



Digitalization and usage of QR-code System in Documents Management

Loai Abdrabou- Adnan
IRIS Construction, Doha, Qatar
loai.a.abdrabou@gmail.com

Abstract

Multiple official documents from various departments have contributed to the rising number of printed pages in construction projects. The dominant explanation for this trend is that printed pages have a direct relationship with the progression of the project as the number of quality assurance, quality control documents, health and safety documents, technical documents, lean and enhancement documents, and store documents get increased with the project timeline. The research data was obtained from one of the infrastructure projects in the north of Qatar between 2020 and 2023 and in line with multiple academic references as listed in the last section of the paper (Ågren, 2014). Contrary to what has often been assumed, the rise in printed pages due to mentioned documents contributes to impacting the earth's environment badly, affecting global warming, cutting additional trees from green lands, reducing project KPIs, increasing overall project budget cost, and generating material waste. Lean enhancement engineers proposed replacing all the above-mentioned documents to be used in the digital format.

Keywords: Digitalization; Waste; Environmental; Sustainability; Quality

1 Introduction

The construction industry is a continuous cycle of producing printed pages due to the obligations of various departments that require physical documents to be in place. Therefore, a case study has been established by the lean enhancement team at an infrastructure project in the north of Qatar. The aim of this case study is to identify the root causes, required actions, and sustainable solutions to prevent such issues from occurring. The case study's need comes to reduce the impact on the environment and greenhouse gases, cut overhead costs, easy accessibility, and save efforts.

2 Methodology of the Proposal

The methodology of using the digital method of the QR-code system can be applied by following simple steps using smartphones. Firstly, collaboration meetings with all focal departments involved in the project, and secondly, identification of the documents in demand for daily usage at project printers. Thirdly, the root cause analysis shall be performed by each department using the Fish-Bone analysis technique and the 5 Whys method. Fourthly, discussion and brainstorming sessions of the pluses and deltas using the case study. Leading to establishing an agreed process to be followed by the concerned parties of the project. Nevertheless, maintaining and checking the proposal to evaluate the outcomes and adoption by the project teams.

3 Benefits of the Proposal

The expected positive outcomes from using the proposed innovative solution are enormous in multiple sectors. For example, it can reduce the impact on forests; cut energy use and climate change emissions and reduce other pollution forms. Also, reducing the demand for paper will also help lessen the social impacts and human rights abuses linked to paper production making it environmentally

friendly (Bikas et al., 2016). Moreover, lessen the cost required and cut overhead costs for the project. It is important to highlight that the scanned file can be either replaced, updated, or deleted which strongly agrees with the concept of saving time as with one click, a document will be updated and can be accessed globally by every personnel.

4 Methods and Tools to Measure Proposal Success

Multiple highlighted tools can be used to examine the case study’s success such as measuring compliance by the team from GEC and the contractor. Also, measuring the outcome on both parties using IT department statistics. The number of printed pages has significantly decreased after the QR-code system implementing (Barlow et al, 2003). Nevertheless, financial results can be measured from the number of requested paper boxes from suppliers’ quotations. Finally, before and after quantity tables were used in the lean case study to use the power of visual management aids in examining the success of the case study.

5 Environmental, Quality, Sustainability Standards

Using the QR-code digital system, compliance with multiple major environmental, quality and sustainability standards will be fulfilled for current as well as future projects. For example, ISO-9001 is customer-focused and places an emphasis on continuous improvement and top management processes that extended throughout the organization (Atkin, 2014), also, complying with ISO-14001 principles by saving printed pages, energy, costs, and efforts for the staff members. Moreover, confirming with ISO-50001 standards as an Energy Management System (EMS) is dedicated to improving energy usage and efficiency. This includes reducing an organization’s energy footprint by reducing greenhouse gas emissions as well as energy costs. Finally, in line with ISO-20121 by sustaining energy savings and reducing the environmental footprint (Barlow, 2000).

6 Equations and Data Sheets

The enhancement team has gathered data about the number of printed pages in both contractor and consultant offices as shown below in Table 1.

Table 1: Data Collection

Printer location	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9
Contractor printer “Pages”	1600	1550	1400	2000	2200	2100	1900	1700	1450
GEC offices “Pages”	400	350	250	500	550	600	320	160	330

Although a collaboration awareness session on the importance of keeping the environment safe and minimizing the usage of printed pages was held, the number is yet to be increased as shown in Figure 1.



Fig. 1: Unused printed pages

$$Y = x A \quad (1)$$

Where:

- Y : The overhead cost from printed pages = $QR \frac{21,840}{year}$.
- x : The unit price of 1 pack of white paper around $QR 14$.
- A : The daily average number of printed pages multiplied by the working days/year 780,000 pages.

$$Z = \frac{B}{w} \quad (2)$$

Where:

- Z : The number of trees cut per year = 98 Trees/year .
- w : One tree makes over 8,000 pieces of paper (Fratzl, 2018).
- A : The daily average number of printed pages multiplied by the working days 780,000 pages.

$$O = \frac{Z}{p} * 100\% \quad (3)$$

Where:

- O : Hectare of forest being demolished per year for the process of paper production = 9.8%.
- p : The number of trees planted per hectare will vary from 1,000 to 2,500 trees, depending on the species and the type of planting (Gurav, 2003).
- Z : The number of trees cut per year = $98 \frac{Trees}{year}$.

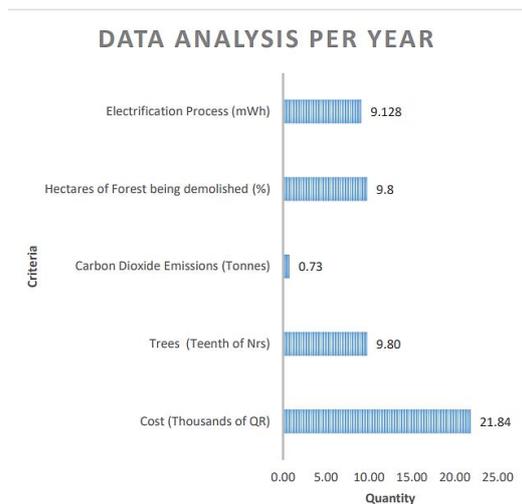


Fig. 2: Savings Per Year (ASTM, 2012)

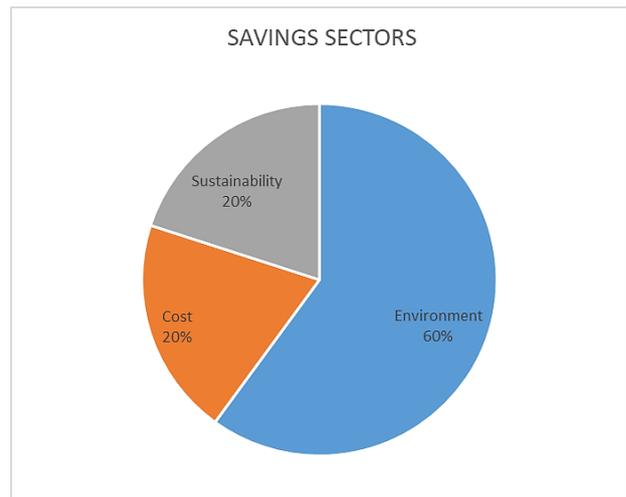


Fig. 3: Savings Per Sector

7 Proposal Usage Road Map

Case study implementation can be illustrated below in Figure 4. At the infrastructure project in the north of Qatar, 4 different departments are using the digital format of documents such as safety, quality, stakeholder, and lean departments. Firstly, each department will have to upload the document as a normal unofficial, transmittal, or submittal. Then, the file needs to be uploaded to specific software that can generate the QR code for each document. In this process, the generator may choose to have a lock or not to increase the safety and secure the information shared with others as some documents may be sensitive and cannot be shared with everyone. Finally, the document control centre starts by submitting the official document in the client portal for the consultant to be printed and reviewed. In this process either the consultant approves and uploads the document in the authority platform, or it is rejected and revised by the contractor for resubmission.

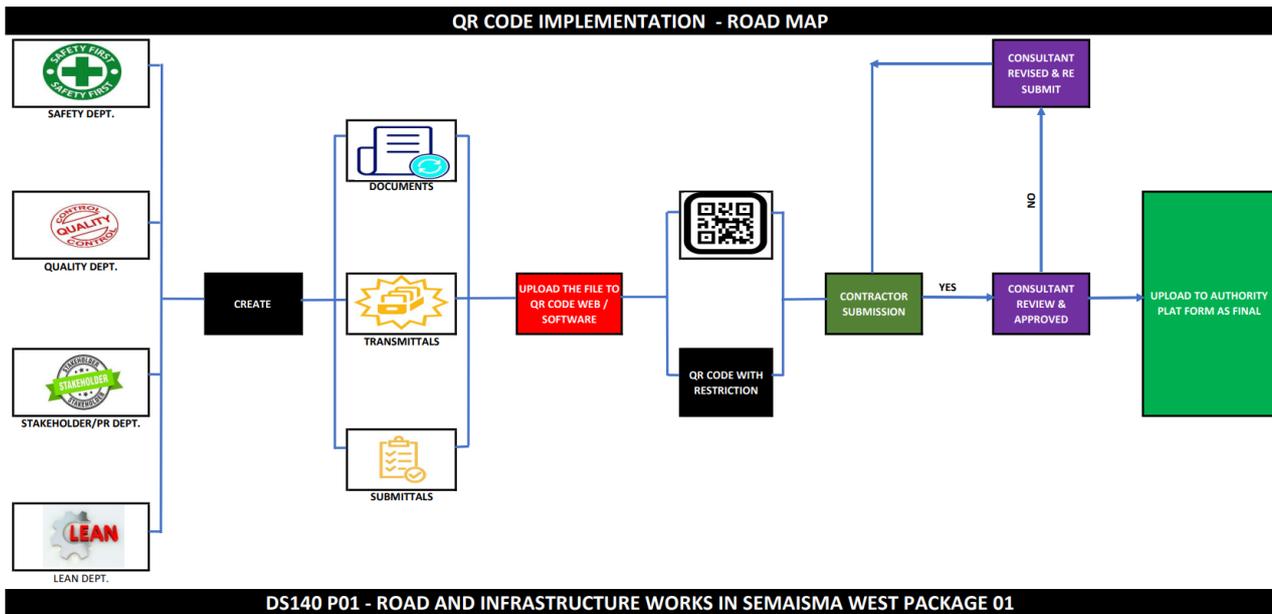


Fig. 4: QR-Code System Implementation Road Map

8 Conclusion

Enhancement engineers believe in the environment as the future of growth countries and in PWA's vision, "Qatar deserves the best." The case study has been submitted officially to ASHGHAL for their review and comments to specify the limitations of work in current projects and the future for upcoming projects if needed. Nevertheless, the contractor is using the digital study and started the implementation process internally among project staff to minimize the daily usage of paper. Finally, the proposal and implementation are under study in the phase of the data collection process in order to cover all aspects of the proposal in terms of the positive and negative points by the contractor, the supervision consultant, and the client. It is important to highlight that it is being used to enhance reducing overhead budget costs and saving efficient energy, feasible method and user-friendly, easy to use and convenient, more accessible by others, and confirming future needs. (Ballard & Howell, 2003).

References

- ASTM International (2012). ASTM Standard Terminology for Additive Manufacturing Technologies, ASTM Committee F42 on Additive Manufacturing Technologies ASTM Committee F42 on Additive Manufacturing Technologies Subcommittee F4291 on Terminology.
- Atkin, B. (2014). Industrialized building Construct. *Manag. Econ.*, pp. 1-6.
- Fratzl, P. (2018). Wood made Denser and Stronger.
- Ballard, G. & Howell, G. (2003). Lean Project Management Build. *Res. Inf.*, pp. 119-133.
- Barlow, J. (2000). Innovation and Learning in Complex Offshore Construction Projects. *Res. Pol.*, pp. 973-989.
- Barlow, J. et al. (2003). Choice and Delivery in Housebuilding: Lessons from Japan for UK House Builders. *Build. Res. Inf.*, pp. 134-145.
- Bikas, H., Stavropoulos, P., & Chryssolouris, G. (2016). Additive Manufacturing Methods and Modelling Approaches: A Critical Review. *Int. J. Adv. Manuf. Technol.*, pp. 389-405.

- Gurav, S. P. et al. (2003). Mechanical Properties of Paper-Pulp Packaging. *Composites Science and Technology*, 63(9), 1325-1334.
- M'hamdi, A. I. et al. (2017). Life cycle Assessment of Paper Production from Treated Wood. *Energy Procedia*, 128, 461-468.

Cite as: Abdrabou L., "Digitalization and usage of QR-code System in Documents Management", *The 2nd International Conference on Civil Infrastructure and Construction (CIC 2023)*, Doha, Qatar, 5-8 February 2023, DOI: <https://doi.org/10.29117/cic.2023.0019>