



WHAT IS THE ROLE OF A CONSTRUCTION MANAGER'S QUALITY MANAGEMENT SYSTEM AND SHOULD IT BE STANDARDIZED?

BY

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Abstract

The need for quality management systems is being increasingly acknowledged by general craftsmen and construction managers. The construction manager's quality management system (QMS) is his most valuable tool and is a system of organization and processes where the construction manager documents what needs to be done, he executes what has been documented and then confirms that the task has been completed with supporting documents. It ensures that the construction manager can achieve its objectives of building a structure according to laws and regulations, while performing his duties as the manager of the entire construction project. The study aims to clarify and to investigate the purpose and role of the construction managers quality management system and its importance and effect on structures, as well as clarify if there is a need for a standardized quality management system. A blend of qualitative and quantitative research methods was used, with interviews and a questionnaire.

There are various QMSs available for a fee, but there is not a ready-made system available for new construction managers, merely instructions on how to make their own system. The main conclusion was that there is a significant need for a standardized quality management system for independent construction managers and smaller companies. It is crucial for the upholding of standards in structures that there be a clearer standardization of concise quality management systems.

There does not appear to be a difference between construction managers who work according to their own QMS and those who have bought a QMS. Experienced construction managers seem to be using their QMS correctly, but inspection forms seem to differ between QMSs, since they make it themselves in accordance to HMS instructions.

The decisive results show that there is a great need and demand for standardization. By standardizing the basic quality management system for all construction managers, it should ensure equal quality for all structures and are easily comparable across the country.

Keywords

Construction manager, quality, quality management, quality management system, QMS, standardization, standardized system, HMS, building regulations, master craftsmen, construction, building officials.

Útdráttur

Pörfin fyrir gæðastjórnunarkerfi er í auknum mæli viðurkennd af byggingarstjórum og iðnaðarmönnum almennt. Gæðastjórnunarkerfi byggingarstjóra (QMS) er hans dýrmætasta verkfæri og er skipulags- og ferlakerfi. Byggingarstjóri skjalfestir það sem þarf að gera, gerir það sem skjalfest er og staðfestir síðan með fylgigögnum að verkið hafi verið unnið. Þetta tryggir að byggingarstjóri getur náð þeim markmiðum sínum að byggja mannvirki samkvæmt lögum og reglum, samhliða því að gegna störfum sínum sem framkvæmdastjóri alls byggingarframkvæmdarinnar.

Rannsókninni er ætlað að skilgreina og leggja mat á mikilvægi og áhrif gæðastjórnunarkerfis byggingarstjóra á mannvirki, auk þess að skera úr um hvort staðlað gæðastjórnunarkerfi sé nauðsynlegt. Þar var blandað saman eigindlegri og meginlegri rannsóknartækni, þar á meðal spurningalistum og viðtölum. Það eru nokkur gæðastjórnunarkerfi í boði en nýir byggingarstjórar geta ekki fengið tilbúið kerfi; þess í stað verða þeir að fylgja leiðbeiningum til þess að búa til eigið kerfi. Lykilniðurstaðan var sú að byggingarstjórar, sem eru einyrkjar og/eða eru hluti af smærri fyrirtækjum, hafa brýna þörf fyrir staðlað gæðastjórnunarkerfi. Nauðsynlegt er að skýrari stöðlun verði á hnitmiðuðum gæðastjórnunarkerfum til að viðhalda stöðlum í mannvirkjum.

Ekki virðist vera munur á byggingarstjórum sem vinna eftir eigin gæðastjórnunarkerfi og þeim sem hafa keypt gæðastjórnunarkerfi. Byggingarstjórar með reynslu virðast nýta sér QMS rétt, en þar sem þeir búa til skoðunareyðublöðin sjálfir, þó í samræmi við leiðbeiningar HMS, virðast þau vera mismunandi eftir gæðastjórnunarkerfum.

Afgerandi niðurstöður sýna að það er mikil þörf og eftirspurn á stöðlun. Með því að staðla grunn gæðastjórnunarkerfið fyrir alla byggingarstjóra þá ætti það að tryggja jöfn gæði allra mannvirkja og eru auðveldlega samanburðarhæf um land allt.

Leitarorð

Byggingarstjóri, gæði, gæðastjórnun, gæðastjórnunarkerfi, QMS, stöðlun, staðlað kerfi, HMS, byggingarreglugerð, iðnmeistarar, byggingariðnaður, byggingarfulltrúar.

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1 Introduction

A quality management system (QMS) is an important tool that every master craftsman and construction manager should have according to the Civil Engineering Act (160/2010) (Alpingi, 2023a). This acts as a guidance tool and as a certain insurance for both them personally and their work. If this system is used correctly, it is possible to track all decisions in all projects, project by project. Yet, many construction managers do not seem to use their QMS as it is intended.

Consistency between construction managers' practices is essential to uphold the standards in the construction industry. Therefore there needs to be consistency in construction managers' quality management systems.

1.1 Current Situation

According to the Civil Engineering Act from 2010, it is essential that construction managers and master craftsmen implement a quality management system (QMS) and work according to it in order to obtain a work permit. It is up to the Housing & Construction Authority (HMS) to provide certification and supervise the process.(Alpingi, 2023a)

With an increasing speed of construction works, people are calling into question defect rates in civil engineering and suspect them to grow alongside increased construction speed. (RÚV, 2013) (MBL, 2007)

1.2 Aim and objective

In order to ensure exemplary construction, good work practices are needed where quality management is essential so that there is consistency.

The objective of this research is to investigate the purpose and role of the construction managers QMS and its importance and effect on structures. In order to do so, it is essential to understand the laws and regulations that were set in place not too long ago.

Questions sought to be answered are as follows:

1. What is the role of the construction managers quality management system?
2. Should the construction managers quality management system be standardized
3. What is the difference between construction managers who work according to their own quality management system and those who have bought a QMS?
4. Are construction managers using their QMS correctly and are they the ones attending to its upkeep?

A meeting was held with a number of companies, including HMS, SI, and İḋan, in order to receive answers to the aforementioned questions. Additionally, master craftsmen, construction managers, building officials, and executives from the aforementioned institutions were interviewed.

1.3 Thesis structure

The thesis begins with an introduction of the current situation which presents the setting of the research. The aim and goals of the thesis are thereafter presented, followed by the organizational structure of the thesis. An overview of the main concepts is presented in chapter 2, as well as previous studies on the subject, with a focus on construction managers. The main establishments in the construction sector are introduced as well as known construction manager's quality management systems and their organisational framework. The research approach is described in chapter 3, which also covers topics such as methods, research design and sample requirements and the execution of the research. Chapter 4 features interviews with various organizations and individuals in the industrial sector. Chapter 5 displays an overview of larger construction companies and their status. Chapter 6 presents the results from the questionnaire and subsequently the discussion about the main conclusions and suggestions follows in chapter 7. The conclusion is presented in chapter 8 along with suggestions for further research and the answers to the research questions.

2 Literature Review

The chapter presents an overview of research and literature related to this study. It will address the main concepts, the laws and regulations at hand and the change that came with it.

According to the Civil Engineering Act from 2010, it is essential that construction managers implement a quality management system in order to obtain a work permit, and it is up to the Housing & Construction Authority (HMS) to provide certification and supervise the process. (Alþingi, 2023a)

2.1 Quality

The word quality comes from the word *qualitas* which means character or nature. The concept of quality can be split up into two parts. One represents the features while the other represents the delivery of a product/service. The features are what it is supposed to deliver. Supposing that a product feature is examined then the feature can refer to the reliability of the product, its durability, how well it functions etc. When the product delivery is examined the the delivery refers to the actual presentation of the product to the customer, with the product flawless and no mistakes in the production. Service delivery on the other hand represents the actual delivery process of the product and refers to punctuality, accuracy, and functionality of the whole service. The service feature defines how the service should be and what is intended to be delivered. In other words, is the provided service delivered in the correct manner? When the "correct manner" is defined, then the quality can be measured. Both products and services should be delivered flawlessly.

The more features that are built into a product or service, the higher the price tag will be. Therefore, the features of a product correspond to the quality of the design. But while the price is defined by the seller, the value is defined as the ratio between quality and price (Þór Ingason, 2020), see equation 1 below.

$$Value = \frac{Quality}{Price} \quad (1)$$

Quality expectations and quality assurance are interlinked. The understanding of one

leads to a better understanding of the other one.

2.2 Quality management

Quality management (QM) ensures that a product, service or an organization consistently functions well. QM has four main components: quality planning, quality assurance, quality control and quality improvement. (Kenneth, 2005) Quality management focuses both on the product and the service quality, as well as the means to achieve those qualities. Quality management therefore uses quality assurance and control to achieve more dependable quality.

"Quality management is the act of overseeing all activities and tasks that must be accomplished to maintain a desired level of excellence. This includes the determination of a quality policy, creating and implementing quality planning and assurance, and quality control and quality improvement. It is also referred to as total quality management (TQM)." (Investopedia, 2022b)

Quality management (QM) focuses on long-term goals by implementing short-term initiatives. Total quality management (TQM) is a system of management that requires all staff members work together to maintain and improve processes, products, services and the culture of the company itself. TQM provides quality assurance to the customer as well as a process for managing unsatisfied customers. (Investopedia, 2022a)

2.2.1 QM: The four main components

Quality planning is integrated with quality management because the first step of implementing a QMS is to develop and present a quality policy. (Þór Ingason, 2020)

Quality assurance is defined in the book *Quality Management* as providing confidence that quality requirements will be fulfilled, that is to reassure the customer that their expectations of the product or service will be met. This can also be built by issuing an insurance policy to the customer that commits the company to meet specific expectations that are decided in advance. (Þór Ingason, 2020) This is done in the construction

industry using the building regulations and laws around it.

"Quality control is the process that is constantly applied to meet the criteria that have been defined in the operation." (Þór Ingason, 2020)

An essential feature of quality control is what to observe and therefor most important to set an appropriate measurement that measures what matters. Specifications must be clearly defined and the process must be monitored. The results of the measurement are compared to the specifications defined. If the measured values are outside the given specifications, then it is noticed right away and indicates an error which calls for immediate action. Quality control is applied in order to be able to detect variation in processes, look for opportunities for improvement and therefor continuous improvement, and more. So it is justifiable to say that measurements are a prerequisite for quality control as well as a prerequisite for all quality management, quality planning and continuous improvement. (Þór Ingason, 2020) To simplify, quality control is a system of maintaining standards.

Quality improvement is the structure used to consistently improve processes and systems. It is built on measurements, goal setting and testing and can then improve processes towards specific goals.

Continuous improvement is said to be one of the pillars of quality management. This is stated in the quality trilogy (Juran, 1989) and is reflected in the ISO9001 standard. The trilogy is quality planning, quality control and quality improvement. (Þór Ingason, 2020)

2.2.2 ISO 9001 and PDCA

The ISO 9001 is an international standard and is used to specify the specifications for a quality management system (QMS). ISO 9001 stands for the International Organization for Standardization's 9001 standard for Quality Management Systems and it is used by businesses and organizations to show that they can consistently deliver services and products that comply with legal and customer standards. It can be used by businesses in any industry and is the most widely used standard in the ISO 9000 series.

One of the main benefits of ISO 9001 is its continuous improvement.

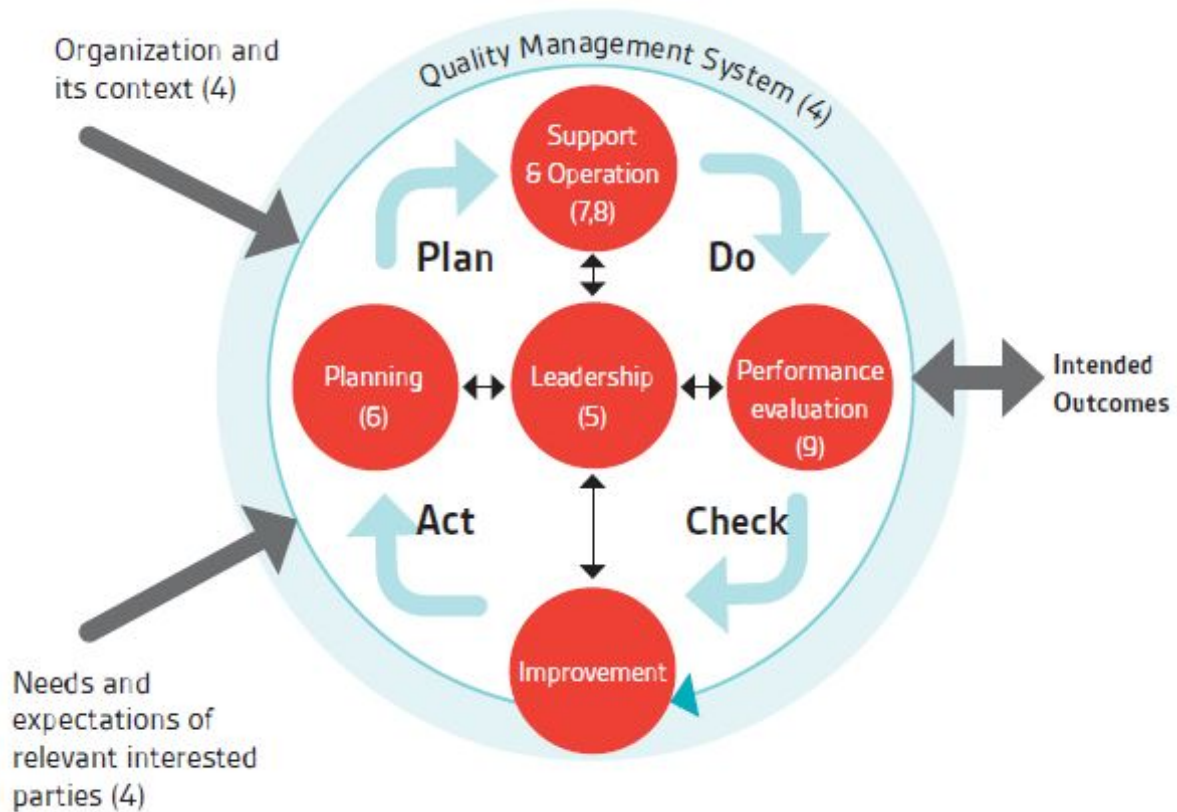


Figure 1: The PDCA cycle

The plan-do-check-act (PDCA) methodology is the foundation of ISO 9001 and offers a process-oriented approach to describing and assessing the organizational structure, roles, and processes necessary to accomplish effective quality management.

Planning, doing, checking, and acting are the four steps that make up the PDCA cycle. For problem-solving and change management, it offers a straightforward method. When modifying procedures and working methods, the model can be very helpful for testing improvement measures on a small scale. "Plan-Do-Check-Act (PDCA) is the operating principle of ISO 9001. It's applied to all processes and the QMS as a whole. This diagram shows how Clauses 4 to 10 of ISO 9001 can be grouped in relation to PDCA." (BSI, 2015), see figure 1

2.2.3 The value chain

A value chain connects the key parties from beginning to end. Brian Beers wrote "*A value chain is a business term describing the full range of iterative activities a company uses to create a product or a service. The purpose of value-chain analysis is to increase production efficiency so that a company can deliver maximum value for the least possible cost.*" (Investopedia, 2021)



Figure 2: The value chain linking an organisation to its suppliers and customers (Helgason, 2020)

The value chain has five main components. These primary value chain activities are listed in the following list as well as their examples.(Investopedia, 2021)

1. Inbound logistics (warehouse, inventory, etc)
2. Operations (convert raw materials to a finished product, etc)
3. Outbound logistics (distribution)
4. Marketing and sales (advertising, pricing, etc)
5. Service (customer service, maintenance, etc)

Companies are constantly competing with each other by improving their product and/or service and fitting it into the needs of the customer. Competition is always a good thing and keeps up quality standards. By creating certain expertise by analyzing

and improving one or more of the five primary value chain activities, a company can gain a competitive edge and therefor boost profits. (Investopedia, 2021) Continuous improvement is what keeps the competitive edge and high profits. Listening to what the customer wants and needs is of great importance.

2.2.4 The development of quality management

Quality management started off as quality control, producing a product to meet the expectations of the buyer.

"During the last decades of the twentieth century, quality management evolved from being purely about control, with a focus on ensuring that the features of the products are in accordance with the clients' specifications, into a management style or ideology that companies wanted to follow in a larger context. (Þór Ingason, 2020)

Quality control of the final product is just as important as of the production itself. The quality of the final product is defined by design, handling of raw materials, customer complaints processes among other things. This is what is called the period of total quality control. The quality is defined by the whole operation, not just the production. (Þór Ingason, 2020)

2.3 Quality in the construction industry

Quality in the construction industry relies on the building regulations (112/2012) (Byggingarreglugerð, 2023) and the Civil Engineering Act (2010) (Alþingi, 2023a).

Buildings can only be built in a certain way, due to regulations, which can vary by countries. For each building there is a construction manager who is responsible for all of the work to be done according to the building regulations and laws. He has masters in every field required (e.g. electricians, plumbers, masons, etc) sign documents which confirm that they and their staff are working under these laws and regulations. But overall the construction manager of the building is responsible and therefor has to pay close attention. If the construction manager makes a mistake, he is financially responsible. This way the customer, the buyer of the structure, has quality assurance.

In Oakland and Marosszek's book, Total Quality in the Construction Supply Chain, they believe that one of the main problems in the construction industry is the vague definition

of quality. The current definitions of the term are considered to be more applicable to products in the manufacturing industry rather than the work of construction workers. The problem lies primarily in the complex chain of parties involved in each project. In order to achieve the right quality, good communication, cooperation between all parties and consistency is required.(John Oakland, 2006)

2.4 Laws and Regulations

Quality in the construction industry mainly relies on two things, the building regulations (112/2012) and the Civil Engineering Act (2010).

2.4.1 Building regulations (112/2012)

The regulation, also known as Byggingarreglugerð nr. 112/2012, applies to all structures built on land, to all aspects of structures including vegetation on plots, finishing and appearance of plots. It can be found on the website www.byggingarreglugerð.is where it is updated regularly and it is possible to observe it there, as well as sign up for a mailing list to receive notifications of updates and changes of the building regulation.

The aim of this regulation is the following: (Byggingarreglugerð, 2023)

- a) To protect human life and health, property and the environment by ensuring professional preparation for the construction of structures and active monitoring that the requirements for the safety of structures and health are met.
- b) To promote the durability and efficiency of structures, i.a. by ensuring that they are designed and built in such a way that they are suitable for Icelandic conditions.
- c) To promote the protection of the environment by having sustainable development as a guiding light when designing and making structures.
- d) To promote technical progress and innovations in the construction industry.
- e) Ensuring accessibility for all.
- f) To promote good energy efficiency in the operation of buildings.

2.4.2 Civil Engineering Act

A new law on structures was approved and signed on December 28th 2010 and went into effect on January 1st of 2011. Their purpose, among other things, is to improve consumer protection, infrastructure administration effectiveness, and infrastructure quality.

Article 5 of the law mandates that the state run a certain Civil Engineering Agency with responsibility for, among other things, monitoring the law's execution (Alþingi, 2023a). Manvirkjastofnun, now known as HMS, started operations on January 1, 2011 on the basis of the Fire Protection Agency with the same number of employees. (B. Jónsson, 2023)

The aim of this regulation is similar to the building regulation (112/2012). This law seeks to accomplish the following:

- a. By ensuring that structures are properly prepared and actively ensuring that the standards for the safety of structures and health are satisfied, it is possible to protect human life, health, property, and the environment.
- b. To encourage the robustness and effectiveness of structures, including by ensuring that they are planned and constructed in accordance with the unique conditions of Iceland.
- c. To support environmental protection by using sustainable development as a guiding principle in the planning and construction of buildings.
- d. To encourage technological advancement and creativity in the building sector.
- e. Providing universal accessibility.
- f. To encourage effective construction operations that use less energy.

According to the Civil Engineering act, the main tasks of the Housing & Construction Authority (HMS) are:

- (1.) to coordinate building inspection, fire safety inspection, and fire brigade operations across the nation in conjunction with the appropriate authorities,
- (2.) to coordinate with SÍS and other interested parties to create rules, methods, and inspection manuals relevant to the institution's field of expertise,
- (3.) to be in charge of building product market surveillance in accordance with the law regarding building products,
- (4.) To address accessibility concerns,
- (5.) to oversee the application of Law No. 146/1996 Concerning the Safety of Electric

Power Plants, Utilities, and Electricity Consumers,

(6.) to run a national electronic database on buildings and construction, see Article 61.

(7.) to look after publicity and stakeholder and public education,

to conduct research on construction and infrastructure, as well as to promote it, educate people about it, and collect data in this regard.

(9.) to grant building licenses and oversee the construction projects covered by paragraph 3.

(10.) To offer training for designers' and construction managers' legal rights and to offer certification for designers, artisans, and firefighters,

(11.) to oversee the Fire Training School's operations, including the hiring of fire chiefs and fire safety inspectors,

(12.) to grant work permits to construction managers and inspection organizations that carry out this law's requirements and keep an eye on their operations,

(13.) to approve municipal fire prevention plans in line with the provisions of the law on fire prevention, to grant work permits to supervisors and suppliers of fire prevention services,

(14.) to handle the management of the competition fund for civil engineering and construction research, see Article 54a,

(15.) to coordinate with interested parties in managing and promoting research in the fields of civil engineering, fire prevention, and the built environment, as well as managing and promoting the publication of information on those topics,

(16.) to handle fire safety control for buildings inside the exclusive economic zone and continental shelf boundaries that are being planned or built as a result of the study and production of hydrogen gas,

(17.) In order to take part in the Icelandic Standards Council's work on the development of Icelandic and European standards in the field of civil engineering and to nominate parties to take part in the EOTA's work,

(18.) To collaborate with comparable organizations abroad and in nearby nations,

(19.) to offer recommendations on civil engineering-related issues to the ministry and other authorities. (Alþingi, 2023a)

2.5 A Quality Management System (QMS)

Quality management systems (QMS) are defined as "a set of defined processes that are expected to ensure that the organisation can operate and achieve its objectives."

QMS rely on continuous improvement. Throughout the construction industry, the QMS structure should be the same while the content is different between industries. "The International Standards Organisation (ISO) defines this concept as 'a part of a management system with regard to quality' where a management system is defined as a 'set of interrelated or interacting elements of an organization to establish policies and objectives, and processes to achieve those objectives' (Icelandic Standards, 2015a). The quality system is founded on a very simple idea, to issue a promise regarding how the operation of the organisation will take place." (Pór Ingason, 2020)

For their operations to be compliant with official requirements, laws, and regulations, all professionals in the construction sector (designers and design managers, construction managers, artisans, etc.) must have an approved QMS before beginning projects that require a building permit. Additionally, all building officials in the country must also have a QMS approved by HMS. (HMS, 2023m)

Before the applicant begins the process of registering a QMS, he must first submit an application for the registration of a QMS to HMS. An accredited inspection or certification office must then conduct a document inspection of the system. Following that, a signed inspection report detailing the findings of the inspection must be given to HMS in pdf format. (HMS, 2023g)

In the construction sector, the term "quality management system" (QMS) is actually built on three key terms: quality planning, quality assurance, and quality control. The QMS helps users find a balance between quality, cost and time and achieve certain objectives and compliance of the construction industry. The QMS is a tool that can help make sure that building projects are successfully finished, within the time frame and cost plan initially given. Additionally, QMS can provide preventive features if used correctly. By taking preventive action, an appropriate level of quality is determined in the first phase of construction. The QMS supports all phases of the construction. (Aura, 2023)

The requirements of the project owners, constructors, and other participants must be met in order to increase customer satisfaction, and this is where the QMS comes in. Master craftsmen are aware of the value of compliance and inspection benefits for the construction industry as a whole. Poor quality can cause the construction manager to incur unintended expense increases, due to failure, prevention, and evaluation to name a few. As a result, quality must be considered throughout the entire process, starting from the beginning. It is crucial and very beneficial to start with a quality management plan when beginning a project, when blueprints, drawings and design documents are prepared. This plan is what the quality manual defines and is presented alongside the QMS. When management continues to support the project, quality standards and quality design can raise the project's quality, thus the quality of the construction manager and his reputation. The success of the project depends on the cooperation of all parties participating in the process. When everyone works together as a team and follows the same manual, then the goal set will be achieved. (Aura, 2023)

2.6 Quality Management Systems

Construction managers have access to a wide range of quality management systems (QMS) and solutions on the market today. It is challenging to declare one superior to the other because what works for one person may not always work for another. Therefore, it is crucial to carefully consider what is appropriate for each construction manager as well as the kinds of projects that each handles. It is safe to claim that development is quick, but success is unfortunately unlikely to occur regardless of how trendy or technically advanced a QMS is if no one is motivated to put it into practice or participate in the project.

The human element, what the individual has to perform and manually enter into the system, is the weakest link in all systems. It will be simpler to operate the system and encourage ongoing improvement if the workplace culture is supportive of it, which will boost competitiveness and increase revenues.

The qualities of various systems are defined in the following subsections. This list of QMSs in the subsections of this chapter is not exhaustive but merely the ones the researcher heard the most about.

2.6.1 Computer filing system

A homemade digital folder system is a suitable solution for smaller companies. This is essentially a system of ordered folders maintained on a computer, but it makes more sense to save it on an internet platform such as the cloud, e.g. dropbox, onedrive, or google drive. The system may be easily customized to meet individual demands, and there are no additional costs, only the time required to set it up. The biggest disadvantages, however, are that the system needs to be inspected by a licensed inspection agency in order to receive HMS approval. Additionally, the construction manager must himself monitor changes in laws and regulations and update the system accordingly. The system installation requires a lot of labor at first, but it can be done by following the HMS instructions. This, however, may prove to be challenging for those who are new to the industry due to a lack of certain terminology. Read more below on this topic.

In the following figure, figure 3, a certified QMS filing system is displayed.

- ▼ QMS - Company Name
 - ▼ Auxiliary data
 - HMS general letters and recommendations
 - ▼ Company Name - Construction Manager
 - ▼ YEAR - 00# Address
 - > 01 Milestone Inspections
 - 02 Meetings
 - > 03 Record of comments and communications
 - 04 Plans - Registration
 - > 05 Verification of construction products (CE)
 - > 06 Inspections
 - 07 Building permit
 - > 08 Pictures
 - 09 Change of master and construction manager
 - 10 Contracts
 - > 11 Improvements
 - > 12 Manual of Structure
 - > 13 Other
 - Company Name - Design Manager
 - Contracts
 - Disclaimers
 - Insurance
 - ▼ Other
 - Accounting
 - ▼ Quality Management System (QMS)
 - ▼ Digital Data
 - About the company
 - Certificates and documents
 - Frumherji
 - ▼ HMS
 - Checklists and reference books
 - ▼ Icelandic Revenue and Customs (RSK)
 - Annual accounts and tax returns
 - Ýmis gögn RSK
 - Laws and Regulations
 - The Quality Manual

Figure 3: An overview of a certified digital filing system

A better look into the filing system for each project is shown in figure 4 and figure 5 below. The head file for each specific project is named and categorized by year and given a number, starting at 001. Additionally the address of the project is applied to the name. The head file name is therefore "year - project number - address". This can be seen highlighted in figure 4.

- ▼ ■ Company Name - Construction Manager
- ▼ ■ YEAR - 00# Address
- ▼ ■ 01 Milestone Inspections
 - Checklist - Milestone Inspections
 - HMS Byggingar Gáttin - Overview
 - Inspection - 0. Foundation
 - Inspection - 1. & 2. Floor May 2022
 - Inspection - 1. Floor Foundation
 - Inspection - 1. Floor June 2021
 - Inspection - 2. Floor Desember 2021
 - Inspection - 2. Floor Foundation Aug2021
 - Inspection - Roof March 2022
- 02 Meetings
- ▼ ■ 03 Record of comments and communications
 - Building units
 - City of Reykjavík
 - Costruction Design
 - HMS
 - Master craftsmen
 - Veitur Utilities
- 04 Plans - Registration
- ▼ ■ 05 Verification of construction products (CE)
 - Electrical products
 - House cladding
 - Masonry products
 - Plumbing products
 - Structure and Roof
 - Windows and doors

Figure 4: An overview of a certified digital filing system; a better look into project filing (part 1/2).

- 06 Inspections
 - 1. Sealproof inspection
 - 2. Safety inspection
 - 3. Final inspection
 - > Checklists
 - 07 Building permit
 - > 08 Pictures
 - 09 Change of master and construction manager
 - 10 Contracts
 - 11 Improvements
 - Improvements - Comments interim inspections
 - Improvements - Other
 - Improvements - Variations in internal control
 - 12 Manual of Structure
 - Completion Report
 - AOSH (Vinnueftirlitið)
 - Master Builder
 - Master Electrician
 - Master plumber
 - Other
 - Tinsmiths
 - Handbook of the House
 - 13 Other
 - > Design Documents - Drawings

Figure 5: An overview of a certified digital filing system; a better look into project filing (part 2/2).

2.6.2 Ajour system

Ajour System is a Danish company, privately owned, with approximately 36 employees and offices in Denmark, Germany, Iceland, Poland, and Sweden. Their platform is therefore available in Danish, English, German, Icelandic, Swedish, Norwegian, Polish, Russian, Ukrainian, and Hungarian. Ajour is a very well known system and has many satisfied users. They have more than 4,000 companies and 40,000 daily users of our solutions. (Ajour, 2023h)

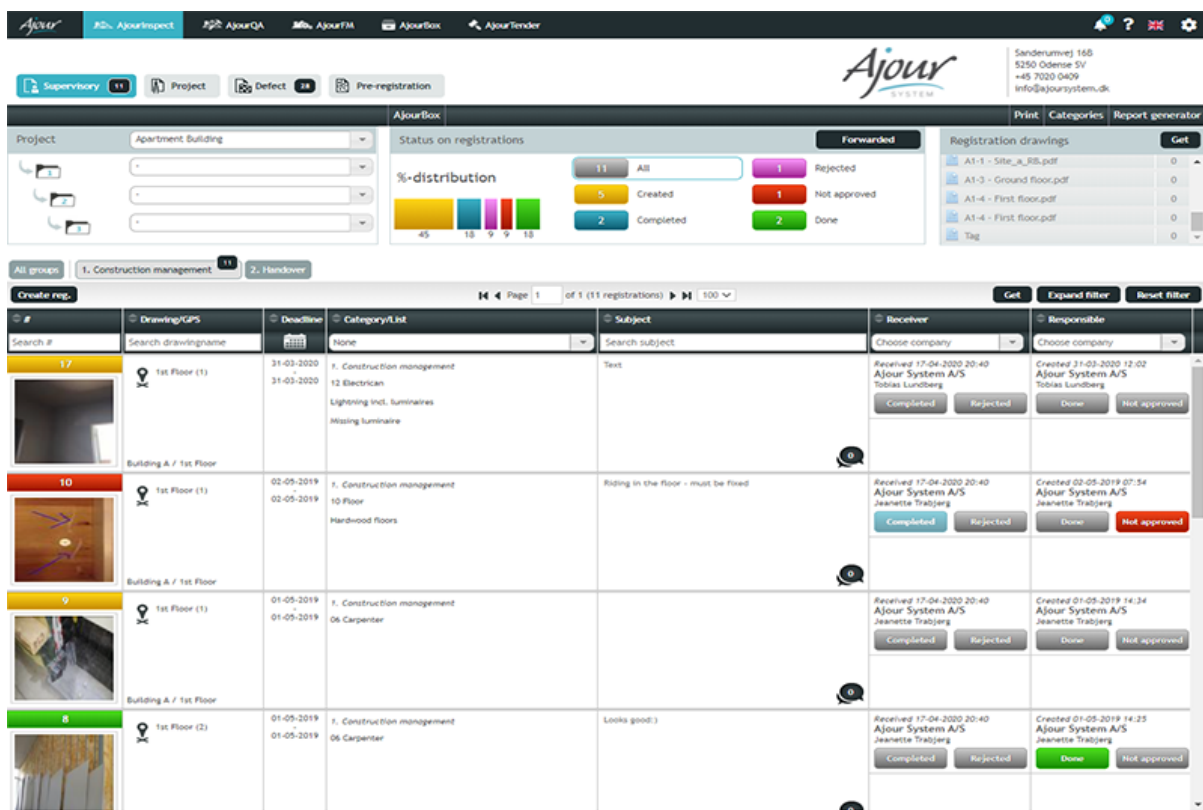


Figure 6: An overview of the Ajour system. (Ajour, 2023d)

Ajour System has specialized in quality assurance (QA) for the construction industry for the past 10 years. They have provided relevant digital tools that ensure professional documentation as well as skilled consultants who ensure that the system is set up and works correctly. They have set up great groundwork but the user can adjust the quality assurance templates, checklists, etc. to their needs.

Many companies use Ajour systems for their QMS, but some municipalities in Iceland use Ajour systems as well, such as Ölfus and Árborg. The administration of the municipality decided to implement the systems of Ajour System on all its construction projects.

The Danish system can be broken down into eight product groups, which then complement one another. The categories are as follows:

- **Ajour Box**

AjourBox is a web-based professional project web for version control of documents and drawings. AjourBox is accessible anywhere, anytime and ensures that the project parties are always up to date, which makes it very user friendly. (Ajour, 2023a)

- **Ajour QA**

AjourQA is a system for quality assurance with a focus on photo documentation on construction projects. AjourQA creates ready to print documentation. (Ajour, 2023g)

- **Ajour Inspect**

AjourInspect is tool for Construction Managers for construction management and technical inspections. It is one of the most used communication tools in the Danish construction industry.(Ajour, 2023d)

- **Ajour Tender**

AjourTender is a platform for tenders. It provides an overview of who wants to participate in the tender and what is needed in the tender. Ajour has integrated the common European Tender Document, also known as the European Single Procurement Document (ESPD) in their system. (Ajour, 2023i)

- **Ajour FM**

Planning and management of operation and maintenance. (Ajour, 2023c)

- **Ajour Objects**

BIM building components are gathered and shared in the cloud and are therefore available to all employees in the company. (Ajour, 2023f)

- **Ajour Manufacturer**

Publish manufacturer data through Ajour Objects platform. (Ajour, 2023e)

- **Ajour Collab**

BIM and information managaement. (Ajour, 2023b)

Mobile phones, tablets, and laptops can all use the system. The system comes with a built-in folder structure that is simple to customize to one's needs. The system can also be created from scratch. An intriguing aspect of the bim viewer is that it enables web component opening of 3D models by construction managers. Another advantage of the system with drawings is the way it is set up. A database storage system for architects and engineers is included in Ajour objects, and its installation guarantees that you are always working with the most recent information. Direct data transfer into Revit gives the user access to all building components and allows for on-demand maintenance.

2.6.3 JibbyByggir

Jibby.com was created in Iceland by Uppstraei ehf, a company with decades of project management expertise in a variety of industries. The Jibby environment aims to make it possible for users to utilize fewer tools, store crucial data, make plans, monitor progress, and cooperate with others. The Jibby environment is a powerful folder system where each folder has many features. There are unlimited number of checklists in each folder, along with text descriptions and text that can be assigned to other people. Then, each folder has an independent chat room. In the Jibby system, all folders inherit the attributes of the so-called parent folder, including the permissions to read, modify, and delete. Subfolders, however, can be set up with various user access levels.

Each folder in the Jibby environment has several functionalities in addition to just being able to store documents of all kinds. An unlimited number of checklists are available for each folder, each of which can be delegated, along with descriptions and text.

The Jibby system produced JibbyByggir. There, any user can design their own version of a quality management system by customizing JibbyByggir to suit their needs. (Jibby, 2023a)

Jibby provides installation and training for its system. The installation assistance is provided online or by a company representative visiting the customer's home or workplace. The training consists of of three-hour courses that are routinely held. (Jibby, 2023b)

2.6.4 The Bygg System

The Bygg system is made by Hannarr ehf, which also published *Hannars building key*, which contains various costs items, cost estimates and more.

Developers, designers, design managers, construction managers, craftspeople, and contractors can use the Bygg system to collaborate on and deploy the components they require during construction projects. The system guides the user through each step from conception to finished product. The user may look up instructions about any items he has to remember in the system, access all the data, systems, and forms he needs to use, and store any data that are generated during execution and are required to be stored. The user can check up and work on the job at any time, from any location. (Hannarr, 2023b)

The standard ST 30 is freely available to users for one workstation in an electronic format. With ten years of expertise, the Bygg system is a full solution that guarantees that the right data is utilized and that everyone uses the same data. Construction costs and CO2 emissions may be calculated automatically because the technology uses Hannarr's construction price list for generating cost estimates.(Hannarr, 2023b)

The Bygg system also includes an inspection tool. The Bygg app is a tool for evaluating the condition of structures from the inside out. It can print out condition inspections, maintenance plans, and the information required for choices and contracts on the construction, as well as an estimate of the cost of fixing what needs to be corrected. (Hannarr, 2023a)

2.6.5 MindManager

MindManager is a mind-mapping software for businesses. It is widely used to keep track of employees and where they are working at any given time. There, it is possible to set up flowcharts, register staff for projects, manage projects, schedule meetings, enter data, and more. In Iceland, the majority of people who use MindManager also use another system simultaneously. (MindManager, 2023)

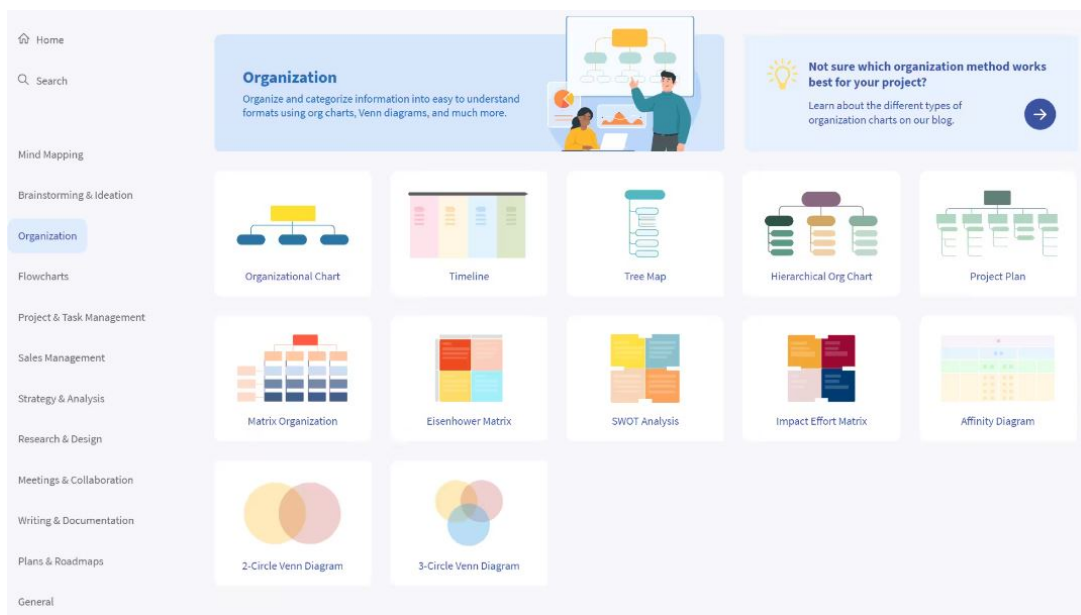


Figure 7: A simple overview of MindManager (MindManager, 2023)

2.6.6 Procore

Procore aims to connect everyone in the industrial sector and everything concerning it on one platform to build better structures.

Procore offers four categories; pre-construction, workforce management, project management, and financial management. (Procore, 2023b) Procore is an extensive software with many significant features, one of whom is BIM. BIM is a design and modeling software in 3D that can help optimize the work of designing for various structures. Procore has gotten many praises from large companies in the construction industry regarding the architectural drawing-part of their system.

Mobile collaboration solutions in Procore are created for the field and make it simple for everyone to understand what has to be completed each day in order to stay on time and avoid rework. Procore swiftly pinpoints potential problems and their effects on budgets and timelines. Procore’s enhanced project visibility can also aid in preventing unpleasant surprises.(Procore, 2023c)

Any computer, laptop, or mobile device with a wifi connection can run Procore. Procore’s offline mode allows users to see and modify files even when they aren’t connected to the internet. They will preserve their updates once they are reconnected.(Procore, 2023d)

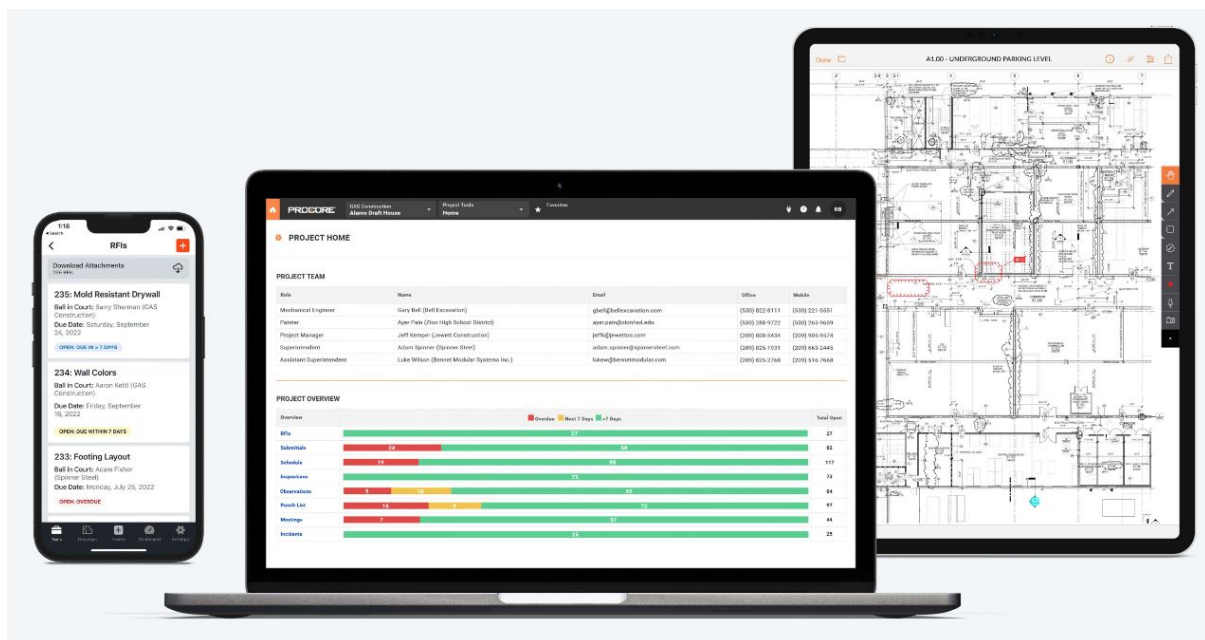


Figure 8: A simple overview of Procore(Procore, 2023a)

Interestingly, Procore offers an incident registration, in their construction site quality and safety management software, with a human model where injuries or soreness can be marked.

2.6.7 Sharepoint

SharePoint is a web-based collaborative platform that works with Microsoft 365. It is mainly sold as a storage system and for document management, since it is a safe location to store, organize, share, and access information from any device through a web browser. It can also be shared within a team using a team site, therefore controlling who has access to it. (Microsoft, 2023)

2.6.8 M-files

M-files is a platform for document management which works with sharepoint and other similar systems. (M-Files, 2023). According to some interviewees, those who use M-files in Iceland in their QMS most likely also use another system simultaneously.

2.6.9 7.is

The company 7.is was arranged with experts in management systems where consultants lead and build on proven concepts, methods and techniques. 7.is consultants assist managers in streamlining business processes to eliminate confusion and inconsistency and enhance performance.

With the aid of the QMS, bottlenecks were eliminated, job quality was supported without hindrance, and work was done against waste and interruptions. International standards for management systems outline requirements on which those involved in the standards process have come to agreement. The creation and modification of the standards involves thousands of specialists from around the world. The ISO 9001 standard for quality management, the ISO 14001 standard for environmental management, the ISO 27001 standard for information security management, and the ISO 45001 standard for workplace health and safety are all employed at 7.is.

The company is no longer working, but was certified and highly recommended by the accredited inspection agencies.

2.7 HMS: The Housing & Construction Authority

The Housing & Construction Authority, known as Húsnæðis- og mannvirkjastofnun (HMS) is an institution that ensures professional preparation for construction and does active monitoring of quality and safety, as of January 1, 2010, therefore contributing to a better supply of affordable housing.

HMS supervises the work of accredited designers, certified craftsmen and construction managers. They do this through inspections of their quality management systems. Inspections of these quality management systems must be carried out at least every five years, in addition to which it is permitted to carry out increased and/or more frequent inspections if there are repeated irregularities in their work. Only certified agencies can do these inspections. The more experienced master craftsmen and construction managers wish for these functional inspections more often, not every 5 years but rather every 2 years.

For all inspections of the quality management systems of designers, design managers, construction managers, and foremen, HMS has produced a procedure. The procedure's goal is to maintain consistency in the inspections that an inspection agency will conduct on behalf of HMS. This procedural rule is HMS document number 9.007. Due to the evaluation and approval by HMS of the design and operation of the quality management systems in accordance with Paragraph 5 of Article 17 of Act No. 160/2010 on Structures, this procedure is applicable to all inspections of the quality management systems of designers and design managers, construction managers, and foremen that are specified in the building regulations and are carried out by qualified inspection or certification agencies. (HMS, 2023c)

HMS offers instructions for the application procedure as well as the quality management system. There is a lot of information to read for construction managers because these instructions are all written only. The following rules apply to the construction manager's quality management system: (HMS, 2023h)

- 4.8.1 Instructions for the construction manager’s quality management system (HMS, 2023a)
- 9.046 Instructions for registering a quality management system (HMS, 2023f)
- 9.022 Application for registration of a quality management system (HMS, 2023d) (HMS, 2023e)
- 9.001-2 Inspection Manual for the Construction Manager’s Quality Management System (HMS, 2023b)
- 9.003 Inspection report for the construction manager’s quality management system (excel document) (HMS, 2023g)

HMS registers the quality management system of the relevant party on the basis of the inspection report of an accredited inspection or certification body submitted by the applicant.

2.8 Accredited inspection agencies

Accredited inspection agencies and certification agencies are authorized to assess the design and effectiveness of quality management systems for application and renewal applications for the certification of designers, design managers and craftsmen, as well as for construction managers’ work permits.

When carrying out inspections, as well as when applying for a work permit or its renewal, the parties subject to inspection must obtain and submit an inspection report on the design or effectiveness of the quality management system from a qualified inspection or certification agency.

At this time there are only 3 agencies that have been accredited in the aforementioned areas and authorized by HMS to carry out inspections of quality management systems. They are Frumherji, BSI and Vottun.

2.8.1 Frumherji

Frumherji is a leader in the field of inspections, tests and related services in Iceland. It operates as a professional inspection agency as well as a testing and certification agency in five professional areas in full compliance with ISO standards 17020, 17025 and 17065. The company is free from any commercial, financial or other pressure that may affect its neutrality and survey results in accordance with the requirements of those standards.

2.8.2 British Standards Institution (BSI)

British Standards Institution (BSI) or *BSI á Íslandi* is a worldwide institution and is a leading provider of expert services to organizations. According to ISO standards and other widely accepted worldwide standards, BSI is a top source of professional certification of control systems. The proof is in the over 80,000 customers BIS has from all around the world. These include certification of the ISO 9001 quality management system, the ISO 14001 environmental management system, the ISO 27001 information security management system, the ISO 45001 health and safety at work standard, the ISO 13485 management system for medical devices, the TL 9000 quality management system for telecommunications companies, and the FSSC / ISO 22000 international standard that defines requirements for a food safety management system. (2023)

BSI's service units are divided into the following sections:

Standard setting: There you can access standards ranging from copyright protection to technical descriptions of systems.

Audits and certifications: Professional audits of management systems. All quality management systems need professional audits.

Product testing: BSI tests many products in various fields, such as in the construction industry, and compares them to CE standards their CE markings indicate. They are a guideline as well for the development of new products.

Courses: BSI Learning is a leading provider of courses for management system standards, procedures and international requirements.

2.8.3 Vottun

Vottun has been providing Icelandic companies an internationally recognized certification service in the most economical way, thus strengthening their competitive position and ensuring access to foreign markets. Vottun cooperates with foreign, accredited certification agencies for audits and certifications. They provide courses, on their own and in collaboration with others.

2.9 Other organizations

2.9.1 The Federation of Icelandic Industries (SI)

The federation of Icelandic industries, or Samtök Iðnaðarins (SI), are a so-called employers organization and lead their reorganisation. Their purpose is to define each member's responsibilities, rationalize business, and increase greater employer cooperation. SI is the largest member organisation of The Confederation of Icelandic Employers, better known as Samtök Atvinnulífsins (SA).

SI was established in 1993. With roughly 1.400 member companies that range greatly in size and industry, it is the biggest employers' organization in Iceland. Construction, manufacturing, the food industry, power-intensive industries, high-tech, and creative industries are just a few of the sectors that are represented.

There are 19 employees and 10 members of the board of directors, all from different industrial sectors. (SI, 2023)

2.9.2 The Confederation of Icelandic Enterprise (SA)

SA, or Samtök Atvinnulífsins, is an organization that is a support network for Icelandic companies. SA is leading a competitive business environment that promotes a profitable, diverse and responsible business that improves everyone's standard of living. A few examples of SA projects are negotiations with unions, promoting an internationally competitive legal and regulatory environment, and interpreting and distributing governmental decisions that have an immediate impact on the business environment. (SA, 2023b)

Approximately 2.000 enterprises are part of SA, or Samtök Atvinnulífsins, and its member organisations. About 70% of all salaried workers on the Icelandic labor market are employed by the organization. This broad representation positions SA well to represent Icelandic business. (SA, 2023a)

2.9.3 The Icelandic Association of Local Authorities (SÍS)

The Icelandic Association of Local Authorities, or Samband íslenskra sveitarfélaga (SÍS), is the agency for cooperation between local authorities. The main role of the association is to act as a common advocate for the municipalities in the country and to work towards their common interests and cooperation. (SÍS, 2023b)

SIS was founded in 1945 by a total of 52 local authorities. All local authorities, or municipalities, in Iceland have been members of the association since 1973. The number of municipal areas has recently decreased as they have been consolidated into larger units. In 2000, the number of municipalities in Iceland was 124; in June 2022, there were only 64. The role of local authorities has changed and become more complex, as it now includes elementary school and social services. The entire administration of the elementary school was taken over by the municipalities on August 1, 1996, and now accounts for the largest single aspect of their work. On January 1, 2011, the municipalities took over all services for disabled people. (SÍS, 2023a)

The association works to strengthen Icelandic municipalities and their interests. A significant part of the association work consists of advocating for the local authorities towards the government and other domestic and foreign parties. The association shapes the policies of the municipalities for specific issues. Therefore the association has a close relationship with the government and Alþingi, which is the supreme national parliament of Iceland. (SÍS, 2023c) (Alþingi, 2023b)

2.9.4 Iðan Education center (IÐAN)

Iðan is a private, non-profit education and training organization. They provide lifelong education for employees in the automotive, construction and civil engineering, metal and mechanical engineering, computer drawing and design, printing and media, and food and

catering industries.

Iðan's main responsibility is to raise the level of expertise of industrial businesses and workers. For its members, Iðan provides a wide range of services, including counseling, courses, and validation of prior learning. Since it plays a crucial role in supplying businesses and individuals with new knowledge and skills as required, the course offerings are varied and constantly evolving. Many of the provided courses are quite essential and popular. For instance, they offer a two-day course on "construction manager's responsibility" for construction managers, which graduates students with construction manager's rights. A master's degree in at least one industrial trade is required to be eligible to enroll in a course. (Iðan, 2023a)

Iðan has been awarded the EQM (European Quality Mark) quality certification, demonstrating that its courses meet the European requirements for the quality of education providers. (Iðan, 2023c) Iðan offers a wide range of quality courses for industry professionals and fully equipped teaching facilities. Distance learning options are available at Iðan and on-site customized corporate training programs are additionally offered as well as practical courses, webinars and courses that provide various licenses.

In order to embrace innovation and meet new challenges in support of the industrial sector, Iðan also offer a range of services to the ministry of education, science, and culture, as well as participating in the formation of both national and international collaborations. (Iðan, 2023a)

Idan seems to have a head start on the future. They have started uploading various educational videos to the YouTube website and some are 2 years old. Examples of their videos include videos on practical skills assessment, innovation, sustainable industry, interviews with various people and various so-called educational nuggets.

The researcher was invited to attend the course for information purposes. Many construction managers had negative things to say about the course and desired that more time and money had been put into the presentation of the QMS. In hindsight, they believed that additional training on the application of QMS and its actual significance would have been more logical and desirable .

The researcher's experience of the course is disclosed in continuation of the following subchapter.

2.10 Construction manager (CM)

The construction manager (CM) of a structure manages the owner's internal inspection from the time the building permit is issued until the final inspection has been carried out. (Alþingi, 2023a)

A construction manager (CM) is most often the manager of the building process of a structure, the person in charge of all decisions and is responsible for the whole project. He makes sure that all aspects of the structure are according to regulations and the architectural drawings. The construction manager is most often a master craftsman who has finished a course about a construction managers responsibilities at Iðan, which is a private, non-profit education and training organization that is supported by the Federation of Icelandic Industries (SI), unions and more.

2.10.1 Construction manager's work permit

Construction managers' work permits are issued by HMS. The work permit must be requested from HMS, either electronically through the HMS website or by email in an application form obtained from the institute's website. HMS can revoke a work permit if the construction manager no longer meets the conditions for granting the permit. All construction managers need a QMS with the same basic requirements.

The agency issues three different licenses depending on the type and scope of structures; Construction Manager I, Construction Manager II, and Construction Manager III. The following are some examples of how the type of structure and the scope of the work limit the construction manager's authority, as well as the prerequisites. (HMS, 2023k)

Construction Manager I

Construction projects with a surface area of up to 2000 m² and a maximum height of 16 meters may be managed by the construction manager I, as well as its outside upkeep. However, this rule does not apply to public buildings, such as hospitals, law enforcement offices, transportation hubs, educational facilities, or buildings. They are covered by construction manager II. (HMS, 2023k)

The prerequisites for submitting an application for a work permit as a Construction Manager I are at least one of the following:

Master builder, Master mason, Master plumber, Master electrician, Master tinsmith and/or construction technician with **two years** of work experience as a construction technician or certified master craftsman. Architect, structural engineer, technician, and/or engineer with five years of work experience since graduation in building design, construction supervision, and/or project management during construction. (Alpingi, 2023a)

Both a registered quality system and completion of a course on construction managers' responsibilities are requirements as well.

Construction Manager II

Construction Manager II is authorized to manage projects for oil refineries, water dams, hydroelectric power plants, and other energy plants for new construction, maintenance, alterations, reconstruction, and demolition. (HMS, 2023k)

The prerequisites for submitting an application for a work permit as a Construction Manager II are at least one of the following:

Engineers and technicians having ten years' expertise in design, administration, or supervision of construction projects. They must have a minimum of three years of professional experience managing or supervising civil engineering projects. (Alpingi, 2023a)

Both a registered quality system and completion of a course on construction managers' responsibilities are requirements as well.

Construction Manager III

Construction Manager III is qualified to oversee the building of new structures as well as their upkeep, modifications, reconstruction, and demolition, with the exception of those managed by construction managers I and II. (HMS, 2023k)

The prerequisites for submitting an application for a work permit as a Construction Manager III are at least one of the following:

Master builder, Master mason, Master plumber, Master electrician, Master tinsmith and/or construction technician with **three years** of work experience as a construction

technician or certified master craftsman. Architect, structural engineer, technician, and engineer with five years of work experience since graduation in building design, construction supervision, and project management during construction. (Alpingi, 2023a)

Engineers and technicians having ten years' expertise in design, administration, or supervision of construction projects. They must have a minimum of three years of professional experience managing or supervising civil engineering projects. (Alpingi, 2023a)

Both a registered quality system and completion of a course on construction managers' responsibilities are requirements as well.

2.10.2 Construction managers responsibilities

The construction manager must sign off on all the master craftsmen inspections, which confirms his acceptance of the inspection. The construction manager of the structure is responsible for all aspects of that structure. Therefore, it is in the construction managers best interest to visit the location and ascertain the condition for himself each time. If there are aspects that need to be changed or improved, then he can point that out to the master craftsmen during the inspection as well as have it in written form. That way there is trail of comments and changes during the building process. All communication between the construction manager and the master craftsmen is documented and put into the QMS, both the construction managers QMS as well as the master craftsmen, since all master craftsmen need to uphold their own QMS.

2.10.3 Construction manager course

Iðan educational center has arranged a mandatory course for future construction managers. This course is called "construction managers responsibilities" and focuses on just that, their responsibilities, what needs to be done and what to look out for. This course is necessary for those who intend to work as construction managers in accordance with laws and regulations. According to Iðan's website, its purpose is to educate participants on their duties and obligations. It discusses building permits and other communications that the construction manager has to have with the building authorities and his role during construction. The course is held in collaboration with HMS. (Iðan, 2023b)

The training covers the construction manager's responsibilities for handling insurance,

laws, rules, and plans. Construction managers' interactions with building officials, such as requesting a building permit, are covered. The effectiveness and execution of structural inspections, such as milestone, seal proof, and final inspections, are also examined. İđan wants the course's attendees to leave knowing what their roles and obligations as construction managers are.

It was surprising to discover that the course description makes no mention of QMS, it being a significant and essential factor for construction managers.

The researcher was invited to attend the course and examine the data that the students receive. The course had 18 participants, all male but one. It was surprising what was emphasized, e.g. CM markings on construction material. The course was taught using the traditional manner, which involved speaking from slides. Numerous case studies were presented by instructors, many of which were based on real-world experiences they or other members of their staff had. The researcher believes that the instruction and course material falls short of what is expected of construction managers. While it is true that it is crucial to learn from the mistakes, triumphs, and experiences of others, it is first necessary to set a solid basis for the construction managers' QMS and their responsibilities.

Many, if not all, of the students, questioned whether HMS was providing a fundamental QMS framework or whether it was covered in this specific course. It was expressed that HMS does not and cannot offer these services but the instructor concluded that there are other courses at İđan that offer these services and pointed out some quality management systems that could be beneficial.

Putting complex ideas into simple terms can be challenging. When it comes to teaching basic concepts in general, it often seems lacking to completely simplify them in order to eliminate any misunderstanding or misinterpretation. The instruction in this course appeared rushed when it came to the basics because it appears that it is expected that the students have some familiarity with these ideas. The course's instruction appears to bypass the fundamentals and move quickly through the theories. This could ofcourse be due to the timeframe of the course, however, the emphasis and timing of the material don't seem correct.

In the researcher's opinion, the course itself could be available online by having a video tutorial on the subject being taught. That way all information is delivered in a short, clear, and concise manner. Following that, it would be possible to have cross-examination questions, in which case a specific minimum score confirming 80% correct answers would be required for ongoing participation in the course. As a result, construction managers need to read the curriculum and get to know the material better. Subsequently, a split lesson would be useful, where the students begin by putting together a simple folder system with the instructor's assistance. Thereafter there is a free-flowing discussion where the instructor can respond to any inquiries.

2.11 Construction manager's QMS

A Construction manager's quality management system is most often a digital filing system with professional supervision. On the one hand, there is a quality manual, which is a document, resembling a handbook, that the construction manager has written on *how* the organization is done according to instructions from the Housing & Construction Authority (HMS). On the other hand, a folder system is set up for all projects and all documentation of the craftsman, e.g. certificates and documents, building permits, construction manager's liability insurance, inspection reports, applications, assessments, photos and architectural drawings etc.

One of the conditions for a building permit to be issued, according to item 5 of article 13 of the Act on Structures (no. 160/2010), is that the relevant construction manager and all craftsmen have a quality management system in accordance with the provisions of the law and that the quality management systems have been registered in the database of HMS. All craftsmen, construction managers and structural designers must have a quality management system that demonstrates that they meet the requirements that are made to them cf. provisions of the building regulations.

The situation today is that craftsmen stand alone with instructions from HMS when it comes to registering a quality management system. These instructions seem incomprehensible to rookies. HMS does not offer a standard system but rather guidelines for its creation. HMS encourages people to contact them if they have questions, but few dare to contact them because they don't want to put any extra attention on their QMS. Ev-

everyone therefore has to create their own system from scratch with a quality manual, that explains how the QMS is used, and get it approved by a accredited inspection agency. Each inspection has a cost and sometimes more than one inspection is required, but it depends on the number of errors during the inspection of the system. If the instructions are followed 100%, there are still comments during the audit, which indicated inconsistency within HMS or between HMS and the accredited inspection agencies. Later on, the quality management system is subject to a regular so-called functional review to check if the person is using the system as he/she said he/she would. If he/she doesn't, the they loses their **permission/permit/** and have to start the application process all over again.

A quality management system is a great tool that every master craftsman should have. This acts as an insurance for both them personally and their work. If this system is used correctly, it is possible to track all decisions in all projects, project by project. All that is needed is one standardized system with a well-organized management behind it. If a good idea doesn't work, then the manager behind it needs to be reconsidered, cf. continuous improvement.

Today there are some companies that sell their QMS or sell access to their online mapping system, but none of them are the same or have the same requirements.

2.11.1 QMS requirements

To guarantee that all of his efforts are in compliance with the rules, the construction manager must establish a clear QMS. The construction manager conducts his business in accordance with all applicable building regulations, the instructions of HMS, and other applicable laws and regulations.

According to article 4.8.1 of building regulations no. 112/2012 and the HMS instructions, the construction manager's quality management system (QMS) must at the very least include the following: (HMS, 2023a)

1. Confirmation of the competence and continuing education of construction manager.
2. A record of the internal controls implemented by the construction manager for each project, along with a description of those controls.

3. A record of received design data.
4. A record of instructions and communications with building authorities and inspection agencies.
5. A copy of the list of craftsmen and the projects they are responsible for, their statements of responsibility as well as comments on their work
6. A record of milestone inspections and results, as well as safety inspections.
7. A list of design managers, designers with comments regarding their design data.
8. A recording of the construction manager's other decisions and comments.
9. A description of the final inspection and its preparation, including a report on all inspections, the handbook's completion, a description of the work, and a list of approved design papers.

For registration in the agency's database, the construction manager must inform HMS about his quality management system. If the construction manager's quality management system is not certified by an accredited certification agency, HMS shall conduct an assessment of its design and effectiveness. (HMS, 2023a)

The instructions from HMS apply to the operations that, in accordance with the construction regulations, are within the scope of the construction manager's license. The quality management system's functioning and compliance with defined guidelines are entirely the responsibility of the construction manager.

Examples of the above items are the following:

1.
 - certificates and documents related to the construction manager's work permit
 - other certificates and documents concerning the education and qualifications of construction managers
2.
 - guarantee declarations for the granting of building permits

- notifications to building officials and owners about the change of construction manager.
 - an internal control plan
 - contracts between the owner and the construction manager
 - a record of internal controls, inspections and their results
3.
 - a record of received design data, project specifications and other data
 4.
 - an agreement with the license provider regarding the authorization of interim inspections
 - a certificate from the Administration of Occupational Safety and Health (Vinnueftirlit), as appropriate
 - reports and letters on inspections and instructions from building authorities and other inspectors
 5.
 - a list of the work components for which the craftsman has declared responsibility
 - comments on the master craftsman's work
 6.
 - documentation of milestone inspections, safety inspections and inspection reports
 7.
 - for each project, a list of designers and design managers
 - a record of comments on design data
 8.
 - A record of communications with the owner, designer, design manager and master craftsman regarding decisions and comments on construction
 9.
 - A description of the final inspection and its preparation, including a report on all inspections, the handbook's completion, a description of the work, and a list of approved design papers.

After doing a final evaluation, the construction manager is required to gather all the information and documents for each project and provide them over to the owner. Following the final audit, the following data must be provided to the owner, e.g. Milestone

inspections, a work description manual, a list of authorized design data, and certificates or other confirmation documentation for construction products. (HMS, 2023a)

2.12 Other researches on QMS in Iceland

In recent years, some studies have been carried out in relation to QMS in Iceland. These researches aimed to shed light on whether the QMS was delivering results, in more than one category.

The following subchapters display and disclose the main aspects and results of a few researches in this field.

2.12.1 Impact of quality management on construction

This thesis was written in 2011 by Anna Hulda Ólafsdóttir. It sought to investigate the impact of quality management on Iceland's construction sector. The impact of quality management on the contractee is specifically examined, and it is determined whether there are any discernible differences in contractee satisfaction with regard to project execution depending on whether the project is completed by contractors who adhere to a quality management system or contractors who do not. Additionally, to investigate whether there is a discernible difference between the working practices of contractors who assert to adhere to a quality management system and those who do not. Finally, the situation of quality management in Iceland's construction sector is investigated.

A questionnaire was created and distributed to contractees and contractors in an effort to gather information to address these questions. Contractees were given a survey over the phone asking them to name the major contractor working on the relevant project. The contractor was then given a questionnaire, and the answers from the contractee were matched to those from the engaged contractor(s). As a result, a correlation between the contracting company's satisfaction with the contractor's completion of a project and specific elements related to the contractor's examination, such as whether or not he carried out his operations in accordance with a quality management system, was assessed.

In addition to looking at earlier studies and drawing conclusions from them, other survey results were examined separately and conclusions drawn from them. The author also

conducted interviews with experts at conferences and meetings related to the topic to gain additional insight.

The key results were that whether or not the contractor runs his operations in accordance with a quality management system, there is a considerable difference and a strong association between contractee satisfaction with a project's execution. The results also show that contractors who claim to run their businesses in line with a quality management system use much more focused and efficient working techniques than contractors who don't, although there were noticeable differences in many areas between individual contractors' working techniques and whether or not they ran their businesses in line with a quality management system. Last but not least, the results demonstrate that the smaller construction firms in Iceland have particularly weak quality management practices. Regarding large construction organizations, the situation is entirely different because their knowledge and working practices appear to be of a much higher caliber.

The primary conclusions of this research were that contractors, particularly in small businesses, lack knowledge of quality management in the field. It may be argued that contractors who follow a quality management system have much more organized and efficient work practices in terms of the contractor's processes. Last but not least, there is a considerable and positive association between the contractor's compliance with a quality management system and the project buyer's satisfaction with how it was carried out.

The new Civil Engineering Act emphasizes the need for parties within the industrial sector to work in accordance with a quality management system as society's demands for contractors for quality work practices and more effective management increase.

The report's author considered a number of methods for calculating the effect of quality management on construction, but the topic is complicated and very extensive. These recommendations for additional study on the topic were made as a result of this study.

Numerous research that both supported the findings of this study and looked at the topic from various angles would be required to have a clearer understanding of the overall effect. An investigation of how quality management affects business operations optimization in the construction sector could be quite helpful in this situation.

The report's author also suggests that creating a dynamic system model of the topic would

be beneficial since it would give a clearer overall picture of how quality management affects the construction industry. By doing this, it would be possible to steer company managers clear of quick fixes that frequently result in expensive long-term consequences, as cuts in quality management are likely to be.

The only information provided by the outcomes is the contractor's evaluation of his own knowledge. Therefore, it would be extremely useful to examine the contractors' knowledge of quality management in its entirety, since this study gives a limited picture of it. The researcher concluded that it would be very beneficial to look into the most effective ways to set up QMSs for small contractors.

The following are the research questions as well as a summary of the responses to these inquiries. (Ólafsdóttir, 2011)

1. What is the status of quality management in civil engineering?

According to the author, the survey findings for both project purchasers and contractors indicate that Iceland's quality management system was generally insufficient in the year 2011 when written. The results are not surprising since the law, Civil Engineering Act, was signed December 28th 2010. It was still very new at the time and it takes time to polish. Additionally, the findings showed that compared to individual procurement, corporate procurement placed much higher demands on contractors for certain work practices and management.

The results showed that in relation to the size of the contracting companies, there is a significant disparity in the condition of quality management. Knowledge and procedures are far better in the bigger organizations than in the smaller ones. The report's author argues that small contractors urgently require an approachable and user-friendly quality management system, but it is undeniable that the size of the company should always be considered when determining the extent of a quality management system.

(a) What is the contractor's knowledge of quality management?

According to the findings, around half of the participants had gained knowledge about quality management. Considerably more people said they had studied the contents of ÍST 30 than ISO 9001. These findings, however, are entirely

based on the contractor's evaluation of their own knowledge; further research would be required to examine their knowledge as it actually is.

2. What is the difference between contractors who work according to a quality management system and contractors who do not work according to a quality management system?

(a) Are companies that operate according to a quality management system more satisfied customers but companies that do not operate according to a quality management system?

Buyers' satisfaction with a contractor's execution of a project varied significantly depending on whether that contractor complies to a quality management system based on accepted quality management standards.

In general, project purchasers were happier working with contractors who adhered to the QMS than they were with those who did not. It seems likely that contractors who work according to a QMS are more concerned about safety than those who do not work according to a QMS.

(b) Are the procedures of Icelandic construction contractors lacking?

Overall, the findings indicate that contractors that are committed to a QMS based on internationally accepted quality standards employ far more focused and effective work procedures than those who do not. It appears that contractors that follow to a QMS are more likely to be worried about safety than those who do not, because they are more aware.

(c) How is the relationship between the buyer and the contractor handled in civil engineering?

The findings of the surveys show that there is no significant correlation between QMS and project buyers' satisfaction with communication. Nobody should be surprised, however, that there is a very strong correlation between the buyer's satisfaction with the contractor in question's performance of the work and the buyer's satisfaction with the contractor's communication. Additionally, the results showed that 75% were very satisfied with their interactions with contractors.

(d) What is the contractor's attitude to quality management?

There wasn't time to directly investigate the aforementioned claims, but the contractor's attitude toward quality management was examined, along with their opinion of the claims made; more specifically, if there was a difference in the contractor's attitude toward quality management depending on whether or not the contractor operates according to a quality management system.

The inquiry into the contractor's attitude toward quality management revealed that 90% of contractors have a generally positive attitude toward quality management and believe it belongs in the construction business.

The findings indicate that contractors who have used a quality management system before have a significantly more positive attitude regarding it.

(e) Requirements for contractors regarding organization and targeted management?

and modify their work accordingly. If the contractor is unaware of the procurement requirements, quality assurance will probably not have much of an impact. In general, contractors believed that the demands of public institutions were generally higher than those of individual procurement with regard to organization and targeted management.

No significant correlation was detected between the level of demands the contractors felt the procurement had on them and the QMS.

(f) What is the status of quality assurance in civil engineering?

The term "quality assurance" refers to a written document in which the contractor outlines all the work procedures he intends to use to guarantee a particular level of quality.

The results of both surveys show that Icelandic civil engineering quality assurance is in extremely poor shape. Nearly 84% of project buyers who responded to a poll on project buyers stated they didn't request quality assurance, however as was already mentioned, this suggests that project buyers don't generally require contractors for organization and focused management enough.

According to the findings of a survey of contractors, in general, contractors didn't appear to demand quality assurance from subcontractors. Only 3% of contractors claimed they always ask their subcontractors for quality assurance.

3. Which factors have the greatest influence on the satisfaction of project

buyers?

It was prioritized to determine the factors that have the most impact on project buyers' satisfaction with the works' execution. It was looked at how each of the other questions on the contractor survey related to how satisfied the contractor was with how the project was carried out by the contractor. Additionally, the relationship between the criteria that the aforementioned contractors were questioned about and the degree to which the project purchase was satisfied was examined.

The following survey variables were measured with significant correlation to the project purchaser's satisfaction with how the project was carried out by the contractor in question. On the satisfaction scale, the following elements are given in descending order, from most correlation to least correlation with satisfaction: communication, quality, quality assurance, QMS, planning, tidiness, safety, collectively examined were attitudes, knowledge and procedures and finally basic factors (age, gender and more).

2.12.2 Construction manager's quality management system

This thesis was written in 2020 by Björgvin Hörður Arnarson. The project's goal was to analyze quality management systems used by construction managers and compare them internally and to the standards set by HMS as well as the expectations of the market. The researcher of this thesis presented an overview of the set requirements from HMS regarding the QMS. Additionally he presented the overall status, an enumeration, in 2020 regarding the QMS for construction managers; what it was intended for, the prerequisites, data needed in QMS and more.

The result of the project was supposed to be a summary of the needs and goals of all parties involved in quality management systems, including HMS, building officials, designers, construction managers, master craftsmen, and quality system inspectors from licensed agencies.

The results indicate that it was evident that the procedures had become clearer and there were fewer disputes than when started, despite the fact that the implementation process of HMS had taken longer than the initial plans expected and that revisions and tweaks had been required as frequently as possible. He interviewed many construction managers who

were involved in projects of varying sizes and he felt that the mindset had changed then, in 2020, five years after the requirement for a quality management system was imposed. Less was said about the administrative expenses and more was said about the benefits. It was suggested that the government was not adequately ready for the adjustments, which hurt the market. But the majority of the time, that seems to be the Icelandic way, to just go for it. Particularly with the "Byggingargáttin" construction portal, where the municipal offices and HMS were not prepared for electronic maintenance. He does not define *how* they were not ready, but due to certain hiccups in QMS process with HMS and building officials, it is possible to imagine that that is the reason behind it. They got a little bit ahead of themselves. Both the public and corporate sectors appeared to be more optimistic about the future, and the situation appeared to be improving. There are several quality management systems available and every construction manager should be able to find a suitable QMS. (Arnarson, 2020)

2.12.3 Construction defects in new buildings

This study's objective was to identify the magnitude, underlying causes, and financial impact of construction defects that occur during delivery or emerge after delivery of newly constructed real estate in Iceland.

According to a study of court cases in this research, the majority of construction flaws were caused by inadequate finishing or poor work habits of the workers, but relatively the largest damages were given for building flaws brought on by inadequate or incorrect design. For building projects, it is vital to try to prevent this kind of error through better work practices, better supervision, greater professional knowledge, and better feedback. (Birgisson, 2013)

The extent of construction defects is significant because, according to data from insurance companies and legal proceedings, one in every thirteen properties had damage or flaws that were documented in 2013. However, it should be pointed out that this amount does not account for issues over which the developer directly negotiated with the customer, which occasionally results in real estate price reductions. It is therefore quite likely that many more properties have structural issues that have not been identified. (Birgisson, 2013)

According to data from insurance companies and court proceedings, it is estimated that there was approximately 4.1 billion ISK worth of defects-related damages from 1998 to 2012, of which approximately 2.8 billion ISK were paid in compensation. The magnitude of building defects in the research is restricted to information from insurance companies and court actions, therefore the total amount of damage caused by defects is probably substantially larger. Contracts that are made directly between the property buyer and the construction manager are excluded from these numbers since there is no documentation about them.(Birgisson, 2013)

According to this research study, quality management systems and quality assurance are key factors in order to decrease the number of construction defects. He expresses how important it is for the parties participating in the project to implement quality management systems, but quality assurance of the completed work should take precedence. The quality assurance is based on the fact that the job is performed in a professional manner, by licensed craftsmen, and under active supervision of master craftsmen and the construction manager, with a strong emphasis on each individual's training and knowledge. As a result, it is crucial that the educational materials used to train those who work in the construction industry reflect the methods that are actually used there. There must be coordination between the two as it benefits everyone in the construction industry.

The researcher in question proposed the creation of a fund, as the Danes did for residential buildings built with public funds. That fund was intended to pay for housing inspections and provide financial support to achieve repairs to building defects. Information obtained from those inspections was recorded in a special database which is then used to develop solutions to prevent construction defects. It follows that the funds in question have been set aside for this specific purpose and must be applied to it. They could therefore be used to discover solutions for structural defects and preventative actions.

2.13 Literature Review summary

Standardization and quality management are essential for producing products of quality, in this case high-quality buildings. Standardization provides structured methods and reliable data that save time.

It is important to understand these aforementioned basic concepts in order to understand how crucial they are to a construction manager's quality management system and to the buildings the construction manager is responsible for.

Other researches that have been conducted in the past 10-15 years indicate a need for a simple, accessible, and user-friendly quality management system for the smaller contractors. Understandably, the larger companies are the target group for the average QMS, since that is where it is most profitable. But it is obvious that the size of the business should always be considered when determining the extent of a quality management system. There is a need for a smaller and simpler QMS for smaller and simpler companies. Therefore, there needs to be an effort to supply what is asked for.

Other researches confirm that procedures have become clearer throughout the years and there have been fewer disputes than when started, despite the fact that the implementation process of HMS had taken longer than the initially expected. From former interviews it is evident that the mindset has changed with each year and interviewees felt that the QMS implementation has been beneficial. Although, many interviewees and other researchers believed that the government was not adequately ready for the adjustments and therefore there are still some "bumps in the road" that need fixing. But there are plenty quality management systems available on the market, the trick is to find the appropriate one.

According to the research study regarding structural defects, quality management systems and quality assurance seem to be key factors in order to decrease the number of construction defects. He expressed how important it is for the parties participating in the project to implement quality management systems with extra attention to quality assurance by having professional craftsmen working the projects.

3 Methodology

The goal of the thesis is to consider the objective of the construction managers QMS, if it is paying off and if QMSs should be standardized on the basis of basic quality definitions. The research methodology and procedures are explored in this chapter as well as how this research was conducted. The data collection and analysis process are likewise described, followed by the quality of the research in the next chapter.

3.1 Research Methods

Data collection was done with interviews and a questionnaire. Master craftsmen, construction managers, building officials and parties of various agencies were interviewed and a questionnaire was submitted to the respondents. The Federation of Icelandic Industries (SI) helped with the distribution of the questionnaire, sending it to various companies in the industrial sector. The thesis is based on the data obtained from the questionnaire and interviews.

Qualitative research is expressed in words while quantitative research is expressed in numbers. Therefore a blend of qualitative and quantitative research methods were used, where the qualitative method was the interviews and the quantitative method was the questionnaire.

The questionnaire was distributed to a group of respondents with standard and predetermined questions and answer options. The group of respondents all needed to be at least craftsmen, but preferably masters in their field. Since the target group was Icelandic construction managers, the questionnaire was in Icelandic, see Appendix A for details.

Questionnaires are a common technique for social research when it's important to collect data from people to forecast the public opinion. All survey questions had predetermined responses, while the "Other" option gave a text area for more explanation. To minimize the dropout rate, the number of questions was kept to a minimum and the questions kept simple and concise. This was done without affecting the quality of the survey or the respondent's point of view.

The questionnaire was made using survey software, QuestionPro, which automatically displays the statistical results. An overview of the questions and data results may be

found in the Appendix.

3.2 Sample Criteria

The survey was intended to assess the opinion of construction managers and other master craftsmen, therefore it is crucial to have a varied range of craftsmen respondents. Only then are the results of the survey meaningful and it can then be argued that the results accurately represent craftsman's views. It was believed that it would be valuable to include both construction managers and master craftsmen in the questionnaire, since both use the same type of QMS.

The poll was sent via email to various craftsmen and construction managers. After a stagnation of participants then The federation of Icelandic industries, or Samtök Iðnaðarins (SI) stepped in and helped with the distribution of the questionnaire to the appropriate parties. Due to their assistance, wider groups were reached, that is, various smaller and larger companies were reached.

It was thought important to get a diverse background of the construction manager respondents, but their age wasn't necessarily important although it was an interesting factor. Their work experience and years on the job were of more importance to this research. Additionally, it was believed to be beneficial to include both satisfied users of QMSs and unsatisfied, with the hope of noticing pros and cons.

3.3 Research Design

The questionnaire consisted of 10 questions to validate the opinions of the respondents with an additional open-ended question where respondents could put their input on the current QMS status in Iceland. Interviews were conducted with 23 parties; master craftsmen, building officials, construction managers, and various institutions. Many of whom were met with more than once. Some interviews were not significant and did not end with any results so they were not included. The interviewees were asked 3 questions and were given the opportunity to reveal their thoughts and their past experiences in the industry.

3.4 Conduct of Research

To get the most diverse answers, it was decided to try to distribute the questionnaire among people on social media. It was evident that it could prove difficult to reach people in the industrial sector and have them answer a questionnaire. But to do so, the questionnaire was posted on several Facebook groups that were connected to either people asking for craftsmen, craftsmen were advertising their work or an isolated group for professionals in the industrial sector. Since the questionnaire is about the general opinion of QMS users in the industrial sector, it is important to get a diverse group of people to answer it.

3.5 Quality of Research

Overall, the responses were positive and provide some insight and understanding into the user's perception of the current status of QMSs. There were 50 individuals who responded to the survey, with no dropouts. Answers are shown in chapter 6 below.

Since this is a research regarding the role of the QMS in Iceland, the respondents were all Icelandic. Interestingly, approximately 94% of the respondents originated in Iceland, 4% in Spain and 2% in Austria, which indicates that 6% of the respondents were either working abroad or on vacation at the time of response.

The portion of women answering the survey was surprising, as it was only 4%, men 96%. The average years of occupation was listed as 18 years. The age of the respondents may have an impact on the results since the younger generation is more computerized and therefore the QMS structure serves them therefore better. The average age is calculated as 63 years old, which indicates a higher age range. The age is rather evenly ranged from 32 to 77, of which 17 were in their 50s.

4 Interviews

When trying to understand a problem, one must look at all angles of the situation, all points of views. That is why it is important to contemplate how the organizations feel about the current situation of the construction managers' QMS. In this chapter interviews

with various organizations and individuals in the industrial sector will be analyzed.

4.1 Icelandic institutions

4.1.1 HMS

A meeting was arranged with HMS and took place on December 8th, 2022 at the HMS headquarters. The interviewees were, Þóra Margrét Þorgeirsdóttir (Executive Director of infrastructure and sustainability), Jóhann Ólafsson (Executive Director and team leader of electrical and product safety) and Jónas Þórðarsson (specialist in work environment of infrastructure).

In the year 2022 HMS put the spotlight on functional inspections for construction managers QMS. A number of 1.450 construction managers were on their list as active, but by the end of the year 700 had finished the functional inspection of which 400 were failed and were then unregistered and lost their permit and 100 had an invalid/expired work permit.

The top five categories with the most errors in the functional inspection were the following, in order:

- Part 3.7 - Contracts with contractors and craftsmen
Lacking contracts or contracts are deficient between the construction manager and the master craftsmen on the project.
- Part 4.1 - Construction manager's project registration
Lacking or deficient project registration.
- Part 4.12 - Certificates/material specifications of construction products
Lacking or deficient specifications of construction products; information about the products used, pictures of products, their CE markings and instructions.
- Part 4.13 - The house manual
Lacking or deficient house manual where all information regarding the project is stored as a user manual for the house. It includes all parties involved as well as all products used and their information.

- Part 5.2 - Internal audits for own work, checklists

Lacking or deficient check lists for internal audit.

When HMS was asked if they would consider publishing their own QMS for construction managers, they said No. The main reason they gave was that their lawyers recommended that they would not do so in order to avoid lawsuits from private companies. They tried to give an example one year but it was quickly removed due to these legal issues and a threat of legal action an owner of one of the QMS online. The private companies were not happy with that since that was their market and the QMS example was not like all other QMSs, which could close the door on some companies.

To put it simply, HMS only asks for certain things to be done and turned in. How a construction manager stores this or what kind of software the construction manager uses is irrelevant. HMS compared themselves to how RSK does things. RSK (Director of Internal Revenue of the State) asks for accounting information such as the VAT report, but RSK does not publish their own software for bookkeeping since that would be a conflict of interest. They merely ask for certain things to be turned in in a certain way and bookkeepers follow those instructions and turn it what is needed, in the correct manner. HMS is aware of the uncertainty that follows young construction managers while creating their QMS but they seem to be between a rock and a hard place, and encourage people to phone them for assistance. Unfortunately, few dare to call HMS for help, afraid to turn the spotlight on themselves.

Many companies, agencies and other service providers use videos as a helping tool. They make videos, teaching users how to execute certain tasks, especially those that seem to be more complicated than others. Veitur is one example of producing videos and sharing them on their website, in order to help their users perform measurements the correct way. Few have the patience and understanding of reading a long and thorough list of instructions, while many more can understand the videos. By viewing how things are done, it simplifies the process for the user significantly.

HMS has one video online at the moment regarding the functional inspection process. Many have complemented the video, although they would have wanted more clarification, and celebrated the direction HMS seems to be steering. When HMS was asked if they

would produce teaching videos around the instructions and checklists, they answered that this is something that they want to do but has not been done yet. When asked why, they answered that this is due to legal aspects and that they need to make sure that what they say, do, show and indicate in the videos is authorized legally. Therefore it is a lot of work, and other things within the agency are more of a priority at the moment.

4.1.2 Vottun hf

A phone meeting was set with Vottun hf and took place in December, 2022. The interviewee wished to be anonymous but had plenty of experience in the QMS audit environment. He was of the same opinion that there needed to be more standardization of the quality managements systems that the construction managers use. He said that this was similar to when the food industry went through similar functional inspections for their QMS. Both then and now the QMS seems to be more of a decorative system since rather than a strong tool for some, since many copy-paste an approved QMS and use it as their own. This is what the interviewee called an "Hazard system" where men grabbed onto any system because of the requirements set. The problem there is that many do not understand the importance and the organization behind the QMS they are using, which is the basis of a functional QMS.

4.2 The local authorities: Building officials

Each municipality has its own local authorities, also known as building officials (BO) and they are responsible for the employment of their BO, but they must report their employment to the Housing & Construction Authority (HMS). In Iceland, there are 64 listed building officials.

The Building Official conducts inspections on new and existing buildings and structures and investigates complaints regarding safety concerns in the built environment. The Building Official does not design, redesign or supervise any construction project. The BO works on the basis of the Civil Engineering Act (160/2010) and Building Regulations (112/2012), as well as making sure that construction works are in line with the functioning organization in his district.

The main task of a BO is to grant building permits for construction projects as well as supervise structures and the construction process of structures. Supervision of structures consists of monitoring the construction in consultation with the construction manager, as well as conduct a final assessment of the structures and therefore has the power to complete the construction with his assessment. (HMS, 2023i)

There are three main monitoring audits, or so-called inspections, that building officials report. They are the sealproof-, safety- and final inspections of buildings. The safety- and final inspections are most often done together. Inspection systems differ between municipalities as each municipality chooses its own system that meets the set requirements of HMS. Most often it is in place before the building official starts their reign. Construction managers have to use the inspection system that is set in place in each municipality.

These inspection reports are turned into the structure register (mannvirkjaskrá) owned by HMS. The various inspection systems send the inspection reports to HMSs structure register. The size and characteristics of structures, their construction status, and details like building permits and inspections by construction managers and building officials that are helpful for tracking the progress of structures can all be found in the structure register (mannvirkjaskrá).(HMS, 2023l)

Interviews were established with 6 different building officials around the country and they got the opportunity to share their experiences as building officials and their ideas for improvement. Continuous improvement is a key factor in terms of quality. They shared which inspection system they used and if it has been satisfactory. In order for the building officials to feel they could speak freely, it was agreed to have the interviews all anonymous, even though some were willing to sign their name. In order to keep the anonymity of the group, all were to be anonymous and categorized according the size of the municipality.

4.2.1 Building Official 1

Small municipality - HMS building portal (+)

The municipality of building official 1 (BO 1) is small in size, according to the numbers shown in figure 9. They chose to use the HMS building portal for their inspections, known as "byggingargáttin", due to its modest size. Additionally, they set up their own digital

Size of municipalities		
Small	Medium	Large
0 - 10.000	10.000 - 50.000	50.000+

Figure 9: A simple overview of how the size of municipalities is categorized by size with respect to the population.

filing system according to the HMS instructions. When asked if he chose the system himself, he explained that he did not. The system was already in place before he became the building official. He revealed that the building officials have the option to change systems if they so choose, but this is not solely their call and is rarely done. They at least have a vote when it comes to choosing whether or not to change systems and then what system to choose.

When asked if there was anything he would like to modify for the building officials in Iceland, he responded that he would want to see a simple inspection system that all municipalities would use. He felt it was an unnecessary complication to have many inspection systems in such a small country and could be easily avoidable.

4.2.2 Building Official 2

Medium municipality - Oneland Robot system

The municipality of building official 2 (BO 2) is defined as medium sized municipality according to figure 9, and uses Oneland Robot system for their inspections. This municipality has tried various systems and feels that the current system used is sufficient, compared to what is available, but by no means good enough. This has been expressed to HMS and SI often, but no solution is yet available to building official 2. In the past and most recently, if changes were done to the inspection system this municipality used, then the building officials were neither notified nor consulted with regarding the possible changes. Only after the changes were implemented were they notified by HMS, but the building officials have no say in the changes and from the experience of building official 2, many changes have not been for the better.

This building official has many years of experience in this field and is very passionate

about this work and its importance. Building official 2, therefore, wished that in the future HMS would consult with the building officials in the country to find the best solution. This building official has several years of experience but claims that neither HMS nor SI has ever contacted him for an opinion regarding the inspection systems the building officials use, that is what aspects are of more importance, what aspects are of less importance and what needs improvement. He has many comments regarding many aspects of the inspection system and has an idea in his head of how it should be and how it can be accomplished. When asked if there was anything else he would improve, the building official immediately said that he would want to see a single, uniform system for all municipalities as well as training on that system that included a manual.

4.2.3 Building Official 3

Large municipality - HMS building portal

The municipality of building official 3 (BO 3) is defined as large sized municipality according to figure 9, and uses the HMS building portal, also known as "byggingargáttin", for their inspections. Building official 3 was very excited to talk about the current situation regarding the systems available for the building officials of Iceland. He was very interested and enthusiastic about the research and wished to discuss the matter thoroughly. There are a lot of various inspection systems and apps, which building official 3 finds to be a problem. He believed that there should only be 1 inspection system for all. He also believes that there is a severe absence of documentation in the structural register (mannvirkjaskrá) confirming the construction manager's completion of specific project components and, as a result, the completion of all requirements for milestone inspections. He doesn't recognize it in his system, at least. The systems' inability to communicate with one another could be the cause. He also said that he felt that the assessment form was not clear enough as it is now and even rather "open". Currently, when a construction manager is performing an inspection, he himself writes what he is inspecting and writes a text about it and checks the appropriate boxes. It is up to the construction manager what he writes on the inspection sheet, that is how clearly he explains what exactly is being inspected and what the status is. He cites as an example, if a construction manager would be inspecting the 1st floor and he would write in his inspection report that he was inspecting the bearing capacity, then this could become confusing for the reader. The

reader of the report could conclude that all the bearing capacity in the building is being inspected, not just in a limited place; e.g. base plate 1st floor. By writing instead, "1st floor base plate - bearing capacity" or something similar, it can eliminate all uncertainty, which is very important regarding the efficiency of the inspection and future inspections. The inspection report should lead all readers to the same conclusion.

In the past, when building officials carried out the inspections, there were defined entries, e.g. full inspection or partial inspection. If it was a partial inspection, it had to be well-defined separately. Everything had to be defined better so that the results could not be misinterpreted. It should be taken into consideration that many people usually claim that things were better in the past, but that's not necessarily true, so it's best to take such revelations with a little skepticism.

Construction managers are responsible for doing all milestone inspections before the safety- and final inspections are performed by building officials. Building inspector 3 felt that during inspections, it is not properly clear which work parts have been inspected by the construction manager. He's expressed dissatisfaction about this before. He felt that a standardized form should be required to avoid text misunderstandings during inspections. People explain various factors differently and in this industry, they rarely write more text than is necessary. Most construction managers and master craftsmen want to keep their text brief, yet doing so might make it unclear and inaccurate for a variety of tasks.

The building official claims that it is usually difficult to distinguish this, that is to say, whether the inspection reports are thorough inspections of the construction manager or not. Often it is difficult for the building official to understand what the construction manager was inspecting. The current situation is that he has to look at each inspection report separately and determine whether everything has been inspected or if there is something missing before he goes forward to the safety and final inspections.

He wants to propose that before a safety and final inspection is requested, a statement from the construction manager must be submitted, stating that he has completed all required inspections, which are comprised of 21 elements and shall all be stated in said statement as well. Building official 3 additionally said that the inspection systems used by the municipalities in Iceland should, in his opinion, be the one and same since the

inspections are essentially the same.

The researcher does, however, question whether anyone has gone through the safety and final inspections without having done adequate milestone checks. Building officials are humans and can of course make mistakes. It's possible that some building officials didn't completely evaluate all the data and may have interpreted some of the unclear inspection reports incorrectly. The proposal is to project an awareness of responsibility to the building manager

Changes are inevitable, but when changes are made, it is important to think them through. This is where the individual's understanding and experience of the market comes into play. A new case system is now being introduced in municipality 3, but the old system was in use for 25 years. An immeasurable amount of work went into the launch of the old system where every little thing was thought out. But then a new system comes on the market from what could be classified as newcomers to the industry. Now when the new system is brought in with new emphasis and various changes, it is as if the important details that were thought out in the old system are accidentally washed out to make room for new, and certain knowledge and ways of thinking are lost with it. which is a tragic waste and a great loss.

Changes are most often for the better, as they are aimed to improve situations. In the opinion of building official 3, they often appear to be pet projects with an unrealistic goal, due to insufficient preparation from the project supervisor. There are many things that this building official has noticed, such as various changes that were not necessarily for the better.

There are several system modifications happening in general. Building official 3 is currently not fully aware of what is *in* and what is *out*, for example, "gáttin" the HMS app. The "structure portal" app, also known as "mannvirkjagáttin" or "gáttin," was developed by HMS for inspections. Then, other parties, including Ajour, created their own inspection systems using their QMS, according to building official 3. They received confirmation from HMS that they could use it for their inspections and could submit all of their inspections through it. Building official 3 discovered that HMS can be flexible regarding the form that is used, as long as it is completed and should be registered in the

structure register. The only requirement is that the product be delivered from destination A, an inspection system, to destination B, HMS, that is the inspection report needs to be delivered to HMS through a system.

Despite being a seasoned building official for a sizable municipality, building official 3 was unaware that the app was no longer functional.

4.2.4 Building Official 4

Small municipality - Oneland Robot system

The municipality of building official 4, BO 4, is defined as small sized municipality according to figure 9, and uses Oneland Robot system from One system. When asked if he was satisfied with the system, he expressed that there is always room for improvement but the current system used, Oneland Robot, was sufficient. When asked why they used the Oneland Robot system, he answered that it was already in place and he did not choose the system. He had little knowledge about the system and was still a little lost but felt that is was sufficient. When asked if he would change anything for building officials in Iceland he answered that he would like to see the same system for all municipalities as well as a training video that they can always rely on if they need assistance or to refresh their knowledge on the system.

4.2.5 Building Official 5

Medium municipality - HMS building portal (+)

The municipality of building official 5 (BO 5) is defined as medium sized municipality according to figure 9. They chose to use the HMS building portal for their inspections, known as "byggingargáttin", due to its modest size to save expenses. Additionally, they have their own digital filing system according to the HMS instructions in Sharepoint systems. When asked if he was satisfied with the system, he expressed that they had tried various systems, such as GoPro and others, and the HMS building portal suited them best at this point and was sufficient. When asked if he would change anything for building officials in Iceland he was slightly indifferent but answered that he would like to see the same system for all municipalities.

Additionally he had a proposal for filing projects. He explained that each building can

have many project numbers to it. For example, if a construction manager was building a house and later it was decided to add to the house an extra 30 m², then those extra 30 m² along with their architectural drawings were on a different project number and not connected to the address in any way. He felt that the project address should additionally have an independent folder so that it would simplify future searches for building officials. His proposal therefore sounds like the system has double storage, on the one hand, a folder for the project itself that is being worked on each time, and on the other hand a folder for the address of the work as a whole. So all additions are saved in one and the same folder.

4.2.6 Building Official 6

Small municipality - HMS builidng portal (+)

The municipality of building official 6 (BO 6) is defined as small sized municipality according to figure 9. Building official 6 (BO 6) was asked what inspection system they used and if it has been satisfactory. He replied that they use the construction portal from HMS, "Byggingargátt", and overall, it has been adequate, but no more than that. It was exclaimed that it was the most functional option available, in their opinion.

BO 6 is also a construction manager and a design manager. He expressed his extreme dissatisfaction when he was provided with the first draft of the HMS inspection system for the building officials. He thought it was that it was the worst system he had ever used. He added that they had to start somewhere, but he had an unspoken feeling that the top officials may not have been entirely prepared to do this at the time. It felt very rushed in his opinion.

He exclaimed that he was currently using the construction portal from HMS, located at the webpage www.bh.hms.is. He exclaimed that this was below average but he had a better overview of all of his projects in this certain portal. BO 6 organizes his documentation using M-files in addition to the HMS construction portal, making it simple for him to distinguish between the roles he plays at different times and the tasks at hand. The fact that Iceland has so many operating systems for inspections and that they don't "communicate" with the HMS system puzzled him. If HMS cannot control which system the municipalities use, it should at least be possible to set conditions for data and how it should be set up in the certified systems used. He felt that it would be easier if

all municipalities would use the same inspection system, that way they would all be in compliance with each other, without a doubt.

He has countless comments regarding the system and has pointed them out to HMS, e.g. the HMS portal and the inner net of HMS do not communicate. In addition, he adds some feedback on the system's training. He did not receive any training or instructional aids for the system. He had to learn many things on his own. Even now, years later, he still has many questions about why certain things are the way they are. He felt that he missed a teaching lesson on the system, but it is not available.

4.2.7 Building Officials conclusion

A standardized inspection system is desired from the building officials interviewed as well as training videos for the system used. In their opinion, it should be composed of one system that all building officials and construction managers can use for their inspections and can communicate with HMS and its system. Currently, construction managers that work in various municipalities need to do inspections in various systems. For many, this is a headache and often leads to the result that construction managers are only willing to work in certain regions of the country; only the municipalities with the system they are used to. This mainly applies to the smaller construction managers rather than the larger ones, since the larger ones often have a QMS team that assists with all documentation regarding the QMS.

Each municipality controls which system is used and they believe it is unfair to construction managers to make them navigate the confusion of many systems. Instead, a single system that manages inspections and has access to relevant HMS data should be used, in their opinion.

Construction managers shouldn't be left behind in the chaos to handle things on their own. It is more reasonable for the institutions, to handle the issue so that individuals don't have to shoulder the load on their own.

The majority of the interviewed building officials use the HMS building portal, also known as *Byggingargáttin*. According to building official 2, most of the building officials in Iceland are using Oneland Robot System but the researcher does not have data to confirm this. Thus, the top 2 inspection systems at this time are HMS Building Portal

and Oneland Robot System. Other systems that have been used prior were GoPro and several others, but all have tried HMS Building Portal at some point.

Many building officials have expressed dissatisfaction with the recent changes to the inspection processes and related documentation, which may be inferred from their statements. They are merely informed of changes; it is not discussed with them what would be the best to do or modify, rather they are notified of the changes after the decision has been made. Many building officials want to be involved in future decisions, e.g. which system to use, changes, development, and improvements. The building officials interviewed hope that HMS will consult with them in the future, to find a better solution for both QMSs and systems for building officials.

Most building officials understood and said so themselves, that ofcourse they had to start somewhere, but they feel that the birth of this process and the time of cultivation are far too long, especially since this is a matter of quality.

After the results were acquired from the building officials, the Federation of Icelandic Industries (SI) was contacted and they provided interesting results. The municipalities were of the same opinion as SI completely. They believe the current arrangement of QMS and inspection systems is far too complicated and nobody within HMS, SÍS and the ministry seems to want to manage the necessary changes needed to have simpler and more efficient systems. Municipalities want to partner with SI to test various implementations of adjustments. Work has begun on a complete review of the building regulations, but that work will take several years to complete.

One can ask why the Association of Icelandic Rural Associations (SÍS) does not lay down the line (even the tools/technology) so that all rural associations are working according to the same system. The answer that has been received from SÍS is that they are an advocacy organization and nothing else. However, in the Nordic countries, the same organization (SÍS), sets a guideline for rural associations in the respective country. So why not in Iceland?

Notably, this is their perspective on the matter and their own experience with numerous developments. Changes are made for a reason and to satisfy a need or demand rather than just for the sake of change. However, certain adjustments might have been made too quickly and might have needed more time to be polished before they were released to the public. Similar to when a product is released to the market, it needs to be tested

and evaluated. It goes through a testing phase in order to identify and fix any flaws.

ID	Country	Job title	Size of municipality	QMS
1	Iceland	Building Official	Small	HMS Building Portal
2	Iceland	Building Official	Medium	Oneland Robot System
3	Iceland	Building Official	Large	HMS Building Portal
4	Iceland	Building Official	Small	Oneland Robot System
5	Iceland	Building Official	Medium	HMS Building Portal
6	Iceland	Building Official	Small	HMS Building Portal

Figure 10: List of interviewed building Officials and their basic information

4.3 Companies abroad

Six companies were interviewed abroad with regards to their QMS and QMS in Iceland. They are defined with double letters, "AA", while interviewees within Iceland are defined with singular letters, "A".

One company was contacted in the United States of America (USA) through the telephone. Five parties were initially interviewed in Spain, in person, but not all of them were able to fully respond to the questions. One of them did not fit the criteria to be an interviewee in this research, since they were not in construction work themselves. They had access to contractors, but they were not a part of their company. The interviewees in Spain were prepared differently to answer questions. Some spoke honestly and candidly, while others were more hesitant and cautious with their responses. Some essentially did not have answers to give, in some parts.

The following are the interviews with five foreign companies in the industrial sector.

4.3.1 Interviewee AA

Interviewee AA is an Icelandic master mason who founded a company 1985 in Tulsa, Oklahoma in the USA. His company is now Tulsa's premier source of natural stone. The company has 20 employees and has suppliers mainly in Spain, Italy, and Brazil. It was instantly prominent due to their European standards. The European factor was thought to be very elegant by the customer, but with time it was proven to be a very smart choice as well since their QMS is built on Icelandic QMS standards as well as certified masons. Initially, it started out as a company with only masonry services but in the early 1990's it started heading in a new direction due to two main things; supply and demand. There was a significant increase in demand to create natural stone countertops and fireplaces which presented a new direction for the company.

After talking with interviewee AA, the CEO, it was evident that the excellent employees of his company were the foundation of its success. A company can have the best QMS available, yet fail if the management is not competent. This is not the case at the interviewee AAs company. The management team of 3 are leading with great example and they themselves are the main quality control in their production. When asked more deeply about his quality control he explained by being visible on the ground floor, where the stones are cut and polished, they uphold the standards. They walk around checking if everything is working and looking as it should. Every employee knows what is expected of them but every worker is human and therefore can have a bad day. By being visible, they know that they need to be on their "A-game".

According to interviewee AA, the USA doesn't have an institution that is similar to HMS in Iceland, at least not with the same standards. Iceland has much higher standards when it comes to the durability of houses. Houses in the USA can not withstand tough weather like Icelandic houses can. Most houses in the USA are made from wood with less construction support than used in Iceland while Iceland has most of its houses made from cement.

"Iceland is very advanced when it comes to the quality of infrastructure, far more advanced than the USA, in my opinion." This is thanks to the QMS guidelines HMS has set and the Construction Managers have followed. Jóhann has tried to use Icelandic standards in his QMS, which benefitted him greatly and has given him a certain quality factor and raises him above others in this field of work. He uses a general computer filing system

where each person has their own file. Customer contact information, design documents of the project, measurements, and before and after pictures are all within this file. The pictures that were taken assure what was done and how it was done. So if interviewee AA is not in the area when the installation is done, he can look at the pictures to check how things were installed.

4.3.2 Interviewee BB

BB, a sales representative for a construction company, agreed to an interview. The business BB is one of the construction companies for a unique Lake and Life Resort that also sells the properties. Although BB is an average size company in Spain's industrial sector, the majority of their other projects are residential buildings. They offer selections of new built and resale properties. They have built over 3.500 properties and have more than 40 years of experience. They offer maintenance services, home remodeling services, and legal services to their consumers.

Due to BBs inexperience, confidentiality obligations, and fear of breaking privacy laws, BB did not have many answers to offer. BB did disclose that their company did not have their own master craftsmen, rather, they had contracts with other craftsmen; subcontractors, who acquired their own masters. Those master craftsmen then took care of the inspections. They made their own QMS by using a digital filing system, following a set of instructions from the Spanish authorities. Their QMS consists of contracts, customer communications, notarized architectural drawings, a list of all master craftsmen in each project as well as a copy of the "construction QMS", as BB called it, which is a copy of the Construction Managers QMS for each project. Interviewee BB also informed the researcher that many master craftsmen in Spain use a QMS called BIM. It is quite possible that this particular BIM is the same BIM that Procore systems uses which is a 3D design and modeling software that can help optimize the work of designing for various structures. From his explanations, it seems very likely.

4.3.3 Interviewee CC

A sales person, CC, from a building contractor's sales office was gracious enough to respond to a few questions after the office was contacted for an interview. CC had little information to give, but CC did his best to answer what he could. He sent his boss a

brief list of inquiries in hope for more information. The supervisor however did not have time to respond to the email with detailed responses,

The CC company has a wide range of professionals, from designers to industrial workers and masters. They have worked in the building and housing development industries for more than 30 years and have their own QMS which is a digital filing system. About 10-15 years prior, there came new and improved regulations that forced the construction managers and master craftsmen to have their own QMS. This company uses a digital filing system, which they made by following the instructions and regulations in Spain. They are similar to Iceland's from what CC understood. Their master craftsmen inspect each part of their projects and they put that information into the company's QMS. The master craftsmen are responsible for inserting all documentation and the office manager has to make sure that all documentation is in the correct place before each sale. The office manager is therefore partially a quality manager as well. Their construction manager goes through all inspections as well. His signature is needed on all inspections in all categories. Sometimes he comes to the location, other times he goes over the paperwork at the office with the master craftsman. The regulations in Spain, according to CC, state that the construction manager's signature is needed on all inspections which confirms his acceptance of the inspection. The construction manager of a structure is responsible for all aspects of that structure. Therefore, it is in his best interest to visit the location and ascertain the condition for himself each time. If there are aspects needing changing, then he can point that out to the master craftsmen during the inspection and write a comment in the inspection. That way there is a trail of comments and changes during the building process.

4.3.4 Interviewee DD

An interview was established with a sales representative of a large building contractor, DD, who was hesitant to answer questions regarding their QMS. That is mainly because the DD company is the main developer of a unique Lake and Life Resort and are very large in Spain. They are the developer of this new and unique resort concept; a new way of combining home, resort, and community entertainment. From construction to sale with all personnel and master craftsmen in between, DD's company manages every position inside the project.

The DD company is a national construction company in Spain, family-owned and in business for more than 60 years. Their main concepts are reliability, experience, formality and commitment. Internationally renowned companies have collaborated with the company over the years to build many of its projects. DD is present in many locations in Spain and is responsible for the construction of many large projects in Spain, such as IKEA, Leroy Merlin, Carrefour, Bricomart, large leisure complexes, hotels and industrial infrastructures, as well as large residential complexes.

Due to their expertise, they have designed their own QMS with its very own website and administration. The website is their QMS. They have a so-called "all-in-one" company, as interviewee DD exclaimed. They are very committed to customer service and environmental factors, therefore they use an integrated Quality and Environmental Management system (QEMS) that complies with the requirements of the international ISO 9001 and 14001 standards. They are adamant on preventing pollution throughout their construction process.

4.3.5 Interviewee EE

A sales representative for a construction company, EE, agreed to an interview. The company EE is one of many building contractors of a distinctive Lake and Life Resort. EE is not as large as DD, but they have many other projects which are mostly residential buildings. From real estate agents to construction managers and all industrial personnel in between, EE's company manages every position inside the project.

The EE company is both friendly and competent in their field. They answered very openly all questions but the interviewee had limited knowledge regarding the company's QMS. EE referred the researcher to the supervisors, but no answers were received. What was confirmed was that EE companies use a digital filing system for their projects and link the construction folders to the purchase folders. Their system appears to be split in two but talks to each other. They have a folder for each property with the property number, drawings, materials used and more. It specifies who buys what and when. But they also have a folder for customers, or buyers. Some people buy more than one property, so they can easily look up the person in question and view all his properties.

Interviewee EE went through their process and the documentation of relevant papers

in the QMS. Their documentation filing is similar to the Icelandic filing system and the Icelandic process. They ask for the same documents as Iceland does; school certificates, building permits and more. When it came to their inspection process in Spain, it was discovered that Spain's inspection procedure involves much more inspections than Iceland's does. Each part of a project in Spain is followed by an inspection, e.g. foundation, plumbing, electricity, windows, stairs, each floor, etc. The inspector comes more often and inspects smaller parts at a time while Iceland inspects a wider range in each inspection. The inspector inspecting the work must be a master in that department, same as in Iceland, e.g. the plumbing inspector has to be a master plumber, etc. An inspector from their company, EE company, visits and performs the necessary measurements, takes photographs, completes a paper report, scans it into the computer, inserts it into their QMS and sends all pertinent information to the appropriate party, corresponding to HMS in Iceland. Each inspector is therefore the master craftsman and all inspections must be approved by the construction manager, who is also the main inspector.

4.3.6 Companies abroad conclusion

Based on these interviews, it is evident that Iceland is very advanced when it comes to the quality standards of buildings, whether it is residential or commercial buildings. An excellent QMS standard is set by HMS, which should lead to better construction if followed correctly.

It came as a surprise that larger contractors in Spain have a significant and diverse team. They design their projects from start to finish, they build, shape and finish all of their projects before they are sold, nothing is left unfinished. Part of their team are educated real estate agents, who work solely in selling and reselling their properties. The sales team works with the office team, where the quality manager works as well. The quality manager in Spain serves a slightly different role than he does in Iceland. In Iceland he has many responsibilities and needs to be well acquainted with the ISO standards, while in Spain he only oversees the digital filing system and makes sure that all relevant folders are being used. The quality manager checks to make sure all pertinent documentation is in its proper location both after each inspection and before each sale. In this way, he monitors all projects and has a better overview at all times.

ID	Country	Job title	Type of business	Number of employees	QMS	Years of experience
AA	USA	Master Mason	Granit installation	20	Digital filing system	40+
BB	Spain	Sales Representative	Construction and sales	40 + contractors	Digital filing system, BIM	40+
CC	Spain	Sales Representative	Construction and sales	60 + contractors	Digital filing system, BIM	30+
DD	Spain	Sales Representative	Construction and sales	400 + contractors	Their own system	60+
EE	Spain	Sales Representative	Construction and sales	30 + contractors	Digital filing system	30+

Figure 11: List of interviewees abroad and their basic information

4.4 Icelandic contractors

The interviewees were varied, in terms of size. The size of the company was determined by the number of employees and was categorized accordingly. Some interviewees are subcontractors to the larger construction companies in Iceland, who some were also interviewees in this study. Interviewees asked to be anonymous and were asked 3 main questions:

1. *Did you make your own QMS?*
2. *Do you manage your QMS yourself?*
3. *How do you feel about the current QMS status?*

4.4.1 Interviewee A

The interviewee is a master electrician and a CM. He is an experienced electrician and finished his masters licence in 2019 and CM licence in 2020. Interviewee A founded a company in 2018 as a master electrician and him being the only employee. The main projects were general electrical maintenance in residential buildings as well as some sign offs for new electrical projects that require a master's signature, e.g. a small cabin.

Now, with 8 employees as well as many subcontractors in various fields in the industrial sector, their main projects are residential and commercial buildings; new construction, maintenance, etc. He has additionally added 2 houses to his list of projects as the master electrician. Therefore, his QMS is very important and has grown with his growing company.

As an accredited electrician, he is required to have a certain kind of safety management system (SMS). Only those who have received HMS certification for electrical work may be responsible for any type of electrical work. Electrical contractors accredited by HMS operate according to a defined safety management system, set by HMS, to ensure as much as possible that their activities are in accordance with the safety requirements of laws and regulations so that the requirements for the quality of work and the safety of equipment are met.

As an electrician he has had higher demands earlier on than other craftsmen, with the SMS requirement. His experience, with both the SMS and the QMS, was that the process wasn't efficient enough and he felt that he was on his own to find the relevant information he needed in order to fulfill the requirements set by HMS.

4.4.2 Interviewee B

The interviewee is a master electrician and a CM. He is an experienced electrician and finished his CM licence in 2020. Interviewee B founded a company in 2020 as a master electrician and him being the only employee.

Interviewee B was extremely fortunate, compared to many, as he has a brother who went through this process two years prior and he had a licensed QMS. He therefore had a slight advantage and contacted an inspection agency. In spite of this advantage, he encountered unexpected experiences with the inspection agency, which he wanted to disclose with the aim of warning others and highlighting discrepancies between employees within the same organization. Human errors can always occur, but quality factors, such as QMS and work processes should minimize this.

The inspector at the agency, hereinafter referred to as inspector 1, gave interviewee B tips on what could be improved in the system and he happily followed those instructions. He wanted the system to be impeccable and believed it would be so, if he followed the suggestions of the licensed inspector. However, when it came to the inspection of inter-

viewee A's system, another inspector, hereinafter referred to as inspector 2, within the same agency inspected B's QMS and it received many errors. Most of those errors were due to the suggestions of inspector 1, while the rest were slight changes within the agency and were more suggestions rather than errors. Interviewee B felt that many things were evaluated based on feeling rather than a set list. This revealed a huge discrepancy within the inspection agency. Interviewee A believed he had a strong QMS, since it was flawless and without comment 2 years prior and no changes had been made in the regulations or instructions from HMS in that time. He contacted the inspector who examined his system, inspector 2, and pointed out the discrepancies between the inspectors within the same agency. Inspector 2 could not understand why inspector 1 would make those suggestions and had no other answers for interviewee B. The suggestions made by inspector 1 were all in written form via email, but the agency were not concerned by that. The only thing that could be done in that situation, according to inspector 2, was to go back for another inspection with the QMS where B would have to have fixed these aforementioned errors. This conclusion was not shaken and B was forced to follow those instructions if he wanted a licensed QMS. All communication between B and inspector 2 was in written form as well, where all of this information appears. He fixed the errors, sent copies of the email communication with inspector 1 to inspector 2 where the suggestions appear. In continuation he made a new appointment for a QMS inspection as inspector 2 ordered. The inspection went well, carried out by inspector 2 again. The system was flawless and was as it was in the beginning, before the changes from inspector 1. Afterwards, interviewee B sent all of his communication to the agency, to point out this discrepancy in hope that it would not happen again and for the agency to be aware of what had happened. This incident was not good publicity for this inspection agency, since this is a flaw within their internal audit.

The only answer he got was a double invoice for 2 inspections. Despite evidence that an inspector from them, inspector 1, wanted to change the original and flawless QMS. The outcome in this case was that he got a small discount as he had to pay for both inspections or his QMS would not be approved.

Interviewee B got a licensed QMS from another CM, a digital filing system. He inserted the appropriate documents in the appropriate place within the QMS. He maintains the

QMS himself and has passed the functional inspection from the same agency in 2022, but with another inspector. B hopes that some kind of basic system will be published and presented in the construction manager course so that people can master this tool as it is important, in his opinion, and it is important to keep it in order so that it fulfills its purpose.

4.4.3 Interviewee C

An interview was established with one of two owners of a construction contractor company with a background in carpentry. He is a master carpenter since 1996 and has been in the industry since 1986. The company's main focus is on first steps in the construction process of large projects; the construction of foundations, cement walls and their finishing. They have an employee size of 180 where approximately 95% are educated carpenters, 3% office employees and 2% uneducated, but qualified, construction workers. They have quality managers that have an overview of all quality factors of the company, whether it is regarding the registration of relevant data or listing of tools.

They were asked a few questions regarding their quality management system. They did not make their own QMS, rather bought a qualified system; Ajour. They were happy with the service Ajour provides, but find their prices rather high and there are some aspects regarding the QMA that Procure does better and provides better service; regarding the drawings of buildings/projects, and comments about the drawings and possibly changes or corrections of some aspects of the drawings.

This particular company would love to see a QMS from HMS, or at least a basic foundation of a QMS system. They would have preferred that, to begin with at least. Now with a larger company, they need a more polished system and find Ajour to be adequate at the moment, but not outstanding.

4.4.4 Interviewee D

Interviewee D is a Master mason, since 1995, and a CM since 2018. He has been a Master mason for many houses and projects through the years and has significant experience there. Originally he had a simple folder system in a filing cabinet for these projects, but he stated that it was not nearly as orderly as it is nowadays.

When things in general transitioned and became more computerized, he then had help

from other craftsmen around him. They set up a QMS, a digital filing system, for him and showed him where to file his documents. They were experienced in this field and knew their system well, so interviewee D thought this was very simple. From 2008 until 2018, he only took on a hand full of small projects that didn't require a lot of management nor paperwork. It wasn't until late 2018 that he needed to follow the QMS wholeheartedly and fill out the relevant documents, because then he became a CM and the QMS became broader and more complex for him. With that came more responsibility and various inspections that he had to take care of and be responsible for. He wanted to do this right and sought out assistance. He had access to a ISO:9001 quality certified QMS and started using that in 2020. He did not know how to use it properly and maintain it, therefore it was a ticking time bomb. Then came the so-called functional review of the QMS, from the accredited inspection agency, and there it was apparent that he did not know his own system, since he did not set it up himself and didn't get appropriate training for said system. Consequently he lost his permit, to sign for projects as a master mason and a CM, since this was a QMS for both. He felt he could not ask HMS for help, because he was afraid of casting a spotlight on himself, if there answers would have been negative. After this setback he looked into QMSs with support and came across Ajour. He said it seemed simple and thought about trying Ajour, but hesitated due to the high cost. He didn't find it suitable for him, with the few projects he had versus the high cost of the Ajour QMS.

In conclusion, interviewee D had a "home made" QMS, but he did not make it himself. He maintained his QMS, but not the way he should have and didn't meet the proper standards. Interviewee D hopes that HMS, or an appropriate agency, will issue a basic QMS that can be added to, if needed. A basic QMS should therefore be sufficient for smaller companies as well as solo contractors.

4.4.5 Interviewee E

The interviewee is a master electrician and CM. He is an electrician originally and finished his masters license in 2013. He is an independent craftsman and is only responsible for one house as a construction manager, his home. He is the construction manager on his own house which is a detached house. He has experience in new construction, maintenance and more as well as a background in concrete sawing. He is responsible for

2 electrical projects since his day job is more office related. These 2 projects are very different; one is a new tool shed while the other is a detached house built in 2020.

When he got his license in 2013 he did not have anybody to help him with his QMS. He contacted other master craftsmen he knew and got an old quality manual which he was able to build his QMS on, since he felt the instructions from HMS were too complicated compared to his knowledge at the time. In the beginning he felt the paperwork around it was unnecessary and useless but after using the same QMS for the tool shed and the detached house, he realized the importance of it and its foundation. He had all the documentation needed for each project in the QMS. He grasped the concept of it and was grateful for the insurance the QMS granted him for his work. Since he used his QMS as described in his quality manual, he has insured his work with evidence of correct work done with pictures and documented communication.

4.4.6 Interviewee F

The interviewee is a master plumber since 2022. He is going through the process now of applying for the certified license from HMS and therefore preparing his own QMS. His first thought was "why can't I get a QMS from HMS?"

During the interview, he got a better understanding of how the QMS should be and was thankful for that. He wished that HMS would issue a short video, or series of videos that could explain this better. The HMS instructions are fully comprehensive, but feel unclear to him and seem much more complicated than they are, considering they are lengthy and in complicated language.

In conclusion, interviewee F will make his own QMS built on a friends QMS. He will maintain it himself and hopefully learn from the mistakes of his more experienced friends in the industry. He requests instructional videos from HMS.

4.4.7 Interviewee G

The interviewee is a master painter since 2019 but with many years of experience. He has a company in painting with 4 employees, him included. When starting the QMS creation journey, he encountered a QMS system that was not digital but a tangible paper folder system, which he bought from Gunnar Jónatansson. Interviewee G felt that his

was sufficient for him and his small business. Additionally, G has made an extension to this QMS by composing a filing system in Dropbox, where he can insert images from projects, before and after, as well as customer contact information. The dropbox works as a backup for his QMS with additional information and images.

When asked how G feels about the current QMS status, he answered immediately that he would like a small and simple QMS system from the inspection agencies, or other agencies with connections to HMS, as know the HMS standards clearly and can present a simple system that can be built on top of. G expressed, "All the systems I have looked at have been too big, too complicated and too expensive for me, as I currently have a rather small business."

4.4.8 Summary of interviews

In conclusion, all of the interviewed master craftsmen and building officials want to see a simple base of a QMS which meets the requirements of HMS, preferably issued by HMS, a licensed inspection agency, or another relevant organization that does this in order to maintain the quality of structures in Iceland and not with the sole purpose to make a profit.

The interviewees unanimously wished for a certain "starter-kit" for when craftsmen apply for a licensed QMS. Many felt that HMS should provide it, since they have all the information needed and could connect its system to the QMS. But others felt that it could come from Iðan, through the construction manager course. There, all construction managers sit the course in order to obtain their permit. They are given basic information on QMS, but many anticipated receiving a QMS in the course.

A difference is noticeable between Iceland and Spain was that contractors of larger structures and projects in Spain have a larger team, which forms a stronger unit. That is, from real estate agents to construction managers and all industrial personnel in between, they manage every position regarding the project. By doing so, they uphold their quality assurance to their customers. If the team is good, then they get a good reputation and the future customers are assured that their project will meet all requirements, according to their quality standards.

The Spanish interviewees all used a digital filing system and some used an online system

with BIM. BIM is used within the Procore QMS, therefore there is a similarity between the countries, both in QMS and inspections.

ID	Country	Job title	Type of business	Number of employees	QMS	Years of experience
A	Iceland	Master Electrician & Construction Manager	Electrical contractor	8	Digital filing system	5
B	Iceland	Construction Manager	Construction	1	Digital filing system	3
C	Iceland	Master Builder	Construction	180	Ajour	38
D	Iceland	Master Mason & Construction Manager	Construction	1	Digital filing system	28
E	Iceland	Master Electrician & Construction Manager	Electrical contractor	1	Digital filing system	10
F	Iceland	Master Plumber	Plumbing contractor	8	Digital filing system	1
G	Iceland	Master Painter	Painting	4	Digital filing system	20

Figure 12: List of Icelandic interviewees in and their basic information

The inspection agencies are to follow a certain checklist when inspecting QMSs. What is interesting is that some inspectors go off the list and add their personal opinions verbally to the requirements for construction managers and other master craftsmen during the inspection. This is something that should not happen, because the inspection checklist is there for a reason. HMS has set the guidelines that are supposed to be followed and it is a quality factor to follow the guidelines set, to provide quality assurance of the product. Yet, some inspectors have managed to tamper with the checklists by implementing their opinion and methods into other QMSs during the inspection. The interviewees disclosed various inconsistencies in the inspections conducted by the inspection agencies. Some had friends with the same QMS, the same amount of documentation and the same usage but due to similar companies, they did not get the same results in the inspection. This was more than on 1 occasion, more than 1 interviewee. Based on the explanation of the interviewees, inconsistencies were experienced at 2 of the 3 inspection agencies. When they talked to a supervisor at the inspection agencies, they were met with disregard for the matter. The supervisors spoken to, at both agencies, showed no interest in the comments and complaints. This resulted in the QMSs having to be re-inspected. In one case,

the construction manager had to pay the re-inspection fee, even though the errors were in accordance with their inspector's comments. In another case, the master craftsman did not have to pay the fee due to the fact that the inspection agency performed the wrong type of inspection. It was only noticed afterwards when the interviewee was trying to fix the errors, but couldn't. It is not taken into account the time and effort this master craftsman put into changing his QMS in accordance to the remarks from the inspection agency. This is lost time, and therefore lost money for him.

When such warning signs appear, inconsistencies within the certified inspection agencies, it makes you stop and think. Especially when they don't feel that it is a big problem. The researcher suggests that inspection agencies follow their own internal control and review it in line with the basics of quality management; continuous improvement.

5 Overview of larger construction companies

5.1 Company 1

The owner is a master builder with over 30 years of experience. He has a company in construction with approximately 230 employees. They use the QMS called The Bygg System and provides a full overview of all of their construction projects. Both quality managers and the master craftsmen uphold the QMS. The company's quality manager oversees the QMS and ensures that all data is returned to the correct places within the system.

5.2 Company 2

This company is Iceland's most experienced general contractor with over 60 years of experience. Company 2 has approximately 240 employees. They use the QMS called Ajour as well as their own QMS they have made. Both quality managers and the master craftsmen uphold the QMS. The company's quality manager oversees the QMS and ensures that all data is returned to the correct places within the system.

5.3 Company 3

The owner is a master builder and CM with over 20 years of experience. He has a company in construction with approximately 40 employees. They use the QMS called Ajour, as well as their own filing system they set up. This combination provides a good overview of all of their construction projects. Both quality managers and the master craftsmen uphold the QMS. The company's construction manager oversees the QMS and ensures that all data is returned to the correct places within the system.

6 The questionnaire

A questionnaire was sent to various master craftsmen and CMs, with a total of 50 correspondents. The results of the survey are reviewed below, with charts to better illustrate them. All answers are anonymous and cannot be traced back to the respondent. Each has an ID number, so it is possible to review each respondent's complete survey answers. That way, one can see the background of the respondent to better understand their comments, if any. A comprehensive overview of the questionnaire is shown in Appendix A below.

6.1 Respondent's background

In the beginning of the survey, the questions regarding the respondents' backgrounds were asked. It is crucial to collect a diverse sample of respondents to comprehend the demographics of the group in order to draw conclusions about the results. Respondents were asked five questions to get deeper knowledge about their age, gender, professional age and title.

Question 1: Age

The average age of the respondents was 63 years, which may impact the results since the younger generation is more computerized. The current computerized QMS environment seems to work better for the younger generation rather than the older generation. The age is rather evenly ranged from 32 to 77, of which 17 were in their 50s.

The age distribution is displayed in figure 13, where they are listed with respect to the number of correspondents, from highest to lowest. As seen in figure 13 below, 3 people were 53 years old, 3 people were 51 years old, 3 people were 64 years old, 3 people were 47 years old and so on.

Having this age range is significant and indicates a more experienced group. Many have therefore gone through the changes in regulations in the past years and therefore have the comparison of how things were and how things are. Their opinions and comments are consequently important.

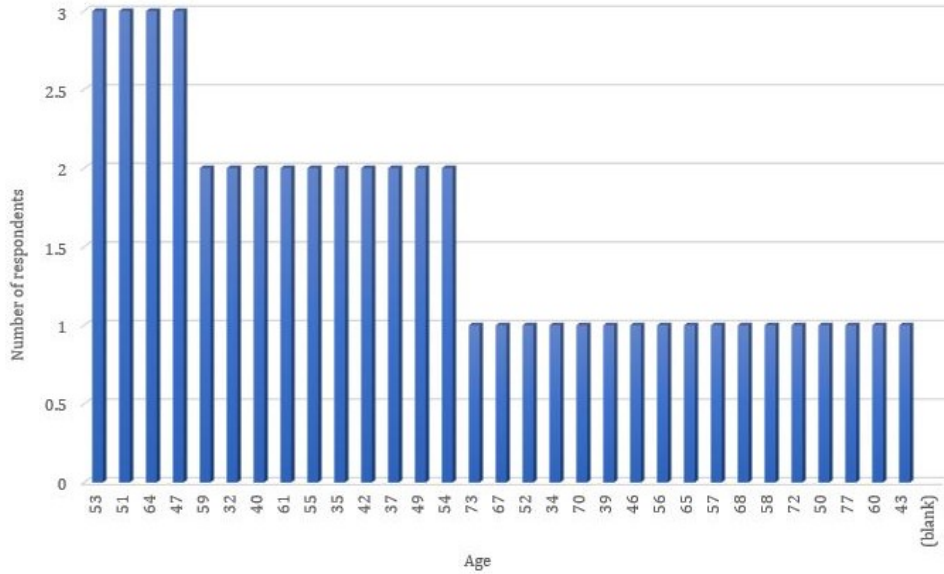


Figure 13: Age distribution of respondents

Question 2: Sex

Both men and women answered the survey, but surprisingly only 2 women answered. The rest were men, which presents only 4% women and 96% men.

People are different, but men and women often have different strengths if you look at the whole. More often than not, women are more favorable than men at paperwork, while men are often stronger than women. Therefore the strengths of the two are highlighted and used accordingly. Of course this does not apply for all, but the results indicate this as well, see below, where the men had their wives write up the QMS for them, with their guidance.

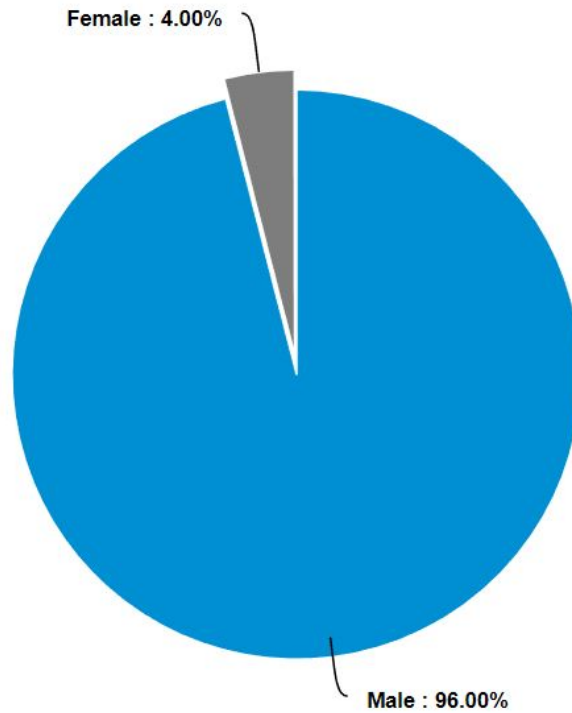


Figure 14: Sex of respondents

Question 3: Years of CM occupation

When asked about how long they had been a CM, some answered that they had 0 years experience as a CM. When they were examined more closely, it became clear that they were only master craftsmen and not CMs as well. It was therefore ruled out that it was a new CM who did not have experience. When these zeros were removed, then the average years of occupation were 18 years. The overview of CMs occupational years was widespread, but a the top 3 showed a total of 16% of the CMs had 20 years of experience as a CM, 9% had 15 years and another 9% had 2 years. If the CM group were to be divided in two parts, more than 20 years and less than 20 years of experience. It would then be evident that 42% had more than 20 years of experience and 58% had less than 20 years of experience.

It was very interesting to see the high numbers in this category. The oldest CM out of the respondents, that is has worked the longest as a CM, had 59 years under his belt as a CM. 59 years of monitoring and steering all aspects of various buildings, that is quite impressive.

Looking at CM's responses alone, it turns out that the vast majority want a standardized system released for all CMs, or 79%, leaving 21% that said no. Some explain that their system is sufficient enough, while others gave no reason.

Question 4: Job title

As noted above, a CM needs to be a master craftsman originally. Approximately 39% of the respondents were CMs. The majority of craftsmen who participated in the survey were master builders, or about 38%, next in line were master electricians with 12%, then master painters with 2.3% and the master masons with 1.2%. No master plumbers par took in the survey, but additionally quality managers were 4.8% and the other 2.4% were Construction engineers and project managers.

Figure 15 displays a pie chart showing the various job titles of the respondents. Most of then were CMs and master builders. This is better portrayed in figure 16.

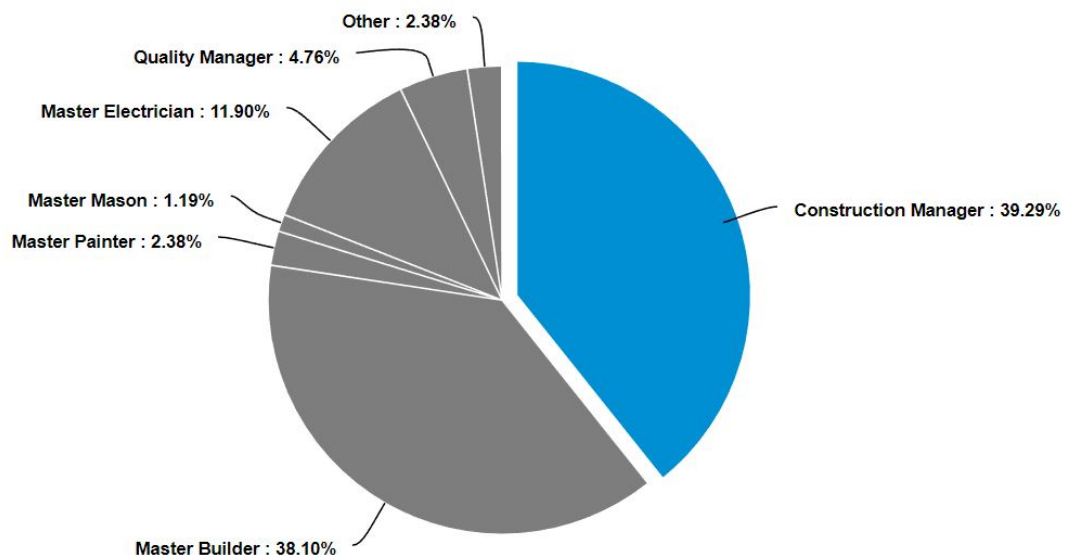


Figure 15: A pie chart of the respondents job title

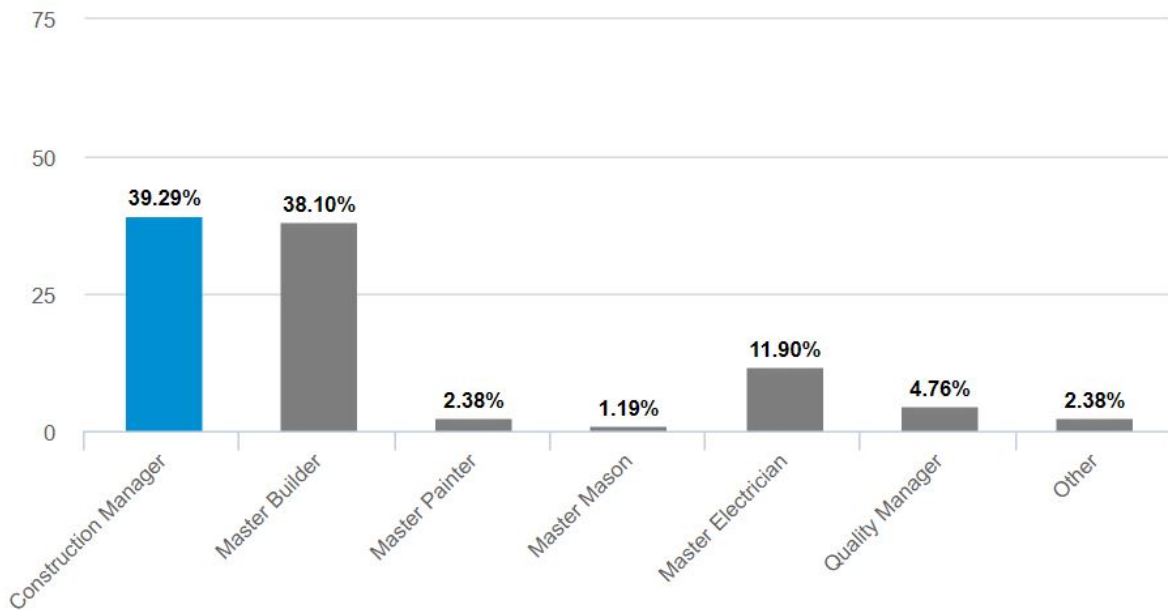


Figure 16: A bar chart of the respondents job title

Question 5: Number of employees

The respondents were asked how many employees they had. A large portion of the respondents, 38%, had only 1-5 employees, 22% had over 50 employees and the rest, 36%, were in between with 6-49 employees. Therefore the majority of respondents had few employees and their voices subsequently the highest in this survey. Figure 17 displays a pie chart showing the following percentages of employees.

The solo craftsmen, the people who don't necessarily have a company around this work, or are the only employee, amount to 18% of the respondents. The ones with a company around this work, having 1-5 employees, amount to 20%, making the first two groups 38% together. Respondents with 6-10 employees amount to 14%, 10-20 employees amount to 8%, 20-49 amount to 14% and 50+ amount to 22%. The remaining 4% go to the "other" option where 2 respondents answered. One of them has 300 employees while the other is solo and is about to quit due to illness. This therefore changes the solo percentage from 18% to 20% and the 50+ changes from 22% to 24%. The largest groups are still 0-5 employees, with 30%, and 50+ with 24%.

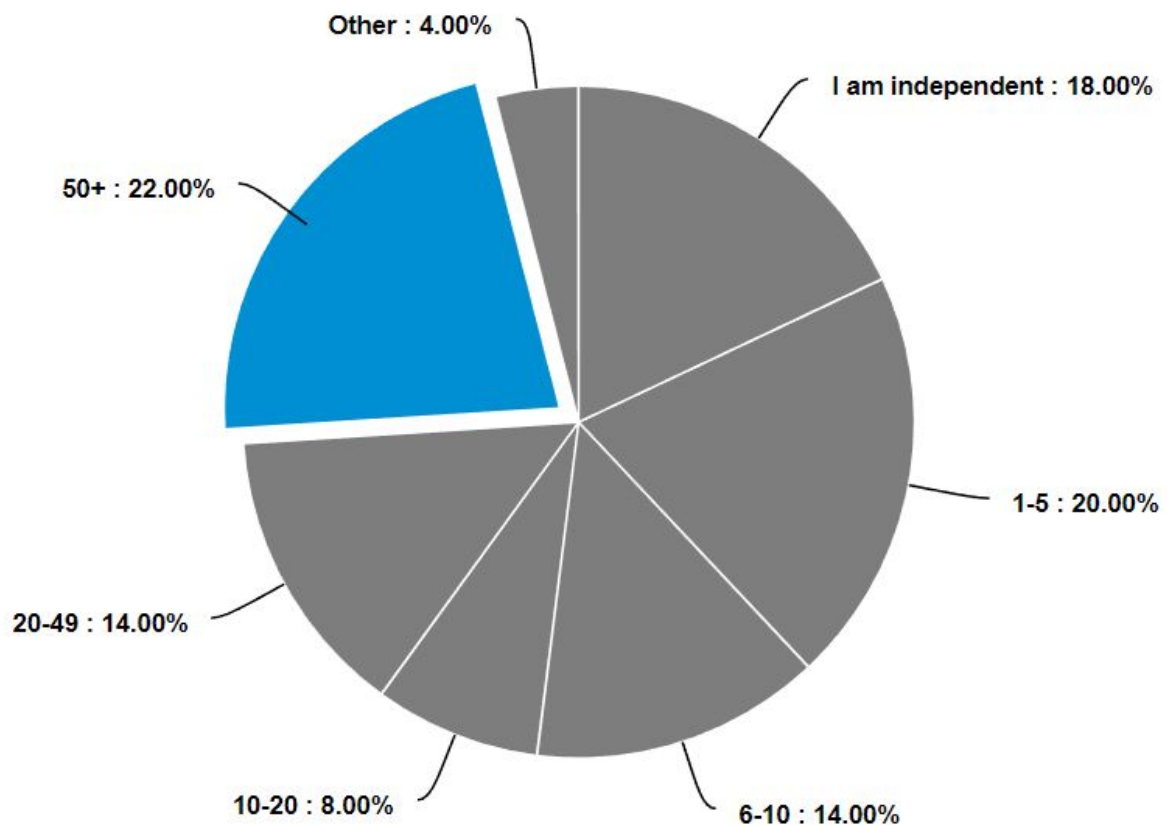


Figure 17: Number of Employees

Question 6: Did you make your own QMS

The respondents were asked if they made their own QMS or not. If not, then someone else made it for them or they bought it. Some companies specialize in QMSs and sell them. Some have simple digital filing systems that are sold as a piece product with no service nor maintenance included. Others have specialised an online system with service and maintenance, but it does not come cheap. This can be a deal breaker for the ones with a small company around this QMS. For larger companies it is not as big of a problem, but some have expressed their dissatisfaction with the systems simply because they are too expensive.

The answers available in the survey to this question were "yes", "no" and "other". 36% answered "yes", 62% answered "no" and 2% answered "other". The "other" answer can be classified as "yes" since the individual writes that the QMS was homemade but had help by comparing systems. Most digital filing systems are made my using a basis from an older verified QMS.

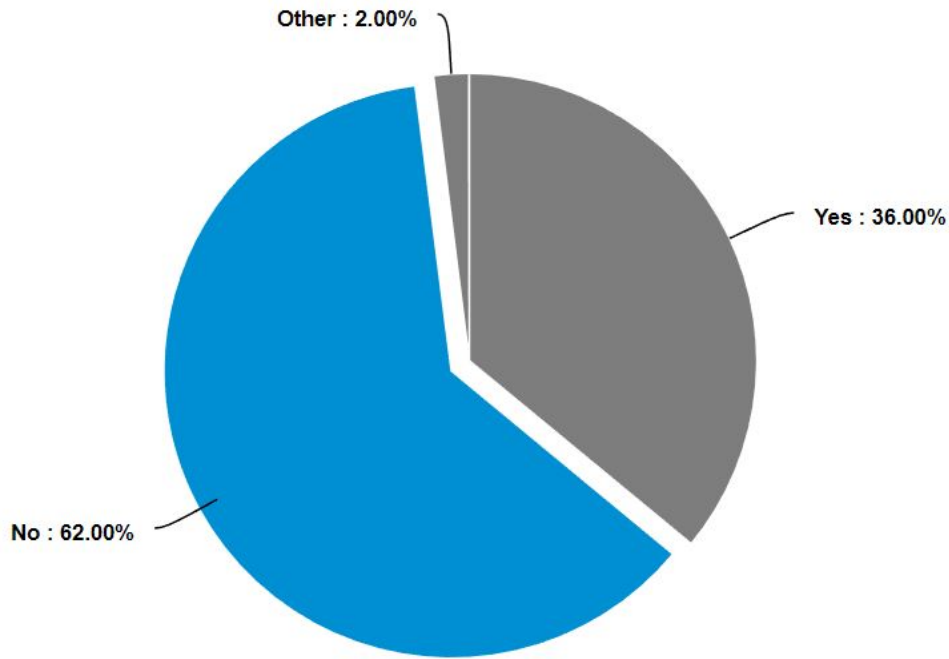


Figure 18: Production of own QMS

There are various systems available and were the most popular listed, but with an alternative option; "other". There, the respondents could insert what their QMS was called. Originally, see figure 19, the digital filing system, "Rafrænt Möppukerfi" had 22%. However, many chose the "other" option but wrote what was available, such as a digital filing system, while others added Excel, Gunnar Jónatansson and more. The systems used by these respondents are displayed in figure 19 below. According to the published graph, the most used QMS is a digital filing system with 36%, after adding 14% from the "other" option to 22% which were before. Next most respondents, with 28%, was Ajour Systems, Sharepoint with 14%, JibbyByggir with 4%, MindManager with 2% and Procore with 2%. From the "other" option, 2% had Excel, 2% from SI, 2% a system from school, 2% from Verksýn and 6% from Gunnar Jónatansson.

These results do not necessarily report what is most used, but most likely gives an indication of what is popular. It should be noted that there can be great differences between the respondents. Some solo craftsmen or CMs while others have dozens or hundreds of employees. Their subordinates probably use the same system as them, so there may be more behind some of these numbers.

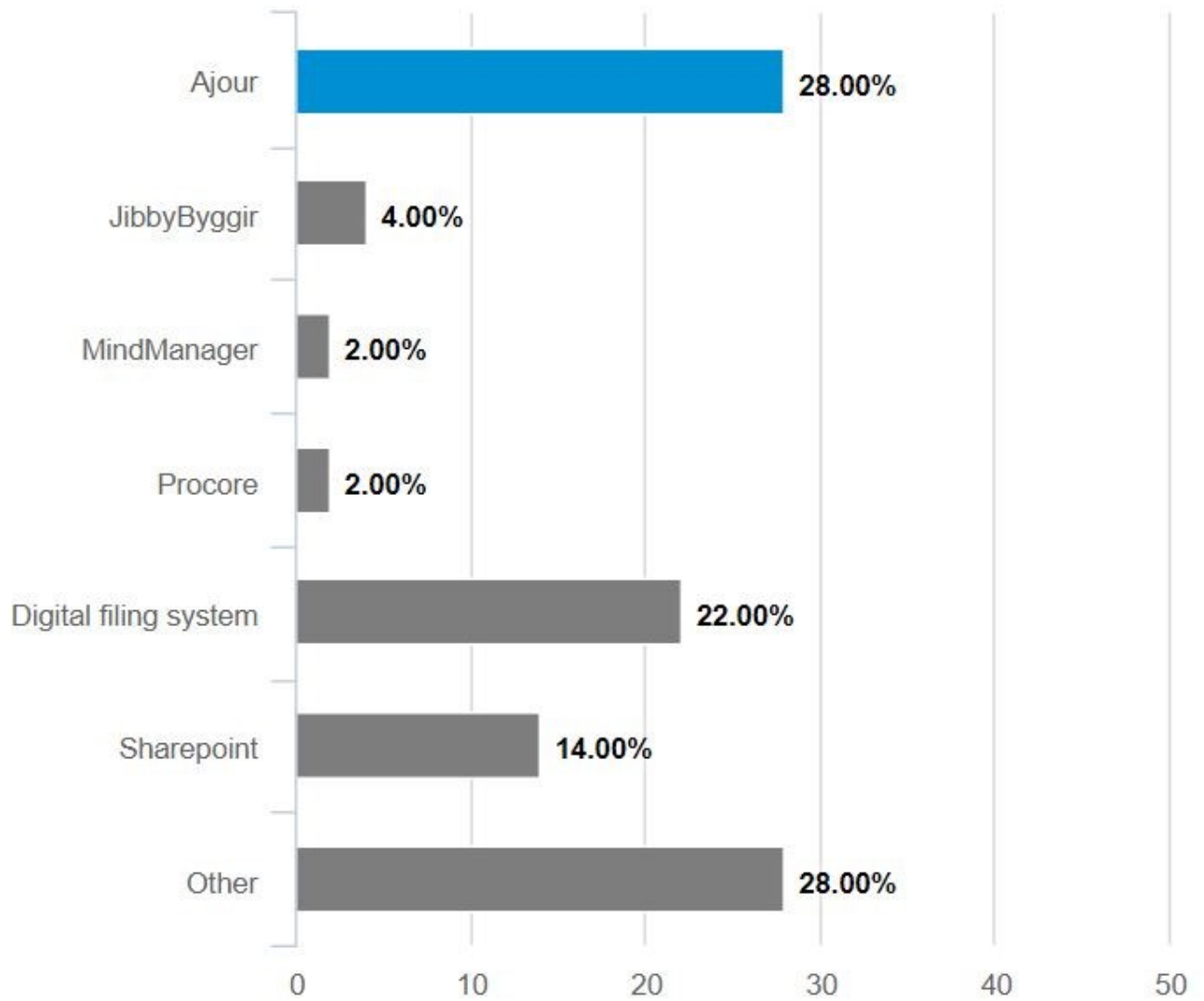


Figure 19: If respondent answered No, What kind of QMS was used then?

Question 7: Do you mind your QMS yourself?

The respondents were asked if they take care of their own QMS, make sure it is up to date and fulfills all the set standards. They were given 3 answer options; "yes", "no" and "other". 80% of the respondents answered "yes", they mind their own QMS themselves. But that does not mean that a Quality Manager doesn't assist, that depends on the work environment and the size of the company, if there is a company at all.

The "other" option text indicates who takes care of the QMS, the company and the wife of the respondent. The "other" option is therefore the same as the "No" option, therefore with a total of 20%.

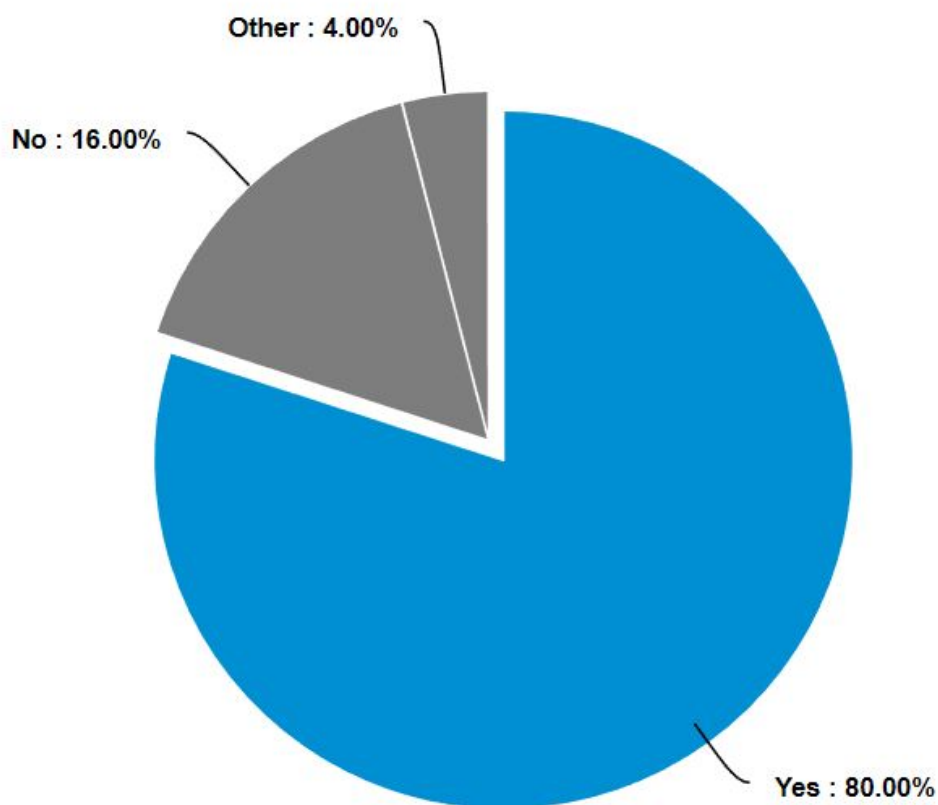


Figure 20: QMS uphold: Does the owner do it?

6.2 Respondent's opinion on assertions

Question 8: Satisfaction scale

The following statements were presented to explore respondents' satisfaction with the QMS in general. They were asked how much they agreed or disagreed on the following 5 statements.

1. Access to quality management systems is good.
2. It is easy to make your own quality management system.
3. Quality management systems are important.
4. Quality management system are easy to use.
5. Functional review of quality management systems is important.

The following figure, figure 21, displays the satisfaction scale revealing where respondents were most agreeable and least.

The Satisfaction scale came out rather positive and indicates a positive mentality towards QMS and their purpose. 40% agreed that the access to the QMS is good, 28% agreed that it is easy to make your own QMS, 38% highly agreed that QMSs are important, 46% agreed that the QMS is easy to use and 40% agreed that the functional review is important.

Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Overall
1. Access to quality management systems is good.	4 8%	9 18%	9 18%	20 40%	8 16%	50 100%
2. It is easy to make your own quality management system.	6 12%	13 26%	11 22%	14 28%	6 12%	50 100%
3. Quality management systems are important.	1 2%	6 12%	9 18%	15 30%	19 38%	50 100%
4. Quality management systems are easy to use.	2 4%	5 10%	10 20%	23 46%	10 20%	50 100%
5. Functional reviews of quality management systems are important	1 2%	7 14%	10 20%	12 24%	20 40%	50 100%



Figure 21: The satisfaction scale

What was interesting was the second statement, where 28% agreed that it was easy to make their own QMS but 26% 28% disagreed that it was easy to make their own QMS. There the answers contradict each other and basically cancel each other out, leaving 22% that don't have an opinion on the subject. This contradiction can most likely be traced to the difference in the size of the business. As per the interviews, larger companies feel that the QMS process is not a difficult one, while the smaller companies struggle with the whole package.

6.3 Respondent's opinions and statements

In this section of the survey, questions had various answer options where an effort was made to discover what the respondents' thoughts were on specific topics on connection with QMS. The respondents also had the option to select "Other," where they could type their responses if they were not available in the other given options.

Question 9: Would you like to receive a ready-made QMS with training included?

In the figure below, figure 22, it is indisputable that the majority, or 74% of respondents, would like ready-made QMSs and therefore feel like there is a need for it. By examining the "other" option, an extra 2% is added to the "yes" pool since one answered "yes, if it does not cost too much", changing it to 76% answering "yes".

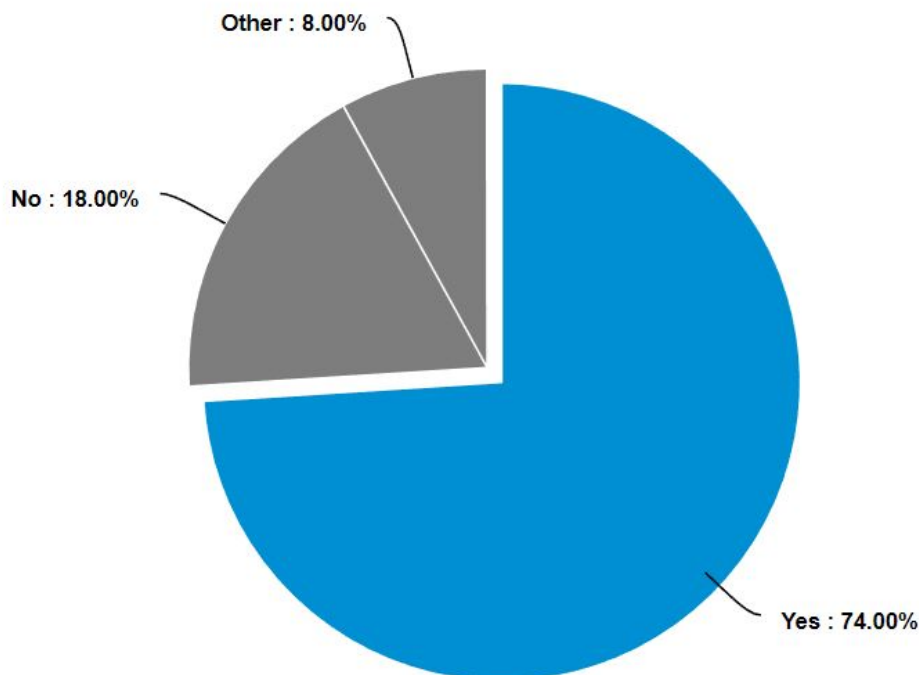


Figure 22: An interest in a ready-made QMS

Question 10: Do you feel something is missing in the QMS? If yes, what do you think is missing?

The following statements were given from the respondents answering what they felt was missing in the current QMS.

1. *"A QMS that works for small businesses. These are often such large packages"*
2. *"Efficiency"*
3. *"Simplicity and cost-effectiveness"*
4. *"approved architectural drawings and changes to the drawings. Photos during assessments (separate folder) more emphasis on "Manual of structures" i.e. everything appears there for the owners. There is often slack on the part of smaller contractors, but regardless, it is important and good to know, for example, which floor paint was used, if the floor material needs to be changed or if the walls need to be repainted, that the correct paint number is recorded and when it was done. This is a kind of service manual of the house and nevertheless important."*
5. *"Emphasis on architectural drawings within a quality management system."*
6. *"Unfortunately, all craftsmen in the construction industry do not receive the rights as construction managers, a standard, simple and accessible quality management system could be designed for those parties/companies who are not construction managers."*
7. *"Connection to inspections at HMS"*
8. *"A directory of contacts for all those involved in the work"*

Is there something else that you wish to communicate regarding the Quality Management System for Construction Managers? Comments/Advantages/Disadvantages

26% said no, they did not want to say anything.

One mentioned that they use both Ajour and Sharepoint. Another hoped for better and proper instruction on this material, the QMS setup and usage, in the construction manager course taught at IDAN.

Some have strong opinions while others do not. The following are the comments of the respondents:

1. *"I was very surprised by how much you had to create your own system. I first started using the system from SI, and there is, for example, no ready list regarding your own inspections. then I got Ajour, but now I'm using two systems today and the cost of that is very high."*
2. *"I would like to see a list from HMS, on the HMS site even, where there is a list of approved quality management systems. I knew of various systems but I know of a few who are not familiar with these systems and this would be a good solution. It is also a definite carrot for the companies behind the quality management systems to be on the HMS list. HMS sets X requirements, if they are met then those companies are published on this list HMS."*
3. *"It would be good if these items belonging to internal inspections could be simplified."*
4. *"A ready-made basis for a quality management system should of course be included with the construction manager course along with instruction on it. For a sole proprietor, starting to set up a quality management system is daunting. If you now had a basic system that you could build on, you would be much better off and would understand the importance of such a system sooner."*
5. *"Functional inspections need to be more frequent and cost less."*
6. *"Undoubtedly good for lawyers and large companies, but too many systems in operation, no coordination in these systems at the various building officials (BO) around the country"*

7 Discussion

The inspection agency, BSI, is far larger than initially estimated. It has a lot to offer but it seems that not many know of it and what it can do to help. From the interviews, it was grasped that the smaller contractors and independent industrial workers tend not to go to BSI, but rather to Frumherji. Not because they dislike BSI, but rather they do not necessarily know about their services and Frumherji is a familiar name through the car inspection services. People tend to stick to what they know or are familiar with. Larger contractors seek to be ISO certified and therefore look to BSI instead since that is a service they provide, with decades of experience.

When inspecting QMSs, the inspection agencies must adhere to a certain checklist. The fact that some inspectors deviate from the list and add their own standards for construction managers and other master craftsmen to pass the inspection is both intriguing and strange, not to mention not allowed. As the inspection checklist is there for a reason, this should not occur. This is a protocol set in place. Although HMS has established the rules that must be followed, some inspectors have managed to add to the checklists by incorporating their ideas and techniques into other QMSs while conducting the inspection. When the supervisors learned about the comments and complaints, they showed little concern toward them. They ignored the situation and showed complete disregard in more than one occurrence.

These kinds of incidents are red flags that something has to change. Particularly when authorized inspection offices are at fault, they cannot and should not be disregarded. The researcher suggests that a re-evaluation of procedures within the agencies is needed. Although inspection agencies have their own internal control procedures, it is clear that they need to assess them in light of recent events as well as the principles of quality management, continuous improvement, and the PDCA circle (see chapter 2.2.2).

Continuous improvement is one of the key factors in general quality management where the PDCA circle is of much importance: Plan - Do - Check - Act, see chapter 2.2.2 ISO 9001 and PDCA and figure 1. The quality management system is in great need of a run-through through the PDCA circle, at least for the smaller contractors and those who use a digital filing system.

Many correspondents of the researcher's survey responded to an open-ended question, when asked if they wanted to conclude something. It was evident that many representatives of smaller contracting companies thought that the current quality management systems were better suited for larger companies, where their processes could be much simpler. Additionally, according to interviewees, studies have shown that quality management techniques used by big businesses are not always appropriate for the smaller ones. The fact that quality management methods are not created to meet the essential traits of small enterprises has also drawn criticism. The researcher, therefore, reflected that the adaption process in small businesses may require additional attention. All large companies are small to begin with.

One can ask why the Icelandic Association of Local Authorities or "Samtök Íslenskra Sveitarfélaga" (SÍS) does not lay down the line, maybe just the tools and technology, so that all rural associations are working according to the same system. The answer that SI has received from SÍS is that they are an advocacy organization and nothing else. However, according to SI, the corresponding organization in the Nordic countries, SÍS, lays the line for rural associations in the respective country. Why is this not an option in Iceland? The researcher, therefore, reflected that this may require additional research.

In the majority of cases, the construction manager is the one who oversees the construction of the house, whereas the owner may not be present at the time. The construction manager is responsible for supervising himself and ensuring that he follows all established laws and regulations. The building official comes to the site for three inspections; sealproof-, safety- and final inspection. That's not a good example of adequate quality control, in the opinion of the researcher. The construction manager fulfills certain inspections, but ofcourse there should be more inspections from an outside party, similar to a building official.

Many construction managers focus their efforts on this kind of work; as a result, they manage both the responsibilities of a construction manager and a seller of the property. Numerous concerns regarding the construction manager's quality and quality control developed when the sales aspect entered the picture. Naturally, the person who builds a

house with the intention of selling it would want to make more money from it than less. Because of this, it is neither unreasonable nor unthinkable that some people might try to "shortcut their way" by using low-grade supplies or not upholding all of the established quality requirements. Construction managers and craftsmen are often under a lot of pressure to deliver houses by a particular period and certain aspects, if not all elements, must be completed, thus they are under a lot of pressure to finish. As a result, they could ignore or forget crucial details, such as important features in the instructions for the use of material. The building's cladding can be used as an example. Many people prefer to glue the cladding to the house instead of screwing it down, for appearance reasons, that is in order to avoid leaving any visible signs of the screws. This is fine in and of itself, but this particular adhesive can only be used in situations where the temperature does not drop down below 5°C for a period of 48 hours. Its adhesive properties are ineffective and its quality cannot be trusted if the temperature falls below this level, even briefly. Most people are aware that the weather in Iceland is frequently unpredictable and that weather forecasts should only be used as a guide and for peace of mind. There is a very narrow window of opportunity left to complete it if the construction manager decides to use this method of gluing the cladding to the building. He is responsible for the proper and high-quality of the glue. The construction manager is liable if, e.g. a cladding plate comes off after a few years and hurts someone, such as the owner. As a result, few people take this chance. However, this component, this feature of safety and quality, must be taken into consideration if the consumer, for instance, wants to purchase a glued covering. An inspection from an outside party, e.g. a building official, could inspect the gluing process from start to finish by requesting pictures of the task that are inserted on the day of the execution as well as a notice 4 hours prior to the building official or other inspector. That way the building official has a choice whether he comes or not and lets the pictures suffice. A construction manager can finish that portion of the project, but if he is pressed for time, who will oversee him and this portion to guarantee that the house is delivered in the proper condition? The law specifies that the construction manager is responsible for overseeing this. However, it is questionable in the real estate industry when a construction manager sells his own goods unsupervised. Because it's simple to make compromises and choose a less expensive way during construction, which ultimately lowers the building's quality. But in the end, we must have faith that the construction

managers follow their own quality manual and quality management system and perform what they say they will. The QMS is their safeguard after all, if used correctly.

The reputation of construction managers and master craftsmen, together with satisfied customers, serves as their biggest and best form of advertising, thus it is in everyone's best interest to stay committed to their quality management system.

At the beginning of creating a QMS, these two parties appear to stand alone but require the most assistance to get started. The larger companies can afford to pay for services on various systems and many even have a team of quality managers and construction managers who work together on the documentation that goes along with every project. The current system seems to be working well for the larger companies, but everyone agreed that it would be good to have a pre-built QMS in the beginning. In particular, many of them are aware of what it's like to be alone as they begin this QMS process because they haven't always been large.

Many people rely on obtaining a pre-built QMS system from an acquaintance or friend in the industrial sector. If these pre-built systems are not carried out properly, the next individual will experience the same low quality. It would be simpler for newcomers to have a pre-built fundamental system that ensures compliance with standards rather than following an unclear approach.

HMS claims that they are restricted by the law and have their hands tied. They claim that because they are government-run, they cannot enter the commercial sector with their own QMS. They are not permitted to publish systems or examples of systems since doing so would put them in direct rivalry with private-sector businesses. Because HMS provided a basic example of a QMS on their website, legal action has been threatened against them. They have been instructed not to repeat this by HMS' legal staff.

The researchers believes it would be beneficial to examine more closely at the legal issues of this case and see whether and how it may be resolved with everyone's best interests in mind. Good structures that are constructed correctly and effectively on the first attempt are beneficial to everyone.

If the QMS is not supported by the software; an online QMS webpage, managers and inspectors will have more files to work on and paperwork that accumulates in the office,

which is double the work unnecessarily. All information is readily available online and paperless. It can be pulled out of reports with the touch of a mouse once software is installed. The QMS software can quickly identify non-compliance, if initially set.

Everything is readily available and organized to make it simple to upload new data to the QMS, such as design documents and drawings for new projects. All forms are at hand and can be easily filled out with the customers information. By having a QMS online, such as a simple webpage, it can simplify many things and reduce the work time on each item individually by preventing repetition work.

By adding videos that show exactly how to do each task and when to do it, in what order, it will simplify things for so many construction managers and master craftsmen. Not to mention, it would increase quality and efficiency.

The need for a fundamental QMS is supported and demonstrated by prior research, surveys, and interviews with foremen, construction managers, and government officials. The HMS instructions are clear and comprehensive, but they can be difficult for those who are new to the field and have never heard of a QMS system, much less used one. The effectiveness of the quality depends on the strength and quality of the foundation. All construction managers must be consistent regarding data storage, data return (the building's manual), inspections, and other matters. It should be feasible to rely on the fact that all buildings in Iceland adhere to the same standards and that the same data (equally detailed drawings, building manuals, in-depth assessments, etc.) can be found regarding each one. All data should be stored in an online database where owners can have access to it. It should not only be feasible for those who buy structures from larger companies. If all construction managers were required to use a QMS that was an online filing system, then other systems could connect to it. That way there would be a possibility that the larger companies wouldn't need to stop using their QMS, e.g. Procore, Ajour and more. If these systems were to adjust to the simplifying improvements by HMS, then users would be able to continue to use these systems and insert all their documentation their. That system (Procore, Ajour and more) would then connect to the HMS quality management system and there the relevant documentation would be uploaded, with the standardized forms in place.

Instructional videos for QMS installation instructions would be very nice and useful. Many interviewees talked about how nice it would have been to have access to a video that walked them through the process, step by step. Although everything is available on the HMS website, it can be difficult to sit down and read this kind of material, especially for newcomers to the profession. It seems easier to watch a short and concise educational video. This way you can also promote the importance of having a QMS with tips on hidden hazards and more.

It is important that all inspection lists are standardized by HMS and that comments can be added to the fields. All uncertainty needs to be ruled out when reading audit reports. That's where standardization comes in and its importance.

It has been made clear that a single system is desired for the inspection of construction managers and building officials, the same system throughout the country. There is a vast majority who want this. It was not investigated, but based on these results, it is likely that they will want to have the architectural designers' inspections in the same system as well, but of course, adapted to each trade individually.

8 Conclusion

More and more construction managers and craftsmen, in general, are more aware of the significance of quality management systems. Master craftsmen are taking their baby steps in quality management systems while construction managers are more experienced and understand why it is in use.

The construction managers quality management system (QMS) is a system of organization and processes. It ensures that the construction manager can achieve its objectives; building a structure according to the laws and regulations. In the quality management system, all documentation a construction manager needs in each project is stored.

In accordance to the definitions of quality, quality management and quality assurance, a standardized quality management system is significantly beneficial. Additionally, there is a demand for a standardized quality management system as well as a standardized inspection system.

There does not appear to be a difference between construction managers who work ac-

ording to their own quality management system and those who have bought a quality management system. There is rather a difference in system performance.

Experienced construction managers seem to be using their QMS correctly, but inspection forms seem to differ between quality management systems, since they make it themselves in accordance to HMS instructions. In smaller companies and independent construction managers attend to the quality management systems upkeep. In larger companies, it is a mixture of quality managers and construction managers that attend to the upkeep of the QMS.

According to interviews with foreign parties, Iceland is very advanced in terms of quality standards and QMS on a world scale.

According to the research above, the greatest need is a simple quality management system (QMS), as well as a quality manual, that is standardized for individual craftsmen and smaller businesses.

A blend of qualitative and quantitative research methods were used, where the qualitative method was interviews and the quantitative method was a questionnaire. The questionnaire was distributed to a group of master craftsmen and construction managers in order to examine the current situation in the quality management systems in the industrial sector, with a focus on construction managers. Over 20 interviews were established with various craftsmen, construction managers, and companys abroad and in Iceland.

Hopefully, this research will help recommend where to focus the attention for continuous improvements in quality management systems.

After reviewing the answers from the interviews and survey, it is clear that there is a need and demand for a standardized QMS foundation that all construction managers can use and can add to it according to their needs. Preferably, the QMS would be online so it is accessible anywhere as discussed in the previous chapter. Subsequently, the interviews and survey suggest that general masters in the industrial sector wish for a general standardized QMS. By standardizing the basic quality management system for all construction managers, it should ensure equal quality for all structures and are easily comparable across the country.

9 Terminology translations

Áfangaúttekt = Milestone Inspection

Byggingarfulltrúi = Building Official (BO)

Byggingarfulltrúi = Local Authorities

Byggingargátt = Building portal

Byggingariðnfræðingur = construction technician

Byggingarstjóri = Construction Manager

Eftirlitsaðilar = regulatory agencies

Einkageirinn = Commercial sector

Einyrki = independent industrial worker/craftsman

Erlendur byggingaraðili = Foreign builder

Faggilt skoðunarstofa = Accredited inspection agency

Fokheldis úttekt = Seal Inspection

Gæðahandbók = Quality manual

Gæðastjórnunarkerfi = Quality Management System (QMS)

Hagsmunasamtök = Advocacy organization

Hönnuður = Designer

Hönnunargögn = Design documents

Hönnunarstjóri = Design manager

Húsasmíðameistari = Master builder

Húsnæðis- og Mannvirkja stofnun (HMS) = Housing & Construction Authority

Iðan fræðslusetur = Iðan Education center

Iðnaðargeirinn = industrial sector

Iðnaðarmenn = Craftsmen

Iðnaðarmenn = Craftsmen/Industrial workers

Iðnaðarstétt = Industrial class

Iðnmeistari = Master craftsman

Innra eftirlit = Internal control

Lokaúttekt = Final Inspection

Mannvirkjagerð = Civil engineering
Mannvirkjaskrá = Structure register
Málarameistari = Master painter
Meistari = Master
Múrarmeistari = Master mason
Öryggisúttekt = Safety Inspection
Pípulagningameistari = Master plumber
Rafrænt möppukerfi = digital filing system
Rafvirkjameistari = Master electrician
Samtök Atvinnulífsins = The Confederation of Icelandic Employers
Samtök Iðnaðarins (SI) = The Federation of Icelandic Industries
Samtök Íslenskra Sveitarfélaga (SÍS) = Icelandic Association of Local Authorities
Úttekt = Inspection
Úttektaraðili = Inspector
Úttektarkerfi = inspection system
Verkkaupi = Contractee Vinnueftirlitið = Administration of Occupational Safety and Health
Virkniskoðun = Functional review
Þinglystar teikningar = Notarized architectural drawings

10 Abbreviations

QMS = Quality Management System

CM = Construction Manager

BO = Building Official

SA = Samtök Atvinnulífsins = The Confederation of Icelandic Employers

SI = Samtök Iðnaðarins = The Federation of Icelandic Industries

SÍS = Samtök Íslenskra Sveitarfélaga = Icelandic Association of Local Authorities

References

- Ajour. (2023a). *Ajourbox*. Retrieved 2023-04-18, from <https://ajoursystem.com/en/ajourbox/>
- Ajour. (2023b). *Ajourcollab*. Retrieved 2023-04-18, from <https://ajoursystem.com/en/ajourcollab/>
- Ajour. (2023c). *Ajourfm*. Retrieved 2023-04-18, from <https://ajoursystem.com/en/ajourfm/>
- Ajour. (2023d). *Ajourinspect*. Retrieved 2022-11-20, from <https://ajoursystem.com/en/ajourinspect/>
- Ajour. (2023e). *Ajourmanufacturer*. Retrieved 2023-04-18, from <https://ajoursystem.com/en/ajourmanufacturer/>
- Ajour. (2023f). *Ajourobjects*. Retrieved 2023-04-18, from <https://ajoursystem.com/en/ajourobjects/>
- Ajour. (2023g). *Ajourqa*. Retrieved 2023-04-18, from <https://ajoursystem.com/en/ajourqa/>
- Ajour. (2023h). *Ajour system - about us*. Retrieved 2022-11-20, from <https://ajoursystem.com/en/about-us/>
- Ajour. (2023i). *Ajourtender*. Retrieved 2023-04-18, from <https://ajoursystem.com/en/ajourtender/>
- Alþingi. (2023a). *160/2010: Lög um mannvirki*. Retrieved 2022-10-05, from <https://www.althingi.is/lagas/nuna/2010160.html>
- Alþingi. (2023b). *Um alþingi*. Retrieved 2023-01-05, from <https://www.althingi.is/um-althingi/>
- Arnarson, B. H. (2020). *Gæðastjórnunarkerfi byggingarstjóra*. Undergraduate thesis, Reykjavík University. Skemman.
- Aura. (2023). *Aura quality management*. Retrieved 2023-02-22, from [http://www.auraqualitymanagement.com/blog/importance-quality-management-systems-construction-industry/: :text=The%20Quality%20Management%20System%20\(QMS,compliance%20of%20the%20construction%20industry.](http://www.auraqualitymanagement.com/blog/importance-quality-management-systems-construction-industry/: :text=The%20Quality%20Management%20System%20(QMS,compliance%20of%20the%20construction%20industry.)
- Birgisson, S. R. (2013). *Byggingargallar í nýbyggingum á Íslandi*. Undergraduate thesis,

Reykjavík University. Skemman.

B. Jónsson, G. G. (2023). *Mannvirkjastofnun*. Retrieved 2023-05-10, from

https://www.skipulag.is/media/skipulagsmal/MVS_glaerur.pdf

BSI. (2015). *Iso 9001:2015 - your implementation guide*. BSI Group.

BSI. (2023). *Bsi - vottun stjórnkerfa*. Retrieved 2022-10-23, from

<https://bsiaislandi.is/vottun-stjornkerfa/>

Byggingarreglugerð. (2023). *Byggingarreglugerð*. Retrieved 2022-10-15, from

<https://www.byggingarreglugerd.is/>

Hannarr. (2023a). *Bygg appið*. Retrieved 2023-04-20, from

<https://www.hannarr.com/bygg-appid/>

Hannarr. (2023b). *Bygg-kerfið*. Retrieved 2023-04-20, from

<https://www.hannarr.com/tolvukerfi/byggkerfid/>

HMS. (2023a). *4.8.1: Hms leiðbeiningar*. Retrieved 2023-12-01, from

https://hms-web.cdn.prismic.io/hms-web/4b5cabf3-89bb-46e8-a3d8-0c11aff741fb_481-krofur-gaedastjornunarkerfi-byggingarstjora-24.pdf

HMS. (2023b). *9.001-2: Hms skoðunarhandbók gæðastjórnunarkerfis byggingarstjóra*.

Retrieved 2023-05-14, from

https://hms-web.cdn.prismic.io/hms-web/565c7bd8-cbfd-4269-8cad-6b4ba2a35757_9.001-2+Skoðunarhandbók+gæðastjórnunarkerfis+byggingarstjora

HMS. (2023c). *9.007: Skoðun gæðastjórnunarkerfa fagaðila*. Retrieved 2023-05-14, from

https://hms-web.cdn.prismic.io/hms-web/12bef0f2-ec7b-4f2f-ae33-15354ed647f4_9007-skodun-gaedastjornunarkerfa-honnuda-honnunarstjora-byggingarstjora-og-idnmeistara-26.pdf

HMS. (2023d). *9.022: Hms umsókn um skráningu gæðastjórnunarkerfis*. Retrieved 2023-01-12, from

https://hms-web.cdn.prismic.io/hms-web/0b4028de-0c77-4b7f-a126-371f36a7eadf_9022-umsokn-um-skraningu-gaedastjornunarkerfis-innfyllanlegt.pdf

- HMS. (2023e). *9.022: Hms umsókn um skráningu gæðastjórnunarkerfis með rafrænum skilríkjum*. Retrieved 2023-05-15, from <https://innskraning.island.is/?id=mvs.is>
- HMS. (2023f). *9.046: Hms leiðbeiningar fyrir skráningur á gæðastjórnunarkerfi*. Retrieved 2023-01-12, from https://hms-web.cdn.prismic.io/hms-web/814ba8bf-dc08-4128-af6e-d770c5a60dc8_9046-leidbeiningar-fyrir-skraningu-a-gaedastjornunarkerfi
- HMS. (2023g). *Gæðastjórnunarkerfi*. Retrieved 2023-03-22, from <https://hms.is/mannvirki/fagaðilar-i-mannvirkjagerd/gaedastjornunarkerfi>
- HMS. (2023h). *Gæðastjórnunarkerfi byggingarstjóra*. Retrieved 2023-04-22, from <https://hms.is/mannvirki/fagaðilar-i-mannvirkjagerd/gaedastjornunarkerfi/gaedastjornunarkerfi-byggingarstjora>
- HMS. (2023i). *Hlutverk byggingarfulltrúa*. Retrieved 2023-02-25, from <https://hms.is/mannvirki/fagadilar-i-mannvirkjagerd/byggingarfulltruar/hlutverk-byggingarfulltrua>
- HMS. (2023j). *Hms - accreditation of electrical contractors*. Retrieved 2023-04-01, from <https://hms.is/mannvirki/rafmagnsoryggi/rafverktakar/loggilding-rafverktaka>
- HMS. (2023k). *Hms - starfsleyfi byggingarstjóra*. Retrieved 2023-05-13, from <https://hms.is/mannvirki/fagadilar-i-mannvirkjagerd/starfsleyfi-og-loggildingar/starfsleyfi-byggingarstjora>
- HMS. (2023l). *Mannvirkjaskrá*. Retrieved 2023-05-11, from <https://hms.is/mannvirki/mannvirkjaskra>
- HMS. (2023m). *Spurt og svarað um gæðastjórnunarkerfi*. Retrieved 2023-01-12, from <https://hms.is/mannvirki/faga%C3%B0ilar-i-mannvirkjagerd/g%C3%A6%C3%B0astjornunarkerfi/spurt-og-svara%C3%B0-um-g%C3%A6%C3%B0astjornunarkerfi>
- Investopedia. (2021). *Value chain analysis: Advantages and disadvantages*. Retrieved 2023-01-17, from <https://www.investopedia.com/ask/answers/061115/what-are-some->

- advantages-and-disadvantages-value-chain-analysis.asp
- Investopedia. (2022a). *Quality management*. Retrieved 2023-01-17, from <https://www.investopedia.com/terms/q/quality-management.asp>
- Investopedia. (2022b). *Quality management: Definition plus example*. Retrieved 2023-01-17, from <https://www.investopedia.com/terms/q/quality-management.asp>
- Iðan. (2023a). *Iðan fræðslusetur*. Retrieved 2023-05-09, from <https://www.idan.is/um-okkur/skipulag-og-stjorn-idunnar/idan-i-hnotskurn/>
- Iðan. (2023b). *Iðan - Ábyrgð byggingastjóra*. Retrieved 2023-05-12, from <https://www.idan.is/minar-sidur/nanar-um-namskeid/?allotmentid=d30041c7-3388-4655-bae0-28906ab7b0cd>
- Iðan. (2023c). *Saga iðunnar*. Retrieved 2023-05-06, from <https://www.idan.is/um-okkur/fyrir-fjolmidla/saga-idunnar/>
- Jibby. (2023a). *Jibbybyggir gæðakerfi*. Retrieved 2023-04-20, from <http://jibbybyggir.com/>
- Jibby. (2023b). *Um jibbybyggir*. Retrieved 2023-04-20, from <https://jibbybyggir.com/umjibbybyggir/>
- John Oakland, M. M. (2006). *Total quality in the construction supply chain*. Butterworth-Heinemann.
- Kenneth, R. H. (2005). *Project quality management: Why, what and how*. J. Ross Publishing.
- MBL. (2007). „Þýðir ekkert að segja: ég er bara fúskari!“. Retrieved 2023-05-15, from https://www.mbl.is/frettir/innlent/2007/10/27/thydir_ekkert_ad_segja_eg_er_barra_fuskari/
- M-Files. (2023). *M-files*. Retrieved 2023-05-15, from <https://www.m-files.com/>
- Microsoft. (2023). *Sharepoint*. Retrieved 2023-05-14, from <https://support.microsoft.com/en-us/office/what-is-sharepoint-97b915e6-651b-43b2-827d-fb25777f446f>

- MindManager. (2023). *Mindmanager*. Retrieved 2023-05-10, from <https://www.mindmanager.com/en/product/mindmanager/teams/?nav=p-mmt>
- Procore. (2023a). *About procore*. Retrieved 2023-05-12, from <https://www.procore.com/en-gb/about>
- Procore. (2023b). *Procore*. Retrieved 2023-05-12, from <https://www.procore.com/en-gb>
- Procore. (2023c). *Project management*. Retrieved 2023-05-12, from <https://www.procore.com/en-gb/project-management>
- Procore. (2023d). *What is procore*. Retrieved 2023-05-12, from <https://www.procore.com/en-gb/what-is-procore>
- RÚV. (2013). *Algengari byggingargallar*. Retrieved 2023-05-15, from <https://www.ruv.is/frettir/innlent/algengari-byggingargallar>
- SA. (2023a). *Samtök atvinnulífsins*. Retrieved 2023-05-09, from https://quillbot.com/?utm_medium=paid_search&utm_source=google&utm_campaign=paraphrase_premium_rmcampaign_type=search&gclid=Cj0KCQjw0tKiBhC6ARIsAAOXutlbnDRy1rHdYpuHK&eEEUGGqZ088VlNi8wb73Ia9_hev2MCb0aAkIiEALw_wcB
- SA. (2023b). *Samtök atvinnulífsins - um okkur*. Retrieved 2023-05-09, from <https://www.sa.is/um-okkur/um-sa>
- Scribbr. (2023). *Qualitative vs. quantitative research*. Retrieved 2023-04-27, from <https://www.scribbr.com/methodology/qualitative-quantitative-research/>
- SI. (2023). *Samtök iðnaðarins - starfsemi*. Retrieved 2023-05-09, from <https://www.si.is/starfsemi/>
- SÍS. (2023a). *Icelandic association of local authorities*. Retrieved 2023-05-04, from <https://www.samband.is/english/>
- SÍS. (2023b). *SÍs: Starfsemi*. Retrieved 2023-05-05, from <https://www.samband.is/um-sambandid/starfsemi/>
- SÍS. (2023c). *SÍs: Um sambandið*. Retrieved 2023-05-05, from <https://www.samband.is/um-sambandid/>

Ólafsdóttir, A. H. (2011). *Áhrif gæðastjórnunar á mannvirkjagerð*. Graduate thesis, University of Iceland. Skemman.

Pór Ingason, H. (2020). *Quality management: A project management perspective*. Routledge.

11 Appendix A: Questionnaire English

Gæðastjórnunarkerfi Byggingarstjóra - Dashboard

227

Viewed

50

Total Responses

50

Completed

100%

Completion Rate

0

Dropouts

7 min

Average Time



Countries	Responses
IS	94.00%
ES	4.00%
AT	2.00%
Total	100.00%

1. Age

03/15/2023 104638221 53

03/14/2023 104624375 47

03/14/2023 104623231 37

03/14/2023 104622507 43

03/14/2023 104621910 35

03/13/2023 104581967 51

03/13/2023 104553609 42

03/12/2023 104472516 40

03/10/2023 104406083 46

03/10/2023 104398608 70

03/10/2023 104396815 32

03/10/2023 104396199 57

02/17/2023 103109101 64 ára

02/14/2023 102937548 59

02/13/2023 102893666 51

02/10/2023 102752126 73

02/08/2023 102499048 61

02/07/2023 102334123 60

02/06/2023 102243624 37

02/06/2023 102243361 39

02/04/2023 102206735 65

02/04/2023 102206629 47

02/03/2023 102104161 72

02/03/2023 102103013 54

02/03/2023 102102539 53

02/03/2023 102102028 47

02/03/2023 102101727 200

02/02/2023 102028116 50

02/02/2023 102025834 55

02/02/2023 102025106 54

02/02/2023 102024755 77

02/02/2023 102023481 53

02/02/2023 102023134 61 ára.

02/02/2023 102022981 58

02/02/2023 102022940 49

02/02/2023 102022031 64

02/02/2023 102021966 52

02/02/2023 102021604 68

02/02/2023 102021113 40

02/02/2023 102020915 67

02/02/2023 102018616 49

02/02/2023 102018053 56

02/02/2023 102017207 55

02/02/2023 102016752 51

02/02/2023 102016696 35

02/02/2023 102016661 59

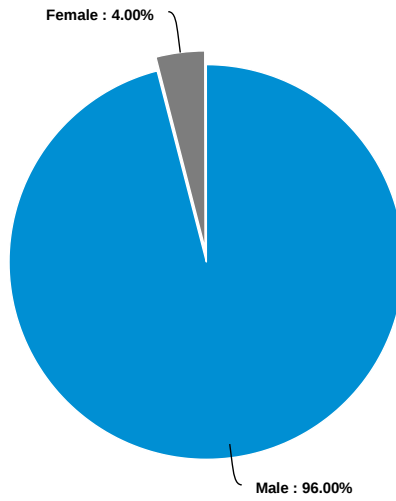
02/02/2023 102016611 42

02/02/2023 102016593 34

02/01/2023 101985786 32

02/01/2023 101820970 64

2. Sex



Answer	Count	Percent	20%	40%	60%	80%	100%
Male	48	96%					
Female	2	4%					
Other	0	0%					
Total	50	100 %					

2. Sex - Text Data for Other

3. Years of experience as a construction manager

03/15/2023	104638221	30
03/14/2023	104624375	0
03/14/2023	104623231	1
03/14/2023	104622507	43
03/14/2023	104621910	5
03/13/2023	104581967	8
03/13/2023	104553609	1
03/12/2023	104472516	0
03/10/2023	104406083	0
03/10/2023	104398608	40ár
03/10/2023	104396815	2
03/10/2023	104396199	0
02/17/2023	103109101	47 (20 sem byggingastjóri)
02/14/2023	102937548	man ekki ca 10 ár
02/13/2023	102893666	Er ekki byggingarstjóri
02/10/2023	102752126	40+
02/08/2023	102499048	45 ár
02/07/2023	102334123	15
02/06/2023	102243624	4
02/06/2023	102243361	Ég hef verið 5 ár hjá fyrirtæki sem er ábyrgðaraðili byggingarstjóra, með 9 byggingarstjórum
02/04/2023	102206735	15 ár
02/04/2023	102206629	20 ár
02/03/2023	102104161	40 ár
02/03/2023	102103013	7
02/03/2023	102102539	15
02/03/2023	102102028	20
02/03/2023	102101727	20
02/02/2023	102028116	25
02/02/2023	102025834	23 ár
02/02/2023	102025106	11 ár
02/02/2023	102024755	?
02/02/2023	102023481	2ár
02/02/2023	102023134	16 ár
02/02/2023	102022981	20

02/02/2023 102022940 20 ár

02/02/2023 102022031 10

02/02/2023 102021966 9

02/02/2023 102021604 53 ár

02/02/2023 102021113 15

02/02/2023 102020915 4 ár

02/02/2023 102018616 8 ár

02/02/2023 102018053 20

02/02/2023 102017207 22

02/02/2023 102016752 19

02/02/2023 102016696 4

02/02/2023 102016661 59

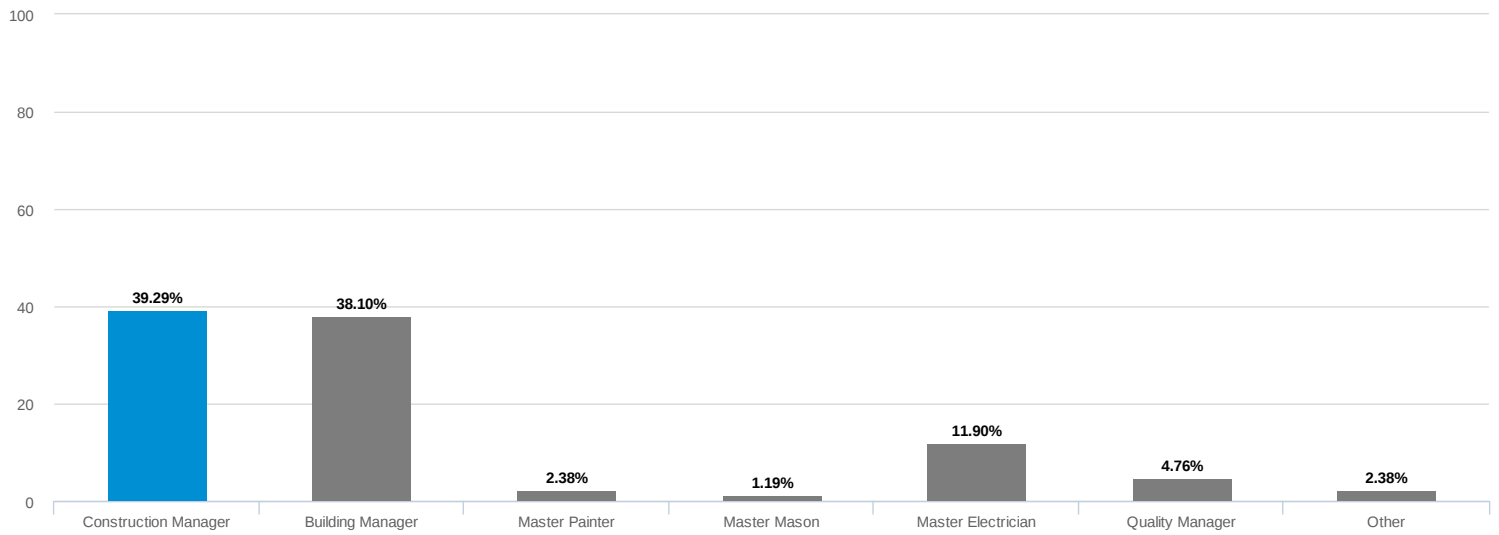
02/02/2023 102016611 6

02/02/2023 102016593 2

02/01/2023 101985786 2

02/01/2023 101820970 20 ár

4. Job title You can choose more than one



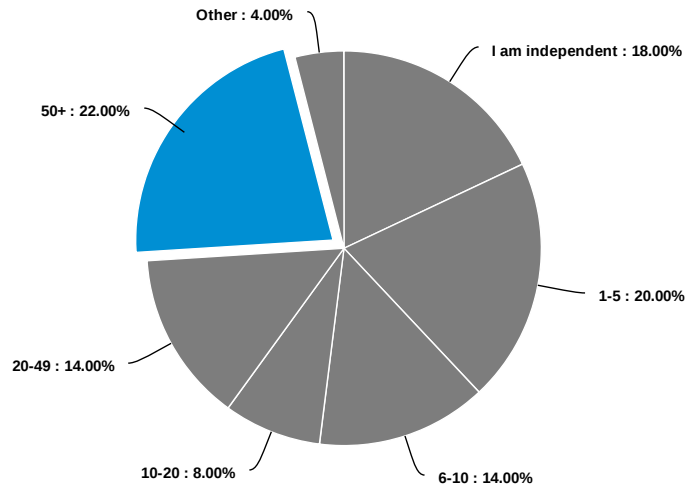
Answer	Count	Percent	20%	40%	60%	80%	100%
Construction Manager	33	39.29%	<div style="width: 39.29%;"></div>				
Building Manager	32	38.1%	<div style="width: 38.1%;"></div>				
Master Painter	2	2.38%	<div style="width: 2.38%;"></div>				
Master Mason	1	1.19%	<div style="width: 1.19%;"></div>				
Master Plumber	0	0%	<div style="width: 0%;"></div>				
Master Electrician	10	11.9%	<div style="width: 11.9%;"></div>				
Quality Manager	4	4.76%	<div style="width: 4.76%;"></div>				
Other	2	2.38%	<div style="width: 2.38%;"></div>				
Total	84	100 %					

4. Job title You can choose more than one - Text Data for Other

02/14/2023 102937548 Byggingariðnfræðingur

02/02/2023 102023134 Verkstjórn

5. Number of employees:



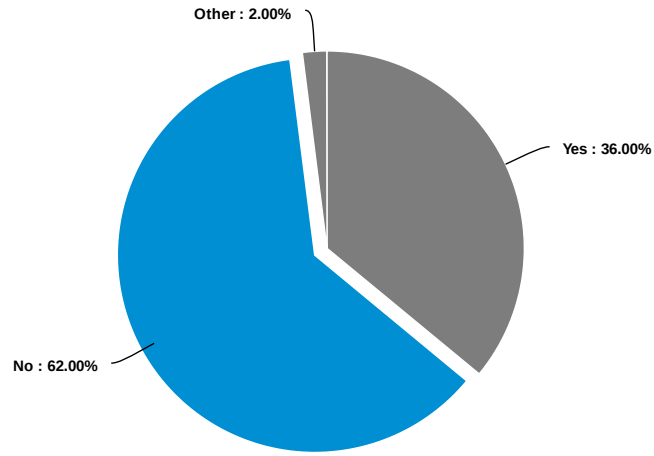
Answer	Count	Percent	20%	40%	60%	80%	100%
I am independent	9	18%	<div style="width: 18%;"></div>				
1-5	10	20%	<div style="width: 20%;"></div>				
6-10	7	14%	<div style="width: 14%;"></div>				
10-20	4	8%	<div style="width: 8%;"></div>				
20-49	7	14%	<div style="width: 14%;"></div>				
50+	11	22%	<div style="width: 22%;"></div>				
Other	2	4%	<div style="width: 4%;"></div>				
Total	50	100 %					

5. Number of employees: - Text Data for Other

02/10/2023 102752126 300

02/02/2023 102022981 er að hætta vegna veikinda

6. Did you make your own quality management system?

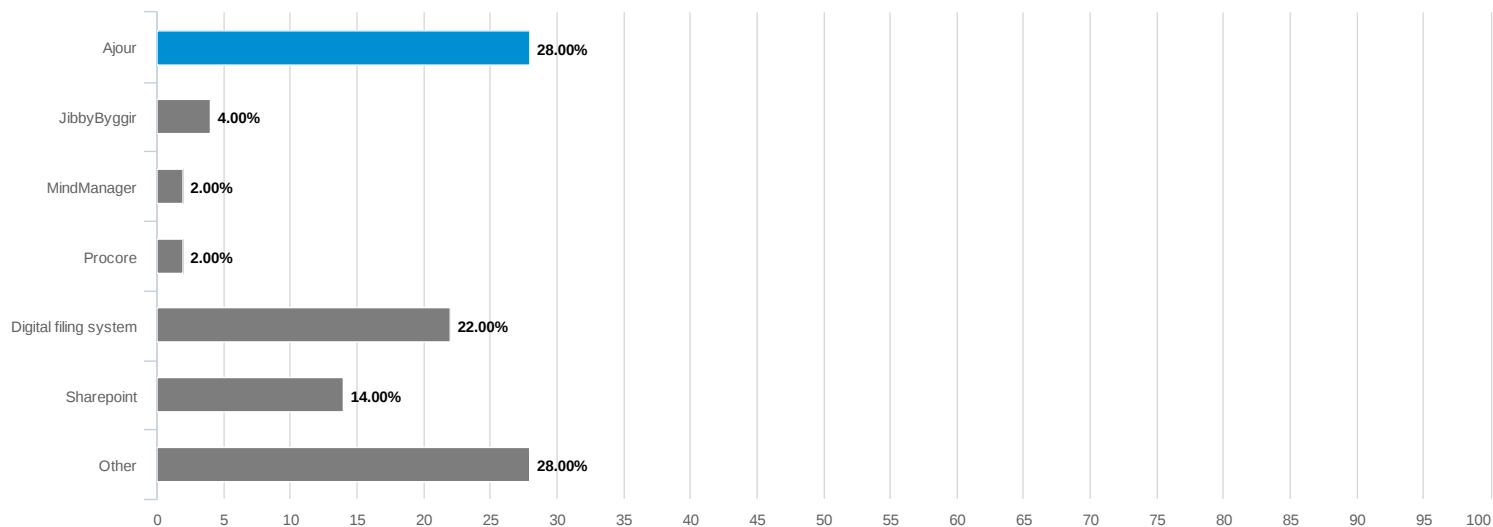


Answer	Count	Percent	20%	40%	60%	80%	100%
Yes	18	36%	<div style="width: 36%;"></div>				
No	31	62%	<div style="width: 62%;"></div>				
Other	1	2%	<div style="width: 2%;"></div>				
Total	50	100%					

6. Did you make your own quality management system? - Text Data for Other

02/03/2023 102103013 Hluta já, hluta nei

6a. If no, what quality management system do you use?



Answer	Count	Percent	20%	40%	60%	80%	100%
Ajour	14	28%	<div style="width: 28%;"></div>				
Bygg System (Hannarr)	0	0%	<div style="width: 0%;"></div>				
JibbyByggir	2	4%	<div style="width: 4%;"></div>				
MindManager	1	2%	<div style="width: 2%;"></div>				
Procure	1	2%	<div style="width: 2%;"></div>				
Digital filing system	11	22%	<div style="width: 22%;"></div>				
Sharepoint	7	14%	<div style="width: 14%;"></div>				
Other	14	28%	<div style="width: 28%;"></div>				
Total	50	100 %					

6a. If no, what quality management system do you use? - Text Data for Other

03/14/2023 104624375 Excel

03/10/2023 104396815 á ekki við, ég bjó til mitt eigið.

02/13/2023 102893666 Frá námi

02/08/2023 102499048 Gæðakerfi búið til af öðrum aðila.

02/06/2023 102243624 Mitt eigið

02/04/2023 102206735 Grunnur frá samtökun iðnaðarins

02/03/2023 102102539 Gunnar Jónatansson

02/02/2023 102025106 Verksýn

02/02/2023 102024755 Gunnar Jónatansson

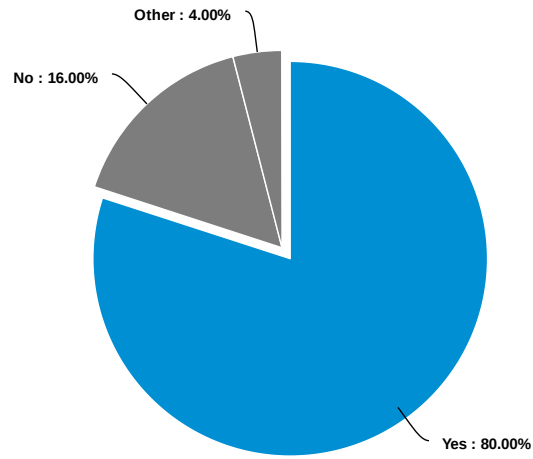
02/02/2023 102020915 Gunnar Jónatansson

02/02/2023 102018616 Eigið

02/02/2023 102016611 eigið kerfi

02/01/2023 101985786 konan mín bjó það til, rafrænt möppukerfi

7. Do you attend to your quality management system yourself?



Answer	Count	Percent	20%	40%	60%	80%	100%
Yes	40	80%	<div style="width: 80%;"></div>				
No	8	16%	<div style="width: 16%;"></div>				
Other	2	4%	<div style="width: 4%;"></div>				
Total	50	100 %					

7. Do you attend to your quality management system yourself? - Text Data for Other

02/10/2023 102752126 IAV

02/01/2023 101985786 Konan sér um það

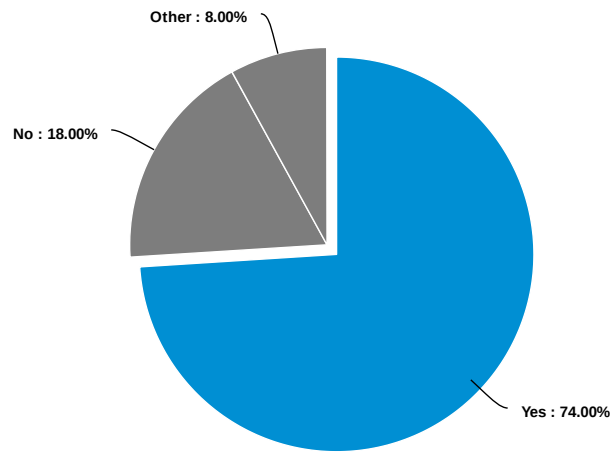
8. Satisfaction scale of quality management systems How much do you agree or disagree with the following statements?

Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Overall
1. Access to quality management systems is good.	4 8%	9 18%	9 18%	20 40%	8 16%	50 100%
2. It is easy to make your own quality management system.	6 12%	13 26%	11 22%	14 28%	6 12%	50 100%
3. Quality management systems are important.	1 2%	6 12%	9 18%	15 30%	19 38%	50 100%
4. Quality management systems are easy to use.	2 4%	5 10%	10 20%	23 46%	10 20%	50 100%
5. Functional reviews of quality management systems are important	1 2%	7 14%	10 20%	12 24%	20 40%	50 100%



Question	Count	Score	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1. Access to quality management systems is good.	50	3.38					
2. It is easy to make your own quality management system.	50	3.02					
3. Quality management systems are important.	50	3.9					
4. Quality management systems are easy to use.	50	3.68					
5. Functional reviews of quality management systems are important	50	3.86					
Average		3.57					

9. Would you like to receive a ready-made quality management system with training? e.g. on the construction manager course or from HMS



Answer	Count	Percent	20%	40%	60%	80%	100%
Yes	37	74%	<div style="width: 74%;"></div>				
No	9	18%	<div style="width: 18%;"></div>				
Other	4	8%	<div style="width: 8%;"></div>				
Total	50	100 %					

9. Would you like to receive a ready-made quality management system with training?e.g. on the construction manager course or from HMS - Text Data for Other

02/13/2023 102893666 Á ekki við

02/06/2023 102243624 Ef það kostar ekki of mikið

02/03/2023 102102028 Klikkaði á fyrr spurningu, gerðum okkar sjálfir en notum Ajour líka

02/02/2023 102023481 Er með fullbúið kerfi

10. Do you think something is missing in the quality management system? If yes, what?

03/15/2023	104638221	skilvirkni
03/14/2023	104624375	Nei
03/14/2023	104623231	Nei
03/14/2023	104622507	Nei get ekki sagt það.
03/14/2023	104621910	Einfaldleika og hagkvæmi
03/13/2023	104581967	Nei
03/13/2023	104553609	Meira eftirlit
03/12/2023	104472516	0
03/10/2023	104406083	Gæðakerfi sem virkar fyrir lítil fyrirtæki. Þetta eru oftast svo stórir pakkar
03/10/2023	104398608	Nei
03/10/2023	104396815	samþykktar teikningar og breytingar á teikningum. Myndir við úttektir (sér mappa) meiri áherslu á "Handbók mannvirkis" þ.s. þar kemur allt fram fyrir eigendur. Þarna er oft á tíðum slaki hjá minni verkötum, en engu að síðu mikilvægt og gott að vita t.d. hvaða gólfefni var notað ef skipta þarf um gólf efni eða ef mála þarf veggja upp á nýtt að þá er skráð rétta númer málningar og hvenær það var gert. Þett er eins konar þjónustu handbók hússins og engu að síður mikilvægt.
03/10/2023	104396199	við notum Ajour en ég finn að procore er með betri tekniforrit. Teikningar eru mjög mikilvægar fyrir verkefni og myndi ég vilja sjá áherslu á það innan gæðastjórnunarkerfis.
02/17/2023	103109101	Bæði og
02/14/2023	102937548	Að fá tilbúið kerfi , veit samt ekki hvort HMS sé treistandi fyrir því
02/13/2023	102893666	Á ekki við
02/10/2023	102752126	Nei
02/08/2023	102499048	komi upp sú staða að eitthvað virðist vanta þá er því atriði einfaldlega bætt inn í það kerfi sé ég hef notað.
02/07/2023	102334123	skýrleika
02/06/2023	102243624	App sem hægt er að nota hvar og hvenær sem er. og er skilvirkt
02/06/2023	102243361	Ég skil ekki spurninguna. Áttu við hvort það þurfi að auka kröfur til gæðastjórnunarkerfa?
02/04/2023	102206735	Ja - þjónustuaðilar aðstoða eftir að kerfin eru komin í virkni og væri auðveldara ef kerfin væru færri
02/04/2023	102206629	Nri
02/03/2023	102104161	Nei
02/03/2023	102103013	Nei. En almennt séð vantar meira eftirlit af hálfu opinberra aðila
02/03/2023	102102539	Gerir nóg fyrir okkur.
02/03/2023	102102028	fullt
02/03/2023	102101727	Já miklu einfaldara kerfi og svo er það rangnefni að kalla þetta gæðastjórnunarkerfi því þetta snýst ekki um gæði í vinnubrögðum það ætti því að kalla þetta feril skráningu fyrir lögfræðinga
02/02/2023	102028116	Allir iðnmeistarar í byggingagreinum fá því miður ekki réttindi sem byggingastjórar, hanna mætti staðlað, einfalt og aðgengilegt gæðastjórnunarkerfi fyrir þá aðila/fyrirtæki sem ekki eru byggingastjórar.
02/02/2023	102025834	Nei
02/02/2023	102025106	k
02/02/2023	102024755	Ekkert sérstakt
02/02/2023	102023481	nei

02/02/2023	102023134	Tengingu við úttekt hjá HMS
02/02/2023	102022981	Útektir sem ættu að vera a byggingafultru
02/02/2023	102022940	Nei
02/02/2023	102022031	Já Maður er alltaf að bæta við eyðublöðum
02/02/2023	102021966	Samvinnur við verkefnstóra og eigananda manvirkis
02/02/2023	102021604	nei
02/02/2023	102021113	x
02/02/2023	102020915	nei
02/02/2023	102018616	Nei
02/02/2023	102018053	Nei
02/02/2023	102017207	Nei
02/02/2023	102016752	nei
02/02/2023	102016696	.
02/02/2023	102016661	Nei
02/02/2023	102016611	k
02/02/2023	102016593	Mér finnst kerfin oft á tíðum vera bara óþarflega flókin.
02/01/2023	101985786	tengilliða möppu fyrir alla þá sem koma að verkinu.
02/01/2023	101820970	Nei

* Is there anything else you would like to share about the Construction Manager's Quality Management System? Comments/Advantages/Disadvantages

03/14/2023	104622507	Nei	
03/13/2023	104581967	Nei	
03/13/2023	104553609	Er um að nota bæði Ajour og shere point	
03/12/2023	104472516	0	
03/10/2023	104398608	Nei	
03/10/2023	104396815	Mætt við almennileg kennsla á þetta á byggingarstjóra námskeiðinu. Ég "útskrifaðist" úr byggingarstjóra námskeiðinu engu nær hvað varðar gæðastjórnunarkerfi byggingarstjóra þ.s. á námskeiðinu var þetta aðallega hetjusögur kennara en ekki grunnur að kerfinu okkar. a	
03/10/2023	104396199	Ég myndi vilja sjá lista frá HMS, á HMS síðunni jafnvel, þar sem listi af viðurkenndum gæðastjórnunarkerfum liggur fyrir. Ég vissi af ýmsum kerfum en ég veit um nokkra sem þekkja ekki þessi nkerfi og væri þetta góð lausn. Það er líka ákveðin gulrót fyrir fyrirtækin á bakvið gæðastjórnunarkerfin að vera á listanum hjá HMS. HMS setur X kröfur, ef þær eru uppfylltar þá eru þe .þau fyrirtæki birt á þennan listan HMS.	
02/17/2023	103109101	Nei	
02/14/2023	102937548	Það kom mér mjög á óvart hversu mikið, maður þurfti að hana sín eigin kerfi , Ég byrjaði fyrst að nota kerfið frá Samtökum Iðnaðarins , og þar ver t.d engin tilbúinn listi varðandi eigin úttektir. svo náði ég mér í Adjour . þannig að ég er að nota tvö kerfi í dag og kostnaður við þaðþví full mikil.	
02/13/2023	102893666	Nei	
02/08/2023	102499048	nei	
02/07/2023	102334123	nei	
02/06/2023	102243624	þarf að hafa þetta enfaldara og skýrara, líka mæti vera hægt að nota myndbandsupptökur við úttektir og hafa þetta eins hjá öllum helst.	
02/06/2023	102243361	Gæðastjórnunarkerfi byggingarstjóra er í raun skjalastjórnunarkerfi en ekki gæðastjórnunarkerfi. Gæðastjórnun snýst líka um að samræma vinnubrögð, vera með stöðugar umbætur og auka skilvirkni. Það vantar þekkingu á gæðastjórnun í geirann almenn, sérstaklega hjá minni fyrirtækjum, meisturum og einrykjum en einnig hjá HMS. Vissulega eru aðilar sem gera þetta mjög vel en þeir virðast vera fáir. Við notum Ajour, Sharepoint og möppustrúktúr. Ekkert af þessum kerfum eru gæðastjórnunarkerfi en það er hægt að setja þau upp þannig að þau nýtist sem slík.	
02/04/2023	102206735	nei	
02/04/2023	102206629	Nei	
02/03/2023	102104161	Það vantar gott og ábyggilegt úttektarforrit og samtengja það gæðakerfinu.	
02/03/2023	102103013	Svara sem gæðastjóri , notum bæði Ajour og Sharepoint saman, að viðhalda gæðastjórnunarkerfi er hjá okkur samvinna byggingarstjóra og gæðastjóra.	
02/03/2023	102102028	Fullt, en þetta átti að vera stutt einföld könnun	
02/03/2023	102101727	Kostir eflaust gott fyrir lögfræðinga og stórfyrirtæki en alltof mörg kerfi í gangi engin samræming í þessum kerfum hjá hinum ýmsu byggingafulltrúm um landið	
02/02/2023	102028116	Allir iðnmeistarar í byggingagreinum fá því miður ekki réttindi sem byggingastjórar, hanna mætti staðlað, einfalt og aðgengilegt gæðastjórnunarkerfi fyrir þá aðila/fyrirtæki sem ekki eru byggingastjórar.	
02/02/2023	102024755	nei	
02/02/2023	102023481	Vönduð vinnubrögð koma í veg fyrir galla	
02/02/2023	102022940	Nei	
02/02/2023	102022031	nei	
02/02/2023	102021604	nei	
02/02/2023	102018616	Nei	
02/02/2023	102018053	Gæðakerfi er svo sem ágætt en það leysir ekki gæðavandamálið í byggingariðnaði. Vandamálið er þegar lukkuriddarar í jakkafötum sem kunna bara á Excel ráða til sín byggingarstjóra til að leppa sig og þannig að ódýrasta efni sem hægt er að fá og helst beint frá Kína. og fá svo ódýrasta mannskap sem hægt er að fá í gegnum starfsmannaleigur. Svo er hvert verkefni rekið á sér kennitölu og ekkert þangað að sækja þegar gallar og vanefndir koma fram.	
02/02/2023	102017207	Eingöngu að það er mjög mikilvægt að vera með gæðastjórnunarkerfi.	

02/02/2023 102016752 nei

02/02/2023 102016696 .

02/02/2023 102016661 Nei

02/02/2023 102016611 k

02/02/2023 102016593 Gott væri ef hægt væri að einfalda þessa liði sem tilheyra innri úttektum.

02/01/2023 101985786 Tilbúinn grunnur að gæðastjórnunarkerfi ætti að sjálfsögðu að fylgja með byggingarstjóra námskeiðinu ásamt kennslu á það. Fyrir einyrkja að byrja að útbúa gæðastjórnunarkerfi er svakalegt. Ef maður fengi nú grunn kerfi sem hægt væri að byggja upp á þá væri maður töluvert betur settur og myndi skilja fyrir mikilvægi svona kerfis.

02/01/2023 101820970 Virkniskoðanir þurfa að vera oftari og kosta minna.

12 Appendix A: Questionnaire Icelandic

Gæðastjórnunarkerfi Byggingarstjóra - Dashboard

220

Viewed

50

Total Responses

50

Completed

100%

Completion Rate

0

Dropouts

7 min

Average Time



Countries	Responses
IS	94.00%
ES	4.00%
AT	2.00%
Total	100.00%

1. Aldur

03/15/2023 104638221 53

03/14/2023 104624375 47

03/14/2023 104623231 37

03/14/2023 104622507 43

03/14/2023 104621910 35

03/13/2023 104581967 51

03/13/2023 104553609 42

03/12/2023 104472516 40

03/10/2023 104406083 46

03/10/2023 104398608 70

03/10/2023 104396815 32

03/10/2023 104396199 57

02/17/2023 103109101 64 ára

02/14/2023 102937548 59

02/13/2023 102893666 51

02/10/2023 102752126 73

02/08/2023 102499048 61

02/07/2023 102334123 60

02/06/2023 102243624 37

02/06/2023 102243361 39

02/04/2023 102206735 65

02/04/2023 102206629 47

02/03/2023 102104161 72

02/03/2023 102103013 54

02/03/2023 102102539 53

02/03/2023 102102028 47

02/03/2023 102101727 200

02/02/2023 102028116 50

02/02/2023 102025834 55

02/02/2023 102025106 54

02/02/2023 102024755 77

02/02/2023 102023481 53

02/02/2023 102023134 61 ára.

02/02/2023 102022981 58

02/02/2023 102022940 49

02/02/2023 102022031 64

02/02/2023 102021966 52

02/02/2023 102021604 68

02/02/2023 102021113 40

02/02/2023 102020915 67

02/02/2023 102018616 49

02/02/2023 102018053 56

02/02/2023 102017207 55

02/02/2023 102016752 51

02/02/2023 102016696 35

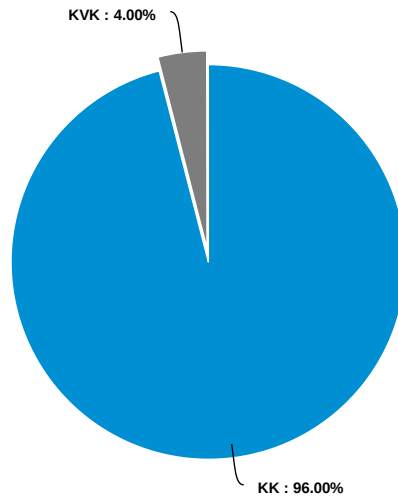
02/02/2023 102016661 59

02/02/2023 102016611 42

02/02/2023 102016593 34

02/01/2023 101985786 32

02/01/2023 101820970 64



Answer	Count	Percent	20%	40%	60%	80%	100%
KK	48	96%					
KVK	2	4%					
Other	0	0%					
Total	50	100 %					

2. Kyn - Text Data for Other

3. Starfsaldur byggingarstjóra

03/15/2023	104638221	30
03/14/2023	104624375	0
03/14/2023	104623231	1
03/14/2023	104622507	43
03/14/2023	104621910	5
03/13/2023	104581967	8
03/13/2023	104553609	1
03/12/2023	104472516	0
03/10/2023	104406083	0
03/10/2023	104398608	40ár
03/10/2023	104396815	2
03/10/2023	104396199	0
02/17/2023	103109101	47 (20 sem byggingastjóri)
02/14/2023	102937548	man ekki ca 10 ár
02/13/2023	102893666	Er ekki byggingarstjóri
02/10/2023	102752126	40+
02/08/2023	102499048	45 ár
02/07/2023	102334123	15
02/06/2023	102243624	4
02/06/2023	102243361	Ég hef verið 5 ár hjá fyrirtæki sem er ábyrgðaraðili byggingarstjóra, með 9 byggingarstjórum
02/04/2023	102206735	15 ár
02/04/2023	102206629	20 ár
02/03/2023	102104161	40 ár
02/03/2023	102103013	7
02/03/2023	102102539	15
02/03/2023	102102028	20
02/03/2023	102101727	20
02/02/2023	102028116	25
02/02/2023	102025834	23 ár
02/02/2023	102025106	11 ár
02/02/2023	102024755	?
02/02/2023	102023481	2ár
02/02/2023	102023134	16 ár
02/02/2023	102022981	20

02/02/2023 102022940 20 ár

02/02/2023 102022031 10

02/02/2023 102021966 9

02/02/2023 102021604 53 ár

02/02/2023 102021113 15

02/02/2023 102020915 4 ár

02/02/2023 102018616 8 ár

02/02/2023 102018053 20

02/02/2023 102017207 22

02/02/2023 102016752 19

02/02/2023 102016696 4

02/02/2023 102016661 59

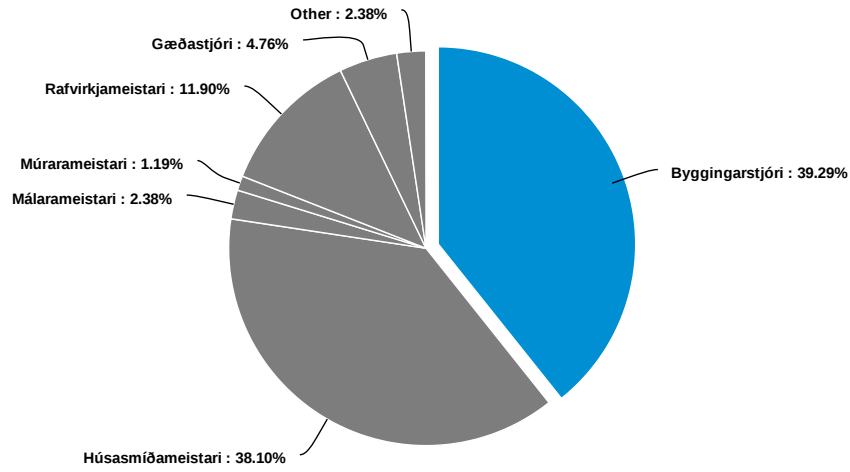
02/02/2023 102016611 6

02/02/2023 102016593 2

02/01/2023 101985786 2

02/01/2023 101820970 20 ár

4. Starfsheiti það má velja fleiri en eitt



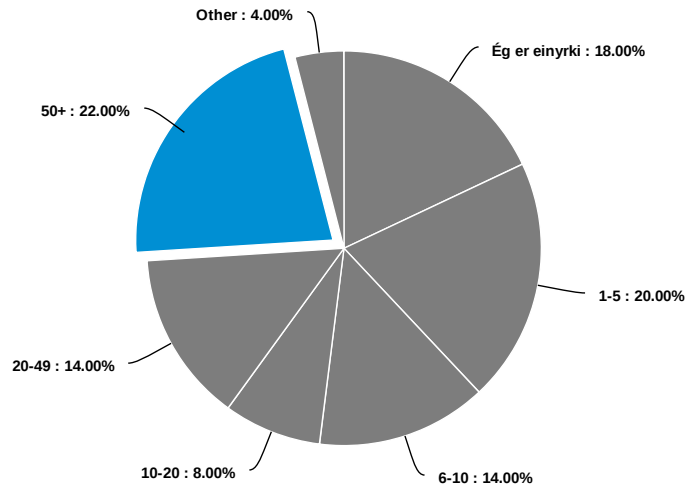
Answer	Count	Percent	20%	40%	60%	80%	100%
Byggingarstjóri	33	39.29%	<div style="width: 39.29%;"></div>				
Húsasmíðameistari	32	38.1%	<div style="width: 38.1%;"></div>				
Málameistari	2	2.38%	<div style="width: 2.38%;"></div>				
Múrarmeistari	1	1.19%	<div style="width: 1.19%;"></div>				
Pípulagningameistari	0	0%	<div style="width: 0%;"></div>				
Rafvirkjameistari	10	11.9%	<div style="width: 11.9%;"></div>				
Gæðastjóri	4	4.76%	<div style="width: 4.76%;"></div>				
Other	2	2.38%	<div style="width: 2.38%;"></div>				
Total	84	100 %					

4. Starfsheiti það má velja fleiri en eitt - Text Data for Other

02/14/2023 102937548 Byggingariðnfræðingur

02/02/2023 102023134 Verkstjórn

5. Starfsmannafjöldi fyrirtækis:



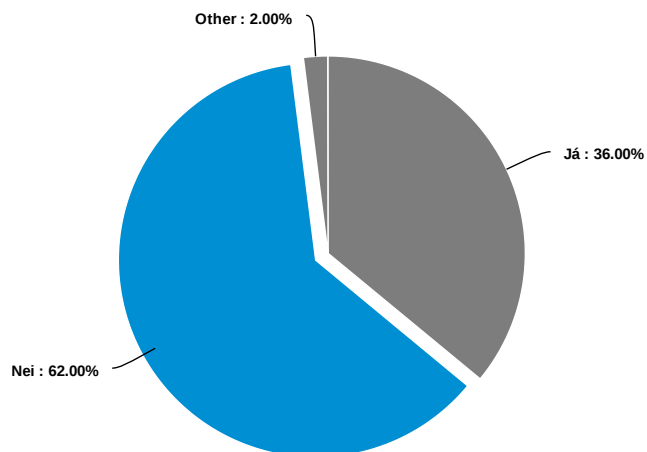
Answer	Count	Percent	20%	40%	60%	80%	100%
Ég er einyrki	9	18%	<div style="width: 18%;"></div>				
1-5	10	20%	<div style="width: 20%;"></div>				
6-10	7	14%	<div style="width: 14%;"></div>				
10-20	4	8%	<div style="width: 8%;"></div>				
20-49	7	14%	<div style="width: 14%;"></div>				
50+	11	22%	<div style="width: 22%;"></div>				
Other	2	4%	<div style="width: 4%;"></div>				
Total	50	100 %					

5. Starfsmannafjöldi fyrirtækis: - Text Data for Other

02/10/2023 102752126 300

02/02/2023 102022981 er að hætta vegna veikinda

6. Bjóst þú til eigið gæðastjórnunarkerfi?

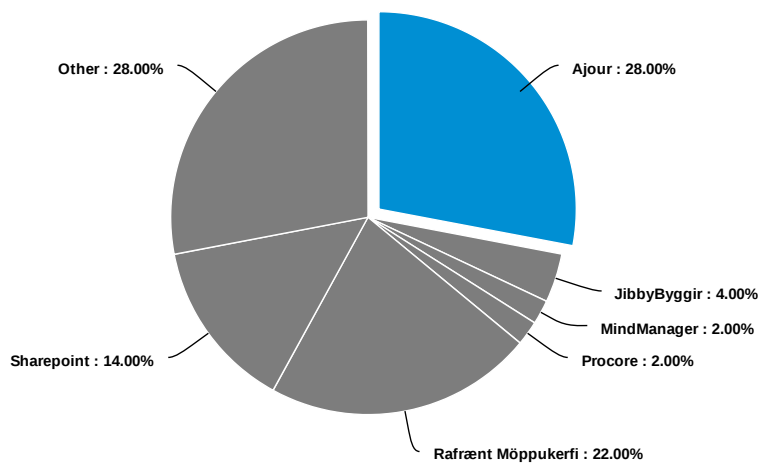


Answer	Count	Percent	20%	40%	60%	80%	100%
Já	18	36%	<div style="width: 36%;"></div>				
Nei	31	62%	<div style="width: 62%;"></div>				
Other	1	2%	<div style="width: 2%;"></div>				
Total	50	100 %					

6. Bjóst þú til eigið gæðastjórnunarkerfi? - Text Data for Other

02/03/2023 102103013 Hluta já, hluta nei

6a. Ef nei, hvaða gæðastjórnunarkerfi (hugbúnað) notar þú?

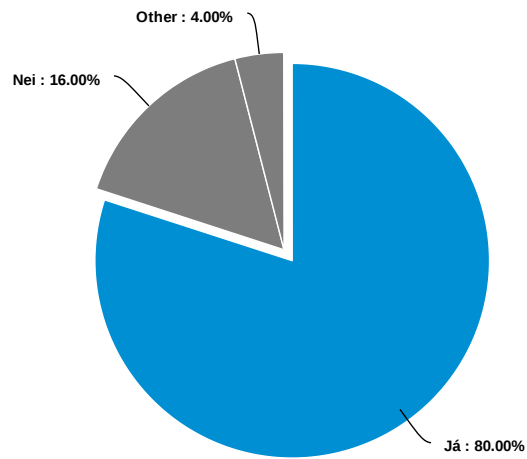


Answer	Count	Percent	20%	40%	60%	80%	100%
Ajour	14	28%	<div style="width: 28%;"></div>				
Bygg Kerfið (Hannarr)	0	0%	<div style="width: 0%;"></div>				
JibbyByggir	2	4%	<div style="width: 4%;"></div>				
MindManager	1	2%	<div style="width: 2%;"></div>				
Procure	1	2%	<div style="width: 2%;"></div>				
Rafrænt Möppukerfi	11	22%	<div style="width: 22%;"></div>				
Sharepoint	7	14%	<div style="width: 14%;"></div>				
Other	14	28%	<div style="width: 28%;"></div>				
Total	50	100 %					

6a. Ef nei, hvaða gæðastjórnunarkerfi (hugbúnað) notar þú? - Text Data for Other

- 03/14/2023 104624375 Excel
- 03/10/2023 104396815 á ekki við, ég bjó til mitt eigið.
- 02/13/2023 102893666 Frá námi
- 02/08/2023 102499048 Gæðakerfi búið til af öðrum aðila.
- 02/06/2023 102243624 Mitt eigið
- 02/04/2023 102206735 Grunnur frá samtökun iðnaðarins
- 02/03/2023 102102539 Gunnar Jónatansson
- 02/02/2023 102025106 Verksýn
- 02/02/2023 102024755 Gunnar Jónatansson
- 02/02/2023 102020915 Gunnar Jónatansson
- 02/02/2023 102018616 Eigið
- 02/02/2023 102016611 eigið kerfi
- 02/01/2023 101985786 konan mín bjó það til, rafrænt möppukerfi

7. Sérð þú um gæðastjórnunarkerfið þitt sjálf/sjálfur?



Answer	Count	Percent	20%	40%	60%	80%	100%
Já	40	80%	<div style="width: 80%; background-color: #0070C0;"></div>				
Nei	8	16%	<div style="width: 16%; background-color: #666666;"></div>				
Other	2	4%	<div style="width: 4%; background-color: #333333;"></div>				
Total	50	100 %					

7. Sérð þú um gæðastjórnunarkerfið þitt sjálf/sjálfur? - Text Data for Other

02/10/2023 102752126 IAV

02/01/2023 101985786 Konan sér um það

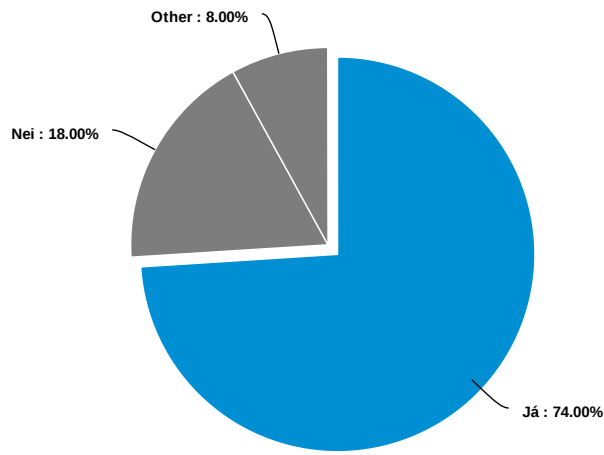
8. Ánægjuskali gæðastjórnunarkerfa Hversu sammála eða ósammála ertu eftirfarandi staðhæfingum?

Statement	Mjög ósammála	Ósammála	Hvorki né	Sammála	Mjög Sammála	Overall
1. Aðgengi að gæðastjórnunarkerfum eru góð.	4 8%	9 18%	9 18%	20 40%	8 16%	50 100%
2. Það er auðvelt að útbúa eigið gæðastjórnunarkerfi.	6 12%	13 26%	11 22%	14 28%	6 12%	50 100%
3. Gæðastjórnunarkerfi eru mikilvæg.	1 2%	6 12%	9 18%	15 30%	19 38%	50 100%
4. Það er auðvelt að nota gæðastjórnunarkerfi	2 4%	5 10%	10 20%	23 46%	10 20%	50 100%
5. Virkniskoðun gæðastjórnunarkerfa er mikilvæg	1 2%	7 14%	10 20%	12 24%	20 40%	50 100%



Question	Count	Score	Mjög ósammála	Ósammála	Hvorki né	Sammála	Mjög Sammála
1. Aðgengi að gæðastjórnunarkerfum eru góð.	50	3.38					
2. Það er auðvelt að útbúa eigið gæðastjórnunarkerfi.	50	3.02					
3. Gæðastjórnunarkerfi eru mikilvæg.	50	3.9					
4. Það er auðvelt að nota gæðastjórnunarkerfi	50	3.68					
5. Virkniskoðun gæðastjórnunarkerfa er mikilvæg	50	3.86					
Average		3.57					

9. Myndir þú vilja fá tilbúið gæðastjórnunarkerfi ásamt kennslu á það? t.d. á byggingarstjóra námskeiðinu eða frá HMS



Answer	Count	Percent	20%	40%	60%	80%	100%
Já	37	74%	<div style="width: 74%;"></div>				
Nei	9	18%	<div style="width: 18%;"></div>				
Other	4	8%	<div style="width: 8%;"></div>				
Total	50	100 %					

9. Myndir þú vilja fá tilbúið gæðastjórnunarkerfi ásamt kennslu á það? t.d. á byggingarstjóra námskeiðinu eða frá HMS - Text Data for Other

02/13/2023 102893666 Á ekki við

02/06/2023 102243624 Ef það kostar ekki of mikið

02/03/2023 102102028 Klikkaði á fyrr spurningu, gerðum okkar sjálfir en notum Ajour líka

02/02/2023 102023481 Er með fullbúið kerfi

10. Finnst þér eitthvað vanta inn í gæðastjórnunarkerfi? Ef já, hvað finnst þér vanta?

03/15/2023	104638221	skilvirkni
03/14/2023	104624375	Nei
03/14/2023	104623231	Nei
03/14/2023	104622507	Nei get ekki sagt það.
03/14/2023	104621910	Einfaldleika og hagkvæmi
03/13/2023	104581967	Nei
03/13/2023	104553609	Meira eftirlit
03/12/2023	104472516	0
03/10/2023	104406083	Gæðakerfi sem virkar fyrir lítil fyrirtæki. Þetta eru oftast svo stórir pakkar
03/10/2023	104398608	Nei
03/10/2023	104396815	samþykktar teikningar og breytingar á teikningum. Myndir við úttektir (sér mappa) meiri áherslu á "Handbók mannvirkis" þ.s. þar kemur allt fram fyrir eigendur. Þarna er oft á tíðum slaki hjá minni verktökum, en engu að síðu mikilvægt og gott að vita t.d. hvaða gólfefni var notað ef skipta þarf um gólf efni eða ef mála þarf veggja upp á nýtt að þá er skráð rétta númer málningar og hvenær það var gert. Þett er eins konar þjónustu handbók hússins og engu að síður mikilvægt.
03/10/2023	104396199	við notum Ajour en ég finn að procore er með betri tekniforrit. Teikningar eru mjög mikilvægar fyrir verkefni og myndi ég vilja sjá áherslu á það innan gæðastjórnunarkerfis.
02/17/2023	103109101	Bæði og
02/14/2023	102937548	Að fá tilbúið kerfi , veit samt ekki hvort HMS sé treistandi fyrir því
02/13/2023	102893666	Á ekki við
02/10/2023	102752126	Nei
02/08/2023	102499048	komi upp sú staða að eitthvað virðist vanta þá er því atriði einfaldlega bætt inn í það kerfi sé ég hef notað.
02/07/2023	102334123	skýrleika
02/06/2023	102243624	App sem hægt er að nota hvar og hvenær sem er. og er skilvirkt
02/06/2023	102243361	Ég skil ekki spurninguna. Áttu við hvort það þurfi að auka kröfur til gæðastjórnunarkerfa?
02/04/2023	102206735	Ja - þjónustuaðilar aðstoða eftir að kerfin eru komin í virkni og væri auðveldara ef kerfin væru færri
02/04/2023	102206629	Nri
02/03/2023	102104161	Nei
02/03/2023	102103013	Nei. En almennt séð vantar meira eftirlit af hálfu opinberra aðila
02/03/2023	102102539	Gerir nóg fyrir okkur.
02/03/2023	102102028	fullt
02/03/2023	102101727	Já miklu einfaldara kerfi og svo er það rangnefni að kalla þetta gæðastjórnunarkerfi því þetta snýst ekki um gæði í vinnubrögðum það ætti því að kalla þetta feril skráningu fyrir lögfræðinga
02/02/2023	102028116	Allir iðnmeistarar í byggingagreinum fá því miður ekki réttindi sem byggingastjórar, hanna mætti staðlað, einfalt og aðgengilegt gæðastjórnunarkerfi fyrir þá aðila/fyrirtæki sem ekki eru byggingastjórar.
02/02/2023	102025834	Nei
02/02/2023	102025106	k
02/02/2023	102024755	Ekkert sérstakt
02/02/2023	102023481	nei

02/02/2023	102023134	Tengingu við úttekt hjá HMS
02/02/2023	102022981	Útektir sem ættu að vera a byggingafultru
02/02/2023	102022940	Nei
02/02/2023	102022031	Já Maður er alltaf að bæta við eyðublöðum
02/02/2023	102021966	Samvinnur við verkefnstóra og eigananda manvirkis
02/02/2023	102021604	nei
02/02/2023	102021113	x
02/02/2023	102020915	nei
02/02/2023	102018616	Nei
02/02/2023	102018053	Nei
02/02/2023	102017207	Nei
02/02/2023	102016752	nei
02/02/2023	102016696	.
02/02/2023	102016661	Nei
02/02/2023	102016611	k
02/02/2023	102016593	Mér finnst kerfin oft á tíðum vera bara óþarflega flókin.
02/01/2023	101985786	tengilliða möppu fyrir alla þá sem koma að verkinu.
02/01/2023	101820970	Nei

* Er eitthvað annað sem þú vilt koma á framfæri um Gæðastjórnarkerfi Byggingarstjóra?
Athugasemdir/Kostir/Gallar

03/14/2023	104622507	Nei	
03/13/2023	104581967	Nei	
03/13/2023	104553609	Er um að nota bæði Ajour og shere point	
03/12/2023	104472516	0	
03/10/2023	104398608	Nei	
03/10/2023	104396815	Mætt við almennileg kennsla á þetta á byggingarstjóra námskeiðinu. Ég "útskrifaðist" úr byggingarstjóra námskeiðinu engu nær hvað varðar gæðastjórnunarkerfi byggingarstjóra þ.s. á námskeiðinu var þetta aðallega hetjusögur kennara en ekki grunnur að kerfinu okkar. a	
03/10/2023	104396199	Ég myndi vilja sjá lista frá HMS, á HMS síðunni jafnvel, þar sem listi af viðurkenndum gæðastjórnunarkerfum liggur fyrir. Ég vissi af ýmsum kerfum en ég veit um nokkra sem þekkja ekki þessi nkerfi og væri þetta góð lausn. Það er líka ákveðin gulrót fyrir fyrirtækin á bakvið gæðastjórnunarkerfin að vera á listanum hjá HMS. HMS setur X kröfur, ef þær eru uppfylltar þá eru þe .þau fyrirtæki birt á þennan listan HMS.	
02/17/2023	103109101	Nei	
02/14/2023	102937548	Það kom mér mjög á óvart hversu mikið, maður þurfti að hana sín eigin kerfi , Ég byrjaði fyrst að nota kerfið frá Samtökum Iðnaðarins , og þar ver t.d engin tilbúinn listi varðandi eigin úttektir. svo náði ég mér í Adjour . þannig að ég er að nota tvö kerfi í dag og kostnaður við þaðþví full mikil.	
02/13/2023	102893666	Nei	
02/08/2023	102499048	nei	
02/07/2023	102334123	nei	
02/06/2023	102243624	þarf að hafa þetta enfaldara og skýrara, líka mæti vera hægt að nota myndbandsupptökur við úttektir og hafa þetta eins hjá öllum helst.	
02/06/2023	102243361	Gæðastjórnunarkerfi byggingarstjóra er í raun skjalastjórnunarkerfi en ekki gæðastjórnunarkerfi. Gæðastjórnun snýst líka um að samræma vinnubrögð, vera með stöðugar umbætur og auka skilvirkni. Það vantar þekkingu á gæðastjórnun í geirann almenn, sérstaklega hjá minni fyrirtækjum, meisturum og einrykjum en einnig hjá HMS. Vissulega eru aðilar sem gera þetta mjög vel en þeir virðast vera fáir. Við notum Ajour, Sharepoint og möppustrúktúr. Ekkert af þessum kerfum eru gæðastjórnunarkerfi en það er hægt að setja þau upp þannig að þau nýtist sem slík.	
02/04/2023	102206735	nei	
02/04/2023	102206629	Nei	
02/03/2023	102104161	Það vantar gott og ábyggilegt úttektarforrit og samtengja það gæðakerfinu.	
02/03/2023	102103013	Svara sem gæðastjóri , notum bæði Ajour og Sharepoint saman, að viðhalda gæðastjórnunarkerfi er hjá okkur samvinna byggingarstjóra og gæðastjóra.	
02/03/2023	102102028	Fullt, en þetta átti að vera stutt einföld könnun	
02/03/2023	102101727	Kostir eflaust gott fyrir lögfræðinga og stórfyrirtæki en alltof mörg kerfi í gangi engin samræming í þessum kerfum hjá hinum ýmsu byggingafulltrúm um landið	
02/02/2023	102028116	Allir iðnmeistarar í byggingagreinum fá því miður ekki réttindi sem byggingastjórar, hanna mætti staðlað, einfalt og aðgengilegt gæðastjórnunarkerfi fyrir þá aðila/fyrirtæki sem ekki eru byggingastjórar.	
02/02/2023	102024755	nei	
02/02/2023	102023481	Vönduð vinnubrögð koma í veg fyrir galla	
02/02/2023	102022940	Nei	
02/02/2023	102022031	nei	
02/02/2023	102021604	nei	
02/02/2023	102018616	Nei	
02/02/2023	102018053	Gæðakerfi er svo sem ágætt en það leysir ekki gæðavandamálið í byggingariðnaði. Vandamálið er þegar lukkuriddarar í jakkafötum sem kunna bara á Excel ráða til sín byggingarstjóra til að leppa sig og þannig bara ódýrasta efni sem hægt er að fá og helst beint frá Kína. og fá svo ódýrasta mannskap sem hægt er að fá í gegnum starfsmannaleigur. Svo er hvert verkefni rekið á sér kennitölu og ekkert þangað að sækja þegar gallar og vanefndir koma fram.	
02/02/2023	102017207	Eingöngu að það er mjög mikilvægt að vera með gæðastjórnunarkerfi.	

02/02/2023 102016752 nei

02/02/2023 102016696 .

02/02/2023 102016661 Nei

02/02/2023 102016611 k

02/02/2023 102016593 Gott væri ef hægt væri að einfalda þessa liði sem tilheyra innri úttektum.

02/01/2023 101985786 Tilbúinn grunnur að gæðastjórnunarkerfi ætti að sjálfsögðu að fylgja með byggingarstjóra námskeiðinu ásamt kennslu á það. Fyrir einyrkja að byrja að útbúa gæðastjórnunarkerfi er svakalegt. Ef maður fengi nú grunn kerfi sem hægt væri að byggja upp á þá væri maður töluvert betur settur og myndi skilja fyrir mikilvægi svona kerfis.

02/01/2023 101820970 Virkniskoðanir þurfa að vera oftari og kosta minna.