A New Solution to Synchronizing Government Acquisition Strategy and Schedule

Analyzing the Impact of Automations in the Workplace Through Actor-Network Theory

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By
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On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

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As their capabilities improve, computers are taking on greater roles in the workplace. Advances like artificial intelligence (AI) are seeing rapid adoption across businesses with a recent survey by global consulting firm McKinsey finding that almost half of respondents have begun trialing AI implementations, another thirty percent are adopting it and eighty percent of adopters report generating moderate to significant business value from applications like robotic process automation, computer vision, and machine learning (Chui & Malhotra, 2018).

AI advances are expected to benefit many fields, including government contracting. According to Kelly Horinek, a government contracting expert from MITRE, a federally funded research and development center, government contracting technology is severely outdated (personal communication, September 4, 2019). As a result, there is a need for a new, AI-enabled technology tool to assist new contracting officers in learning the highly complex and lengthy process and to aid them in making decisions during that process.

The objective of the technical team is to create such a tool in cooperation with MITRE, which is sponsoring the project to simplify government contracting and make it more accessible. Working closely with Horinek, the team will determine the requirements for the tool and design an application to meet those requirements. In the process, the team will directly experience the challenges of implementing AI technology in a new work environment.

The tightly coupled STS research project will employ Actor-Network Theory (ANT) to analyze successes and failures of attempts to adopt RPA in the workplace. While ANT has not been applied to this specific technology, previous work has already applied ANT towards the analysis of other cases of technology adoption, particularly the building of electricity-generating windmills in France (Jolivet & Heiskanen, 2010) and the adoption of mobile phone networks in developing countries (McBride, 2003). Due to the mix of social and technical challenges to the adoption of RPA, ANT promises to provide a richer understanding of these challenges by, "giving an enriched view of the 'process' of the creation of a new technological artifact" (Jolivet & Heiskanen, 2010, p. 3).

NEW TOOLS FOR GOVERNMENT CONTRACTING

Frequently, when the federal government finds that it lacks the capabilities or manpower to do something, it outsources to a contractor. This is one of the most significant annual expenditures by the federal government. In 2018 alone, about $550 billion dollars awarded to various contractors, with the money goes to acquire everything from satellites to bridges ("Federal government contracting for Fiscal Year 2018", 2019).

As so much money is distributed every year, the potential for misuse of funds is high and so there is a "rigid purchasing structure that tries to contain the [misuse]" (Keeney, 2007, p. 12). Finding the right contractor for each contract is difficult and lengthy, requiring skill from the contracting officers tasked with managing the process. In the *Contract Management Body of Knowledge* (CMBOK), the authoritative guide to contract management published by the National Contract Management Association, there are twenty-three significant steps required to award a contract.

Once the government decides on an acquisition, market research must be conducted by contracting officers to understand the domain area and to generate an initial Request for Proposals (RFP) document to distribute among potential contractors. After interested contractors have responded to the RFP, making initial proposals and cost estimates, contracting officers determine an acceptable price range for the contract and engage in detailed negotiations with contractors within that price range. Revised proposals are submitted as the field of competitors is winnowed down before the winning contractor is awarded the final contract (*Contract management body of knowledge*, 2017).

This is an extremely complex process requiring a variety of experts on each contracting officer's team (*Contract management body of knowledge*, 2017). These teams exist on an ad-hoc basis, lasting only for the duration of the project and depending on the specific contract, different subject matter experts are needed. While keeping the team well-coordinated in such situations is critical (Faraj & Sproull, 2000), it is difficult, due to the contracting officer not having operational authority over any of their team members, who frequently divide their time on other projects (K. Horinek, personal communication, September 4, 2019). As a result, it is very difficult for contracting officers to motivate their team to produce quality deliverables on time.

Exacerbating all of these problems is the lack of technology tools to support the process. IT infrastructure across the federal government is frequently outdated (Government Accountability Office, 2016) and acquisitions is no exception, with much of its technology "stuck in the 1980s" (K. Horinek, personal communication, September 4, 2019). Unintuitive and difficult to learn, current software also cannot share work across multiple users, leading many contracting officers to forgo its use entirely. Indeed, Horinek indicated, the lack of good technical tools to facilitate the acquisitions process and the complexity of the process overall has made acquisitions management extremely to difficult learn and the pipeline of contracting officers is shrinking as a result (personal communication, September 4, 2019). To ensure that the federal government will have expert contracting officers in the future, it is essential that a technical tool is developed to help train and support new contracting officers in the present.

The objective of the technical project team is to build a technical tool to help alleviate the challenges described above and support new contracting officers with their decisions and duties in the job in the form of a mobile phone application. The technical project team, advised by Professor Gregory Gerling of the Engineering Systems and Environment Department, is made up of Systems Engineers Amber Ecelbarger, Parker Hamlin, Shannon McGrath, Kelechi Nwanevu, Nick Smith, Agni Stavrinaky, and myself.

The app will aid new contracting officers by providing a high-level view for managing the RFP writing process, assisting officers in finding the right experts for their team, and building in opportunities for MITRE's AI capabilities to make recommendations at key points in the process. Given that the target audience, newer contracting officers between the ages of 20-30, the app must also be approachable and engaging to use by employing gamification.

In addition, there are also several factors to consider. First, as a decision support system which will aid inexperienced contracting officers, the information and guidance required from the app will vary by the particular work environment as well as the time constraints of the project (Huber, 1981). The technical team will carefully consider the work environment for contracting officers based on the information provided by MITRE and factor that into the design accordingly.

Additionally, if an app is improperly designed, introducing it into a workplace may do more harm than good. In hospitals, upon the introduction of a computer system meant to streamline the data entry process, many employees reported increased workloads due to the extra time required to log information into the system as well and needing to check with the system once it was in place, adversely affecting the overall efficiency of the hospital (Ash et al., 2007).

In designing this particular contracting app, the technical team must be aware of these pitfalls and ensure that the app is easy to update and quick to check.

Since the start of the technical project in September, the team has been meeting with MITRE to understand the domain area and the requirements for the app. Beginning in October, the team began ideating solutions to the various challenges facing contracting officers and producing prototype wire frames for the app. The first wireframe, a concept for presenting the overall status of the RFP writing process is shown in Figure 1. Based on feedback from MITRE, the concepts and wireframes will be iterated on, with the goal of producing a final wireframe by the end of the semester. In the spring, user testing will be conducted using the final wireframe to validate the usability of the app and determine the effectiveness in meeting its objectives.

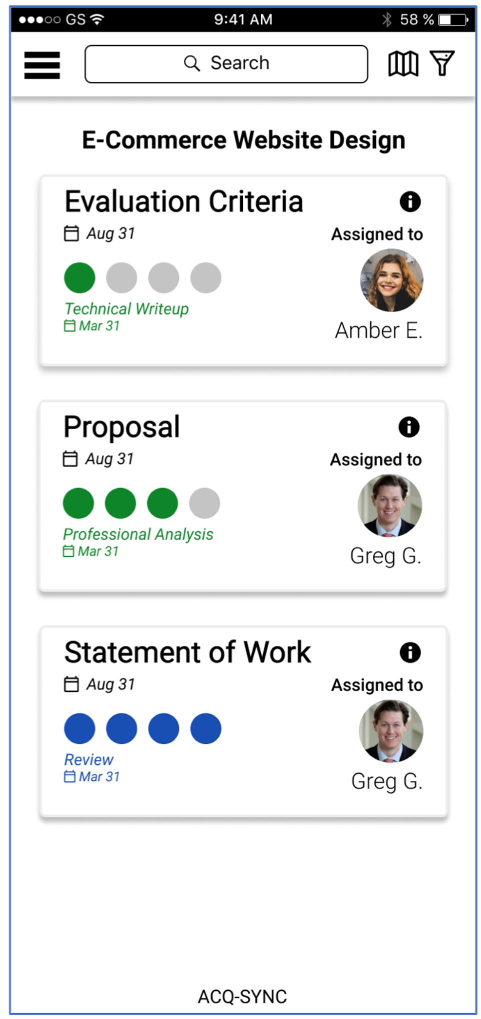

Figure 1: Initial mockup: An early mockup of the management feature of the proposed application (Created by Xu, 2019).

Once the user testing is completed on the final wireframe and the necessary adjustments have been made to the wireframe, it will be turned over to MITRE to be implemented as an actual app for release. The app will then be made available to new contracting officers, where it will aid them in learning the job more effectively than before and producing higher quality RFPs. The technical team will write a conference paper to present its work and the lessons learned on the design of decision support systems and introducing new technology tools in the workplace.

CHALLENGES IMPLEMENTING ROBOTIC PROCESS AUTOMATION

With the continuing development of computers and related technologies, what is possible with automation has expanded dramatically. Businesses have been quick to take action, with Walmart's robot janitors in its stores just one example of the rapid adoption of automation (Harwell, 2019). The number of companies adopting automation technologies is only expected to increase in the future.

This trend has not escaped attention, with fears that this new wave of automation will permanently displace increasingly large segments of the workforce. A recent *Washington Post* article claimed that such an event was only waiting for the next recession, at which point the cheaper computer alternatives to human labor would be too tempting to ignore (Dam, 2019).

Experts have disagreed, with one recent Deloitte study mentioning such job losses are expected to be offset by the creation of new jobs. In addition, a case study from the London School of Economics found that automation, rather than being used to reduce the number of workers, was being used to increase the overall productivity of the business (Willcocks, Lacity, & Craig, 2015, p. 7). This example is borne out by historical evidence, with many previous advances being used to augment, rather than replace workers (Nye, 2006). Overall, fears that the current generation of automations will put humans out of a job appear to be misplaced.

There are however, more real challenges to the introduction of new automations into workplaces. Nye, a historian of technology, has described how during the Industrial Revolution, the assembly line altered the fundamental social nature of the work. Work became more tedious and workers faced greater pressure to conform (2006). These trends are occurring, with employees working with the Walmart robot janitors mentioned previously reporting their work is more tedious and less satisfying because their work now revolves around maintaining the robot janitor. This trend will likely continue in workplaces of the future, especially as automations become more prevalent in them.

Robotic process automation (RPA) is one of the first automations to find great use in the workplace. As seen in Figure 2, RPA is functionally equivalent to a humanoid robot sitting at a computer doing what a worker would once do. Because of RPA's ability to replace workers at various tasks by interacting directly with a computer as a human would, without other mediating technologies, the time required to implement RPA is relatively low, making it an attractive choice for implementing automations. Once implemented, RPA can deliver, "much lower costs while improving service quality, increasing compliance, and decreasing delivery time" (Willcocks et al., 2015, p. 4).

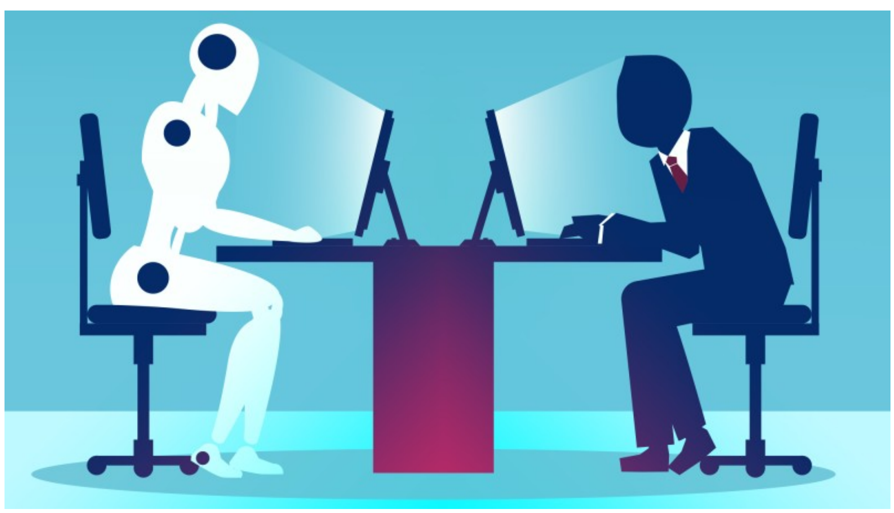

Figure 2: Illustration of Robotic Process Automation. The automation does what the human would do at the computer (Gillman, 2019).

However, there are a number of challenges resulting from the implementation of RPA in the workplace. In many cases, RPA is insufficiently understood and a subpar automation is produced (Lamberton, 2016). In others, the supporting structure technical structure is not put into place for RPA to be truly successful. Many issues arise with workplace stakeholders when implementing RPA. Senior leadership may be insufficiently engaged with the project, reducing the odds of success. Workers themselves may be uncooperative, mistakenly fearing for their jobs, which is exacerbated in many situations by a failure to properly communicate how job roles will change due to the introduction of RPA (Bovaird, Kundu, Moir, Sanmuganathan, & Turk, 2017). The issues span the spectrum of the social and the technical.

The STS topic will explore attempts to implement AI technologies, particularly Robotic Process Automation (RPA), in the workplace and the challenges those attempts encountered. Actor-Network Theory (ANT) will be used to analyze the challenges in AI adoption to determine if ANT provides a richer, more accurate understanding of the RPA implementation process.

Work will start from the linear Actor-Network model of the handoff process for RPA, which can be seen in Figure 3. The model captures the actors and actants at each step of the

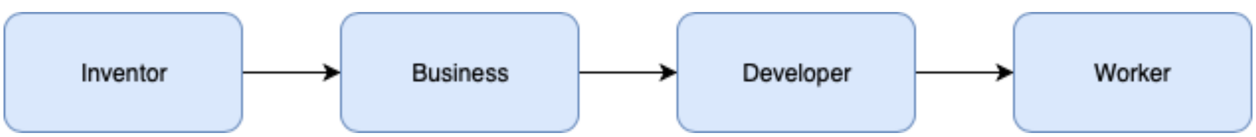

Figure 3: Handoff model: Linear Actor-Network handoff model for RPA adoption (Adapted by Daniel Xu from W. Carlson, 2019)

RPA handoff, from its inventors to the business that adopt it, the software developers that implement it, and the workers that work alongside it. Research will be done to understand each of the handoffs, and actor network at each step. Parallels will be drawn from previous introductions of automation technologies. These parallels may be from the past, as in Nye's description of the adoption of the assembly line (Nye, 2006), or more direct, as with one recent case study on a successful implementation of RPA in a technology company (Willcocks et al., 2015). The ANT network model for RPA workplace adoption will derive from the final handoff model.

Figure 4 displays the current ANT model, based primarily on the handoff in Figure 3 between the business and developer as well as the handoff between the developer and worker. The key actors and actants are drawn from the previous works and the business actor is decomposed into two actors, business executives and people managers, to represent the differing high level and low-level priorities a business would have.

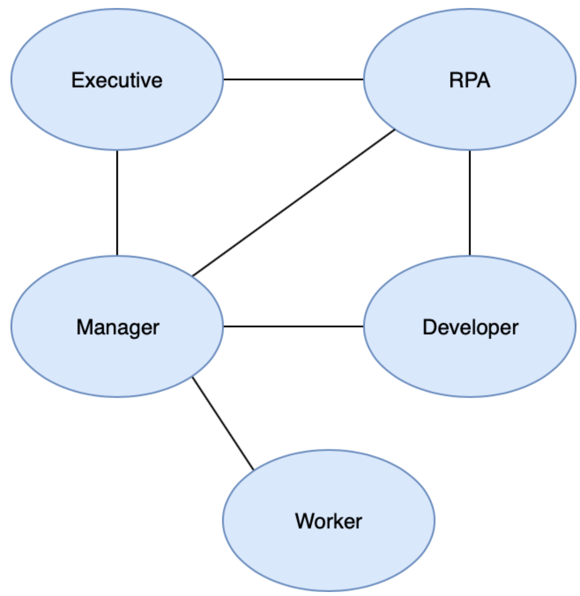

Figure 4: Actor-Network model: Actor-Network model for RPA adoption (Created by Xu, 2019)

The ANT model will be refined using current studies on RPA adoption and previous works applying ANT to analyze technology adoption. The current ANT model highlights the missing link between the developers implementing RPA and the workers who will work with it, reflecting what has been found to be a key reason behind unsuccessful RPA adoptions (Bovaird et al., 2017, p. 8). In parallel, previous work employing ANT to analyze adoption of other technologies will be explored further. One ANT analysis found the alignment of actors in the network is critical for adoption of the phone networks under study(McBride, 2003). This finding is transferable to other technology adoptions, including of RPA, and findings from other ANT analyses of technology adoptions will be investigated and applied to the current ANT model for RPA. Once the ANT model has been fully fleshed out, it will provide a new tool in understanding, and aiding, the implementation of RPA by illuminating the challenges in its full sociotechnical context.

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