig. 2. Robotic process automation and intelligent automation [4]

In order to apply Intelligent Automation (IA) in the enterprise, it is necessary to explain what IA is and what value it can bring. It is needed to get commitment from the top, break the silos and work together, focus and prioritize, involve the people that will be interacting with the new IA tool from the beginning, involve the right experts on time (e.g., privacy, IT security, cloud) and share your success; it will lead to new initiatives [5].

At its core, IPA is an emerging set of new technologies that combines fundamental process redesign with robotic process automation and machine learning. It is a suite of business process improvements and next-generation tools that assists the knowledge worker by removing repetitive, replicable, and routine tasks. And it can radically improve customer journeys by simplifying interactions and speeding up processes. IPA mimics activities carried out by humans and, over time, learns to do them even better. Traditional levers of rule-based automation are augmented with decision-making capabilities thanks to advances in deep learning and cognitive technology. The promise of IPA is radically enhanced efficiency, increased worker performance, reduction of operational risks, and improved response times and customer journey experiences [6].

New technologies that promise double-digit or even triple-digit same-year returns should rightfully be viewed with skepticism. However, experience shows that the promise of Intelligent Process Automation (IPA) is real if executives carefully consider and understand the drivers of opportunity and incorporate them effectively with other approaches and capabilities that drive a next-generation operating model [6]. A business-led RPA Center of Expertise (COE) is the best way to manage and enhance a

virtual workforce - but it does not simply spring into existence. So, the COE processes need to be in place, IT governance agreed, and staff trained to operate robots and continue to enhance processes. Figure 3 below shows the Automation Spectrum and stages of Digital Automation Evolution [4]:

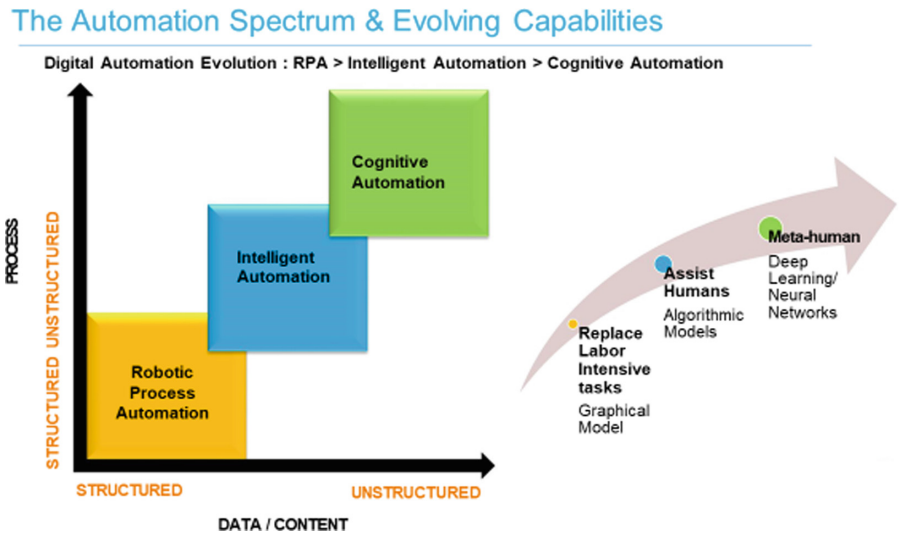

Fig. 3. The automation spectrum and evolving capabilities [4]

Cognitive Automation is defined in the context of a Machine Learning (ML) automation framework. While the proposed properties are found to be critical to such a system, one could arguably relax some of these or expand the notion to include additional desirables. An algorithmic framework will be called cognitive if it has the following properties [7]:

1. It integrates knowledge from (a) various structured or unstructured sources, (b) past experience, and (c) current state, in order to reason with this knowledge as well as to adapt over time;
2. It interacts with the user (e.g., by natural language or visualization) and reasons based on such interactions; and
3. It can generate novel hypotheses and capabilities, and test their effectiveness.

Recently, there have been plenty of predictions about the effects of automation on the nature of human work. Some pundits have predicted that automation will take over more and more functions, leaving very few tasks for humans.

Figure 4 provides characteristics of Core and Non-Core processes [8]. In general, 5% of the processes are Core Differentiating, 15% of processes are Core Competitive and 80% of the processes are Non-Core. Non-Core processes are transactional in nature whereas core processes are knowledge-based.

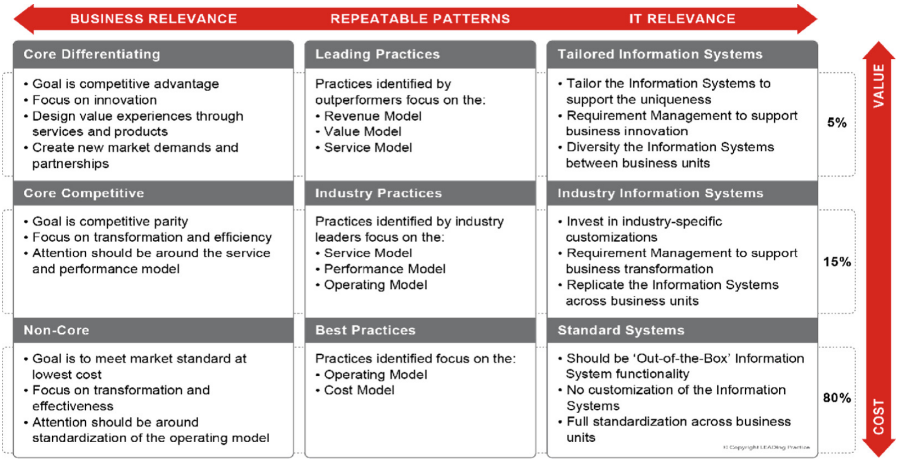

Fig. 4. Characteristics of core and non-core processes [8]

According to [8], the core processes add the most value whereas the non-core processes account for majority of the costs. Figure 4 also classifies requirements for Information Systems as Tailored, Industry and Standard systems.

Reading the headlines and multiple reports, one would think that by mid-2017, most organizations had already automated most of their repetitive, routine activities and processes, and were now well into automating knowledge work - reasoning; natural language processing; probabilistic decision-making; judgment; prediction; understanding context; converting unstructured data into information; and answering "why?" questions. But this is far from the case. Given this context, it becomes valuable to study, empirically, actual implementations - not least because, in the cognitive automation space especially, we are short of independently researched cases that can provide valuable lessons to those just starting their journeys, or still waiting on the sidelines [9].

RPA and cognitive automation are set to be very big game changers for businesses in the coming years. In the case of RPA, the necessary technology is, in many cases, mature enough to be cheaply, easily and non-invasively, adopted. Immediate benefits can include costs savings, faster and higher quality processing, less error and better regulatory compliance. In practice, the cognitive automation market is still quite immature, despite recent heavy investments made into cognitive automation tools and AI. Studies suggest that more advanced forms of service automation, through software moving into more cognitive non-routine work, are less advanced than the hype suggests and will be mostly small-scale, discrete projects within businesses until the back end of 2018 [9].

In the next five years, it is expected that more and more work groups will be composed of both humans and software robots, each performing tasks for which they are best suited. The robots will very quickly extract, consolidate, and rearrange data for humans to assess and act upon. Humans will deal with new business requirements (which humans may later teach to the software robots), troubleshoot and solve

unstructured problems, positively envision services for customers, and build relationships with customers. We are already seeing some of this today, but going forward, robots won't need as much pre-configuration or as much detailed instruction as tools evolve and as robotic process automation moves to the cloud [10].

In some businesses, RPA and CA programs have been managed by different organizational units. RPA is seen as 'today's' tool that could be quickly deployed, whereas CA is seen as more speculative and 'tomorrow's tool. It makes sense to integrate these initiatives going forward as organizations realize that both RPA and CA realms enable business strategies, and together they can complement and magnify value [11].

3 Data Collection Methods

The purposes of this research are to (1) explore where it is most suitable to automate knowledge-based processes within Expertise Shared Services and Centers of Expertise (COE) and (2) understand the value drivers and primary tactical challenges in automating knowledge-based expertise services.

In addition to literature review, in-depth Interviews with executives and experts were conducted. A Process Classification Framework (PCF) published by the American Quality & Productivity Council (AQPC) was used to determine automation scope of Expertise Services and Case Studies were developed for companies where knowledge-based processes are currently being automated.

3.1 In-Depth Interviews

In addition to literature review, in-depth interviews were conducted with 13 executives and experts from 12 industries. In cases where the interviews couldn't be arranged, the questions were emailed to the participants. The demographics of the participants are shown in Table 1 below:

Table 1. In-depth interviews: demographics of participants

S. No.	Industry	Location	Position	No. of participants
1	Engineering services	UK	Head of Analytics	1
2	Consulting	India	Director	1
3	Information technology	China	General Manager - Shared Services	1
4	Innovation practice	UK	Chief Innovation Wizard	1
5	Banking	Canada	Sr. Director, Process Automation & Optimization Vice President, Process Automation	2
6	Telecommunications	The Netherlands	Group SVP - Operations	1

(*continued*)

Table 1. (*continued*)

S. No.	Industry	Location	Position	No. of participants
7	Banking	UK	Director - IT	1
8	Insurance	USA	Group Head of AI	1
9	Research	UK	Advisory Board Member, Google	1
10	Airlines	USA	Director, Supply Chain Management	1
11	Pharmaceuticals	Sweden	Strategic Development Manager	1
12	Consulting	Spain	Head of Strategy Development	1

The purpose of the in-depth interviews was to seek answers to the following 16 questions:

1. Does your company use Robotic Process Automation (RPA), and if so, for what processes?
2. Have you heard about automation of knowledge-based Expertise Services?
3. Is your company looking to further automate your processes related to Expertise Services?
4. What is your definition of Expertise Services?
5. What are the key success factors for delivering Expertise Services in your Company?
6. How would you describe the value proposition of Expertise Services within your company?
7. Do you see any value in automating knowledge-driven processes (Expertise Services) and if yes, which ones, and what do you expect would be the qualitative incremental value?
8. What business processes are currently being automated in your company?
9. What technologies are currently in use to automate your business processes?
10. Have you heard about Software Bots for automating business processes and if yes, what is your definition of Software Bots?
11. What knowledge-driven processes are candidates for automation using Software Bots?
12. Are you familiar with Cognitive Automation (CA) technology and if yes, what cognitive tasks are included in your internal and external knowledge-driven processes?
13. What are the challenges you've encountered in adopting a strategy for automating knowledge-driven processes using Software Bots?
14. Our research indicates that Robotic Process Automation (RPA) is being used to automate transactional services and that automation of knowledge-driven Expertise Services can also be leveraged using Software Bots. Do you agree?

15. As part of our research, we will be providing data necessary for executives to build a business case for adopting a strategy for automation of knowledge-driven processes. Are your executives open to exploring the business case for automating knowledge-based processes?
16. Knowledge-Based Services are being automated by some companies to increase effectiveness of knowledge-driven processes using Software Bots. In your opinion, what other process automation approaches will be helpful for further value creation in delivering knowledge-driven Expertise Services?

The answers to the questions were summarized and analyzed to develop insights about the trend towards automation of Knowledge-Based Shared Services and Centers of Expertise.

3.2 Process Classification Framework (PCF)

Processes lie at the heart of everything that an organization does to maintain its existence and grow. Most processes involve knowledge to some degree. Improving organizational efficiency and effectiveness inevitably involves process improvements.

APQC's Process Classification Framework (PCF) provides a list of processes that organizations can use to define work processes comprehensively and without redundancies. Beyond being just a list, PCF serves as a tool to support benchmarking, manage content, and perform other important process management activities. APQC's PCF is the most widely used process framework in the world and it creates a common language for organizations to communicate and define work processes. Organizations are using it to support benchmarking and perform other performance management activities. APQC's PCF is a taxonomy of business processes that allows organizations to objectively track and compare their performance internally and externally with organizations from any industry. It also forms the basis for a variety of projects related to business processes [12].

APQC's PCF was developed in the early 1990s by APQC and a group of members from a number of industries and countries throughout the world. Originally envisioned as a tool to aid in performance improvement projects, the framework evolved into the broad taxonomy that it is today. Organizations can use the PCF's common terminology to name, organize, and map their processes. It is also helpful as a tool for explaining a business in terms of horizontal processes rather than vertical functions. AQPC's PCF is designed as a framework and global standard to be customized for use in any organization. Thus, the PCF does not list all processes within a specific organization, and every process listed in the framework does not exist in all organizations.

3.3 Case Studies

Three case studies were developed for companies who have automated Expertise Services using technology-based solutions. These are presented below.

Case#1: Company Industry: Information Technology
According to a study by IDC, "The High Cost of not finding Information", the average knowledge worker spends up to 2.5 h per day searching for or gathering information or

data. This includes searches, email queries and other related tasks that all result in a massive amount of time spent trying to find information that already exists. Lucy, by Equals3, offers the next evolution of search, 'reading' through disparate sets of data to find the answer to a specific question posed in natural language. The Expertise Service Automated concerns Market Research.

Business Problems

- Time-consuming to find right information and expensive given resource allocation.
- In many agencies and enterprises, data is locked in silos, either based on access to data or the specialization of resources. Further, businesses invest significantly in data resources that ultimately are poorly used. Too often, important data is not in the hands of the people that need it, as a result they either recreate it, ignore it or waste time trying to procure it through internal channels.
- A global advertising agency experienced this as its employees were spending an inordinate amount of time doing market research, for everything from educating themselves on a competitive market landscape to optimizing audience targeting for a specific campaign.
- The corpus of research included many disparate sources including, the employee's emails, tweets, licensed databases, industry publications and the Internet. Thus, the effort was not only time-consuming, but often incomplete in that only the easiest corpora were searched and read for relevant data.

Solution

- Equals3's Lucy, is an artificially intelligent enterprise solution that can answer questions from all sources of data that she has been integrated with and/or ingested. This means that any team member can ask questions about website analytics, social data, 3rd party research, find information in files, access databases - all through one login and one natural language interface.
- Lucy is trained using IBM Watson's Natural Language Understanding services against the terabytes of unstructured data to analyze text and extract metadata from content such as concepts, entities, keywords, categories, relations and semantic relationships. With internal proprietary services, it integrates and trains external data APIs to be used to answer questions as well. Together, Lucy uncovers insights from unstructured and structured data.
- As artificial intelligence is a shift from deterministic to probabilistic output, Lucy also delivers a confidence interval with each answer. Lucy leverages the confidence interval to get smarter by training on actions when the top answer has a low confidence interval.
- Lucy saved the global agency hundreds of hours of research time on just one account. In just one year, on one account Lucy saved the client 320 h on data collection and mapping, 84 h on basic research question (e.g. how many restaurants are there in NYC), and 720 h on brand specific questions (e.g. how many BMWs were manufactured in the US in 2017).

Benefits

- Enables fewer researchers
- Captures quality research
- Unlocks data in multiple silos
- Savings of $10s of thousands per headcount
- Reduces preliminary research by as much as fifteen times

Case study #2: Company Industry: Professional Services
A large services firm leveraged an automation solution built by Rage Frameworks (recently acquired by Genpact), to cull out more relevant sales lead, as compared to the previous system of manual analysis. Expertise Service Automated: Sales Lead Generation

Business Problems

- The greatest bottleneck hampering growth was lack of visibility into new market opportunities.
- Without timely insights into new opportunities, the company could not align its competitive service offerings with potential sales leads as they arose.

Solution

- Rage Frameworks posited that the problem they faced required understanding the multiple triggers that made for a high value sales lead. If these triggers could be determined and correlated, lead identification could then be automated.
- Rage Frameworks began by acquiring a mass of data that may be indicative of a lead e.g. social media accounts, trade publications, financial statements, news, job postings, and internal CRM data. Following the aggregation of this data, they leveraged their suite of AI tools (Real-Time Intelligence Platform of composable services) to 'read' and analyze the internal and external data. Primarily, natural language services were leveraged and correlated to structured historical data of converted leads.
- The result was immediate. The automated solution discovered two hundred times more high value sales leads in comparison to the manual analysis the company was utilizing. In addition, the ability to rapidly analyze structured and unstructured content offered the company ideas on how to personalize their sales pitch and their future market appetite for new solutions. The professional services company is now leveraging the automation delivered by Rage Frameworks as Intel contributing to sales, product development and market analysis, thereby reassigning labor to more productive tasks.
- Rage Frameworks found that the most important factor to finding high-confidence leads for the client was due to external data, specifically job changes at the lead as well as M&A activity surrounding the target company. The manual process employed before automation did not take these data points into account.

Benefits

- Almost immediately, the automated solution delivered two hundred times more relevant sales leads as compared to the previous system's manual analysis
- The system now also automatically interprets new content to provide instant sales triggers in real-time to ensure sales teams respond quickly to new market opportunities.
- Being able to quickly analyze structured and unstructured content has yielded new ideas for clients and has enabled the predicting of future market appetite for new solutions
- The professional services company can now build product offerings in anticipation of future demand, ahead of market trends enabling capitalization on opportunities.

Case Study #3: Company Industry: Hospitality

The company is a Santa Monica, California, USA based startup that provides an intelligent texting platform for hotels. Founded in 2011, it was built with IBM Watson tools and serves approximately 10 million guests annually through their clients. The Expertise Service Automated is: Customer Service

Business Problems

- Digital disruption and rising competition continues to alter multiple aspects of the hotel industry. For example, hotels are increasingly pressured to control labor costs. From housekeeping to catering to guest services, hotel management is a services business dependent on labor. Thereby, when hotels attempt to cut back on staffing, there is a direct effect on guest experience.
- Given the increased transparency and decision-driving power of guest reviews in social media, along with a new class of competitors (e.g. Airbnb), the correlation of customer satisfaction to revenue has grown significantly.
- Finally, the mobile-first millennial customer base now has expectations of instant response. There is a need to find an innovative way to help hotels improve customer service and satisfaction levels and to automate responses to common guest questions and better anticipate customer needs.
- These intersecting trends put incredible pressure on the very labor force that hotel management is seeking to reduce, particularly guest services. In fact, guest services are the first call for a barrage of frequently asked questions:
  - How do I get on Wi-Fi?
  - Can you send up some fresh towels?
  - What time does the gym close?
  - When is checkout?

These questions take time, and often the busy concierge behind the front desk is forced to put the guest on hold, to check-in the next guest or answer another guest's frequently asked questions.

Solution

It was recognized that the aforementioned pressures within the changing hotel industry required a mobile-first solution to instantly meet guest needs without incremental labor cost. The company found that with text messaging as a universally adopted platform, they could reduce hotel front desk pressures while also meeting guest needs instantly. The company built a virtual concierge service known as Ivy. Ivy answers guests' questions or triggers request through text message. They leveraged the natural language processing (NLP) services offered by IBM Watson to automatically recognize and classify queries as well as respond instantly with answers or actions. Moreover, Watson 'taught' Ivy to detect tone of messages, so if a guest was unhappy, the request could be automatically escalated to a human to speed resolution. The solution is:

- Technology to power a text-based hotel concierge service
- Cloud-based, the company took advantage of application programming interfaces (APIs) and the cloud for its back-end systems so that it can focus on its core competency: customer experience

Benefits

- Guests now engage 10 times more with the new cloud-based service than they do with any other hotel communication channel, leading to improved customer satisfaction levels and reduced problem resolution times

4 Results

The majority of the persons interviewed have been using RPA for automating transactional processes and are looking for solutions to automate their expertise-based processes including decision making based on analysis and judgments. Key success factors for automating Expertise Services include:

- Time saved
- Deep experience and rich knowledge in the function
- Good sense of customer service and responsibility
- Correct root cause analysis

Based on the analysis of data collected, key results are summarized in this section.

4.1 Respondents' Definition of Expertise Services

Literature review and respondents' sentiments can be summarized that Expertise Services are professional services, referring to an organization or individual, requiring professional knowledge and expertise in certain applications, according to customer needs and requirements. Respondents also said that Expertise Services provide advice and help on any domain specific questions, issues and strategic plans. For example, "our HR mobility team has to deal with immigration rules/regulations/options for our 10,000+ employees when they have to travel anywhere in 100+ countries for short

term and long term. An expert can be a system/chat bot that can process thousands of immigration related documents and manage multiple websites, synthesize the information and provide specific answers to the questions on behalf of the HR mobility team".

As per the respondents, Expertise Services are classified as "Core Competitive" and "Core Differentiating" Processes which can be automated using Cognitive Automation. The focus of Core Competitive Services is on transformation and efficiency whereas the focus of Core Differentiating Services is on innovation. These Expertise Services are different from Transactional Services which are classified as "Non-Core Processes" which are being automated using Robotic Process Automation (RPA).

Further, Expertise Services provide customers with specialized services in fields where a high level of speciality knowledge is required and in some if not most instances technology content is high. The focus on automation of Expertise Services will continue to be a huge focus in the Shared Services and COE arenas.

4.2 Cognitive Tasks Identified Across the Shared Services Function

Based on our research, in Shared Services, skill-based design organizational structures group services require similar skill sets (competencies) from service providers. The respondents said that the top-recognized cognitive tasks inherent during the delivery of these skill-based Expertise Services are:

- Brokering (procurement, vendor relations and third-party management)
- Business Advice & Counsel
- Communications & External Affairs
- Working capital Management
- Education and Training
- Management Decision Support
- Customer Service
- Research
- Project Management
- Risk Management

Respondents also agreed that leveraging these "like" skill sets across several provided services will create service provider specialists rather than generalists, resulting in individual efficiency and expert delivery, which in turn contributes to overall customer satisfaction.

4.3 Knowledge-Based Processes (Workflows) Currently Being Automated

Based on our research, in addition to automated receipt processes, automated calculation of declaration and payment of VAT etc., legal advice, immigration advice and controlled research, are currently being automated or are being considered for automation within the next two years (see Table 2).

Table 2. Knowledge - based processes: candidates for automation

Finance function	HR function	IT function
Financial systems development & support Portfolio investment management Tax research, planning and advice Financial planning, budgeting and reporting Financial risk management Funding services Financial analysis Decision support	Recruitment consulting HR advice Expatriation services Supplier management Process management HR information systems support Benefits design Complaint handling	Applications development IT strategy development Vendor management IT research and innovation

4.4 Knowledge-Driven Processes that Are Candidates for Automation

Table 3, created from APQC's Process Classification Framework, provides the potential scope of automation of Expertise Services and Activities in Finance, HR, IT, Supply and Marketing functions.

Table 3. Scope of automation of expertise services

Function	Expertise services (based on AQPC's process classification framework)
Finance	Perform planning/budgeting/forecasting Perform cost accounting and control Evaluate and manage financial performance Manage policies and procedures Perform capital planning and project approval Manage treasury policies and procedures Manage debt and investment Manage financial fraud/dispute cases Establish internal controls, policies, and procedures Operate controls and monitor compliance with internal controls policies procedures Develop tax strategy and plan Perform cost accounting and control
HR	Develop human resources strategy Develop and implement workforce strategy and policies Monitor and update strategy, plans, and policies Develop competency management models Manage employee performance Manage employee development Develop and train employees Manage labor relations Manage collective bargaining process Manage labor management partnerships Manage employee grievances Develop and manage reward, recognition, and motivation programs

(*continued*)

Table 3. (*continued*)

Function	Expertise services (based on AQPC's process classification framework)
IT	Develop the enterprise IT strategy Define the enterprise architecture Manage the IT portfolio Perform IT research and innovation Evaluate and communicate IT business value and performance Develop IT services and solutions strategy Perform demand-side management (DSM) for IT services Market IT services and solutions Establish information security, privacy, and data protection strategies and levels Develop information and content management strategies Develop the IT development strategy Develop the IT deployment strategy Plan and implement changes
Supply	Develop production and materials strategies Manage demand for products and services Establish distribution planning constraints Review distribution planning policies Develop quality standards and procedures Develop sourcing strategies Perform quality testing Provide logistics governance
Marketing	Perform customer and market intelligence analysis Evaluate and prioritize market opportunities Develop marketing strategy Define pricing strategy Define and manage channel strategy Develop marketing communication strategy Design and manage customer loyalty program Establish goals, objectives, and metrics for products/services by channel/segment Establish marketing budgets Develop and manage pricing Develop and manage promotional activities Analyze and respond to customer insight Develop and manage packaging strategy Manage product marketing content Develop sales forecast Develop sales partner/alliance relationships Establish overall sales budgets Establish sales goals and measures Establish customer management measures Manage leads/opportunities Develop and manage sales proposals, bids, and quotes Manage sales partners and alliances

4.5 Business Value of Automation of Knowledge-Based Expertise Services

The respondents identified the perceived/actual benefits of automating Expertise Services. The value is created at three levels:

1. An expert, AI enabled system is as good, if not better, than what a human can deliver, but costs way less.
2. Scaling an expert system comes at near zero additional cost whereas adding another single human doubles the cost.
3. The expert, AI enabled system can be improved over time and it can be tracked objectively whereas for humans it will be difficult because an employee can exit the organization anytime and a new employee comes with a different expertise level.

The amount of time saved in decision making process and the accuracy of the outcome. One specific respondent's response, paraphrased, reads in part: "Our company cultivates energy and chemical industry, with independent intellectual property rights of crude oil, refined oil, chemicals and other logistics management solutions and an intelligent pipeline software suite of products. We have started automation of Knowledge-Based Services and we can now provide customers with multifaceted large data analysis services and promote customer management and operational service innovation."

Using the value created by automating knowledge-based Expertise Services and the implementation cost of the automation tool, a business case can be easily developed to seek approval of the automation strategy.

4.6 Technologies Currently in Use to Automate Business Processes

Based on our research, RPA is being and has been used fairly predominantly for the past several years to automate primarily transactional-based business processes. Software Bots are being used as an expert system to synthesize information from multiple sources and provide answers to specific questions from users. The largest use of bots is in web-spidering (web crawling), in which an automated script fetches, analyzes and files information from web servers at many times the speed of a human. Literature review suggests that more than half of all web traffic is made up of Software Bots.

Based on our research, the tools and technologies currently in use to automate knowledge-based processes include:

- Artificial Intelligence (AI)
- Intelligent Automation (IA)
- Cognitive Automation (CA) tools

A cognitive robot is an autonomous robot that is capable of inference, perception, and learning based on the imperative, autonomic, and cognitive intelligence levels. The representation and modeling of cognitive robots can be carried out by their architectures and behaviors. It is a framework of a cognitive robot that represents the overall structure, components, and their interrelations and a set of intelligent functions and their interactions with the architecture of the cognitive robots [13].

5 Conclusions and Future Research

5.1 Conclusions

The results of this research clearly indicate that automation of knowledge-based processes and Expertise Services is a recent phenomenon. The automation of knowledge-based processes is here to stay and companies are starting to dip their toes into the cognitive system systems space. The adoption rate for automation technologies in Europe and North America is higher than other countries. In this paper, we have indicated both possibilities and limitations of what automation of Knowledge-Based Services can do in the arena of Shared Services and Centers of expertise. What this means is that in future years, we will see much more transformation in the nature of Shared Services work. It is difficult to assess the impact of automation of Knowledge-Based Services on jobs but as automation into Expertise Services continues, fewer people will be needed in these job categories. A backlash from employees is expected due to increased adoption of Intelligent Automation (IA) and further, Cognitive Automation (CA). With this emergence, new job categories will emerge, and the employees will begin understanding the economics of service delivery and the opportunities to work in higher decision-making environments.

Our research also shows that before a company can begin automating Knowledge-Based Processes the organization must:

- Create Leadership buy-in
- Establish a common understanding of "What is Automation?"
- Leverage existing expertise
- Pilot a strategically selected first process

5.2 Future Research

This research paper introduces the concept of automation of Knowledge-Based Expertise Services and offers the value proposition of automating Expertise Services in Shared Services and Centers of Expertise. The findings and analysis presented here will assist more companies to adopt a strategy to automate knowledge-based processes. Future research is required in the areas of service automation providers and service automation tools. Specifically, future research should focus on answering the following questions:

1. Which service provider organizations are providing services for automation of Knowledge-Based Shared Services?
2. What service automation tools e.g. cognitive automation tools are available for automating Knowledge-Based Shared Services?
3. What industries are adopting the service automation strategy to automate their Expertise Services and what implementation approaches have proven to be effective?

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