Application Readiness Exploratory Study:

Investigating Application Quality at the USPTO

An Interactive Qualifying Project for the United States Patent and Trademark Office

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ABSTRACT

The goal of the United States Patent and Trademark Office's (USPTO) Office of Patent and Quality Assurance (OPQA) is to ensure that all patent applications are fairly and accurately examined. The OPQA has begun an initiative to analyze the impact that an application's readiness has on its examination. To help with this initiative, this project developed an Application Readiness Review Form (ARRF) to assess the readiness of a sample of 600 patent applications. The resulting dataset was compared to Integrated Quality System (IQS) metrics, including the types of rejections received and whether those rejections were applied correctly. The result of this analysis will enable the USPTO to continue advancements in the study of Application Readiness, with the goal of making specific improvements in the examinability of applications and increasing the efficiency of USPTO examiners.

EXECUTIVE SUMMARY

The United States Patent and Trademark Office (USPTO) is always working to improve the efficiency and efficacy of its operation. The USPTO recently began investigating for the presence of a link between the quality of an incoming application and a patent examiner's ability to quickly and correctly complete an examination.

To create a foundation for this objective, USPTO's Office of Patent Quality Assurance (OPQA) conducted an examiner perception survey. OPQA held focus groups of Supervisory Patent Examiners (SPE) to identify attributes of an application that may have an impact on their ability to examine an application. The resulting traits came to be known as The 29 Attributes of Application Readiness. OPQA surveyed 1500 patent examiners to determine ratings for how often the examiners experienced a given attribute, and how impactful the attribute is for examination. OPQA then performed a gap analysis on these examiner perceptions to identify attributes that were not provided on applications as frequently as examiners felt necessary.

Specifications	S1	"Background of the Invention" section that provides an overview of the technology and related art
	S2	Inventive concept clearly set forth
	S3	Difference between the invention and the prior art clearly described
	S4	Concise and complete "Brief Description of the Drawings" section
	S5	Specification clearly describe the referenced features in the drawings
	S6	Drawings show the inventive concept
	S7	"Detailed Description of the Invention" expand on the invention disclosed in the "Summary"
	S8	Preferred embodiments described in detail
	S9	Working examples present (mostly found in TC 1600 and 1700)
	S10	Working examples supporting scope of genus claims (mostly found in TC 1600 and 1700)
	S11	Definitions/guidance in the specification to aid in interpreting claim terms
	S12	Glossary of terms provided (separate section in the specification)
	S13	Clear boundaries defined when using exemplifications or inclusion of equivalents (1600/1700)
	S14	Clear terms and correct grammar and syntax
	S15	Specification that teaches the technology of the invention (reads well from a technology standpoint)
	S16	Providing a certified translation (if from a foreign applicant/entity)
Claims	C1	Claims that are clear and correct in syntax and grammar
	C2	Independent claims that capture the same inventive concept disclosed in specification
	C3	Claim terminology that is highly correlated with language disclosed in the specification
	C4	Claims that are solely directed to the inventive concept (not broader than the inventive concept)
	C5	Claims that are logically organized from broadest to narrowest in scope
	C6	Claims that clearly denote whether 112(f) is invoked or not
	C7	Claim sets drawn to a single statutory class of invention
	C8	Claims that have only one reasonable interpretation
	C9	Reasonable/manageable number of claims
IDS	I1	IDS that includes the significance/relevance of each citation to the inventive concept
	I2	All citations in IDS in English (translations are provided with submission)
	I3	Reasonable/manageable number of references cited in IDS
	I4	PCT Search Reports relevant to inventive concept/claims

Figure 1: Examiner Perception Survey Attributes, "The 29 Attributes"

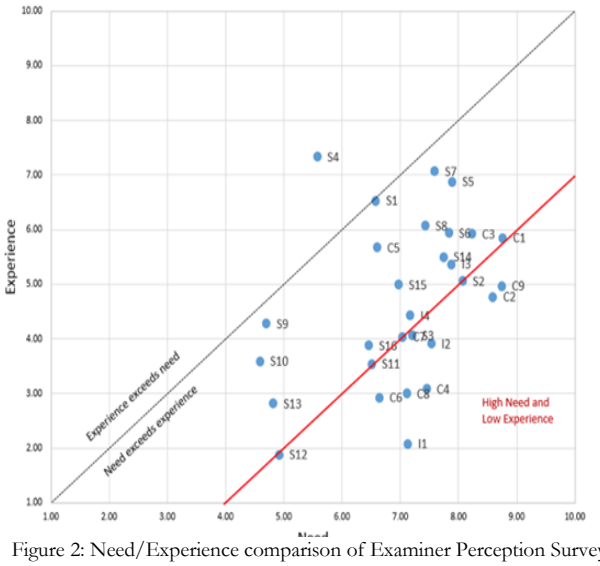


Figure 2: Need/Experience comparison of Examiner Perception Survey

Figures 1 and 2 display the perceived need and experience rates of attributes allowed OPQA to see which parts of an application examiners perceived as important. However, before instituting policies or changes, OPQA needed to confirm that the perceptions were valid with a study. In the past, OPQA has confirmed these kinds of results with a review process. OPQA has a team of reviewers that are capable of analyzing applications at any stage of the examination process and perform quality assessments. Their job is to review the decisions made by examiners and ensure high quality work. Accordingly, OPQA sought to utilize their skill in a review process to assess perception versus reality of Application Readiness. However, the examiner perception survey had not been developed with a review process in mind, and extrapolating to one was no simple task.

A review process was necessary to assess an individual application's readiness attributes, as the direct measurement of Application Readiness could be compared to quality-oriented examination data. This comparison would provide insight on Application Readiness's effect on

timeliness, correctness, and clarity of examinations. To accomplish these goals, our project's methodology was developed as follows:

1. Develop Variables for Assessing Application Readiness
2. Develop Application Readiness Review Form
3. Stakeholder and Expert Feedback
4. Develop Review Form Guidance
5. Administer Review Process
6. Data Analysis

Methodology and Findings

Application Readiness has been defined as the measurement of how well an application is composed to enable it to be effectively examined. The examiner perception survey set the foundation for our Application Readiness Exploratory Study, with the goal of determining whether the attributes identified by examiners impacted examination quality. The team identified which of the attributes were assessable within a reasonable amount of time, and derived questions to measure them. The review process needed to be quick and efficient to keep within the project's 7-week term. Additional questions were developed alongside that could add value to the study while not overburdening reviewers. The resulting set of the questions was implemented as the Application Readiness Review Form (ARRF). A snapshot of the form can be seen below, in Figure 3. The rest of the ARRF can be found in Appendix B.

Application Readiness Review Form (ARRF) **USPTO Office of Patent Quality Assurance**

Review Information	
Application Number:	Reviewer Name:
Date Completed:	

Rating Guide
[**1**: Very Poor] [**2**: Below Average] [**3**: Average] [**4**: Above Average] [**5**: Excellent] [**None**: Trait described is missing from application] [**N/A**: Not Applicable] [**Overburden**: Effectively determining rating would require excessive time and work]

Specification									
1.	Background of Invention provides overview of technology and related art	1	2	3	4	5	None	N/A	Overburden
2.	Difference between invention and prior art described	1	2	3	4	5	None	N/A	Overburden
3.	Application presents a problem that the invention is addressing	1	2	3	4	5	None	N/A	Overburden

Figure 3: ARRF Snapshot

For each question on the ARRF, a response scale was developed which allowed each to be rated despite their subjective natures. Two response types were used: a 5-point scale of *Very Poor* to *Exceptional*, which was centered around average, and *Yes* or *No*. A 5-point scale was chosen to enable a breadth of responses while still enabling quick reviews and a rigid answer space.

OPQA reviewers are veteran USPTO examiners and experts in their fields of technology, and their expertise was used to aid in the creation of the questions and perform the reviews themselves. A set of 600 patent applications that were reviewed in the 2017 fiscal year were chosen for the reviews. The sample was made to accurately represent the proportion of received applications by each Technology Center. A guidance sheet was developed alongside the ARRF to clarify ambiguities and define each question's response scale. Once the review documents were complete, the reviewers began data collection with the ARRF.

Reviewers completed their reviews and the resulting data from each was extracted for analysis. Before proper analysis could be completed, the data had to be cleaned for various reasons. Some reviews contained small problems such as misspelled names, missing ratings, empty applications, and other minor mistakes that could have caused analysis errors. The resulting metrics of Application Readiness were compared to rejection types and compliancy. Our intention was to assess the overall impact of application readiness as well as the impact of individual questions on rejections types and compliancy. To measure overall impact, applications were given a score based on their combined ARRF ratings. To measure the individual question impact, the rejection and compliancy rates of high-scoring applications were compared to those of low-scoring applications on a given question. Some results of these analyses are shown in Figures 4 and 5.

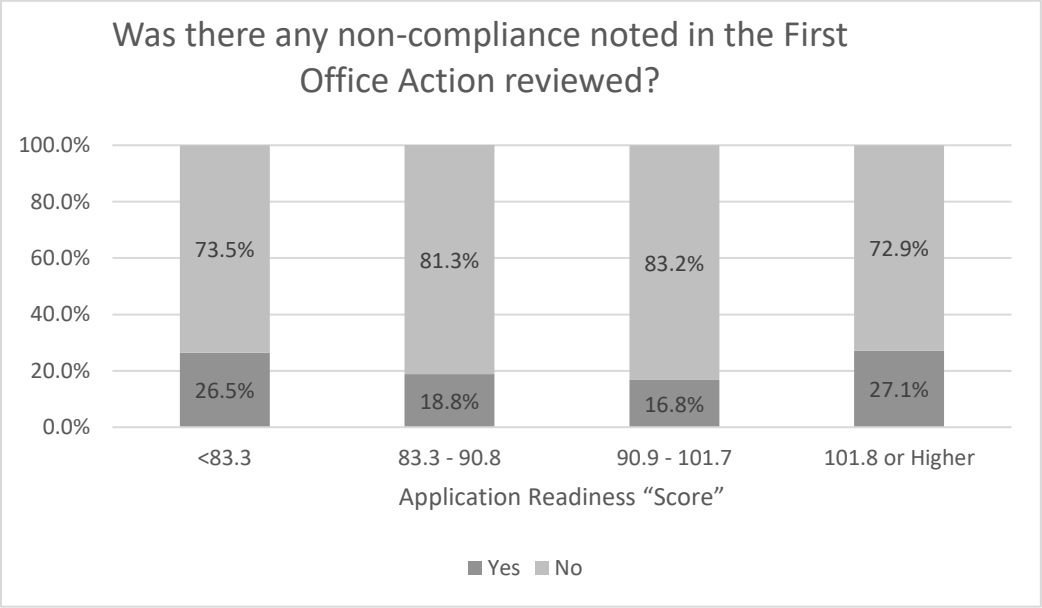


Figure 4: Bucket Comparison for Noted Non-Compliance

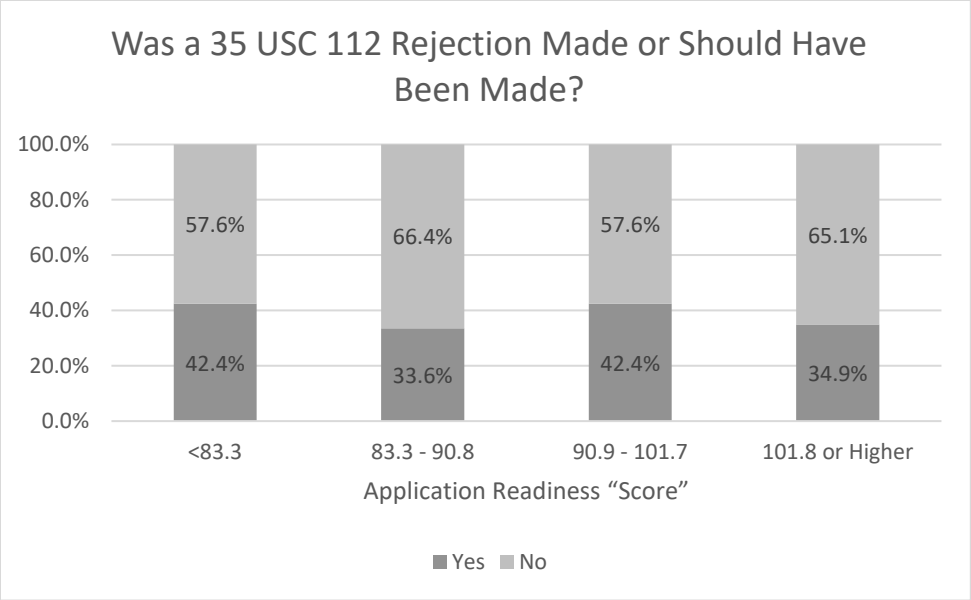


Figure 5: Bucket Comparison for 35 USC 112 Rejection

As seen in Figures 4 and 5, no statistically significant trends were observed from high to low scoring applications on rejection types or compliancy rates. This indicates that although Application Readiness may have a minor impact on these examination metrics, it is not the driving factor or examination success.

Because this is the first major study done on Application Readiness by a patent office, , the methodological process used to create and implement the review is as significant as the results and findings of the study itself. Our methods could be by the Patent Office to further explore Application Readiness's implication in the world of patents.

One other topic the team considered was reviewer and question variance. The team sought to determine the trend in the variance of reviewer ratings for each question by Technology Center.

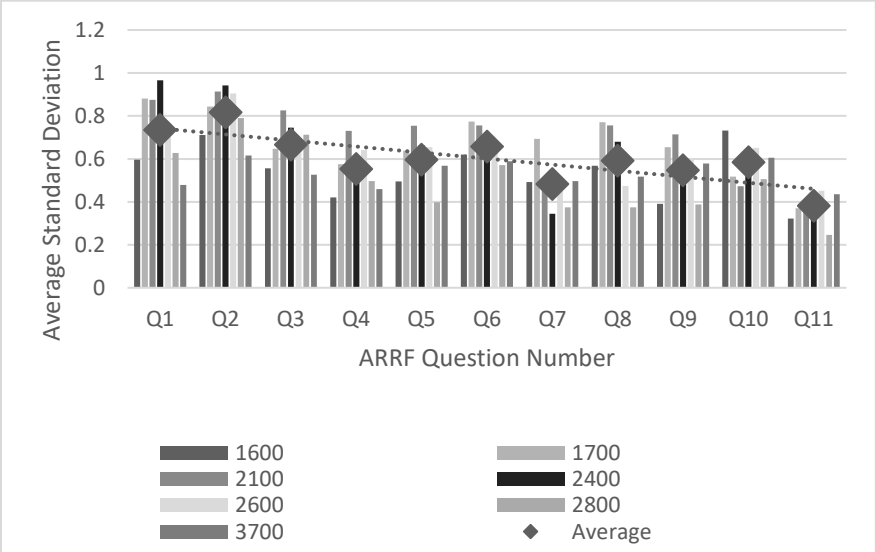


Figure 6: Standard Deviation of ARRF Specification Responses by Question

Figure 6 shows a steady decline in response variance chronologically across an ARRF review. This means that as a reviewer filled out a form, they were more likely to assign the same score on multiple applications. Whether this was due to the categorical ordering of question or a minor reduction in the reviewer's ability to be discerning over a single a review is unclear.

The project's findings provided a greater understanding of how to assess Application Readiness and its influence on examination quality. The methodology of this project will be used to inform future USPTO Application Readiness initiatives.

Recommendations

Based on our findings, we make the following recommendations to the USPTO:

1. To understand what influences different rejections, the Patent Office should perform a causal analysis by taking individual applications that received rejections and determining what contributed to or made the application vulnerable to a rejection of that type.
2. To explore Application Readiness's impact on the timeliness of an examination, the Patent Office should measure the amount of time an examiner worked on an application for the First Office Action. This Application Readiness study could be repeated with applications whose examination time is recorded to analyze timeliness impacts. Additionally, this method of tracking timeliness could aid future OPQA studies designed to examine timeliness.
3. In future similar studies, OPQA should use a small team of reviewers and get their feedback throughout the development of the review process. Having a team with expert knowledge of the review processes perform the studies would likely increase data validity. A smaller team makes it easier to ensure that all reviewers are assessing applications the same way.
4. We recommend that OPQA checks the datasets resulting from other studies for the presence of chronologically decreasing variance. If found, we recommend considering this while designing future studies to prevent chronological skewing.
5. To understand the influences on rejection compliancy, the Patent Office should perform a causal analysis by taking individual applications that received non-compliant Office Actions and determine what contributed to or made the application vulnerable to errors in examination.

1. INTRODUCTION

The United States Patent and Trademark Office (USPTO) provides critical protection for the intellectual property rights of inventors and innovators in America. In the last year alone, over 700,000 applications have been submitted to the USPTO to be examined (USPTO, 2017). This exponentially rising number of submitted applications pressures the office to continuously improve its application and examination processes to function as efficiently as possible. Patents provide inventors with the legal right to exclude competitors from using their intellectual property for a period of time. This economic protection incentivizes scientific innovation and is an integral facilitator of American technological development and economic success. This project was designed as part of the Office of Patent Quality Assurance's (OPQA) continuing efforts to improve the USPTO's ability to process applications and fulfill its purpose of properly granting patent protection.

A patent application is examined for three major aspects: patentability of the subject matter, claims defense, and a prior art review. According to the Manual of Patent Examining Procedure (MPEP), an invention can only be patented if it is not obvious to an expert in the field (MPEP, 2015). Examiners only review applications in their area of technological expertise. Only if the examiner believes that the intellectual information described in a patent application is new and original is it deemed patentable. This prevents patent holders from controlling basic pieces of knowledge. "Patent trolls" are individuals or groups who attempt to abuse the patent system to their advantage, by patenting very basic pieces of information and leveraging their patented information to sue others who utilize their overbroad claims. The Patent Office must ensure that an application cannot be used in this way before issuing a patent, so applicants must submit a defense of their claims. The Defense of Claims section of an application involves sufficiently backing up claims, using drawings and supporting materials (MPEP, 2015). If the information provided by the applicant in this section is well put together and complete, an examiner will be able to review the application faster and more effectively. In addition to reviewing the Defense of Claims, the examiner must assess prior patents, called art, to ensure that the application's claims are unique and do not infringe upon a prior patent. The efficiency of an examination depends directly on the quality of information provided by the applicant.

The OPQA is tasked with improving the efficiency of the patent application process. To further this goal, the Enhanced Patent Quality Initiative (EPQI) was created. The program is designed to improve the examination process by focusing on three "pillars": Excellence in Work Products, Excellence in Measuring Patent Quality, and Excellence in Customer Service (USPTO 2016). To achieve these goals, the programs created are broken into four main implementation areas: Data Analysis, Examiner Resources, Tools & Training, and Changes to Process/Product (USPTO, 2016). These pillars and implementation areas have helped to guide the OPQA's work over the past few years.

Some of this work has been assisted by other WPI IQP teams. These teams have worked with OPQA for the past 4 years, and have helped create implementation area solutions. To name a few, in 2014 a group worked on quality metric analysis, to determine which metrics for examination quality were sufficient, which were unnecessary, and which needed to be improved (Bennett et. al, 2014). Also, in 2016 students analyzed the Master Review Form (MRF) to assess its effectiveness and determine quality data reporting methods for its results. (McCarthy et. al, 2016)

These projects, along with most prior work and research on improving the examination process, have focused on the examiner's perspective (Rater, 2017). Various quality metrics have been developed to improve the examination process itself, but little work has been done on the applicant's side (Rater, 2017). This is true both in the United States and other worldwide corollary institutions. Now, the OPQA is looking to improve the input materials to the system to promote efficiency and reliability of examinations.

The goal of this project was to help the USPTO's Office of Patent Quality Assurance perform an Application Readiness Exploratory Study by creating a review process to quantify the impact of Application Readiness on patent examination quality. Effective methods of measuring Application Readiness were determined and implemented to study the relationship between Application Readiness and examination quality outcomes. The study's findings will allow the USPTO to continue exploring Application Readiness and its implications on the patent system.

2. BACKGROUND

In this chapter, we examine the patent application process, analyze known application problems, and explore previous solutions both in the USPTO and in industry.

2.1 Patents Overview

The purpose of this project is to help to improve the timeliness and quality of a patent application examination. To develop metrics and recommendations for the USPTO, an understanding of what a patent is and the patent application process is necessary. Applications are comprised of many pieces, each of which has different implications for an examination. Given that there are many areas of art which are patentable, an application in one field may differ in requirements and expectations from an application in another field.

2.1.1 What is a Patent?

A patent is the grant of a property right to its inventor, issued by the United States Patent and Trademark Office (USPTO, 2015). Patents exist to protect the intellectual property of inventors and entrepreneurs. A patent is, by definition, a license obtained from a government, which gives the sole right to make and/or control the sale of a particular invention (Merriam-Webster, 2017). A patent enables an inventor to manufacture and sell their product without concern for their intellectual property being infringed upon and sold by someone else. Patent protection incentivizes and promotes innovation of new technologies and products.

There are three types of patents that can be applied for at the patent office. Utility Patents are the most common kind and must fall entirely under the four statutory classes of invention: a process, a machine, an article of manufacture, or a composition of matter. Design Patents are granted to an applicant to protect a design or unique appearance of a manufactured entity. Plant Patent are granted for the "invention or asexual reproduction of new and distinct plant varieties." (FindLaw, 2017)

2.1.2 What does a Patent consist of?

A patent application can range from just a few to hundreds of pages. The limitations and scope of a patent are defined by its claims. These claims define the legal protections of a patent. All other required information enables the examiners to understand the purpose, scope, use and language of each set of claims. This enables the examiners to determine whether the invention is patentable. The claims define the legal scope of the subject matter protected by the patent.

A basic application can have up to three independent claims and a total of twenty claims altogether. An applicant can pay additional fees to include more claims in their application. The independent claims of a patent stand alone and are comprised of a preamble, connecting word, and a list of elements. Dependent claims further specify limitations of their broader independent claim (Brown & Michaels).

2.1.3 How are Patents used?

Patents grant an exclusive right to exclude others from making, using, offering for sale, or selling the invention in the United States (Inventor Resources 2011). The patent gives the owner the right to prevent others from commercially exploiting the patented invention, or to license the right

to produce and sell the invention to others for a licensing fee. Thus, the invention cannot be commercially made, distributed, imported or sold by others without the patent owner's consent (World Intellectual Property Organization). An important distinction to be made surrounding the rights of a patent, is that, although it allows the exclusion of others, it does not grant the patent holder the right to make, sell, or import the invention in the United States of America as the invention must abide by government regulations, laws, and customs.

If a patent is infringed upon, the patent holder can sue to prevent further infringement and receive an award for lost damages in a federal court. Interestingly, the United States government may use any patent without the permission of the patentee, but the patentee is entitled to some compensation for the use of the invention. The defendant in a patent infringement suit has the right to argue that their actions do not infringe on the claims set forth by the patent. Since the limitations of a patent are defined by its claims, the defendant must have violated the language defined in a patent's claims for an infringement to have been committed. (Inventor Resources 2011)

2.1.4 Intellectual Property Comparison

There are three main types of intellectual property protection in the United States: patents, trademarks, and copyrights. Each are unique and differentiable in terms of the protection they provide under United States laws. The nuances of how each type of intellectual property function is important in understanding patents and the application process. Thus, comprehending the full protection of different intellectual property types can give insight into the context and purpose of a patent application.

As stated before, a patent grants an exclusive right to exclude others from manufacturing, distributing, or selling an invention in the United States. Something that is not commonly known about the patent process is that all patent applications and their contents are released to the public 18 months after the earliest filing date. Upon filing, an applicant can make a request for non-publication, but it is not guaranteed. If applying for a non-publicized patent, the invention must not have been patented nor filed at any patent office, foreign or domestic (USPTO).

"A copyright is a form of protection by U.S. law to the authors of 'original works of authorship' fixed in any tangible medium of expression. A copyright gives the author the rights to reproduce, adapt, distribute, publicly perform, and publicly display their work" (Office of Policy and International Affairs). Copyright protection lasts for 95 years after the work's first publication or 120 years after its first creation, whichever is shorter. These are used to protect artistic works rather than technical ones (Office of Policy and International Affairs). Copyrights are filed for at the US Copyright Office.

A trademark is a word, phrase, slogan, symbol, or design that identifies the source of a good from one seller to another. A trademark grants the applicant the rights to use their trademark and the right to exclude others from doing so. Trademarks are the only form of intellectual property which requires verification of its continued use, and can be renewed every ten years indefinitely (Trademarks).

2.2 USPTO Overview

As stated on their website, the USPTO's mission is "fostering innovation, competitiveness and economic growth, domestically and abroad to deliver high quality and timely examination of patent and trademark applications, guiding domestic and international intellectual property policy, and delivering intellectual property information and education worldwide, with a highly skilled,

diverse workforce" (USPTO). The office strives to ensure that patent applications are fairly reviewed and that patents are legally defensible. The examination process is complex, requires detailed scientific knowledge, and is resource intensive.

2.2.1 USPTO Workforce

The USPTO had 12,725 employees at the end of 2016. Of these, 8,351 were patent examiners and 570 were trademark examining attorneys (USPTO, 2016). The number of patent examiners continues to grow to keep up with demand and expansion of fields, as a patent must be thoroughly reviewed by a qualified expert.

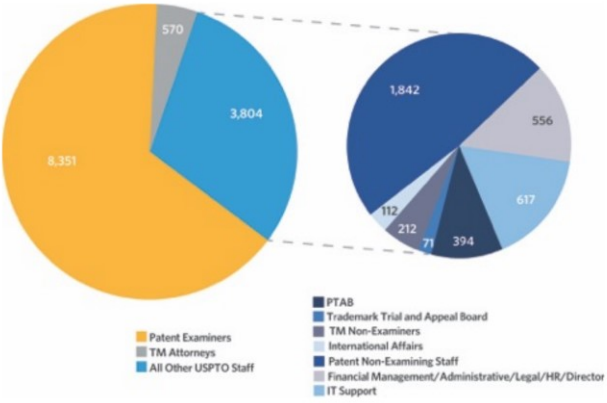


Figure 7: USPTO Job Distribution (USPTO, 2016)

Figure 7 shows the workforce breakdown at the USPTO in 2016. The majority of the staff, 65.6%, at the USPTO works as patent examiners. The number of Patent Examiners has increased gradually over the 200 years that the USPTO has existed, but with the influx of patents over the last 20 years, the hiring rate cannot keep pace from either a fiscal or personnel availability perspective. Due to this constraint, other methods must also be employed to address the backlog, rather than simply hiring more examiners.

2.2.2 USPTO Financial Structure

The Patent Office has a unique financial structure compared to other federal offices. The USPTO is not taxpayer funded and in financially independent from the rest of the government. Instead, all the funding is acquired through fees paid by applicants and attorneys. The Patent Office has a buffer fund which would allow the office to run for 30 days if their income was cut off. This means that, even if the government were to shut down, the Patent Office could continue operations. Given the USPTO's vital position in the entrepreneurial setting of the United States, this financial independence is crucial. This also allows the Patent Office to set wages at levels which attract highly skilled employees, despite the workload and other potential drawbacks of the position, leading to a high retention rate for veteran employees. (Ricks, 2017)

2.3 Patent Application/Examination Process

Forms and materials required of each patent applicant include transmittal forms, data sheets, drawings, specifications for the invention, and more. These items must be submitted for an

application to be reviewed. There is currently no way to know that the applicant's submissions for each section is thorough and of high quality. Patent examiners must use the information provided to them by the applicant to find related work and produce a final judgment for the application. Thus, the quality of the information in the application is paramount to the success of the applicant and of the USPTO as a whole.

2.3.1 Application Contents

The patent application is a formal legal description of an invention, which details how to create and use the invention. The most vital sections of the application are the Specifications and the Claims (Hanlon, 2017). They are the pieces which receive the bulk of the time during an examination and cover all the legally binding aspects of the patent.

The Specification is the section of the application in which the invention is discussed and usually contains an explanation of why it is unique from other similar matter already in the field. In most cases, it is the largest section in the application and must include a description of everything which will appear in the claims section. This section is used to describe what exactly the invention is, how it is created, and is often used to explain why the invention is different from other existing inventions. It is usually in the best interest of the applicant to avoid naming any piece of prior art, as this can lead to difficulties in the examination. Instead, the prior art is referenced in general, without naming specific works, to show that a gap exists which can be filled.

The claims section consists entirely of what the patent is meant to protect. Each claim is either an independent claim, which means that it is a statement on its own, or a dependent claim, which builds on, and adds specificity to an independent claim. Claims are the legally binding portion of the patent, while the other portions of the application are used to give context and assist in the examination process. While everything in the claims must be discussed in the specification, the language used in each is not required to be similar.

The mentioned sections take up a large portion of the examiner's time, in addition to the prior art search (Kolker, 2017). These sections must simultaneously be written with both legal and technological perspectives in mind. This means that the most successful patent attorneys are those who have detailed technological knowledge of their client's invention, as the legal scope of the patent protection is based on the technical descriptions of the inventive concept.

To assist the examiner in the prior art search, the applicant also submits an Information Disclosure Statement (IDS). This is a list of any other patents, scholarly articles, and similar documents that the applicant is aware which are related to their invention. The examiner is responsible for considering all pieces of the IDS which in some cases, may contain hundreds of links. An overly extensive IDS causes an examiner to spend a significant amount of time looking through the IDS that could have been spent considering the rest of the application or conducting the prior art search. However, if well done, the IDS can be a boon to the examiner, as it will relieve the amount of searching that needs to be completed by the examiner and establish the technological gap the invention is intended to fill.

2.3.2 Applicant Assistance

The USPTO provides patent applicants with a variety of assistance methods at all the stages of the patent application process. These methods of assistance range from application filing support, advising if acquiring a patent is the proper step to take, to facilitating prosecution. The assistance

resources provided by the USPTO include the Patent Office website, the inventor assistance shop, the pro bono program, and the Ombudsman program.

The Patent Office website is often the first location people look when considering applying for a patent. It offers a vast array of information to assist an applicant at every point in the process and can also be used to find other sources for more detailed or personal assistance. The website's biggest flaw, is its usability. The website has so much information that searching through all of it to find the piece of information that is needed can be difficult for newer users, and the website seems to have been developed with attorneys in mind rather than inventors (Kolker, 2017). Even when a user knows that a piece of information exists, finding it can be troublesome due to the sheer amount of information. However, the website is not the only source for information about the Patent Office.

The Inventor Assistance Center provides assistance to pro se applicants, inventors that file without an attorney. It is important to note that the USPTO does not, and in fact cannot, make any sort of legal recommendations to the inventors who ask for assistance. They are permitted to give information about what the application process is, how to apply and so on, but they cannot say if they believe that the contents of an application are patentable, or if they believe that the application will protect what the inventor wants. If the inventor wants answers to these sorts of questions, then Inventors' Assistance will direct them to speak with a patent attorney, or if eligible, to consider the pro bono program.

The pro bono program is a source for free legal assistance to inventors. It has several requirements to ensure that the clients need the assistance for free, including an income below a certain threshold. This program is often a way for newer attorneys to get into the field of assisting with the patent application process. Unlike the inventor assistance shop, the pro bono program is often used to gain legal advice.

The Ombudsman program is used to facilitate prosecution and ensure examinations do not get held up. If an applicant believes that an examiner is not properly examining their application or any other problems arise, the applicant can use the Ombudsman program to reach out to the examiner involved and find a solution. Examiners are encouraged to reach out to applicants throughout the course of an examination. The Patent Office believes that interaction between the inventors and examiners has a positive effect on the examination process as well as relations between the Patent Office and examiners.

2.3.3 Examination Process

Once an application is received by the Patent Office, it is placed into a queue, to wait its turn to be considered by an examiner. Pendency is the amount of time between an application's filing date and the USPTO's response, called an Office Action. In the last fiscal year, the average pendency for a First Office Action was 16.3 months, and the average total pendency was 24.2 months. The average pendency is as high as it is because the Patent Office has a large backlog of applications to get through. If an applicant wants an accelerated examination, they can pay a fee to have their application filed as a "Track One" application. The applicant then must submit an exhaustive prior art search and other examination assistance. This reduces the examiner's workload and in return, the Patent Office guarantees a final disposition or decision by the end of the first twelve months. Additionally, the Patent Office only accepts up to 10,000 Track One applications each fiscal year. (USPTO, 2017)

Before an application is assigned to an examiner's docket, it is routed to the art unit that best fits the invention. During the examination, the examiner reads the whole application and accompanying documents and begins a search for prior art. The prior art search involves reviewing both US and international patents, public domain, and public resources such as scientific papers and news articles. The goal of this prior art search is to ascertain if the inventive concept claimed in the application is unique. If the examiner discovers an issue, even very early in the process, they make note of it but continues the examination. This allows the examiner find all potential issues with an application and allows the applicant to address all concerns as soon as possible.

An Office Action is an examiner's response to an application and includes all rejections make if the application isn't given a notice of allowance. In the event of a non-final rejection, the application is sent back to the applicant, along with the details of what caused the rejection. The applicant can choose to make any alterations necessary to the application and resubmit, or to abandon the application altogether. In the event of a final rejection, the applicant may appeal for further review by a board to determine if there was an error in the examination or if the application warrants further examination. If they do not appeal, the matter is considered closed and no patent is commissioned. Finally, in the event of an allowance, the applicant can choose to pay an issuance fee and receive the patent, or they can choose to abandon the application.

If the applicant is filing through an attorney, then the responses are instead sent back and forth between examiner and attorney rather than examiner and inventor. An inventor can submit a provisional application before the actual non-provisional application. The provisional application is simply a placeholder. It can maintain a position for up to one year, at which point the inventor must either submit a full non-provisional application or allow the application to become abandoned. The major advantage to filing a provisional application is that the application does not have to be fully complete, but the filing date of the provisional application may still be used. This is important because the Patent Office recently switched from a first-to-invent policy, in which whoever can prove that they first developed an invention lays claim to it, to a first-to-file system in which the holder of the earliest filing date for the invention is considered its inventor.

2.3.4 Reviewer, Quality Lead, and Director Input

To ensure that an application is fairly and completely reviewed, the Patent Office has a comprehensive quality review system. The Office of Patent Quality Assurance conducts reviews of randomly selected Office Actions, checking their validity and clarity. These reviews are performed by OPQA's Review Quality Assurance Specialists (RQAS). Quality Leads (QL) assign reviews to the RQAS docket and are responsible for double-checking the quality of these reviews. The QLs are broken up by Technology Center (TC) and each QL is responsible for the group of reviewers in the given TC. Above the QLs are the Technology Center Directors. If a final rejection is appealed by an inventor, the case is submitted to the corresponding Technology Center Director for review. The Technology Center Directors are responsible for managing the examiners in their respective fields.

2.4 USPTO Improvement Efforts

The USPTO is constantly striving to improve. Internal and external efforts combine to increase efficiency and efficacy of work at the Patent Office.

2.4.1 Issues Facing the Patent Office

The Patent Office is not without difficulties. For the past few decades, it has faced a large backlog of applications. Over this period, the Office of Patent Quality Assurance has been investigating ways to improve the overall speed and quality of examinations. Due to the Patent Office's unique financial structure, as well as the stringent requirements for examiners, simply hiring more examiners is not a viable long term solution, and thus other options must be explored.

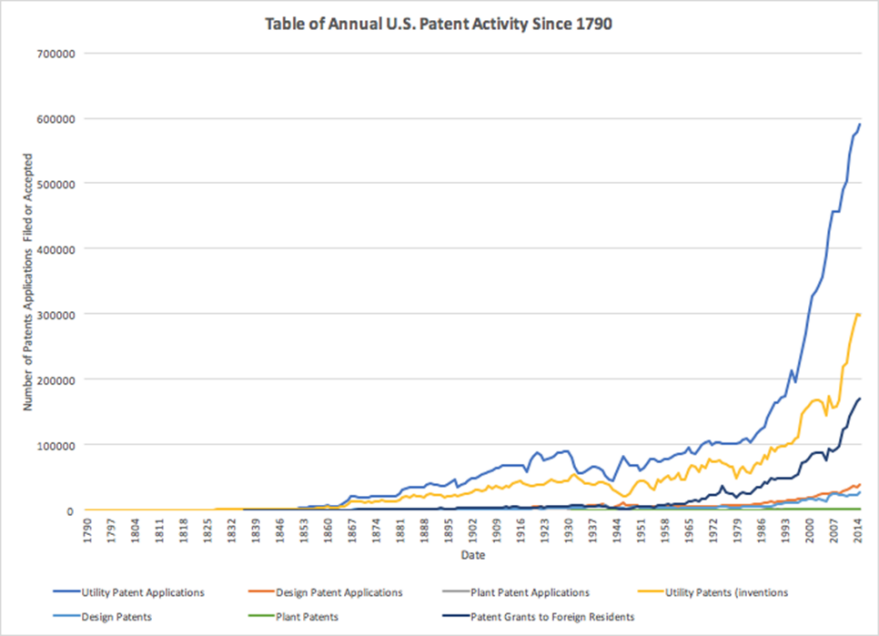


Figure 8: Annual U.S Patent Activity Since 1790 (USPTO, 2017)

In the twenty years between 1978 and 1998, the number of patent applications the USPTO received annually doubled. This substantial, yet manageable change required the Patent Office to hire many new examiners. However, as shown in Figure 8, in the two decades since, the annual number of applications quintupled and shows no signs of slowing down. Unless something can be done to expedite the examination process, the USTPO will see the backlog continue to build.

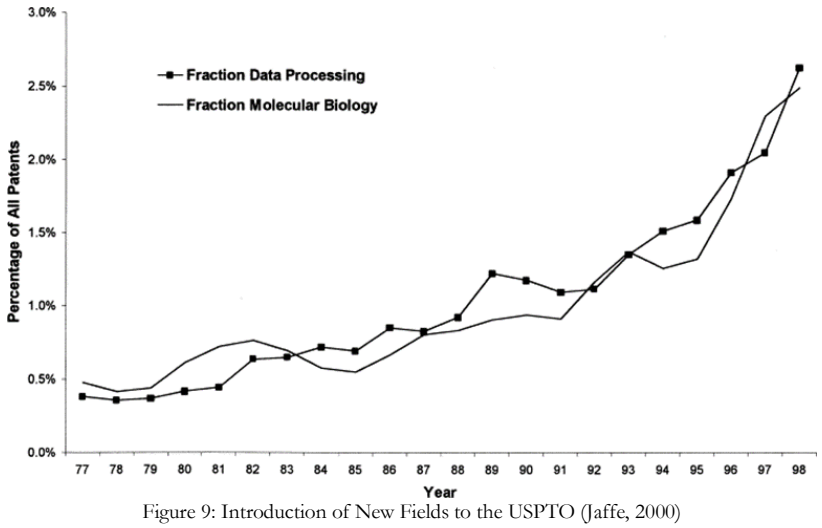


Figure 9: Introduction of New Fields to the USPTO (Jaffe, 2000)

Figure 9 illustrates that certain fields, such as data processing and molecular biology, are seeing sharp rises in their proportion of new applications, on top of the wider growth of overall incoming application count. This means that the examiners in these areas are facing much higher workloads and will continue to, until the Patent Office can sufficiently staff these fields to accommodate such growth.

2.4.2 Previous Efforts

The Patent Office is constantly attempting to improve itself, and has been since its inception. Recent changes have been made with the goal of streamlining the application process. Some of these changes include how allowances of a patent are determined and how examinations are reviewed.

Previous WPI projects have focused on these improvements. In November of 2015, the Patent Office significantly changed how patent examination reviews are performed, switching to the use of the Master Review Form (MRF). The following year, a WPI IQP group worked with OPQA to determine how effective the MRF was and to recommend methods of reporting its quality data. In 2014, a WPI group examined how effective the USPTO's quality metrics were in determining how well an examination was performed. These efforts had one thing in common: they all focused on improvements to the examiner's side of the system and not the applicant's. This distinction is not unique to the US Patent Office, but rather to all the world's major patent offices.

Conversations at the Patent Office have indicated that the principle of "garbage in, garbage out" may be negatively impacting examinations. In other words, if the quality of the application being submitted is low, then the quality of the examination will suffer. As such, the USPTO has begun determining what features of an application make it easier or more difficult to examine. Through a perception survey of almost 1500 patent examiners, OPQA determined 29 attributes which had an impact on the examination of a patent application, even if they were not necessarily required in the forms. These attributes were then ranked by "need" and "experience," where need indicates how important they are to an examination and experience indicates how often they were included in applications. These application readiness attributes were coined "The 29 Attributes" and can be found in Appendix A. The following scatter plot of The 29 Attributes is mapped to each attribute's individual need and experience ratings.

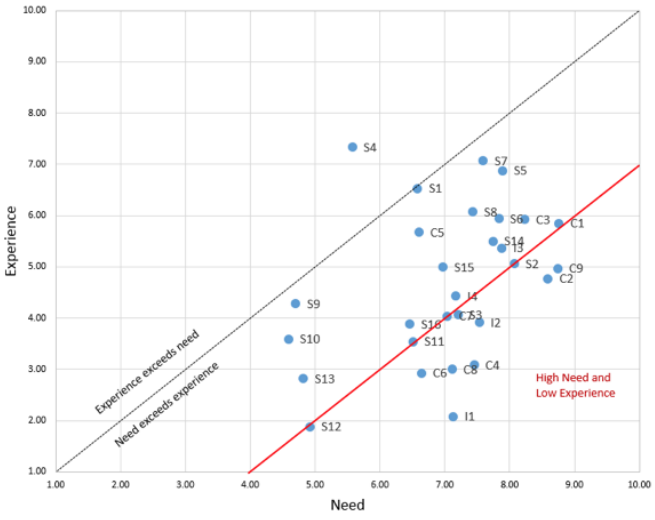


Figure 10: Need/Experience Comparison of Examiner Perception Survey

Specifications	S1	"Background of the Invention" section that provides an overview of the technology and related art
	S2	Inventive concept clearly set forth
	S3	Difference between the invention and the prior art clearly described
	S4	Concise and complete "Brief Description of the Drawings" section
	S5	Specification clearly describe the referenced features in the drawings
	S6	Drawings show the inventive concept
	S7	"Detailed Description of the Invention" expand on the invention disclosed in the "Summary"
	S8	Preferred embodiments described in detail
	S9	Working examples present (mostly found in TC 1600 and 1700)
	S10	Working examples supporting scope of genus claims (mostly found in TC 1600 and 1700)
	S11	Definitions/guidance in the specification to aid in interpreting claim terms
	S12	Glossary of terms provided (separate section in the specification)
	S13	Clear boundaries defined when using exemplifications or inclusion of equivalents (1600/1700)
	S14	Clear terms and correct grammar and syntax
	S15	Specification that teaches the technology of the invention (reads well from a technology standpoint)
	S16	Providing a certified translation (if from a foreign applicant/entity)
Claims	C1	Claims that are clear and correct in syntax and grammar
	C2	Independent claims that capture the same inventive concept disclosed in specification
	C3	Claim terminology that is highly correlated with language disclosed in the specification
	C4	Claims that are solely directed to the inventive concept (not broader than the inventive concept)
	C5	Claims that are logically organized from broadest to narrowest in scope
	C6	Claims that clearly denote whether 112(f) is invoked or not
	C7	Claim sets drawn to a single statutory class of invention
	C8	Claims that have only one reasonable interpretation
	C9	Reasonable/manageable number of claims
IDS	I1	IDS that includes the significance/relevance of each citation to the inventive concept
	I2	All citations in IDS in English (translations are provided with submission)
	I3	Reasonable/manageable number of references cited in IDS
	I4	PCT Search Reports relevant to inventive concept/claims

Figure 11: Examiner Perception Survey Attributes "The 29 Attributes"

The Attributes denoted in Figures 10 and 11 by an *S* refer to the *Specifications* section of an application, while those denoted by *C* refer to *Claims*, and *I* refer to *IDS* (Information Disclosure Statements).

2.4.3 Application Readiness Difficulties

Application Readiness is the measurement of how well an application is composed to enable it to be effectively examined. If the Patent Office could compare a measurement of Application Readiness to the result of an application, they could determine the impact that individual aspects of an application have on application examination. With these findings, they could implement new guidance, suggestions, and rules for patent applicants, possibly expediting the entire process.

Although Application Readiness could have a great impact at the Patent Office, implementing a study of it is difficult. Measurements of Application Readiness are usually qualitative. Unfortunately, their qualitative nature makes them difficult to measure, and near impossible to automate.

3. METHODOLOGY

Mission Statement

The goal of this project was to help the USPTO's Office of Patent Quality Assurance perform an Application Readiness Exploratory Study by creating a review process to quantify the impact of Application Readiness on patent examination quality.

3.1 Develop Variables for Assessing Application Readiness

Application Readiness is the measurement of how well an application is composed to enable it to be effectively examined. More specifically, this measurement indicates how well the applicant communicates their intended meaning through presentation, structure, and clarity. In the context of patents, readiness differs from quality in that it is not based on the patentability of an invention or the practicality of the proposed patent, but rather on how well an applicant's ideas are communicated for examination.

To understand what facets of an application might impact examination, the Office of Patent Quality Assurance (OPQA) generated The 29 Attributes, located in Appendix A, and surveyed examiners for their perceived impact on examination and estimated frequency of appearance in applications. The 29 Attributes were meant to indicate what examiners thought affected an Application's ability to be examined. The ratings given to each attribute were indicative of what examiners thought attribute impacts were, but to draw meaningful conclusions about these attributes, OPQA wished to validate the results through a quantitative study.

The 29 Attributes created the foundation of the review process. Each attribute was analyzed for whether it was directly quantifiable, had to be broken down into items that were quantifiable, or was required individual interpretation. For example, when looking at Attribute S15 ("Specification that Teaches the Technology of the Inventions [Reads Well from a Technology Standpoint]"), it was evident that measuring teachability would require individual interpretation. This meant guidance was necessary to ensure the standardization of measurements. Many attributes needed to be modified in a similar manner. On the other hand, Attribute C9 ("Reasonable/Manageable Number of Claims") could be directly measured as the number of claims in an application. The claims count would not assess reasonableness or manageability, but could be linked to quality data for that purpose. Each Attribute was analyzed for its individual ability to be quantified, and was accordingly developed into readiness metrics.

3.2 Develop Application Readiness Review Form

OPQA has a team of reviewers who assist in collecting quality metric data sets by executing review processes on applications. These reviewers are all veteran USPTO examiners who are experts in their technological field. OPQA utilizes these reviewers' in-depth knowledge of the USPTO processes to assess quality metrics. We developed a review form for these reviewers so that we can use their expertise to analyze these applications and assemble a database of Application Readiness metrics.

Application Readiness Review Form (ARRF) **USPTO Office of Patent Quality Assurance**

Review Information	
Application Number:	Reviewer Name:
Date Completed:	

Rating Guide
[**1**: Very Poor] [**2**: Below Average] [**3**: Average] [**4**: Above Average] [**5**: Excellent]
[**None**: Trait described is missing from application] [**N/A**: Not Applicable]
[**Overburden**: Effectively determining rating would require excessive time and work]

Specification								
1.	Background of Invention provides overview of technology and related art	1	2	3	4	5	None	N/A	Overburden
2.	Difference between invention and prior art described	1	2	3	4	5	None	N/A	Overburden
3.	Application presents a problem that the invention is addressing	1	2	3	4	5	None	N/A	Overburden

Figure 12: ARRF Snapshot

Each metric was developed into a question with quantifiable response scales of 1 (Very Poor) to 5 (Excellent) or Yes/No. This allowed us to assign numerical values to traits that would not otherwise be quantifiable to due to their nature of being interpreted in multiple ways. The 5-point scale was centered around what the reviewer considered the average application. This enables the comparison of an individual application to the overall set of applications. This also facilitated an easy identification of outlying applications, whether they were of high or low rating. Due to the subjectivity of application traits, the study was focused on comparing three main quality categories: average, below average, and above average. However, a 5-point scale enabled reviews to identify applications which stood out from the normal range of applications. Figure 12 is an example question from the Application Readiness Review Form (ARRF) that we developed. The rest of the ARRF can be found in Appendix B.

3.3 Stakeholder and Expert Feedback

While the team worked hard to understand the examination and review process, only so much could be learned in a few weeks' time. As such, recommendations were gathered from examiners and reviewers at the USPTO. The first group to provide input was the OPQA Quality Leads (QL), who supervise the reviewers. Each QL has extensive experience working as both a reviewer and an examiner. In an early discussion of the form, they gave feedback on how to best set up the form, how long it should take to complete, and how the questions should be phrased to best express their content. This feedback helped to shape the ARRF in a similar manner to review forms that OPQA has used before.

After receiving QL input, the form was brought to OPQA Review Quality Assurance Specialists (RQAS). These RQAS's are overseen by the QLs and are the employees who execute individual reviews. RQAS's are split up by Technology Center (TC) and only perform reviews on applications in their area of expertise. One examiner also provided feedback.

This produced several valuable improvements to the ARRF. Each question was analyzed individually, and was revised to minimize ambiguity and to ensure it would provide valuable responses. The insights into how the reviewers were interpreting the questions helped a great deal in determining potential sources of misunderstanding. In addition to shaping the questions on the ARRF itself, reviewer insights created the foundation of the accompanying guidance.

Another valuable recommendation from the RQAS meeting was the inclusion of the miscellaneous options: "None", "N/A", and "Overburden". "None" was included to account for when the attribute in question had not been included in the application. "N/A" was included to account for questions which did not apply to the application. This mostly occurred when the referenced attribute was not applicable for the application's Technology Center. For example, working examples are not typically used in software patents. "Overburden" was included for cases in which adequately reviewing the question would take an undue amount of time. Some applications have a specification section that is hundreds of pages long and would be impossible to review in 30 minutes.

The project liaisons also gave valuable insights for the development of the review process. While their input was sought on all facets of the study, it was particularly vital in the development of the sample set of applications for the review. Ensuring that the sample size was large enough to provide statistically significant results was vital to the study.

A major factor in determining sample size is what kind of data is being collected. For example, binary data (e.g., true/false) is simple to look for trends in, but requires a large sample size to make conclusions with statistical significance. On the other hand, data which is presented on a scale gives more room for differentiation, and thus requires a smaller sample set to achieve the same level of statistical significance. An initial sample size of 600 applications was decided upon, which would yield a margin of error of ±4% at 95% confidence level.

With a reasonable sample size selected, the team needed to decide where to draw these applications from. One possibility was to select applications randomly from a list of all USPTO applications. However, pulling from applications with Office Actions that OPQA had already reviewed would prevent the necessity of performing additional quality reviews. In order to ensure that the sample accurately represented the current state of applications, the sample set was chosen from applications reviewed in the 2017 fiscal year. There were concerns that sampling from these exclusively would not be a representative random sample. The USPTO Chief Statistician, Martin Rater, resolved these concerns, explaining that OPQA samples randomly and that this subsequent random subset should be equally representative of the population.

The sample was limited to applications whose First Office Actions had been reviewed. The overarching goal of this project was to assess how different aspects of an incoming application can affect the timeliness and quality of an examination. As such, it was prudent to assess their initial state (before alterations begin in response to examiner feedback). In the 2017 fiscal year, 49% of the reviews conducted by the OPQA were on First Office Actions.

3.4 Develop Review Form Guidance

To ensure that different reviewers would be filling out the ARRF correctly and consistently, many forms of guidance were provided. The information that the ARRF was intended to collect was nuanced, and required supplemental definitions for each individual question. These individual instructions were compiled into the ARRF Guidance Sheet. In addition to explaining how a reviewer should interpret a question, it also mapped out the answer space. This guidance method increases

the likelihood that the reviewers are interpreting the questions and answers the same way, and would theoretically standardize results. Without this standardization, the data from individual reviewers would not be comparable.

7.	Working examples present and comprehensive			
	A rating of	5	Indicates	Working examples are clearly described in full detail
		1		Insufficient information was provided about the working examples
		None		No working examples are provided and application is in a TC where working examples commonly occur. Working examples should be interpreted as being other embodiments and not the invention itself
		N/A		No working examples are provided and application is in a TC where working examples do not commonly occur.
		Overburden		Specification is too long for a reasonable review of this trait in a 30 minute review

Figure 13: ARRF Form Guidance Example

Figure 13 shows the guidance provided for ARRF question number 7, "Working examples present and comprehensive". This question was intended to measure the communication of embodiments of the application's inventive concept. The guidance for other questions reflected these options, though not all miscellaneous answers were universally necessary. The rest of the ARRF Guidance Sheet can be found in Appendix C.

The guidance sheet also suggested that if RQAS, QLs, or any other party involved had questions specific to the form or the process overall, to direct an email to the study's administrative team. This enabled constant communication and problem resolution throughout the review process.

To ensure that the administration of the study would not interfere with the validity of data, specifically targeted instructions were drafted for the groups involved. These specific instructions enabled all parties involved to execute the study without any misinterpretations. The instructions were provided via email correspondence.

3.5 Administer Review Process

Once the review form and associated guidance had been created, they were distributed to the reviewers by the QL's. In addition to the distribution, the QL's were also asked to record which reviewer received which application in a tracking sheet, delivered alongside the rest of the materials. Utilizing the QL's to distribute the reviews was intended to give the reviewers the feeling of routine, as they were used to receiving these kinds of assignments from their supervisors.

This project had to be completed within a 7-week term, which severely limited the data collection period. A deadline for reviews was provided, though it was intended to be a best-case scenario date. It was inevitable that the high expected workload of the RQAS's might cause them to miss the deadline. A few groups managed to complete their reviews in the requested period, but some did not. This review deadline was intended to allot some time for analysis within the period of the study.

Though the guidance was designed to answer anticipated questions, no plan goes perfectly. As such, reviewers contacted the team with questions about many topics. One reviewer asked about

how to properly score a claim with multiple inventive concepts. Another asked which version of a claim set should be examined. Others yet had similar issues, but all were answered promptly. In each case, the question was considered, the answer clarified, and then the question and answer forwarded to all the reviewers, in case others had the same question. This assistance system resulted in the receipt of no duplicate questions over the course of the review process.

New reviews were recorded biweekly and added to a single file to streamline analysis. During those biweekly additions, data was cleaned and any revised reviews were incorporated. "Cleaning data" involves fixing typos and sorting out discrepancies. One such discrepancy, involved reviewers recording different application numbers on the form and in the file name.

3.6 Data Analysis

The first step in data processing is to summarize the collected dataset. Raw data does a poor job on its own of facilitating an understanding of the set. Averages, variance, ranges, and distributions are the standard basic practices that allow analysts to better understand traits of the dataset. Additionally, most data processing applications, like Excel, have conditional formatting features that colorize data based on value. Colorized representations of raw data are much easier to interpret and can visually reveal data-driven relationships that would be very difficult to identify with charts and numbers alone.

To assess the overall impact, a process of generating an Application Readiness score for individual applications was developed. Points were assigned to questions with a 5-point response scale, based directly on their values. Yes/No questions were assigned 3 points per yes and 0 points per no. The total points awarded to an application were then divided by the "base score," which was equal to 3 points (the average score) per question. This produced a readiness score expressed as a percentage of the base score.

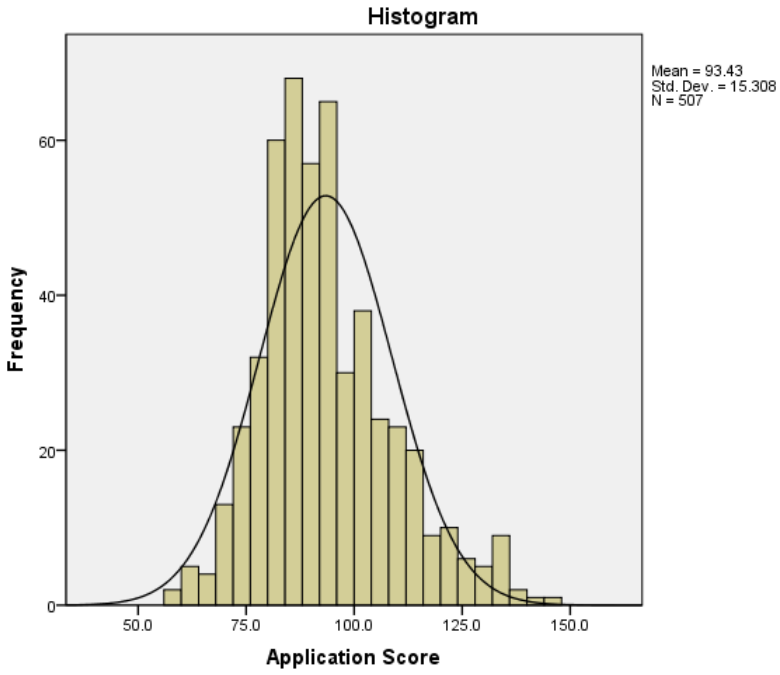


Figure 14: Readiness Score Distribution

Figure 14 illustrates the distribution of these readiness scores. The score distribution is skewed slightly left of average indicating that most applications were rated slightly lower than the "base score". The generated application scores were utilized to assess the impact of an application's overall readiness by comparing the readiness score to rejection and compliancy rates. To do this, applications were grouped into quartiles by score. Each of the four group's rejections and compliancy rates were compared to determine the relationship between overall readiness and quality metrics. To measure the influence individual metrics had on examinations, the rejection and compliancy rates of high-scoring applications were compared to those of low-scoring applications for each given question.

Since we were only studying a sample set of applications that the USPTO has received, the statistical significance of data findings must be considered. As such, a margin of error must be accounted for, that is based on a confidence interval. Margin of error is calculated using the formula in Figure 15.

$$Margin\ of\ Error = Z\ Score\ \times \frac{Standard\ Deviation}{\sqrt{Sample\ Size}}$$

Figure 15: Multilayer Perceptron Prediction Results

With a sample size of 600 applications and a desired confidence level of 95%, the margin of error for ARRF metrics is ±4%. When analyzing subsets of our sample, as was done when comparing high and low scoring applications for rejections and compliancy, the margin of error must be recalculated. When smaller subsets are used, margin of error is greater and statistically significant findings become less precise.

When an applicant fails to define the metes and bounds of their claims to an extent that is not overly broad, they are given a 112(b) rejection. This rejection is more closely assessed by the ARRF metrics due to its reliance on clarity and relationship to the details of the specification. The team wanted to determine if a 112(b) rejection could be predicted based on ARRF results. The accuracy rate of the prediction would indicate how closely related 112(b) rejections are to ARRF metrics.

The tool chosen to develop a model for prediction was Weka because of its ease of use for data mining and familiarity with our team. Given that the recorded data from the ARRF results were nominal, the Weka methods for prediction were limited to Weka's classifiers. The first step to using Weka for a 112(b) rejection prediction was to preprocess the data, which required that the Excel results of ARRF be reformatted to an ARFF file type (no relation to ARRF). The next step was to choose a classifier for the ARRF data. Two classifiers were chosen: a Bayesian Network and a Multilayer Perceptron. A Bayes Network would show the independent effect an ARRF score would have on the prediction of a 112(b) rejection. On the other hand, a Multilayer Perceptron (Simple Neural Network) would possibly provide a better prediction because of its use of backpropagation for supervised learning. Each machine learning model learned from two thirds of the provided set and then was tested against the remaining third of data to determine the accuracy of the models. Training data and testing data are kept separate to ensure that the model can predict using data it wasn't directly trained on and can be used for new data.

n=137	Predicted: Yes	Predicted: No	
Actual: Yes	19	33	52
Actual: No	21	64	85
Accuracy: 60.58%	40	97	

Figure 16: Multilayer Perceptron Prediction Results

n=137	Predicted: Yes	Predicted: No	
Actual: Yes	19	33	52
Actual: No	14	71	85
Accuracy: 65.69%	33	104	

Figure 17: Bayesian Network Prediction Results

Figures 16 and 17 show that the Bayesian Network outperformed the Multilayer Perceptron by 5%. The reasoning for this difference in accuracy could be that Multilayer Perceptron accuracies are largely related to the size of the data set it learns from. The level of accuracy of the implemented methods shows that the scores from ARRF are not strongly related to 112(b) rejections.

4. FINDINGS AND RECOMMENDATIONS

This chapter discusses the findings produced by the methodology of the exploratory study. Recommendations are then given based on these conclusions to guide the USPTO's next step in investigating Application Readiness and its effects. The methods by which Application Readiness can be assessed are important findings themselves and improvements to future Application Readiness studies are presented below.

4.1 Results Findings and Recommendations

Finding 1: Application Readiness does not have a significant impact on rejection types

Application Readiness is the measurement of how well an application is composed to enable it to be effectively examined. As such, this exploratory study sought to determine whether Application Readiness could influence the rejections received in an examination. We compared the rejection rates for positive and negative scores for each question on the ARRF for all rejection types to test whether our Application Readiness metrics bore a negative correlation to the rejections that applications received. Additionally, we compared the impact made on rejections by the overall Application Readiness score.

Figure 5: Bucket Comparison for 35 USC 112 RejectionFigure 5: Bucket Comparison for 35 USC 112 Rejection

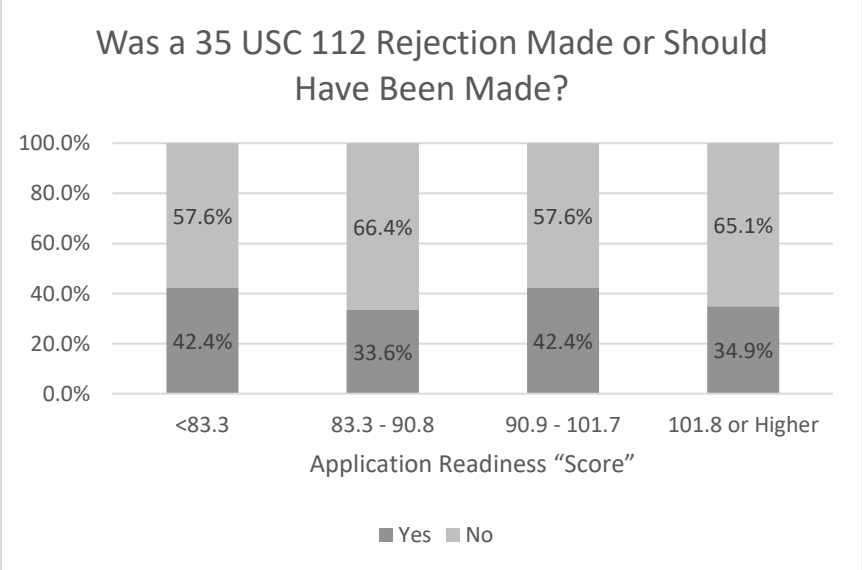


Figure 18: Bucket Comparison for 35 USC 112 Rejection

As shown in Figure 18, our conjecture proved to be false. Although Application Readiness metrics may still impact the examination process in other ways, they do not correlate with the rejection types that applications receive. No statistically significant impact on rejection types was observed. It is believed that this is because, despite the application being written in a difficult to comprehend or unwieldy fashion, it can still be examined effectively. Rejections are based on the content of an application and not on how well that content is communicated. The most common

rejections are 35 U.S.C. § 102, 103, and 112(b). 102 and 103 rejections are given to an application is attempting to claim intellectual property already existing by prior art. 112(b) rejections are given when the scope and limits of a claim are too broad or are not defined clearly. These rejection types are not based directly on the communication of the invention, and as such, Application Readiness cannot reliably indicate a vulnerability to these rejections.

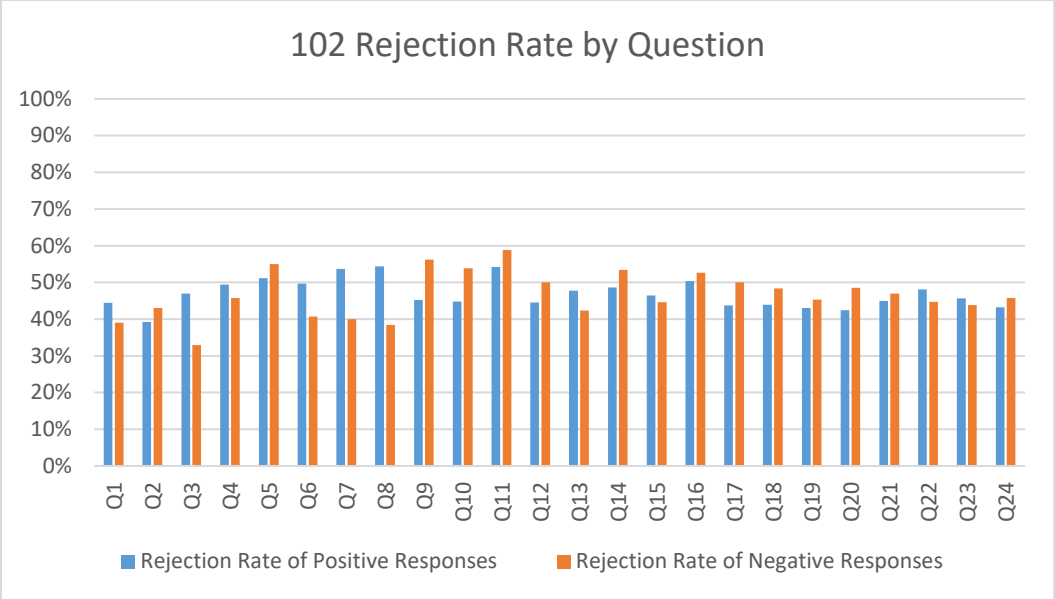


Figure 19: 102 Rejection Rate by Question

In addition to the overall score analysis, the individual impact of questions was assessed. As shown in Figure 19, the comparison of rejection rates for high and low scoring applications on each question also showed no statistically significant impact for all rejection types. The graphs for all rejection types are located in Appendix D. Although results indicated that there could be a small impact, it would be smaller than the margin of error caused by our sample size and had to be discounted. A duplicate study with a greater sample size could prove the existence of these small impacts. However, it would likely not be worthwhile to pursue the confirmation of their impact on rejection rates.

Recommendation: To understand what influences different rejections, the Patent Office should perform a causal analysis by taking individual applications that received rejections and determining what contributed to or made the application vulnerable to a rejection of that type.

Finding 2: Timeliness of Examination is currently immeasurable

The team set out to find how application readiness impacts the timeliness (time required for examination) of a patent application. Unfortunately, it was discovered that the USPTO, and specifically their examiners, have no record of the time they spend reviewing a single application. Examiners are assigned a 'docket' of applications at the beginning of every other week, and then have 2 weeks to review the applications and make an Office Action (statement to an applicant that requires a response). How the examiner splits up the workload over the bi-week is at their discretion, and examination times are not recorded. First Office Action pendency (the time between

the filing date and the First Office Action date) is indicative of the efficiency of the Patent Office but is not indicative of how long that individual examination took. The content of an application isn't examined until it reaches the examiner's docket. Thus, First Office Action pendency is not a measurement of examination timeliness as it includes the time taken for the application to reach the examiner. Additionally, the average First Office Action pendency is 16 months, of which the time of examination is a miniscule fraction. The total number of Office Actions also fails to measure timeliness, as Office Actions themselves don't denote an examiner's time taken per Office Action.

> ***Recommendation:*** To explore Application Readiness's impact on the timeliness of an examination, the Patent Office should measure the amount of time an examiner worked on an application for the First Office Action. This Application Readiness study could be repeated with applications whose examination time is recorded to analyze timeliness impacts. Additionally, this method of tracking timeliness could aid future OPQA studies designed to examine timeliness.

Finding 3: Response variance differed by reviewer which may have distorted data validity

Variance is the average difference between data points and their collective average. The narrowing of a data set caused by low-variance reviewers makes it more difficult to draw conclusions. This is because differences between data points that should have been distinct are not recorded. Low variance on its own does not indicate that data is invalid.

In the case of this study, low variance may be indicative of an underlying discrepancy across reviewers. Concerned for the validity of the review form, an investigation of the cause of this variance was completed. The team observed greater variance amongst reviewers who had been involved in the development of the review process. These people had a greater understanding of the goals of the study and the nuance behind the individual questions.

RQAS Num	TC	Num Apps	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Average
1	1600	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.00
2	2800	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00
3	2800	10	0.3	0.8	0.6	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.16
4	2800	9	0.3		0.0	0.0	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.3	1.3	0.0	0.0		0.17
5	3700	11	0.3	0.3	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.8	0.0	0.0	0.6	0.18
6	2800	9	0.7	0.5	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.7	0.0	0.0	0.0	0.6	0.21
7	2800	9	0.0	0.5	0.3	0.0	0.4	0.7	0.4	0.0	0.4	0.0	0.0	0.0	0.4	0.0	0.4	0.0		0.23
8	3700	4	0.6		2.3	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0		0.24
9	1700	10	0.6	0.0	0.0	0.3	0.3	0.7	0.4	0.0	0.5		0.0	0.0	0.3	0.0	0.0	0.0	1.2	0.27
10	3700	11	0.6	0.4	0.4	0.0	0.3	0.4			0.3	0.5	0.3	0.0	0.8	0.0	0.3	0.0	0.0	0.29
11	2600	7	0.8	1.1	1.1	1.1	0.0	0.8			0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.34
12	3700	11	0.6	0.9	0.6	0.5	0.3	0.6			0.3	0.4	0.0	0.0	0.6	0.0	0.3	0.0		0.37
13	1700	11	0.5	0.7	0.8	0.5	0.4	0.5	0.4	0.3	0.4	0.0	0.3	0.4	0.4	0.5	0.5	0.0	0.0	0.39
14	2600	8	0.9	0.7	0.8	0.5	0.6	0.6			0.4		0.0	0.4	0.0	0.4	0.0	0.0		0.41
15	2800	10	0.0	0.0	0.0	0.0	0.7	0.3	0.0	0.0	0.6	1.0	0.8	0.7	0.0	1.4	0.7	0.7	0.0	0.41
16	2600	9	0.9	0.8	0.8	0.4	0.3	0.3			0.6	0.5	0.5	0.4	0.5	0.0	0.5	0.0	0.0	0.44
17	3700	11	0.4	0.5	0.4	0.3	0.5	0.4	0.5	0.5	0.5	0.7	0.4	0.5	0.6	0.7	0.4	0.3		0.47
18	1600	8	0.5	0.7	0.4	0.5	0.5	0.6	0.5	0.5	0.6	0.8	0.4	0.5	0.8	1.1	0.0	0.0	0.0	0.49
19	2800	11	0.3	0.5	0.5	0.5	0.6	0.6	0.7	0.5	0.5	0.6	0.5	0.4	0.5	0.5	0.6	0.5		0.53
20	2800	11	0.4	1.0	0.0	0.5	0.7	0.4	0.6	0.3	0.4	0.4	0.4	0.7	0.9	0.0	0.8	0.8		0.54
21	2800	11	0.9	0.9	0.8	0.9	0.5	0.5	0.4	0.5	0.0	0.0	0.5	0.3	0.7	0.8	0.5	0.0	1.1	0.55
22	2800	5	0.9	0.9	0.7	0.9	0.5	0.5	0.0	0.4	0.4	0.9	0.0	0.5	0.5	0.4	0.5	0.4		0.55
23	1700	12	0.5	0.6	0.8	0.5	0.4	1.0	0.4	0.4	0.7	0.6	0.6	0.6	0.9	0.7	0.5	0.7	0.0	0.57
24	3700	11	0.6	0.6	0.5	0.5	0.4	0.6	0.6	0.6	0.7	0.4	0.5	0.7	1.2	0.3	0.6	0.3	0.6	0.59
25	2600	8	0.8	0.8	0.7	0.8	0.7	0.8			0.8	0.9	0.4	0.8	0.7	0.0	0.7	0.0	0.0	0.59
26	1600	8	0.7	0.9	0.8	0.5	0.4	0.4	0.5	0.5	0.0	0.9	0.4	0.5	0.5	1.5	1.4	0.4	0.0	0.60
27	2100	8	0.8	0.8	0.6	0.5	0.5	0.5			0.5	0.5	0.5	0.7	0.4	0.9	0.7	0.7		0.61
28	2600	8	1.1	0.8	0.8	0.4	0.5	0.6			0.5	0.5	0.6	1.1	0.9	0.0	0.5	0.5	0.6	0.63
29	2100	8	1.0	0.6	1.1	0.6	0.8	0.5			0.5	0.5	0.4	0.5		1.3	0.5	0.0		0.64
30	2600	9	1.2	1.4	1.0	0.4	0.5	0.5			0.5	0.7	0.7	0.4	0.5	0.5	0.7	0.7	0.0	0.65
31	1600	8	0.5	0.9	0.8	0.7	0.6	0.8	0.6	0.7	0.7	0.7	0.4	0.7	0.8	0.0	0.9	0.5	1.0	0.66
32	2400	38	1.2	1.2	1.1	0.9	0.7	0.6			0.8	0.7	0.2	0.6	0.6	0.4	0.5	0.0	0.6	0.66
33	2100	20	0.7	0.6	0.6	0.7	0.5	0.8			0.5	0.5	0.6	0.5	0.7	0.7	0.6	0.7	1.4	0.67
34	2600	8	1.0		0.8	1.1	0.0	0.9			0.4	0.5	0.4	0.6	1.2	1.0	0.7	0.5		0.68
35	2400	37	1.1	1.1	1.1	0.7	0.4	0.6	0.7	0.9	0.5	0.5	0.4	0.6	0.8	0.3	0.7	0.5	0.9	0.69
36	2100	8	0.7	0.9	0.9	0.8	0.8	0.8			0.5	1.0	0.4	0.6	0.7	0.4	0.5	0.4	1.4	0.71
37	2800	9	0.8	1.0	1.1	0.7	0.5	0.5	1.1	0.9	0.5	1.2	0.5	0.5	0.3	0.7	0.6	0.4		0.72
38	1600	8	0.8	0.8	0.4	0.4	0.9	0.7	0.0	0.4	0.5	0.7	0.5	0.5	1.5	2.1	1.6	0.5		0.77
39	2600	8	0.9	1.4	1.4	0.6	0.5	0.7			0.7	0.5	0.5	0.5	0.7	1.0	0.8	0.5		0.77
40	1600	8	1.0	0.9	1.1	0.4	0.4	1.2	1.2	1.2	0.5	1.4	0.4	0.5	0.7	0.5	0.4	0.0	1.5	0.78
41	2600	7	1.0	1.5	0.9	0.9	0.8	1.1			0.8	0.8	1.0	0.7	0.8	0.0	0.5	0.6	0.6	0.78
42	3600	11	1.0	1.3	0.9	0.9	0.5	0.8	0.0	1.2	0.5	0.5	0.5	1.0	1.0	1.7	0.6	0.8	1.0	0.83
43	1700	12	1.0	1.6	1.0	1.0	0.7	0.7	0.8	0.8	0.8	0.7	0.4	0.6	1.5	1.3	0.6	0.8	0.0	0.83
44	2800	9	1.3	1.3	0.7	0.7	0.9	0.9	0.7	0.7	0.6	1.1	0.6	0.6	0.5	1.7	0.7	0.7		0.86
45	3700	11	0.7	1.2	1.2	0.9	0.8	0.9	0.8	0.9	0.7	0.6	0.7	0.8	0.9	1.1	1.0	0.8	0.8	0.87
46	2100	8	0.7	1.0	0.6	0.7	0.9	0.9			0.6	0.7	0.8	0.8	0.7	1.4	0.4	0.7	2.1	0.88
47	1700	12	0.8	1.4	1.6	1.2	0.5	1.0	0.7	0.5	0.8	0.8	0.7	0.5	0.5	1.7	1.0	0.9	0.5	0.89
48	1700	11	0.9	1.2	0.8	1.2	1.0	1.3	0.7	1.0	1.3	0.0	0.4	0.8	1.4	1.1	1.1	0.3		0.90

Figure 20: Answer Variance by Reviewer

Figure 20 illustrates the variance for each question by reviewer. Each row represents a reviewer and each column denoted by a "Q" represents a question on the ARRF. The values under each question represent the variance a reviewer had on assigning scores to that question. The colors in the TC column represent which Technology Center the reviewer was from. The question columns are conditionally formatted from red (low) to green (high) by their value's percentile compared to all other values. The table is sorted by average variance.

Only two reviewers had a very low degree of variance across all questions. As shown in Figure 20, Reviewers 1 and 2 had answer variances that fell under the 5th percentile of average variance, less than 0.03. It is possible that this was caused by a weaker grasp of what the questions were seeking to find and what their responses should have been. This conjecture, in addition to the increased variance of answers from reviewers who we knew had a greater understanding of the

ARRF, indicated that the variance discrepancy was most likely caused by differing reviewer interpretations.

> ***Recommendation:*** In future similar studies, OPQA should use a small team of reviewers and get their feedback throughout the development of the review process. Having a team with expert knowledge of the review processes perform the studies would likely increase data validity. A smaller team makes it easier to ensure that all reviewers are assessing applications the same way.

Finding 4: Variance per question decreases chronologically from start to end of review

One interesting finding, though not particularly impactful to the study, was that the average variance of answers to ARRF questions decreased chronologically across the form. As shown in Figure 21, the variance of the earlier questions was on average much higher than the variance of the later questions. Questions were grouped by topic, which could have played a role in this observation. Although the effect of this trend on this study is limited, it may be helpful to consider when developing other studies.

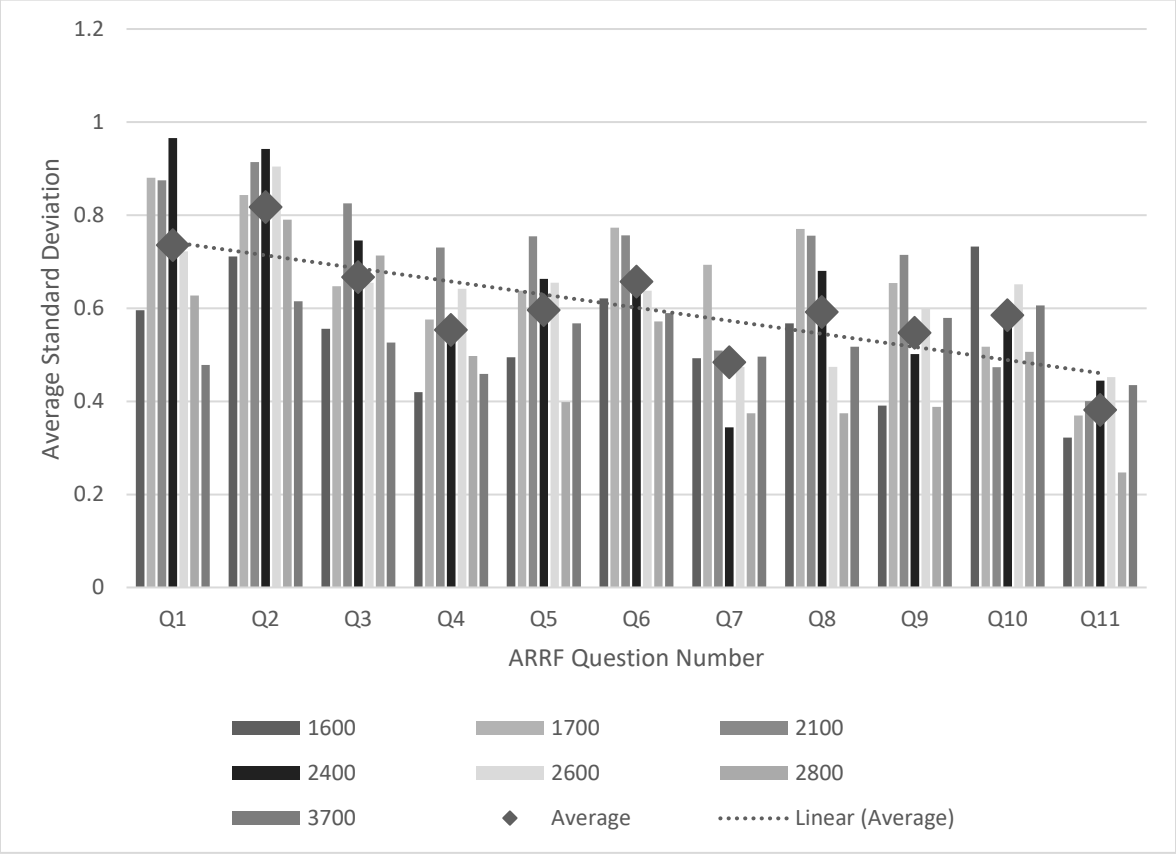


Figure 21: Standard Deviation of ARRF Specification Responses by Question

There are multiple potential causes of this phenomenon, including the categorical ordering of questions and a human element from the reviewers. The human element would be caused by reviewers becoming less discerning over the course of the review form. This is likely not the case, as OPQA has not found issues with this in the past.

A possible way to test for which, if either, of these potential reasons is causing an issue would be to randomize the order of the questions on the form. If the variance continued to decline over the course of the form, it would indicate that the human element may have a considerable impact. If this were this the case, it would be prudent to perform similar tests on other review forms, particularly the Master Review Form (MRF).

Recommendation: We recommend that OPQA checks the datasets resulting from other studies for the presence of chronologically decreasing variance. If found, we recommend considering this while designing future studies to prevent chronological skewing.

Finding 5: Application Readiness does not have a significant impact on compliancy

A key quality metric maintained by the OPQA is rejection compliancy rate. An Office Action is considered non-compliant if an examiner makes a mistake on any given rejection. This could happen either if a rejection is omitted or incorrectly made. Rejection compliancy is critical because it is a direct measure of how accurately applications are examined. A major goal of this study was to discover if Application Readiness makes a significant impact on rejection compliancy. To accomplish this, the compliancy rates for each rejection type were compared for positively and negatively rated applications by question.

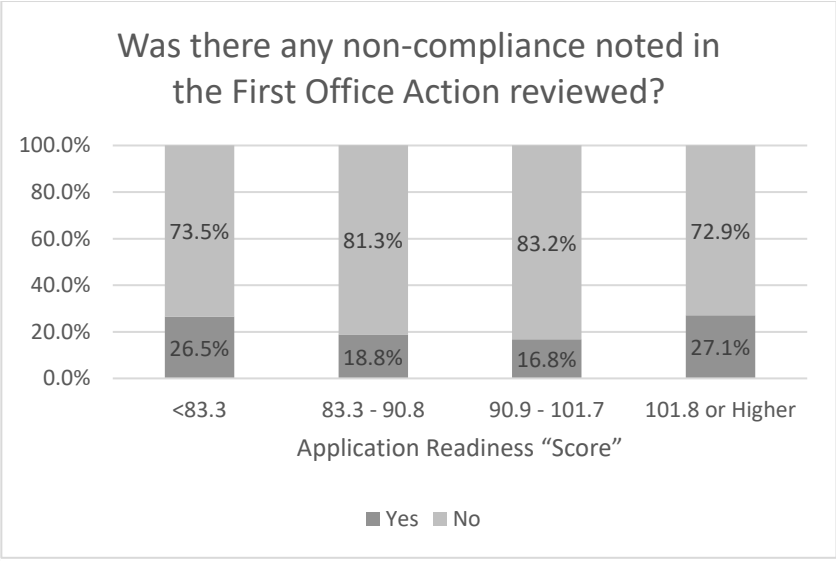


Figure 22: Bucket Comparison for Noted Non-Compliance

As shown in Figure 22, no significant correlations were observed between Application Readiness metrics and compliancy rates for any rejection types. No statistically significant differences between positive and negative responses could be determined. This does not mean that

there is no relationship between Application Readiness and examination, only that Application Readiness does not have a major impact on examination correctness. Based on our results, the difficulty of completing an examination caused by an application with low readiness does not impair examiner's ability to give compliant rejections.

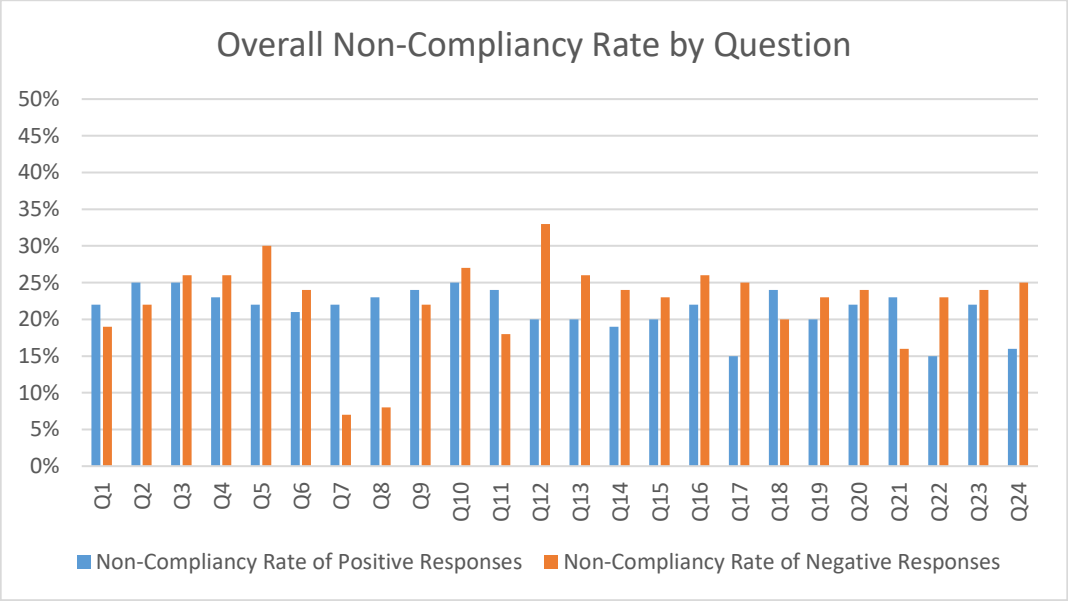


Figure 23: Overall Non-Compliancy Rate by Question

In addition to the overall score analysis, the individual impact of questions was assessed. As shown in Figure 23, the comparison of compliancy rates for high and low scoring applications on each question also showed no statistically significant impact for compliancy of all rejection types. The graphs for all compliancy types are located in Appendix D. Although results indicated that there could be a small impact, it would be smaller than the margin of error caused by the sample size and had to be discounted. Some differences in compliancy rates were quite large, but were caused by a very low number of applications in that category. A duplicate study with a greater sample size could prove the existence of these small impacts. However, it would likely not be worthwhile to pursue the confirmation of their impact on compliancy rates.

Recommendation: To understand the influences on rejection compliancy, the Patent Office should perform a causal analysis by taking individual applications that received non-compliant Office Actions and determine what contributed to or made the application vulnerable to errors in examination.

4.2 Methodological Improvements

Step 1: Develop Variables for Assessing Application Readiness

OPQA should increase the breadth of examined information on future Application Readiness studies. The variables assessed by the ARRF were a result of the 29 attributes. Variables could be drawn from performing similar surveys on other groups at the Patent Office, such as

attorneys from the Office of Patent Legal Administration. Taking additional perspectives into account could result in additional metrics and a deeper understanding of Application Readiness.

Step 2: Develop Application Readiness Review Form

The most apparent recommendation here is to create a longer form, both in terms of its length and the amount of time allowed for its completion. Numerous questions were removed during development because they might have taken an undue amount of time to properly examine, and would detract from the overall quality of the review. With a longer time-allowance, these variables should also be assessed.

A larger scale, such as 0-10, should be used for the rating based questions to allow greater variation and precision of ratings. A wider scale allows for more detailed analysis of the same attributes. However, this increased nuance requires more time and analysis for reviewers to apply properly.

Step 3: Stakeholder and Expert Feedback

The feedback received in the creation of the form was substantive and very reasonable for an internal study from the PTO. However, there were certain potentially impactful groups who did not give direct feedback. Though time constraints limited the perspectives we could get feedback from. Future application of this review form should include efforts to gain feedback from patent applicants and patent holders. Feedback from these groups could not only enable the Patent Office to better understand applicant perception and behavior, but also enable the public to better understand Application Readiness.

Step 4: Develop Review Form Guidance

Guidance could be greatly improved with continued feedback from reviewers. Time constraints required that feedback was prioritized to the ARRF's measured metrics rather than the content of the guidance. Rectifying this situation would be conducive to a smoother review process for the RQAS's.

Giving functional examples of different ratings would better define response scales and facilitate the ease of reviews. A reasonable way to identify exemplary applications would be to draw from the reviews completed in this study which have very high or very low average ratings. OPQA could conduct a focus group with reviewers to analyze these applications to confirm and understand the cause of their why they are good examples of their given rating.

Step 5: Administer Review Process

While the administration of the review process was an overall success, there are a few enhancements which could be made to improve efficiency and effectiveness of the study. Administering the review directly to the RQASs may be conducive to increasing efficiency. Increasing the direct interaction between the RQASs and a study's administrators will create a more cohesive process as the reviewers play a major role in data validity.

Another recommendation would be to work only with a small number of reviewers. While the initial dataset discussed here was collected with a large force of reviewers, this was due to external time constraints. A smaller group of reviewers would do more reviews individually and become more familiar with the review form and process. This would give them more experience at

performing a particular quality review. Additionally, a smaller review team enables better communication and understanding.

Any further use of this review process should utilize a sample set of applications tailored specifically to the targeted aspects of the intended analysis. The exploratory study focused on ensuring proportional representation of each TC and little else. This made sense for the first investigation of Application Readiness, but if the focus was on a more specific form of analysis, the dataset should reflect that. For instance, if a new study sought to determine Application Readiness's effects on 112(b) rejections, then the sample set should contain an even split of applications that did and did not receive a 112(b) rejection.

Step 6: Data Analysis

The ARRF review process was used to assess applications from the Integrated Quality System (IQS) as they already had compliancy and rejection review data on their First Office Action. This limited the number of factors that we could measure against ARRF data. If other examination metrics were recorded, such as examination time or volume of applicant-examiner communications, they could be used to do a further analysis. As such, OPQA should continue to monitor the applications involved in this study against new quality review processes, so that the long-term effects of Application Readiness can be observed.

It may also be informative for OPQA to analyze the ARRF results by clustering metrics. For example, questions 7 and 8 both analyze working examples presented by the application. Analyzing these questions' combined effect as a cluster would likely involve assigning them an aggregate score, and comparing that to other application's "Working Examples Rating." This could provide a more detailed knowledge of how separate metrics combine to make a larger influence.

APPENDICES

Appendix A: The 29 Attributes Table

ID	Attribute Title	Need	Experience	Description
Specifications				
S1	"Background of Invention" Should provide an Overview of the Technology and Related Art	6.58	6.53	This section describes the invention and how it differs from prior art.
S2	Inventive Concept Clearly Set Forth	8.07	5.06	This attribute involves applicants being very clear about what exactly they have invented. The "inventive concept" is very important for litigation, as it essentially describes what has been patented.
S3	Difference Between the Invention and the Prior Art Clearly Described	7.20	4.07	This attribute entails detailing out the Intellectual Property being applied for, and previous patents, in order to then clarify the distinction. A large amount of time in the application examination process is spent comparing the applications details to that of other patents. This is extremely vital to the process, as an application that infringes on another's patented Intellectual Property would leave the Patent Office vulnerable to lawsuits. The patent examiners would need to do this research regardless of whether it is supplied in the application. However, if the applicant includes their distinction of how it differs, the Examiner does not have to spend as much time analyzing and determining the distinctions themselves.
S4	Concise and Complete "Brief Description of the Drawings" Section	5.57	7.34	This attribute entails adding a written description of any and all drawings provided. The USPTO has begun the process of moving to a completely digital application. Having all applications in a digital format enables the examiners to find drawn aspects of applications without having to manually sift through all applications. This attribute will not necessarily speed up the process of examining the application that the description is provided on. However, it will greatly improve the speed at which examiners can find and refer to drawings on these applications when examining future applications.
S5	Specifications Clearly Describe the Referenced Features in the Drawings	7.89	6.88	This attribute entails adding a list of featured elements in any and all drawings provided. This is very similar to S4 (Concise and Complete "Brief Description of the Drawings" Section), the main distinction being that this attribute does significantly improve the speed at which the current application can be processed. By specifically pointing out individual aspects of the drawing and what they mean, the examiner does not have to waste time trying to interpret the meanings themselves. Additionally, these descriptions can provide further insight into the claims and desired intellectual property of the applicant.
S6	Drawings Show the Inventive Concept	7.83	5.94	This attribute designates the kind of drawings that an applicant should include. Although a drawing of the entire product or invention should be included, this attribute refers more specifically to the new IP that the patent is being applied for. For instance, if one were to apply for a smartphone patent, this attribute would request that a drawing (separate or embedded) would be included that displays how it differs from previous patents of the similar field of smartphones. (i.e. The new embedded infrared projector/reader combination used for facial recognition in the new iPhone X)

ID	Attribute Title	Need	Experience	Description
S7	"Detailed Description of the Invention" Expand on the Intention Disclosed in the "Summary"	7.59	7.07	This attribute is included to express that often times the description included in summary is not expanded upon in the Specifications section. The summary is used to get a good idea of what the product is without delving into details, but when making claims, the more specific and well detailed this is, the easier it is to distinctly pass an application as new IP.
S8	Preferred Embodiments Described in Detail	7.43	6.07	This Aspect refers to the methods by which the invention is to be used. Embodiments are the different ways in which the Patent or Intellectual Property is going to be carried out. By providing these in detail, the applicant can further explain what the product is, and what it does, which allows the Examiner to compare the applicant's materials to other applications more efficiently.
S9	Working Examples Present	4.70	4.28	By "Providing specific, working examples in a patent application facilitates, if not ensures, enablement of an invention." (Stanković, 2006) This is vital for certain applications, and involves providing proof that you have actually invented the thing being patented, rather than simply coming up with the concept. This attribute is mostly found in the Biotechnology, Organic, Chemistry, and Materials Engineering fields.
S10	Working Examples Supporting Scope of Genus Claims	4.59	3.59	This attribute requests that the applicant show how the Working Examples support the claims. This attribute boils down to examples of how someone skilled in the art could and could not use the intellectual property described. (MPEP, 2016) This attribute is mostly found in the Biotechnology, Organic, Chemistry, and Materials Engineering fields.
S11	Definitions/Guidance in the Specification to Aid in Interpreting Claim Terms	6.51	3.54	This attribute is a request for a "glossary" of sorts, in order to clarify what the unique claims of the application are. By providing these, the Examiner can know specifically what is meant by any unusual terms in the application, and not make assumptions nor waste time in understanding the terminology.
S12	Glossary of Terms Provided	4.92	1.88	This attribute is similar to S11, but differs in that S11 is asking for specific definitions of claim terms. S12 is less wanted but is asking for a glossary of all terms used, in order to clear up confusion more completely. It is also useful to have all definitions given in one concise place. This is very rarely provided in applications but could speed up the examination process.
S13	Clear Boundaries Defined When Using Exemplifications or Inclusions of Equivalents	4.82	2.82	This attribute follows up on S3, where the examiner can work more efficiently if provided with clear distinctions from the prior art. This attribute more specifically requests a definition of what defines the patent material from other art specifically referenced by the application.
S14	Clear Terms, Correct Grammar, and Syntax	7.74	5.50	If an application contains grammatical, semantic, or syntactical errors, an examiner might have to fail the application. An error here can change the meaning of the application, so even if everything else in the application is correct and complete the application can't pass. This can be a huge waste of an examiner's time.
S15	Specification that Teaches the Technology of the Invention (Reads Well from a Technology Standpoint)	6.97	5.00	A patent is required to explain how to create the invention in a way understandable by an expert in the field. However, it is not required to make this process simple. Keeping it simple to understand aids the examiner to understand the invention.

ID	Attribute Title	Need	Experience	Description
S16	Provided a Certified Translation (If from a Foreign Applicant or Entity)	6.46	3.88	Since the first language of most patent examiners is English, English must be the language the application is provided in. If the original language isn't English, and the translation is poor or incorrect, the application will fail. This could be a massive waste of time if a single mistranslation was the cause of an otherwise passing application to fail.
Claims				
C1	Claims that are Clear and Correct in Syntax and Grammar	8.76	5.85	This issue is born from claims which lack specificity, or which contain errors in spelling/grammar.
C2	Independent Claims that Capture the Same Inventive Concept Disclosed in Specification	8.59	4.77	This references claims that attempt to claim one of the four kinds of utility patent which was not described in the specification.
C3	Claim Terminology that is Highly Correlated with Language Disclosed in the Specification	8.23	5.92	Similar to the above issue, this issue arises when the claim's language is dissimilar to the language in the Specification. This makes it difficult to understand what claim the Specification is referring to.
C4	Claims that are Solely Directed to the Inventive Concept (Not Broader than the Inventive Concept)	7.45	3.08	This issue comes from the applicant leaving the claims broader than their invention warrants.
C5	Claims that are Logically Organized from Broadest to Narrowest in Scope	6.60	5.68	This issue comes from a "train of thought" style of writing the claims, simply putting them down as they come to mind rather than having a planned list. This is required by the MPEP, but because an examiner must completely examine an application even once a rejection has been found, this being done poorly leads to difficulty in completing the rest of the examination.
C6	Claims that Clearly Denote Whether 112(f) is Invoked or Not	6.64	2.93	112(f) is used to denote the usage of the term "means for" or similar terminology. (USPTO 2015) If 112(f) is invoked, it requires an extra effort to look into how it is applied.
C7	Claim Sets Drawn to a Single Statutory Class of Invention	7.04	4.04	This is an issue which comes from claims not being specific enough, and causing ambiguity in what exact kind of invention is being described. Each set of claims can only cover one kind of invention (a process, a machine, an article of manufacture, or a composition of matter).
C8	Claims that have Only One Reasonable Interpretation	7.11	3.00	This is another issue relating to the specificity of claims. In particular, claims are intended to have only one possible interpretation, so as to not cause confusion.
C9	Reasonable/ Manageable Number of Claims	8.74	4.97	This is caused by, as opposed to claims being too general, the applicant attempting to over-specify their creation. Because each claim must be examined individually to ensure that they are patentable, too many claims can enormously bog down an examination.

ID	Attribute Title	Need	Experience	Description
Information Disclosure Statements (IDS)				
I1	IDS that Includes the Significance/ Relevance of Each Citation to the Inventive Concept	7.13	2.08	The IDS is meant to provide the examiner with some research from the applicant. The applicant is also intended to include why the provided citation has been shown.
I2	All Citations in IDS in English (Translations are Provided with Submission)	7.53	3.91	Considering most of the examiners have English as their first language, it is asked that the entirety of applications, including IDS submissions, be in English, or have an English translation.
I3	Reasonable/ Manageable Number of References Cited in IDS	7.88	5.37	While it is important that the IDS be fairly comprehensive, it is important that the sources be high in quality, rather than in quantity.
I4	PCT Search Reports Relevant to Inventive Concept/Claims	7.17	4.43	Similar to the overall citations, the PCT, or Patent Cooperation Treaty, search reports must be accompanied by why they are relevant to the application, rather than just thrown into the application alone.

Appendix B: Application Readiness Review Form (ARRF)

Application Readiness Review Form (ARRF) **USPTO Office of Patent Quality Assurance**

Review Information			
Application Number:		Reviewer Name:	
Date Completed:			

Rating Guide
[1: Very Poor] [2: Below Average] [3: Average] [4: Above Average] [5: Excellent] [**None**: Trait described is missing from application] [**N/A**: Not Applicable] [**Overburden**: Effectively determining rating would require excessive time and work]

Specification									
1.	Background of Invention provides overview of technology and related art	1	2	3	4	5	None	N/A	Overburden
2.	Difference between invention and prior art described	1	2	3	4	5	None	N/A	Overburden
3.	Application presents a problem that the invention is addressing	1	2	3	4	5	None	N/A	Overburden
4.	Inventive Concept set forth	1	2	3	4	5	None	N/A	Overburden
5.	Specification describes the referenced features in drawings	1	2	3	4	5	None	N/A	Overburden
6.	Drawings show the Inventive Concept	1	2	3	4	5	None	N/A	Overburden
7.	Working examples present and comprehensive	1	2	3	4	5	None	N/A	Overburden
8.	Working examples bear relevance to claims	1	2	3	4	5	None	N/A	Overburden
9.	Specification reads well from a technology standpoint	1	2	3	4	5	None	N/A	Overburden
10	Definitions/guidance provided in the Specification (to aid in interpreting claims)	1	2	3	4	5	None	N/A	Overburden
11.	Syntax and grammar of Specification	1	2	3	4	5	None	N/A	Overburden

1

Application Readiness Review Form (ARRF) USPTO Office of Patent Quality Assurance

Claims									
12.	Claim terminology is correlated with language used in the Specification	1	2	3	4	5	None	N/A	Overburden
13.	Claims that are solely directed to the inventive concept (not broader than the Inventive Concept)	1	2	3	4	5	None	N/A	Overburden
14.	Claim sets (Independent claim and its dependents) drawn to a single statutory class of invention	1	2	3	4	5	None	N/A	Overburden
15.	Independent claims have only one reasonable interpretation	1	2	3	4	5	None	N/A	Overburden
16.	Syntax and grammar of Claims	1	2	3	4	5	None	N/A	Overburden

Information Disclosure Statement									
17.	PCT Search Reports relevant to the inventive concept	1	2	3	4	5	None	N/A	Overburden

Miscellaneous					
18.	Does the Application have a separate Field of Invention Section?	Yes	No	N/A	Overburden
19.	Did the Applicant provide a Glossary of Terms?	Yes	No	N/A	Overburden
20.	Do independent claims in all claim sets address the Inventive Concept using language that recites identical scope?	Yes	No	N/A	Overburden
21.	Where a claim sets forth a plurality of elements or steps, is each element or step of the claim separated by a line of indentation?	Yes	No	N/A	Overburden
22.	Are IDS accompanied by a description of relevance/significance?	Yes	No	N/A	Overburden
23.	Are all IDS provided in English?	Yes	No	N/A	Overburden
24.	Is a Certified Translation provided?	Yes	No	N/A	Overburden

Additional Comments

Clear Form Save

Appendix C: ARRF Guidance Sheet

Application Readiness Review Form Guidance Sheet

Ratings: All questions follow a similar scale based on the average application, with slight variation of wording to more accurately express intended interpretations.

(1 2 3 4 5) Assigning a *3* (Average) for a trait denotes that this application did nothing in particular to stand out negatively or positively. If an application performs slightly better or worse than the average, it should receive a rating of 4 or *2, respectively*. A rating of *1* should be assigned when an application's trait is of very poor quality, while a *5* should be assigned when an application's trait is exceptional.

(None) This is used to denote that an application does not contain the attribute in question at all, when other applications of the TC might include it (primarily for Working Examples in TC 1600 and 1700).

(N/A) If another rating does not make sense for this trait, mark *N/A*. The Additional Comments section can be used if something very out of the ordinary is observed.

(Overburden) These reviews are each intended to take 30 minutes. If thoroughly answering a question would likely too much time, save it until you've completed the rest of the form. If at that point it is still an excessive amount of work, mark *Overburden*.

Submission: Name your completed files: *ARRF_XXXXXXXX*, where the *XXXXXXXX* is the application number for that review. Please email the completed reviews to Spencer.Beaupre@USPTO.gov AND Tiffany.Tabb@USPTO.gov, with a subject line: ARRF Reviews. We would like to begin receiving these reviews as soon as possible, but rather than having you send each in an individual email, we ask that you attach all completed reviews at the end of each day.

Any pressing concerns or comments can be directed in email to Spencer Beaupre at Spencer.Beaupre@USPTO.gov, Martin Rater at Marty.Rater@USPTO.GOV, and/or David Fitzpatrick at David.Fitzpatrick@USPTO.GOV with subject line: ARRF Concern.

Specification Instructions				
1.	Background of Invention provides overview of technology and related art			
	A rating of	5	Indicates	Description is exceptionally thorough and effective
		1		Insufficient information is provided and/or not effectively communicated
		None		No background art/technology is described
		N/A		Not Applicable
2.	Difference between invention and prior art described			
	A rating of	5	Indicates	The difference is clearly stated with excellent detail and understanding
		1		Insufficient or ineffective information is disclosed about the difference
		None		No attempt to describe the difference between the invention and the prior art
		N/A		Not Applicable
3.	Application presents a problem that the invention is addressing			
	A rating of	5	Indicates	Problem is clearly and fully described in terms of the technological gap, importance, and relevance to the invention
		1		Insufficient valuable information was communicated about the problem
		None		No attempt was made to articulate the problem being addressed
		N/A		Not Applicable
4.	Inventive Concept set forth			
	A rating of	5	Indicates	Inventive Concept is completely and clearly specified beyond expectations
		1		Inventive concept is insufficiently set forth
		None		No attempt was made to articulate the Inventive Concept
		N/A		Not Applicable
5.	Specification describes the referenced features in drawings			
	A rating of	5	Indicates	Individual features in the drawings are completely and very effectively described
		1		Insufficient information was provided about the details of the drawings
		None		No features are described
		N/A		No drawings are provided
		Overburden		Specification is too long for a reasonable review of this trait in a 30 minute
6.	Drawings show the Inventive Concept			
	A rating of	5	Indicates	The drawings do an excellent job of providing a detailed depiction of the Inventive Concept
		1		The drawings do not effectively depict the Inventive Concept
		None		The Inventive Concept is not shown in the drawings at all
		N/A		There are no drawings

Specification Instructions (Cont.)				
7.	Working examples present and comprehensive			
	A rating of	5	Indicates	Working examples are clearly described in full detail
		1		Insufficient information was provided about the working examples
		None		No working examples are provided and application is in a TC where working examples commonly occur. Working examples should be interpreted as being other embodiments and not the invention itself
		N/A		No working examples are provided and application is in a TC where working examples do not commonly occur.
		Overburden		Specification is too long for a reasonable review of this trait in a 30 minute
8.	Working examples bear relevance to claims			
	A rating of	5	Indicates	The relevance of the working examples to the claims is very significant and clearly expressed
		1		Insufficient information was provided about the working examples to relate them to the claims, or the working examples do not relate to the claims
		None		No working examples are provided and application is in a TC where working examples commonly occur. Working examples should be interpreted as being other embodiments and not the invention itself
		N/A		No working examples are provided and application is in a TC where working examples do not commonly occur.
		Overburden		Specification is too long for a reasonable review of this trait in a 30 minute
9.	Specification reads well from a technology standpoint			
	A rating of	5	Indicates	Specification does an excellent job of completely and effectively describing the technological and/or scientific aspects crucial to understanding the invention
		1		Technological and/or scientific aspects crucial to understanding the invention are insufficiently or incorrectly described
		N/A		Not Applicable
10.	Definitions/guidance provided in the Specification (to aid in interpreting claims)			
	A rating of	5	Indicates	Specification does an excellent job of aiding the reader in interpreting the claims
		1		Specification does not effectively inform the interpretation of claims
		None		No attempt is made to define or help guide in the interpretation of claim language
		N/A		Not Applicable
11.	Syntax and grammar of Specification			
	A rating of	5	Indicates	Syntax and Grammar are not only proper, but make for easy comprehension
		1		Specification was extremely difficult to read or could not effectively communicate is ideas due to poor use of the English language
		N/A		Not Applicable

Claims Instructions				
12.	Claim terminology is correlated with language used in the Specification			
	A rating of	5	Indicates	All invention-related terminology is used in Specifications
		1		Little to no invention-related terminology that is used in the Claims is also used in the Specification
		N/A		Not Applicable
		Overburden		Specification or Claims are too long for a reasonable review of this trait in a 30 minutes
13.	Claims that are solely directed to the Inventive Concept (not broader than the Inventive Concept)			
	A rating of	5	Indicates	Claims clearly fall under the scope of Inventive Concept
		1		Claims are broader in scope than the Inventive Concept or targeted towards a different Inventive Concept altogether
		N/A		Not Applicable
		Overburden		Specification or Claims are too long for a reasonable review of this trait in a 30 minutes
14.	Claim sets (Independent claim and its dependents) drawn to a single statutory class of invention			
	A rating of	5	Indicates	Dependent claims all clearly draw from the same statutory class of invention as their respective independent claim
		1		Dependent claims within a claim set draw from multiple statutory classes of invention or deviate from its corresponding independent claim
		N/A		No dependent claims or otherwise Not Applicable
		Overburden		Specification or Claims are too long for a reasonable review of this trait in a 30 minutes
15.	Independent claims have only one reasonable interpretation			
	A rating of	5	Indicates	Independent claims clearly have only one reasonable interpretation
		1		Independent claims are vague and multiple interpretations can be made
		N/A		Not Applicable
		Overburden		Specification or Claims are too long for a reasonable review of this trait in a 30 minutes
16.	Syntax and grammar of Claims			
	A rating of	5	Indicates	Syntax and Grammar are not only proper, but make for easy comprehension
		1		Claims were extremely difficult to read or could not effectively communicate is ideas due to poor use of the English language
		N/A		Not Applicable
		Overburden		Specification or Claims are too long for a reasonable review of this trait in a 30 minutes

IDS Instructions

17.	PCT Search Reports relevant to the Inventive Concept			
	A rating of	5	Indicates	PCT Search Reports are clearly relevant to the Inventive Concept and bear significance
		1		PCT Search Reports bear no apparent relevance or significance
		None		No PCT Search Reports
		N/A		Not Applicable
		Overburden		PCT Search Reports are too long for a reasonable review of this trait in a 30 minutes

Miscellaneous Instructions

18.	Does the Application have a separate Field of Invention Section?			
	A rating of	Yes	Indicates	Background of Invention contains a separate Field of Invention Section
		No		Background of Invention does not contain a separate Field of Invention Section
		N/A		Not Applicable
19.	Did the Applicant provide a Glossary of Terms?			
	A rating of	Yes	Indicates	A Glossary of Terms was provided
		No		A Glossary of Terms was not provided
		N/A		Not Applicable
20.	Do independent claims in all claim sets address the Inventive Concept using language that recites identical scope?			
	A rating of	Yes	Indicates	Independent claims use the same language to articulate the Inventive Concept and scope
		No		Independent claims use different language to articulate the Inventive Concept and scope
		N/A		Not Applicable
21.	Where a claim sets forth a plurality of elements or steps, is each element or step of the claim separated by a line of indentation?			
	A rating of	Yes	Indicates	Proper indentation is used for claim sets
		No		No indentation, or improper indentation was used when there should have been indentation based on MPEP 608.01(i)
		N/A		Not Applicable
22.	Are IDS accompanied by a description of relevance/significance?			
	A rating of	Yes	Indicates	Some direct description is provided for all or part of IDS
		No		No description or explanation of the IDS is provided with it
		N/A		Not Applicable
23.	Are all IDS provided in English?			
	A rating of	Yes	Indicates	All of the IDS is provided in English
		No		Not all of the IDS is provided in English
		N/A		Not Applicable
		Overburden		The IDS is too long to reasonably assess this

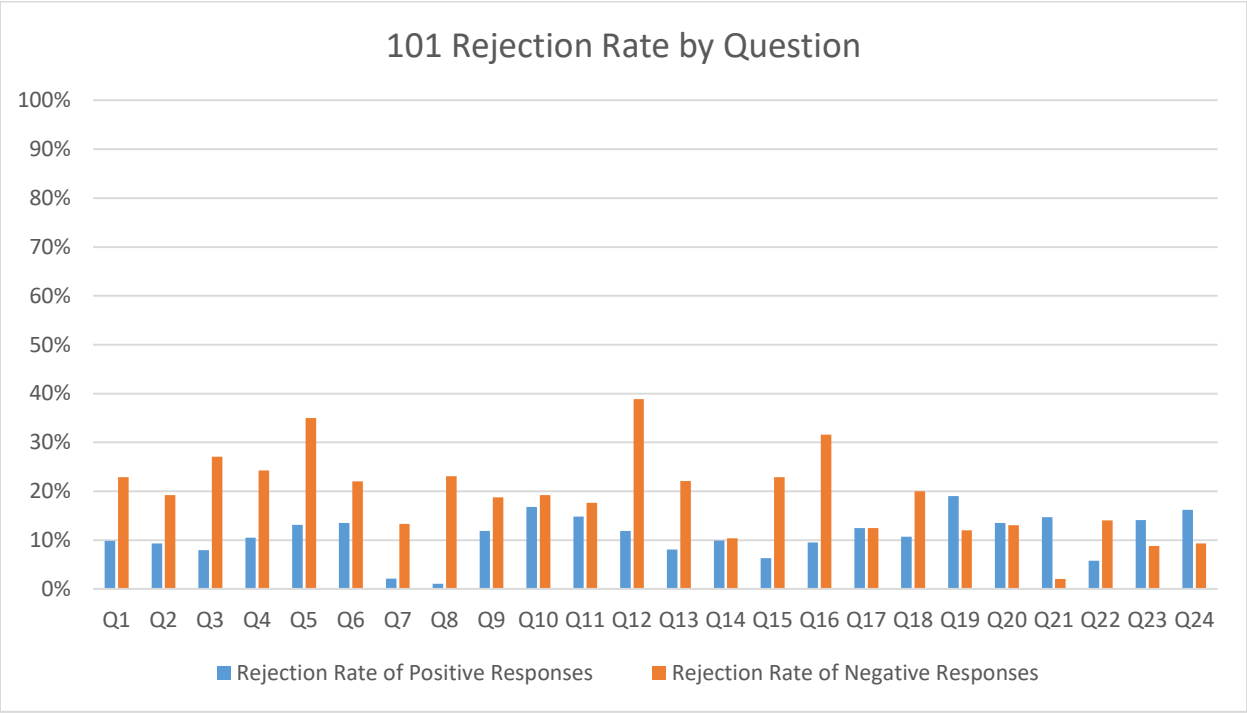
Miscellaneous Instructions (Cont.)

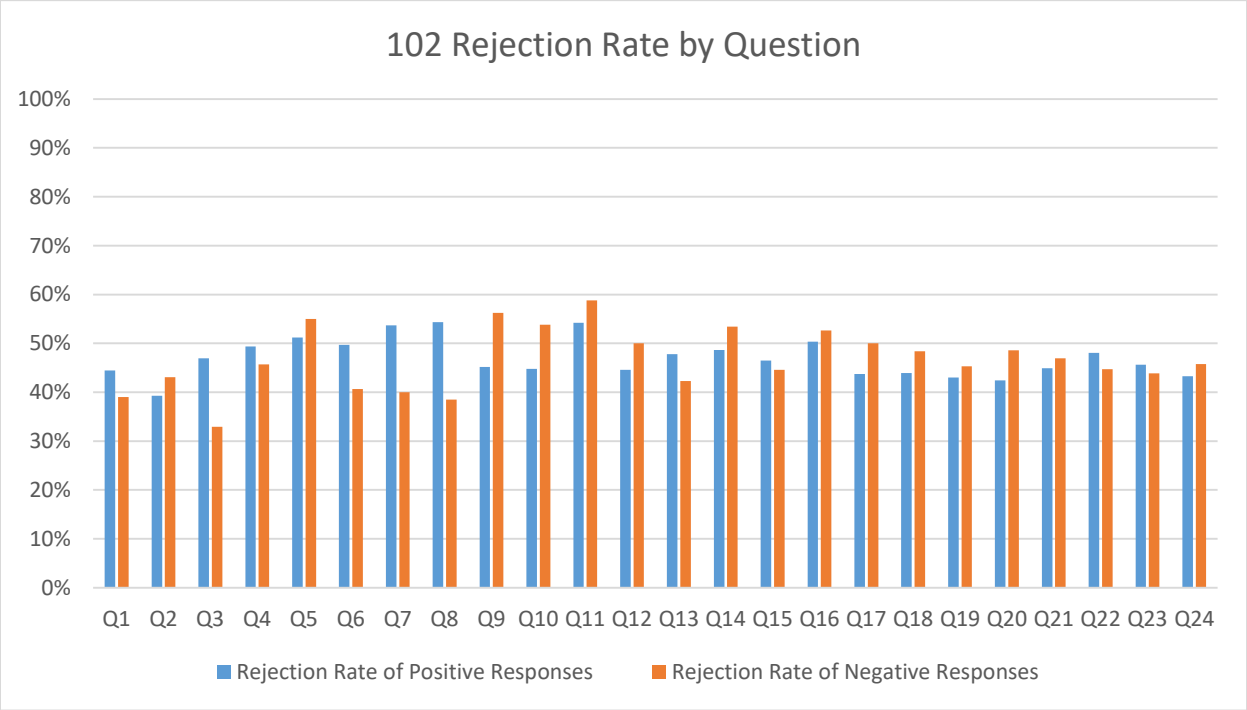
24.	Is a Certified Translation provided?			
	A rating of	Yes	Indicates	The application is originally not in English and Certified Translation is provided
		No		The application is originally not in English and Certified Translation is not provided
		N/A		The application is originally in English or otherwise Not Applicable

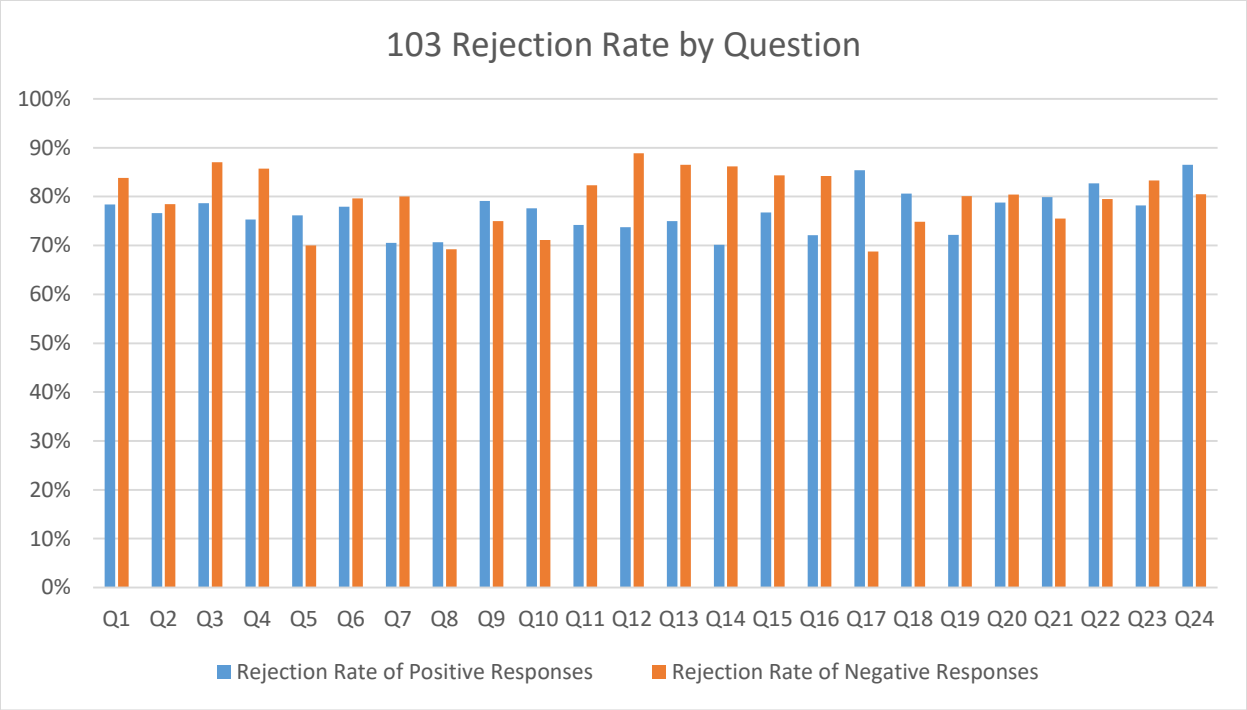
Additional Comments Instructions

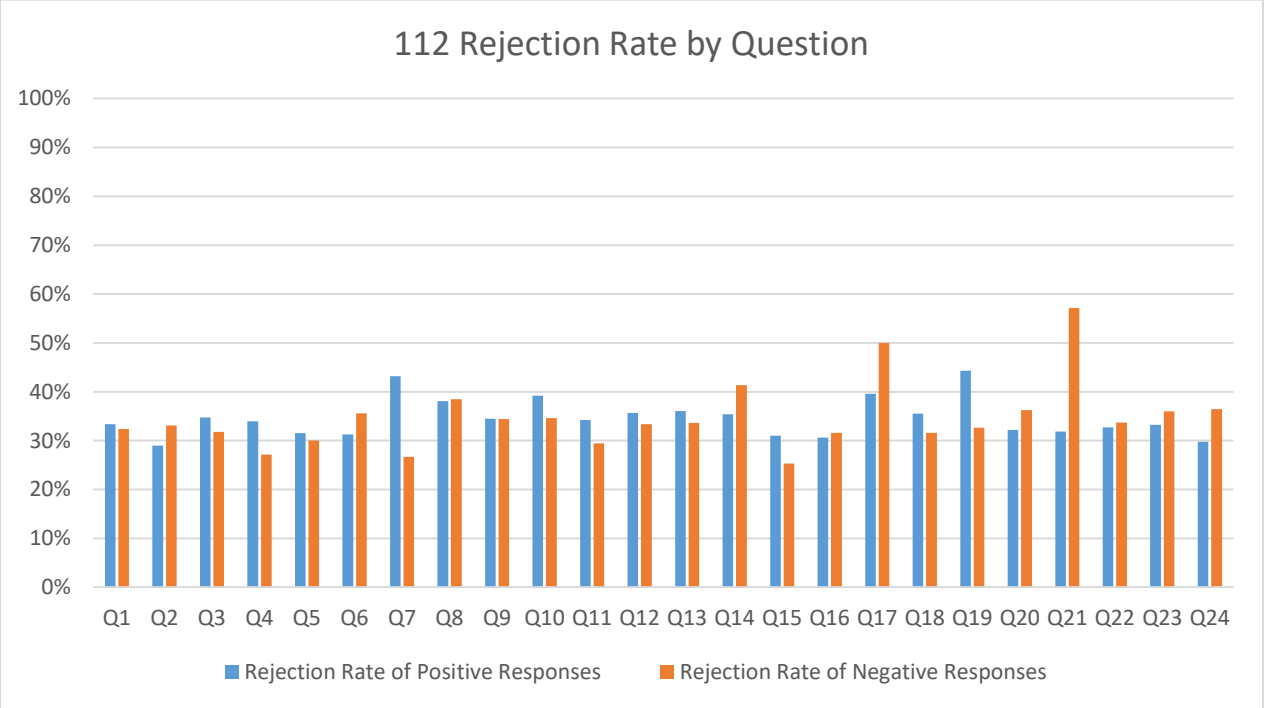
If there any other information about the application that you feel is relevant to this Application Readiness Review, this would be where to mark that (i.e. If you had to mark overburden for multiple questions, a quick note here as to why like, "Specification is 200 pages…", would be helpful). That being said, this section is completely optional and can be left blank if you are limited on time or nothing noteworthy came up during the review.

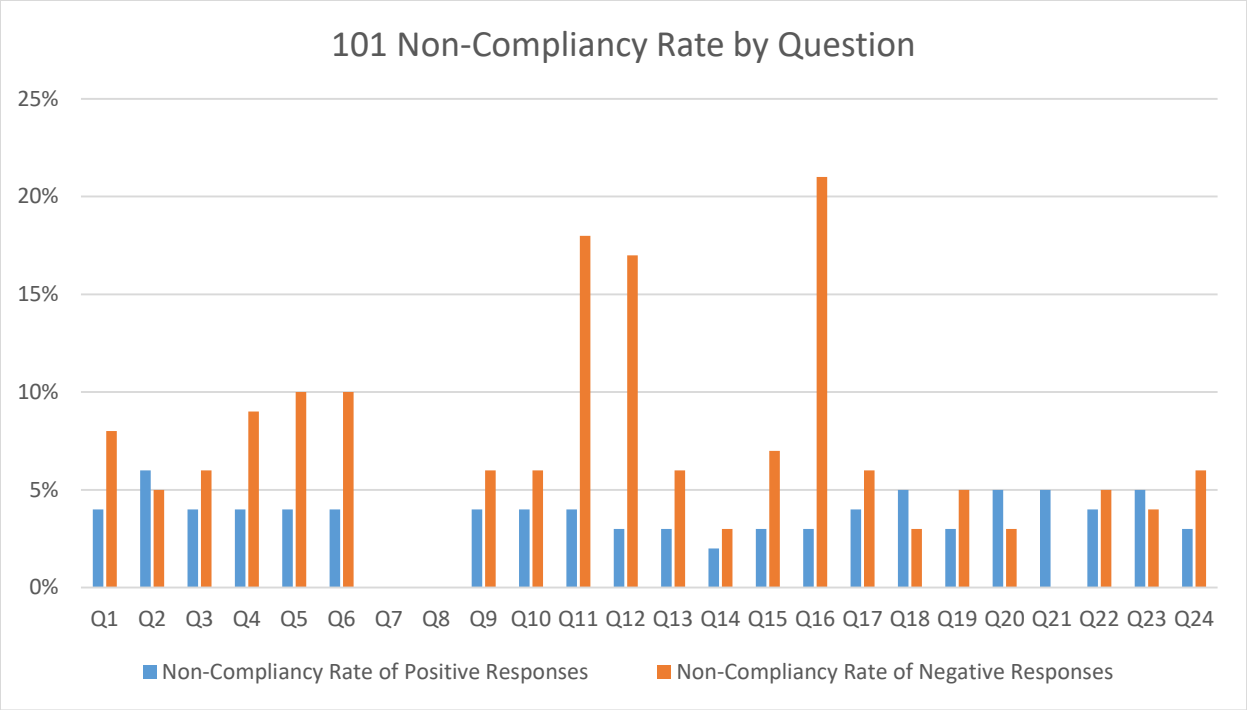
Appendix D: Rejection and Compliancy Charts

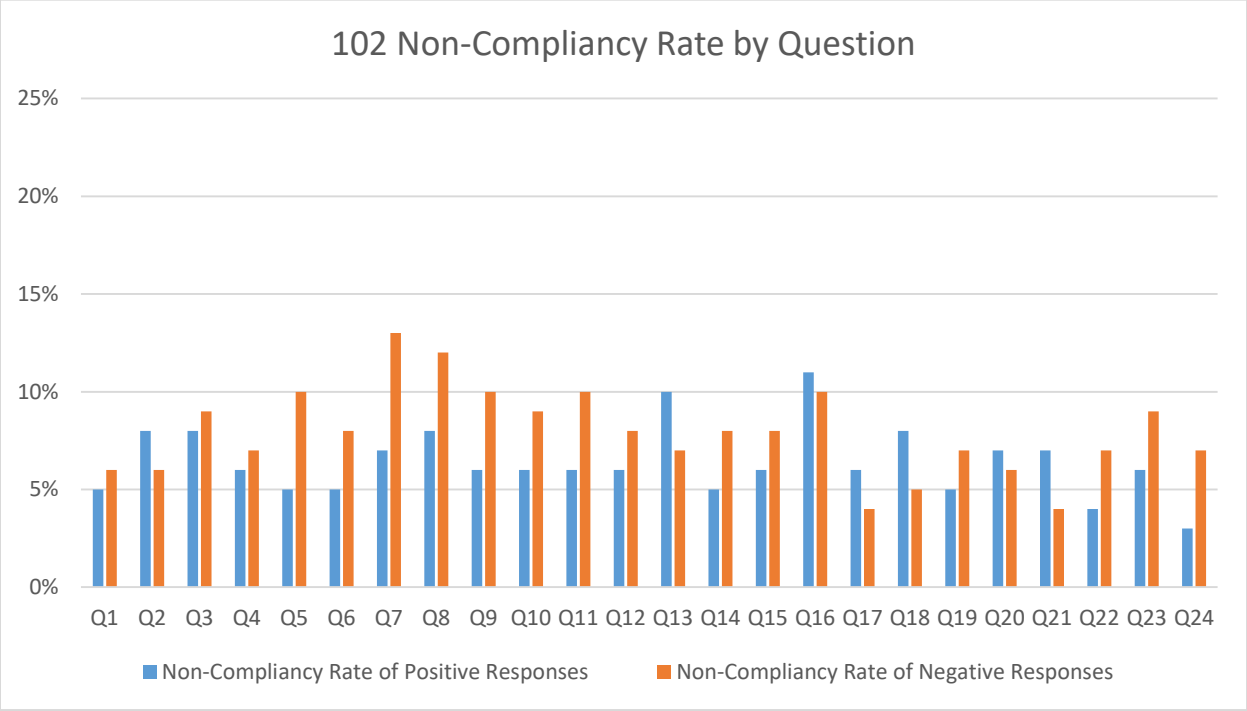


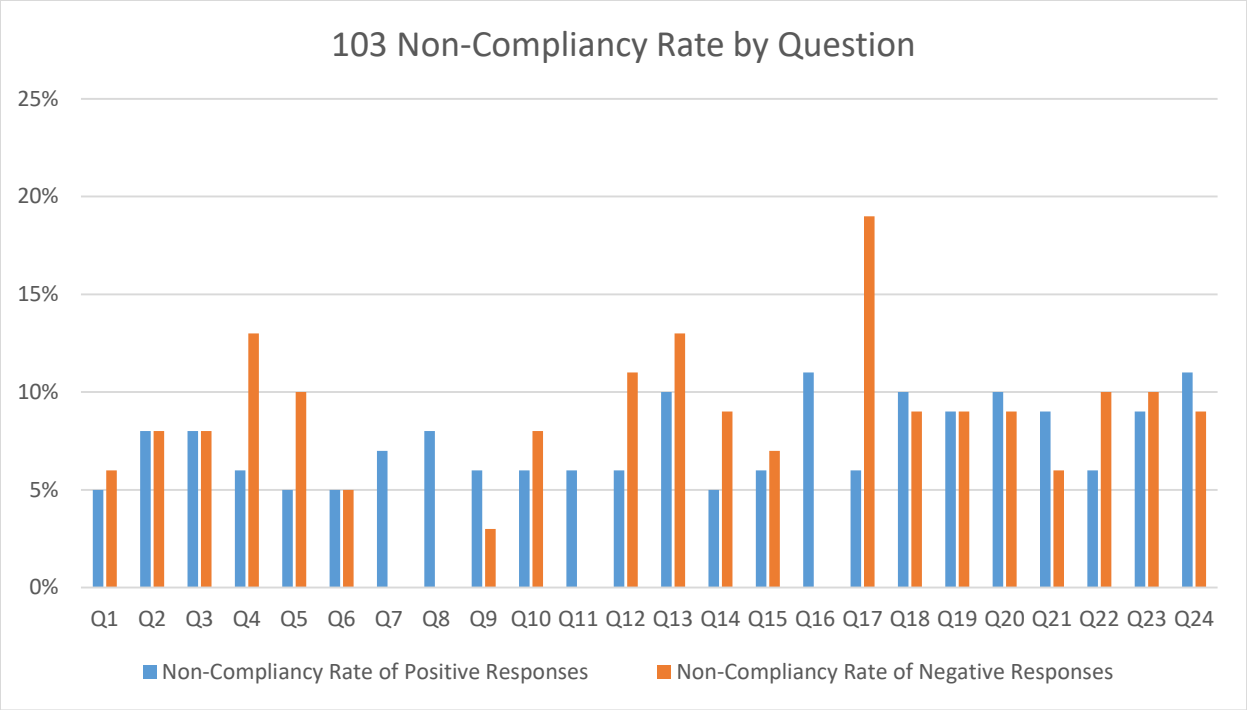


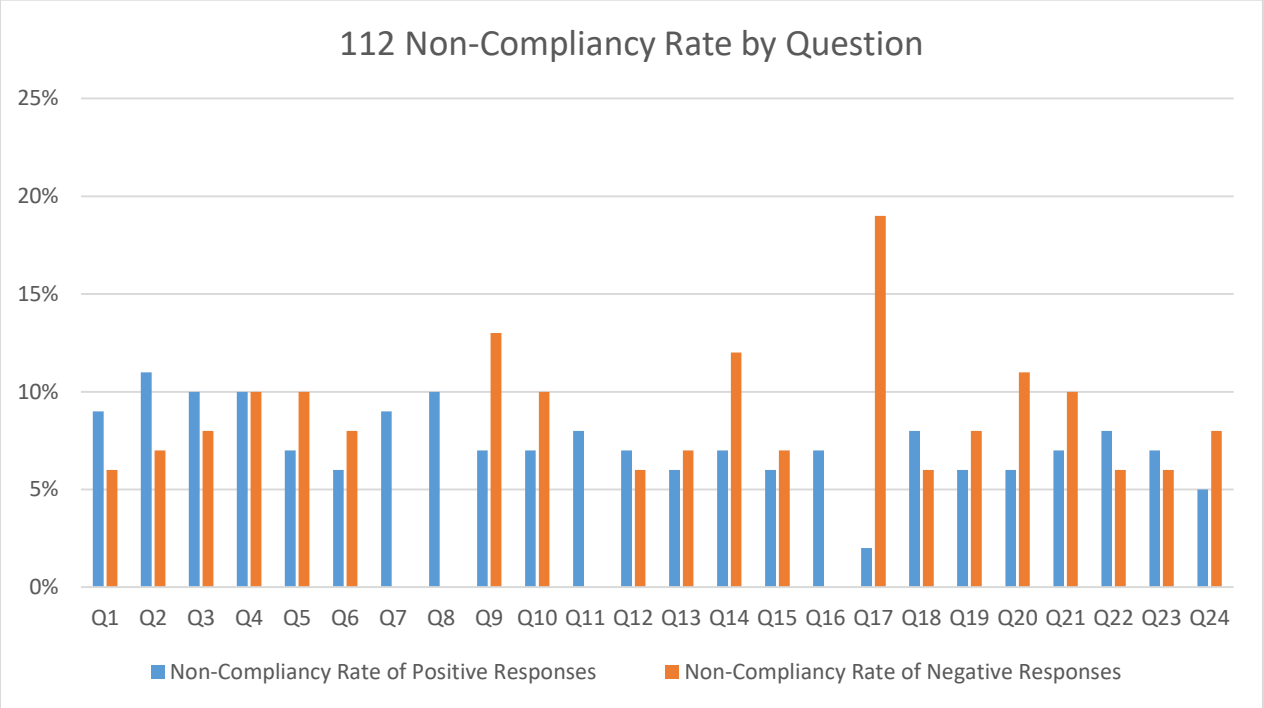

103 Rejection Rate by Question
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Q1 Q2 Q3 Q4 Q5 Q6 Q7 Q8 Q9 Q10 Q11 Q12 Q13 Q14 Q15 Q16 Q17 Q18 Q19 Q20 Q21 Q22 Q23 Q24
Rejection Rate of Positive Responses
Rejection Rate of Negative Responses

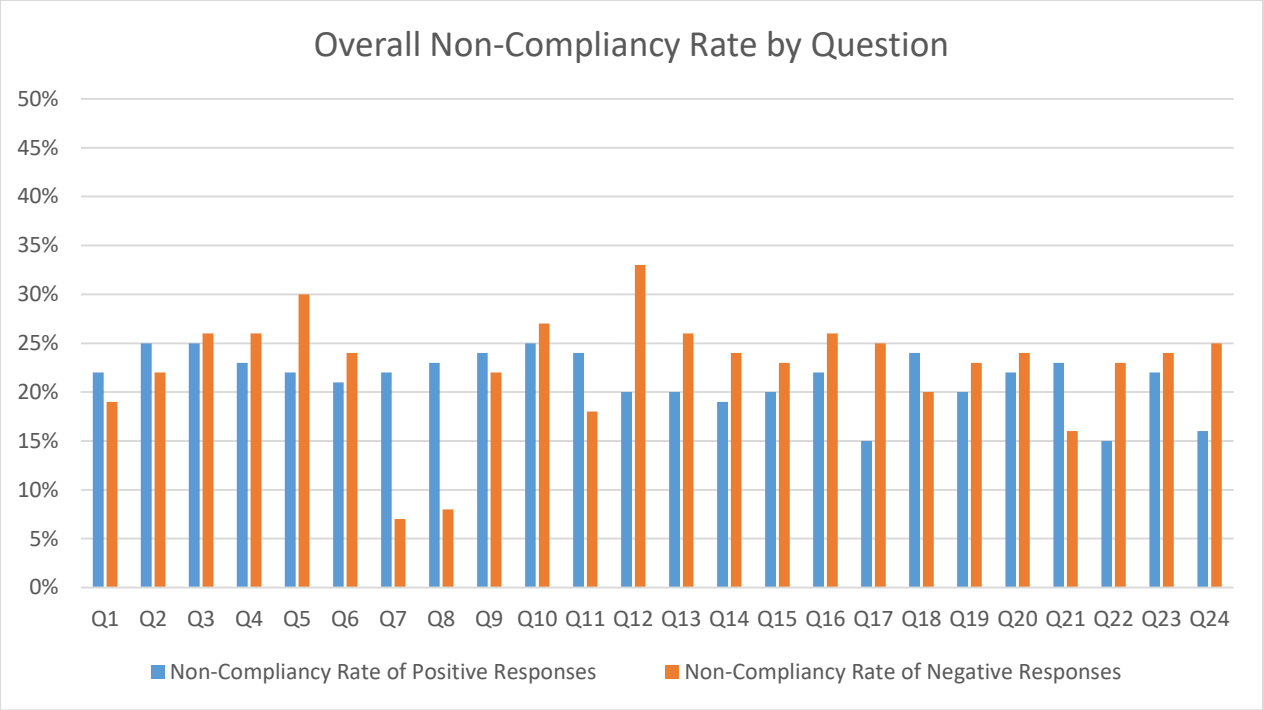

112 Rejection Rate by Question
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Q1 Q2 Q3 Q4 Q5 Q6 Q7 Q8 Q9 Q10 Q11 Q12 Q13 Q14 Q15 Q16 Q17 Q18 Q19 Q20 Q21 Q22 Q23 Q24
Rejection Rate of Positive Responses
Rejection Rate of Negative Responses


101 Non-Compliancy Rate by Question
25%
20%
15%
10%
5%
0%
Q1 Q2 Q3 Q4 Q5 Q6 Q7 Q8 Q9 Q10 Q11 Q12 Q13 Q14 Q15 Q16 Q17 Q18 Q19 Q20 Q21 Q22 Q23 Q24
Non-Compliancy Rate of Positive Responses
Non-Compliancy Rate of Negative Responses


102 Non-Compliancy Rate by Question
25%
20%
15%
10%
5%
0%
Q1 Q2 Q3 Q4 Q5 Q6 Q7 Q8 Q9 Q10 Q11 Q12 Q13 Q14 Q15 Q16 Q17 Q18 Q19 Q20 Q21 Q22 Q23 Q24
Non-Compliancy Rate of Positive Responses
Non-Compliancy Rate of Negative Responses


103 Non-Compliancy Rate by Question
25%
20%
15%
10%
5%
0%
Q1 Q2 Q3 Q4 Q5 Q6 Q7 Q8 Q9 Q10 Q11 Q12 Q13 Q14 Q15 Q16 Q17 Q18 Q19 Q20 Q21 Q22 Q23 Q24
Non-Compliancy Rate of Positive Responses
Non-Compliancy Rate of Negative Responses


112 Non-Compliancy Rate by Question
25%
20%
15%
10%
5%
0%
Q1 Q2 Q3 Q4 Q5 Q6 Q7 Q8 Q9 Q10 Q11 Q12 Q13 Q14 Q15 Q16 Q17 Q18 Q19 Q20 Q21 Q22 Q23 Q24
Non-Compliancy Rate of Positive Responses
Non-Compliancy Rate of Negative Responses


Overall Non-Compliancy Rate by Question
50%
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
Q1 Q2 Q3 Q4 Q5 Q6 Q7 Q8 Q9 Q10 Q11 Q12 Q13 Q14 Q15 Q16 Q17 Q18 Q19 Q20 Q21 Q22 Q23 Q24
Non-Compliancy Rate of Positive Responses
Non-Compliancy Rate of Negative Responses

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