

Process for Implementing a Quality Management System (QMS) Adapted to Architectural Practices in Tunisia, in the Case of ISO 9001

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Abstract

This article explores the significance of implementing quality management systems (QMS) in architectural practices, focusing on the ISO 9001 standard and alternative methodologies like "Planer am Bau.", the article delves into the benefits and challenges of adopting ISO 9001 and provides insights into setting up a QMS tailored to the unique needs of architectural firms in Tunisia.

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1. Introduction

ISO 9001 is an international standard that outlines the requirements for a quality management system (QMS). It is recognized and applied worldwide across all sectors. Adopting this standard can provide numerous benefits for architectural practices, including improved service quality, increased customer satisfaction, and enhanced organizational performance.

ISO 9001 is based on quality management principles such as customer orientation, staff involvement, process approach, continuous improvement, and evidence-based decision-making. Adopting this standard demonstrates an architectural firm's commitment to quality service and customer satisfaction. (Hoyle 2017) In a competitive environment where service quality is a key differentiating factor, ISO 9001 is becoming a strategic tool for architectural practices. This enables them to structure their processes, improve efficiency, and meet customer expectations.

ISO 9001 can play a crucial role in helping architectural practices in Tunisia improve their performance, manage complex projects, comply with current regulations, satisfy customers, and manage resources. The objective of this article is to emphasize the significance of ISO 9001 for architectural practices in Tunisia. The article examines how this standard can enhance the quality of services, increase customer satisfaction, optimize processes, and ensure long-term success. Additionally, the article discusses the process of implementing a QMS tailored to architectural practices.

In summary, ISO 9001 is more than a quality standard. ISO 9001 is a strategic tool that can assist architectural practices in navigating an increasingly complex and competitive environment. By adopting this standard, architectural practices can improve the quality of their services, strengthen their market position, and ensure long-term success. Several quality standards can be applied to architectural practices.

In addition to ISO 9001, one such standard is NF X 35-102 (Ghuilaine Clouet 2009), which defines ergonomic criteria for office workspaces. For instance, it mandates 15 m² of space for each employee in a shared workspace (such as a coworking, flex office, or open-space), and 10 m² for those in individual offices.

Additionally, it references the Planer am Bau quality standard, which was created in partnership with TÜV Rheinland certification body. Finally, it mentions a quality control system. This fragment describes the measures implemented to achieve the quality standards defined in a quality management plan. The purpose of these measures is to prevent errors, reduce the costs associated with correcting them, shorten lead times, and increase productivity.

Architectural practices can improve the quality of their services, increase customer satisfaction, optimize their processes, and ensure long-term success by adhering to these standards, in addition to ISO 9001. It is essential for architectural practices to understand the importance of these standards and strive to adopt them in their daily practices. The purpose of this article is to offer a comprehensive guide on how to implement an ISO 9001-based Quality Management System (QMS) in architectural practices. It explains the fundamental principles of ISO 9001, such as customer focus, staff involvement, process approach, continuous improvement, and evidence-based decision

making. The article emphasizes how ISO 9001 can enhance customer confidence, improve complaints handling, optimize processes, and drive continuous improvement. This article describes the process of implementing a Quality Management System (QMS) from initial assessment to review and improvement. It encourages architectural firms in Tunisia to adopt ISO 9001 to improve their efficiency and quality of service. The article aims to be a valuable resource for any architectural practice seeking to implement an ISO 9001-based QMS.

2. Understanding ISO 9001

ISO 9001 is an international standard that defines the criteria for a quality management system (QMS). It is based on several quality principles, including customer orientation, employee involvement, process approach, continuous improvement, and evidence-based decision-making.

2.1. Customer orientation

ISO 9001 stipulates that organizations should aim to comprehend their customers' present and future needs, meet their requirements, and strive to exceed their expectations. This involves establishing clear communication with customers to understand their needs and expectations, and implementing processes to effectively and consistently meet those needs. Employee involvement is also a crucial principle of ISO 9001. Employees at all levels are crucial to the success of an organization. Their full participation enables the organization to benefit from their capabilities. Management must ensure that staff understand the importance of their role in the QMS and have the necessary skills and resources to carry out their tasks. The process approach, as promoted by ISO 9001, is essential for developing, implementing, and improving the effectiveness of a QMS. A process approach involves managing activities and resources as a process that transforms inputs into outputs, resulting in more predictable and consistent performance.

2.2. ISO 9001 encourages organizations

To take a proactive approach to improving their products, services, and processes through continual improvement. Improvement objectives should be set, plans to achieve them should be implemented, progress should be monitored and measured, and corrective action should be taken when necessary. Also stresses the significance of evidence-based decision-making. This requires decisions to be based on data and information analysis and evaluation, ensuring their effectiveness and contribution to the organization's continuous improvement.

ISO 9001 is a robust standard that can enhance the efficiency and quality of service of architectural practices. By comprehending and implementing the principles of ISO 9001, architectural practices can establish a QMS that caters to their customers' needs, engages their staff, adopts a process-oriented approach, fosters continuous improvement, and facilitates evidence-based decision-making.

3. Benefits of ISO 9001 for architectural practices

In United Kingdom , Large Chartered Practices (with over 51 staff[†]) must adopt an externally certified QMS satisfying the almost universal quality assurance standard: ISO 9001. For some clients, particularly those in public sector, having ISO 9001 in place is a prerequisite of bidding for work.

Small Chartered Practices (up to ten staff) are only required to prepare a Project Quality Plan (PQP) for each project to satisfy the minimum RIBA requirement for Chartered Status.

3.1. How ISO 9001 can boost customer confidence

There are multiple ways in which an architectural firm's adoption of ISO 9001 can enhance customer confidence.

Firstly, ISO 9001 is a globally recognized standard. When an architectural firm is ISO 9001 certified, it means that it has implemented a Quality Management System (QMS) that has been assessed and approved by an independent certification body. This gives customers confidence that the architectural firm is committed to quality and has processes in place to ensure consistency and continuous improvement of its services. (*Krajcsák 2019*)

Secondly, ISO 9001 emphasizes customer orientation. This means that the architectural firm must understand its customers' current and future needs, meet their requirements, and strive to exceed their expectations. Improved communication with customers, a better understanding of their needs and expectations, and a greater ability to deliver services that meet or exceed those expectations are some of the benefits of this approach.

ISO 9001 requires architectural practices to establish processes for monitoring and measuring service quality. This may involve methods such as customer satisfaction surveys, contract reviews, and internal audits. The information gathered can be used to identify areas for improvement and take steps to enhance service quality. ISO 9001 certification gives customers confidence in the architectural firm's commitment to continuous improvement and proactive management of service quality.

Additionally, ISO 9001 promotes evidence-based decision-making, ensuring that decisions are based on data and information rather than supposition or opinion. This can

improve the quality of services provided by the architectural practice. Adopting ISO 9001 can increase customer confidence in the architectural office's decision-making process and commitment to quality. It emphasizes customer focus, monitors and measures service quality, and makes evidence-based decisions. This can result in increased customer satisfaction, a better reputation, and greater success for the architectural firm.

3.2. Efficient claims handling thanks to ISO 9001

When a customer makes a complaint, it indicates dissatisfaction with a product or service. It presents an opportunity for the organization to rectify the issue, improve the customer relationship, and enhance its processes to prevent future occurrences. (*Tzelepis 2006*)

ISO 9001 provides a structured and managed process for handling complaints.

The process involves receiving the complaint and taking appropriate action. The organization should provide a clear and user-friendly process for customers to file complaints. This process can be facilitated through an online form, a dedicated telephone number, or an email address. Additionally, all claims must be registered to enable tracking. Registration should include the customer's name, the date, the nature of the claim, and the product or service in question. Claim Investigation: Upon receipt and registration of a claim, an investigation must be conducted to understand the cause of the issue and determine potential solutions. Complaint Resolution: Based on the investigation's findings, the organization must take appropriate steps to resolve the complaint. This may entail replacing a defective product, offering an additional service, or compensating the customer in some other manner. Communication with the customer is crucial throughout the process to keep them informed of the status of their claim. After resolving a claim, it is crucial to confirm with the customer that they are satisfied with the handling of the claim.

The organization should also conduct regular reviews of claims and their management to identify trends and areas for improvement, in line with ISO 9001's commitment to continual improvement. In summary, ISO 9001 assists organizations in effectively managing complaints, transforming them into opportunities to enhance customer satisfaction and the quality of their products or services.

For architectural firms, this can result in increased customer confidence, a stronger reputation, and ultimately, greater market success.

ISO 9001 can help prevent complaints in several ways.

Firstly, it requires organizations to understand their customers' needs and expectations, promoting customer orientation.

Secondly, it advocates for a process-based approach, which ensures that products or services meet customer needs and expectations. By following these guidelines, organizations can prevent claims arising from misunderstandings or disappointments. ISO 9001 encourages organizations to view their activities and resources as interconnected processes. By understanding how each process affects the others, an organization can identify and resolve problems before they become complaints.

Additionally, ISO 9001 requires organizations to continually seek to improve their processes and performance. This means that individuals or organizations must regularly evaluate their performance, identify areas for improvement, and implement changes. This practice can help prevent complaints by ensuring that problems are resolved before they become major issues.

ISO 9001 requires that decisions be based on the analysis and evaluation of data and information. (*Tarí 2012*) This means that organizations must collect data on their performance, analyze it to identify trends and problems, and use this information to make decisions. Doing so can help prevent claims by ensuring that decisions are made on the basis of facts rather than supposition or conjecture. Additionally, managing relationships with interested parties is crucial. ISO 9001 recognizes that organizations have multiple stakeholders, including customers, staff, suppliers, and the local community. By effectively managing these relationships, an organization can ensure that it meets the expectations of all stakeholders, which can help prevent complaints.

ISO 9001 provides a framework for effectively managing an organization and its processes, which can help prevent complaints. (*Rusjan 2010*) This is why many organizations choose to implement this standard.

3.3. ISO 9001 process improvement

One of the fundamental principles of ISO 9001 is continuous improvement, which is intrinsically linked to process improvement. ISO 9001 can help improve processes in an organization through process identification. (*Demirors 2002*) Organizations are required to identify and understand the processes required for the QMS. ISO 9001 requires organizations to document not only production or service delivery processes but also support processes such as human resources, purchasing, and infrastructure management.

This documentation helps organizations understand how these processes interact and contribute to product or service quality. Documentation is crucial for maintaining quality and ensuring consistency and standardization. It also serves as a basis for process analysis and improvement.

Additionally, ISO 9001 mandates that organizations monitor and measure their processes, which may involve collecting data on key performance indicators like cycle time, defect rate, or customer satisfaction. This data can be analyzed to identify problems or opportunities for improvement.

ISO 9001 promotes a fact-based approach to improvement, meaning that decisions should be based on data and information rather than assumptions or opinions. This ensures that improvement efforts are focused and effective. Additionally, ISO 9001 emphasizes continuous improvement.

Finally, ISO 9001 requires organizations to engage in continuous improvement. This means that they must constantly look for ways to improve their processes and performance. This may involve innovation, adopting new technologies or methods, or simply adjusting and refining existing processes. ISO 9001 provides a framework for process improvement. Organizations can use process management to systematically and objectively identify, understand, document, monitor, measure, and improve their processes. This can lead to improved quality, greater efficiency, and increased customer satisfaction.

For architectural practices, process management can result in better design quality, more efficient project management, and increased customer satisfaction

Table 1. Example table for quality management in an architecture office.© 2024 by [Author]

Step	Description	Example in an architecture office
Identification of processes	Determine which processes are necessary for QMS.	Design, project management, communication with clients, supplier management.
Documentation of processes	Write the details of each process.	The design process includes initial design, revision, client approval.
Monitoring and measurement	Define KPIs for each process and collect data.	Project management KPIs could include adherence to deadlines, budget compliance, customer satisfaction.
Fact-based improvement	Analyze KPI data to identify improvement opportunities.	If meeting deadlines is an issue, analysis might reveal the need to improve project planning or resource management.
Continuous improvement	Implement improvement actions based on analysis.	This could include staff training, process modification, adoption of new technologies.

This table presents a structured methodology for quality management that is tailored to architecture offices. It outlines five key steps that are essential for ensuring the delivery of high-quality projects, efficient client communication, and overall organizational excellence. The methodology includes the identification of processes, documentation of processes, monitoring and measurement, fact-based improvement, and continuous improvement. The first step in establishing a robust quality management system (QMS) within architecture firms is to identify the core processes. These processes, which include design, project management, client communication, and supplier management, form the foundation of the quality management framework.

Documentation of processes involves detailing specific procedures, workflows, and quality standards associated with each identified process. This documentation serves as a reference point for maintaining consistency and adherence to established quality protocols. The next step is monitoring and measurement, which emphasizes defining Key Performance Indicators (KPIs) for each process. (Rezgui 2017) Key Performance Indicators (KPIs)² enable effective tracking and evaluation of process performance, including project timelines and client satisfaction.

The fourth step, fact-based improvement, involves analyzing data collected from KPI measurements to identify areas for enhancement. This evidence-based approach enables architecture offices to pinpoint weaknesses, inefficiencies, and opportunities for process optimization. Finally, continuous improvement emphasizes the iterative nature of quality management. Targeted improvement actions are implemented based on analysis findings. This iterative process cultivates a culture of excellence, innovation, and continuous learning within architecture firms. This table presents a comprehensive framework for architecture offices to systematically manage quality, enhance project outcomes, and maintain a competitive advantage in an ever-evolving industry landscape.

Table 2. Formulas for measuring performance in quality management. © 2024 by [Author]

Performance Indicator	Description	Formula
Percentage of On-Time Delivery	The percentage of projects delivered on schedule	$\frac{\text{Number of projects delivered on time}}{\text{Total number of projects}} \times 100$
Customer Satisfaction Rate	The percentage of satisfied customers out of the total number of surveyed customers	$\frac{\text{Number of satisfied customers}}{\text{Total number of surveyed customers}} \times 100$
Budget Compliance Rate	The percentage of projects completed within budget	$\frac{\text{Number of projects completed within budget}}{\text{Total number of projects}} \times 100$
Product Quality Index	A measure of compliance with standards and specifications	Average of product quality scores

These performance indicators are essential for monitoring and improving quality management processes within an organization. Regularly tracking and analyzing these metrics enables organizations to identify areas for improvement, address potential issues, and optimize their operations to enhance overall quality and customer satisfaction. The provided formulas enable organizations to objectively calculate and benchmark their performance, facilitating data-driven decision-making and continuous improvement efforts.

4. Discussion

ISO 9001 is a widely recognized framework for establishing and maintaining quality management systems in various industries worldwide. Its adoption by architectural practices in developing countries, such as Tunisia, presents significant advantages and potential challenges.

On one hand, ISO 9001 offers tangible benefits for architectural practices. Firstly, ISO 9001 provides a structured and standardized framework for assessing, managing, and improving the quality of services provided. This can lead to improved customer satisfaction, reduced errors and non-conformities, and optimized internal processes. Additionally, ISO 9001 certification can enhance the credibility and reputation of architectural practices in the national and international marketplace by demonstrating their commitment to quality and operational excellence. Moreover, ISO 9001 certification can create new business opportunities for developing architectural practices. By adhering to globally recognized standards, companies can access larger international markets and attract discerning foreign customers who seek reliable and high-quality suppliers.

Nevertheless, implementing ISO 9001 can also pose significant challenges for architectural practices in developing countries. The implementation of the standard often requires a significant up-front investment in terms of time, human and financial resources. Companies must devote time and effort to training staff, documenting processes, and setting up quality management systems that comply with the standard. Additionally, the administrative complexity associated with ISO 9001 can be an obstacle for architectural practices, particularly in environments where resources are limited and traditional practices predominate. However, documenting processes and keeping records in accordance with the standard's requirements can add an additional administrative burden and require significant cultural and organizational adjustments.

Several developing countries have chosen to adopt ISO 9001 for their businesses, including architectural practices. For instance, in recent years, India, Brazil and South Africa have experienced a significant rise in the number of ISO 9001-certified companies. These countries acknowledge the potential advantages of ISO 9001, such as improved quality, enhanced competitiveness in the global marketplace, and access to new markets.

5. Future orientation and possible alternatives

5.1. In Germany

"Planer am Bau" certification is a quality standard specifically designed for architects and engineers. It was developed in collaboration with the certification body TÜV Rheinland.³ The standard aims to improve productivity through structured office organization. It offers a practical alternative to ISO 9001, with just enough and not too much.

"Planer am Bau" certification is based on a pragmatic approach to quality management. The text focuses on the essential aspects that directly impact the quality of planning work, including project management, communication with customers and stakeholders, resource management, and risk management. The 'Planer am Bau' certification is designed to be easy to implement and maintain, without excessive documentation or bureaucratic procedures. It encourages a proactive approach to continuous improvement. Architects and engineers can focus on their planning work with confidence that their processes conform to a recognized quality standard.

Table 3. Comparison of Planer am Bau and ISO 9001 © 2024 by [Author]	
Planer am Bau	ISO 9001
Advantages: <ul style="list-style-type: none">- Improvement of productivity through structured office organization- Exchange of experiences in ERFA circles- Proactive approach to continuous improvement- Certification TÜV after successful examination- Augmentation of client satisfaction	Advantages: <ul style="list-style-type: none">- Increase in customer satisfaction- Improvement of employee productivity- Enhancement of communication- Cost reduction- Increase in efficiency
Disadvantages: <ul style="list-style-type: none">- Costs associated with obtaining and maintaining certification	Disadvantages: <ul style="list-style-type: none">- Expensive to implement, especially for small businesses - Requires initial investment before improvements are realized- Requires ongoing evaluations, which may create additional administrative tasks for employees

The 'Planer am Bau' method, a German approach to quality management, is considered an effective alternative for architectural and engineering practices due to its pragmatism and focus on essential planning and construction aspects. This method's relevance is evident in its structured office organization. "Planer am Bau" promotes a structured office organization by establishing clear and efficient processes for project management, customer communication, resource management, and risk management.

This fosters better coordination of activities and optimized workflows. An important aspect of the "Planer am Bau" methodology is the exchange of experience within ERFA circles⁴. These circles allow members to share knowledge, learn from each other, identify alternative solutions, and highlight best practices. This exchange fosters innovation and continuous improvement within the profession.

'Planer am Bau' promotes a proactive approach to continuous improvement, encouraging architectural practices to identify and implement improvements on an ongoing basis. Based on feedback and lessons learned from ERFA circles, practitioners can adapt their practices to meet evolving market needs and customer expectations. Additionally, architectural and engineering firms can obtain the 'Planer am Bau' quality certificate from TÜV after passing an examination. This certification provides customers and stakeholders with added assurance of the quality and reliability of the company's services. The 'Planer am Bau' method presents a structured and pragmatic approach to quality management in architecture and engineering. It provides a viable alternative to conventional quality standards like ISO 9001, as it prioritizes collaboration, continuous learning, and adaptability to market demands. By adopting this method, architectural firms can improve their operational efficiency, enhance customer satisfaction, and maintain their competitiveness in a constantly changing environment.

5.2. In France

The adoption of the HQE[®] method by French architects and engineers has prompted a reassessment of design management processes to incorporate new environmental objectives into architectural solutions. Consequently, AFAQ AFNOR, the Fédération "des Promoteurs Constructeurs de France", and CERTIVEA⁵ have introduced the QUALIPROM^{®6} referential. This framework enables constructors to integrate HQE[®] goals into all operations, demonstrating the ability to fulfill client requirements and environmental standards. Table 4 provides further details on this methodology, which draws from ISO 9001 requirements and HQE[®] standards.

This document serves as a comparative analysis of various regulations pertaining to quality and environmental management, emphasizing the imperative to adapt design management processes to address contemporary sustainability imperatives. (Salgado 2012).

Table 4. References on Quality and Environmental Management in France (salgado 2011)

Document	Editor	Goals	Methods
ISO 14001	AFNOR	Organize environmental management	General regulations, not specific for the construction sector. The certification has international validity. Possibility to obtain third-party certification issued by an independent organism
ISO 9001	AFNOR	Organize quality management	specific methods used can vary depending on the organization's individual needs and the nature of their work
SME HQE ⁷	Association HQE	Apply environmental management to a specific real estate operation	Report of "l'Association HQE" working group that proposed principles for adaptation of ISO 14001 requirements to the building construction industry. No possibility to obtain an associate certification (with ISO 14001). Can be applied to new constructions or renovations
GA P 01-030	AFNOR	Adapt ISO 14001 to rehabilitated buildings	AFNOR guide that correlates SME HQE referential requirements according to ISO 14001 structure
QUALIMO ⁸	Certivéa	Apply quality criteria to rental housing operations	Quality certification reference specific for rental management, considering the concepts of ISO 9000. Owners rental, including social structures for QUALIMO, real estate developers for QUALIPROM. Both benchmarks are dedicated to the certification by a particular agency: Certivéa
QUALIPROM	Certivéa	Apply quality standards to the operations of housing for ownership	Quality certification reference specific for project management in home ownership considering the concepts of ISO 9000

The French standards, such as ISO 14001 and ISO 9001, provide a solid foundation for environmental and quality management. These standards offer a framework for organizations to establish, implement, maintain, and improve their management systems effectively. However, the applicability of these standards may vary across different sectors and organizational contexts. However, although the French approach has strengths, there are areas where it could be further improved. One such area is accessibility and awareness.

While there are comprehensive standards and certification programs in place, ensuring that stakeholders, particularly smaller firms and practitioners, are aware of and have access to them may be a challenge. Efforts to promote education, training, and outreach initiatives could enhance participation and adoption of quality and environmental management practices in the construction sector.

Achieving meaningful integration and effective implementation of these practices at the operational level may require additional support and resources, despite the framework provided by standards and certification programs. Enhancing capacity-building efforts and providing practical guidance could facilitate smoother implementation and ensure the desired outcomes are achieved.

Table 5. Comparison of Approaches for Small Architectural Practices in Tunisia © 2024 by [Author]

Approach	Advantages	Disadvantages
ISO 9001	<ul style="list-style-type: none">Enhances organizational structure and efficiency.Improves customer satisfaction.Provides internationally recognized certification.	<ul style="list-style-type: none">Initial and ongoing costs associated with certificationImplementation may be resource-intensive for small practices.
Planer am Bau	<ul style="list-style-type: none">Focuses on structured office organization.Encourages productivity improvement.Certification offers credibility.	<ul style="list-style-type: none">Limited international recognition compared to ISO 9001.May require adjustments to existing workflows.
French HQE Standards (ISO 14001 and ISO 9001)	<ul style="list-style-type: none">Emphasizes environmental sustainability.Integrates quality and environmental management.Adheres to international standards.	<ul style="list-style-type: none">Complexity in adapting to Tunisian regulatory frameworks.Resource-intensive implementation.

This table provides a comparative overview of the advantages and disadvantages of each approach for small architectural practices in Tunisia. It is essential for architectural firms to carefully consider these factors and assess their specific needs and priorities before choosing the most appropriate approach for their practice.

6. Conclusion

The adoption of ISO 9001 or other quality management methods presents significant opportunities for architectural practices in Tunisia. By adhering to internationally recognized standards and implementing structured quality management systems, architectural firms can enhance their service quality, increase customer satisfaction, and improve overall organizational performance.

ISO 9001 provides a strong framework based on principles such as customer focus, continuous improvement, and evidence-based decision-making. Although implementing ISO 9001 may present initial challenges in terms of resource investment and administrative complexity, the long-term benefits outweigh the costs. ISO 9001 certification not only enhances the credibility and reputation of architectural firms but also creates new business opportunities in the global marketplace. Moreover, there are alternative approaches, such as 'Planer am Bau,' that provide pragmatic solutions tailored specifically for architects and engineers. These methods emphasize structured office organization, collaborative exchange of experiences, proactive continuous improvement, and certification by reputable bodies like TÜV.

On the other hand, the French HQE standards, including ISO 14001 and ISO 9001, offer a comprehensive framework for integrating environmental sustainability and quality management into architectural projects. While these standards provide valuable guidance on environmental stewardship and regulatory compliance, their applicability to Tunisian practices may depend on factors such as regulatory alignment, resource constraints, and market demand for sustainable design solutions.

In essence, whether adopting ISO 9001 or alternative methods, architectural practices in Tunisia can benefit greatly by prioritizing quality management. By embracing internationally recognized standards and implementing systematic approaches to quality assurance, architectural firms can strengthen their market competitiveness, build trust with clients, and ensure long-term success in a dynamic and competitive industry landscape.

Footnotes

¹ Small Chartered Practices (up to ten staff) are only required to prepare a Project Quality Plan (PQP) for each project to satisfy the minimum RIBA requirement for Chartered Status.

² Key Performance Indicators (KPIs) are quantifiable metrics used to evaluate the success of an organization or a specific activity in achieving its objectives. They serve as measurable markers of progress toward desired outcomes and are typically tied to strategic goals. KPIs help organizations track performance over time, identify areas for improvement, and make informed decisions based on data-driven insights.

³ TÜV Rheinland is an internationally recognized provider of technical services, including testing, inspection, certification, and consulting. With its headquarters in Cologne, Germany, TÜV Rheinland operates globally and offers a broad range of services across various industries, including automotive, energy, information technology, healthcare, and manufacturing. TÜV is known for its expertise in quality management, safety, security, environmental protection, and sustainability, and its certifications and assessments are widely respected in the industry.

⁴The Exchange of Experience Working Group (ERFA) : was founded in germany in 1984 in order to facilitate an exchange between companies in the mechanical and plant engineering sector and thus to jointly become more competitive. Representatives from industry and science have joined forces in this working group to jointly develop practical solutions for the challenges in the field of assembly. :<https://www.wzl.rwth-aachen.de>

⁵ CERTIVEA is France's leading provider of certification and labeling services for commercial buildings and regional development.

⁶ QUALIPROM is a certification attesting to the quality of the production processes used by developers and builders. It is issued by CERTIVEA, a certification body committed to sustainable living.

⁷ The HQE EMS (High Environmental Quality Environmental Management System) is part of the HQE approach, which includes an environmental management system (EMS) and a building environmental quality (BEQ) objective defined by 14 targets. The EMS is a set of procedures relating to project supervision, put in place during construction by the project owner³. HQE is a multi-criteria optimization approach

⁸ QUALIMO is a certification issued by CERTIVEA. It attests to the implementation of quality criteria in residential rental operations.

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