University of Mohammed Kheider- Biskra
Faculty of architecture, urbanism, civil engineering, and hydraulic
Department of Architecture

MASTER'S DISSERTATION

Domain: **Architecture, urbanism, and city professions**

Field: **Construction Project Management**

Specialization: **Construction Project Management**

Presented and defended by:

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Theme:

The relationship between Quality Management and Cost Management within construction projects

Case study: Completion of the martyr Habashi Mabkhout primary school, class A.

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TARMOUNE Asma

Dedication

To my family, small in number and large in love and reassurance

To my home and my safety..... Mommie

To my joy and my support..... My siblings

To all the laughter that passed and all the sorrows that were experienced

To the days we have not yet reached and the dreams, we aspired to achieve

To our hearts that suffered

To the joy that will visit our home and will not go away, God willing

To ourselves

To my family.....Love you

To my grandmother and aunt, may they rest in peace

Your loving daughter / your proud sister

TARMOUNE Asma

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General introduction

“The great value of project management is that it can be applied across industries and situations alike, on multiple levels. It would be difficult to find a more nimble organizational discipline” (Heagney, 2012)

This work has been prepared as part of the completion of the Master's degree 2, specialisation: Construction Project Management from the Department of Architecture

The focus of this research paper is on finding the relationship between quality management and cost management in construction projects, especially since these two departments play an important role in project management.

Project management is a robust framework for achieving the objectives of any endeavor. By encompassing a methodical approach to planning, execution, monitoring, and control, it ensures that all resources—human, financial, and material—are aligned toward the common goal. This alignment minimizes inefficiencies and enhances the likelihood of delivering results on time, within budget, and to the expected quality. (Koul, 2024)

While the principles of project management—such as task breakdown, risk assessment, and stakeholder communication—are universal, the application differs across industries. In construction, this divergence stems from the sector's unique challenges, including its reliance on tangible outcomes, variability in project size, and frequent involvement of multidisciplinary teams. Unlike repetitive projects, construction endeavors are often "one-of-a-kind," demanding bespoke solutions and innovative approaches.

In construction projects, three main constraints must be respected, and a fourth constraint, which plays an important role:

Cost: Managing costs in construction is particularly complex due to fluctuating material prices, unforeseen conditions (e.g., weather), and dependencies on subcontractors. Effective cost control demands rigorous budgeting, precise estimation, and continual tracking of expenditures against the plan.

Scope: Clearly defining the scope is essential to avoid scope creep, where additional tasks or requirements emerge during the project lifecycle. Detailed blueprints, specifications, and agreed-upon deliverables form the backbone of scope management.

Time: Meeting deadlines in construction is a formidable challenge due to delays from external factors such as permitting issues, labor shortages, or logistical bottlenecks. Tools like Critical Path Method (CPM) and Gantt charts aid in planning and adjusting schedules to stay on track. (Schwartz, 2024)

Even if a project is delivered on time and within budget, failing to meet quality standards renders it unsuccessful. In the construction industry, quality management spans structural integrity, safety compliance, and aesthetic appeal. Achieving this demands stringent adherence to regulations, routine inspections, and thorough testing.

A talented project manager controls these constraints effectively and achieves each of them in harmony without favouring one over the other, except in exceptional cases - and managing cost and quality and optimising results in both is one of the most difficult challenges in our industry.

In conclusion, managing the interplay between cost, time, scope, and quality is pivotal in construction. A project manager who masters these dynamics unlocks the potential for creating exemplary structures while meeting stakeholder expectations.

The Problematic

Construction projects in Algeria have consistently struggled with poor cost management. Many projects have been halted midway due to budget overruns or a lack of funds. In the best-case scenarios, cost reductions are prioritized arbitrarily over achieving the required quality, so the real question is (هارون و هارون، 2015) :

- What is the relationship between quality management and cost management?
- How to balance quality and cost management

Obejectives

Through this research, we try to achieve the following objectives:

General goals:

1. Developing theoretical concepts of cost management and quality management.
2. Introducing the project to construct the martyr Habashi Mabkhout primary school class A.

Special Goals:

1. Recognize the fundamental relationship between cost management and quality management.
2. Identify common challenges faced when balancing cost and quality management and propose practical solutions.
3. Highlight best practices and guidelines for achieving optimal cost and quality management in the Martyr Habashi Mabkhout Primary School Class A in Assarek.

Structuring the Memo:

This study memo is entitled the relationship between quality management and cost management in the project of constructing the martyr Habashi Mabkhout primary school class A in Assarek. - Biskra. This memorandum consists of four chapters:

The general introduction to the memorandum outlines a set of key points that help identify the main objectives of this study, including a preface to the topic, a statement of the study's objectives, and an overview of the memorandum's structure.

The first chapter includes general definitions about the education sector in Algeria and the case study, as well as the expansion of the concepts of quality management, cost management, and project management in general, in addition to the project life cycle and stakeholders in construction projects.

As for the second chapter, it includes a definition of all aspects of the project for the construction of the martyr Habashi Mabkhout primary school class A in Assarek - Biskra, as well as the architectural and urban analysis of the project, the planning stages of the study project, and educational projects in Algeria in general.

The last chapter contains the definition of the construction organization and the analysis of the project from the aspects of quality management and cost management, with a comparison with a reference project.

Finally, there will be a general conclusion that combines and connects all the previous conclusions.

Chapter 01: Thematic and Managerial Study

Introduction:

The education sector in Algeria is one of the main pillars for achieving sustainable development and building a knowledge society. As one of the most vital sectors, it plays a crucial role in preparing human competencies and building generations capable of keeping pace with the rapid changes in the world. Since independence, the state has allocated significant costs to promote this sector and try to manage it effectively. (Manajliah, 2015)

This chapter aims to shed light on the management of educational projects in Algeria by providing a clear definition of the project and its characteristics, and reviewing the concept of project management including the project life cycle that starts from the idea stage until the completion of the project and the achievement of its objectives. It also discusses the role of different interveners in implementing educational projects and their impact on their success.

In addition, the chapter addresses cost management as one of the key factors in planning and implementing projects, and presents the tools used to control costs. The chapter also highlights quality management and its importance in enhancing performance and raising the efficiency of projects, while providing tools that can be used to achieve quality standards.

1. Sector Presentation:

1.1. Definition of Education:

There are many definitions of the concept of education due to the multiplicity of fields and different societies, including the following:

Education is a discipline focused on teaching and learning processes within schools or similar settings, distinct from nonformal and informal methods of socialization such as rural development initiatives and parent-child learning interactions.(Lauwerys, 2024)

Parenting is the process by which parents endeavour to provide a safe environment that enables their child to adapt or interact with the society in which he or she lives. This process involves a set of behaviours and influences that foster a set of qualities and skills in the child's personality. Parents perform these behaviours in a planned, deliberate, and purposeful manner that builds the child's knowledge, awareness of their surroundings, questioning, and the ability to make decisions. (العزة، 2023)

Education is the process of gaining knowledge, skills, values, and attitudes through different methods of learning. It involves a deliberate and organized effort to promote growth and development, primarily through formal settings like schools, colleges, and universities, as well as informal avenues such as family, community, and workplaces. (Verma, Vishal Raj, & Verma, 2023)

1.2. Sector of Education

1.2.1. Defintions :

The education sector is recognized as essential infrastructure due to its pivotal role in shaping the future of nations and societies. By cultivating knowledge, skills, and civic engagement, it forms the backbone of human capital development. In addition to its economic contributions to innovation and prosperity, education plays a crucial role in safeguarding national security, strengthening social cohesion, preserving cultural heritage, and promoting public health awareness. (FiveableTeam, 2024)

In Algeria, the Ministry of Education is the representative body for the education sector.

1.2.2. Ministry of Education

It is one of the government ministries concerned with educating the people through its various institutions, from primary school to high school. The Ministry of Education is in charge of carrying out the National Education Policy. The goal of the Ministry of Education is to raise the nation's educational standards by introducing cutting-edge teaching models and training educators in them. (teachmint@wp, 2021)

The Ministry of National Education in Algeria is the government body responsible for organising and developing the country's education system under the auspices of the Minister of National Education. The ministry aims to ensure free and compulsory education for children between the ages of 6 and 16, improve the quality of education and provide equal educational opportunities for all citizens. In addition, the ministry seeks to promote national and cultural values through curricula and the organisation of educational institutions. (Official journal, 2008)

1.2.3. Its structure :

The Ministry is made up of several departments and offices headed by the Minister of Education. The following figure shows the general structure of the Ministry of Education.

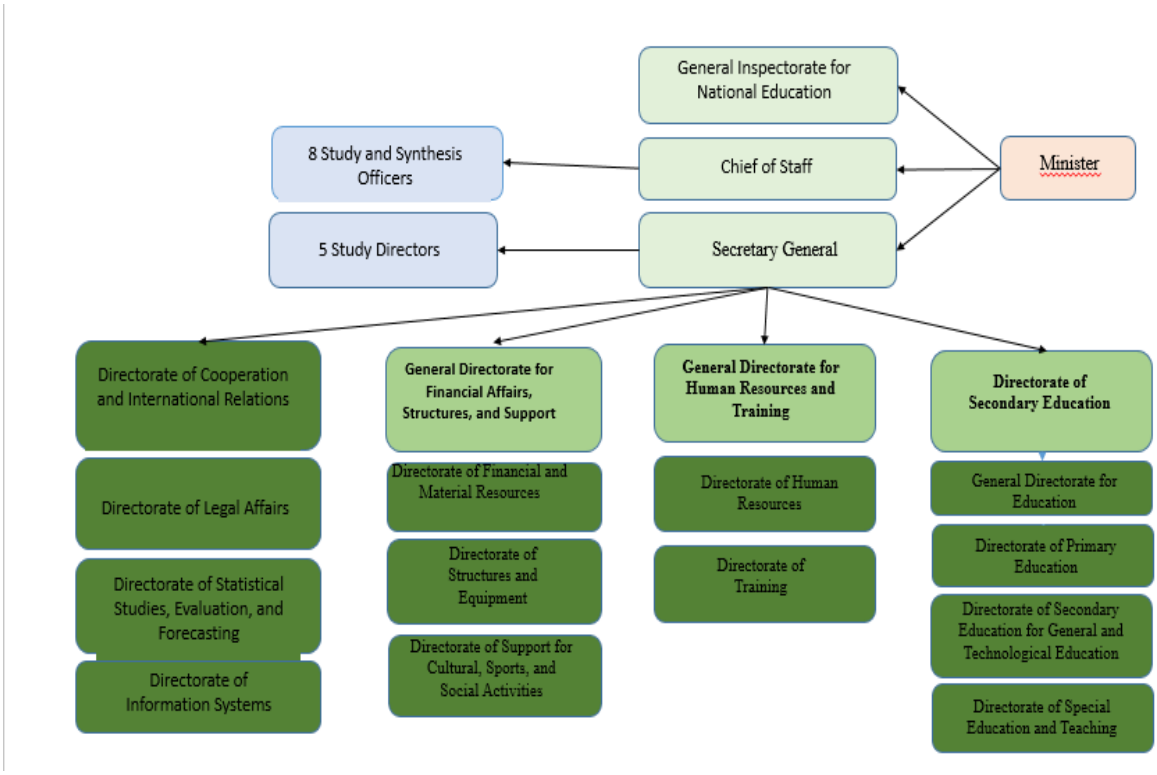


Figure 1: Ministry of Education structure

Source: Official website of the ministry of Education

1.2.4. Ministry bodies :

1.2.4.1. Institutes :

The National Institute for Research in Education: It is an administrative institution with legal personality and financial autonomy:

- Encouraging and disseminating educational and pedagogical research.
- Preparing pedagogical tools and placing them at the disposal of educational institutions.
- Monitoring and evaluating educational policy and organising national and international forums.

The National Institute for the Training and Improvement of Education Employees: This institute is responsible for the training of inspection, management, administration and school activation staff, as well as improving the level of education staff and renewing their training. There are also regional institutes to reduce the pressure on the national institute.(هيبة، 2014)

1.2.4.2. Centers :

- National Centre for Educational Documents: Its mission is to collect documents produced by various national and international bodies, taking into account the modernity of the collection, and to provide various central and other departments, as well as institutions, with the necessary educational documents.
- National Literacy Centre: Its mission is adult education and all related means.

- National Centre for Supply and Maintenance of Educational Equipment and Means: Its mission is to design, acquire, control and maintain scientific equipment and means carry out technical and economic studies to explore the possibilities of national production in the field of educational equipment and means, and provide qualitative documents related to educational equipment and means.

- National Centre for the Integration of Pedagogical Innovations and Development of Information and Communication Technologies in Education: This centre was recently established to undertake modern technological means and communication technology in the education sector in line with the ongoing reforms, and is based in Algiers.

- The National Pedagogical and Linguistic Centre for the Teaching of the Amazigh Language: Its mission is to work on the teaching of the Amazigh language.(هيبة، 2014)

1.2.4.3. Diwan:

- The National Office for School Publications: Established to relieve the burden of the National Institute for Research in Education, it is responsible for printing books, journals, magazines and educational documents, as well as reproducing, publishing and distributing foreign literature, books and documents for school use, concluding all contracts and agreements with national and international bodies, and printing the Official Gazette of Education.
- The National Office for Distance Education and Training: It is a public institution of an administrative nature with legal personality and financial independence, whose mission is education and training by correspondence, by all means, whether by old methods or by modern technological means, according to the curricula and programmes used in regular education and training.
- National Bureau of Examinations and Competitions: It is a public institution of an administrative nature with legal personality and financial independence, established in 1989 in accordance with Executive Decree No. 89-94 dated 20 June 1989, supervised by a Director General and assisted in the performance of his duties by a Secretary General, the Office consists of 5 sub-directories and 12 departments, with 9 regional branches.(هيبة، 2014)

1.2.4.4. Directorate of Education :

It is a provincial directorate among the directorates of the executive authority, headed by the director of education, who is a member of the executive authority. He is responsible for monitoring the education of students, overseeing the programs set by the Ministry of National Education, and managing the administrative files of teachers, administrators, and professional workers in the sector. (مديرية التربية ، 2022)

To put it another way, a Directorate of Education is a governmental organization tasked with coordinating and managing educational activities in a designated area. Its responsibilities include overseeing schools, developing curricula, training teachers, and ensuring education quality. Furthermore, it implements educational policies established by the Ministry of National Education and offers necessary support to schools and educational institutions to meet their educational and pedagogical objectives. Its tasks include (مهام مديريات التربية، 2015)

- Activating and coordinating educational activities in basic and secondary education and training.

- Preparing and updating the school map in coordination with relevant authorities.

- Collecting and analyzing school statistics to assess the educational needs of the state.

- Appointing and following up on educational and administrative staff, and organizing exams and competitions.

- Promoting educational, cultural, and sports activities in educational institutions in collaboration with relevant bodies.

1.3. Education Facilities:

1.3.1. High school :

- High school, in most school systems in the United States, any three- to six-year secondary school serving students approximately 13 (or 14 or 15) through 18 years of age. Often in four-year schools, the different levels are designated, in ascending order, freshman, sophomore, junior, and senior. (Britannica, 2025)
- in the UK and Australia, sometimes used in the names of schools for children aged from eleven to 18 (high school, 2025)
- a school for children who are about 15 to 18 years old that is usually divided into grades nine through twelve or ten through twelve (high school, 2025)

1.3.2. Secondary school :

- a school for children between the ages of 11 and 18, approximately (secondary school, 2025)
- It is known as the middle stage of the education ladder. It is preceded by primary education and followed by secondary education, and it occupies a period of time extending from twelve to fifteen years of age (خورشید، 2019)
- Secondary education consists of two stages: lower and upper secondary. The lower secondary level builds on primary education but shifts to subject-focused instruction, requiring specialized teachers. This stage often marks the end of compulsory education. Upper secondary, the final stage, further deepens subject-based learning, with teachers needing higher or more specialized qualifications. (UNESCO, 2012)

1.3.3. Primary school :

Primary schools are another Facility of the Ministry of National Education that has several categories and many criteria apply to them, which will be discussed later in this memorandum, as it is the case study.

1.4. Spatial Programme

1.4.1. High school Spatial programme :

Table 1: High school spatial programme

Halls	Categorie 600		Categorie 800		Categorie 1000	
	Number	Total Area (m2)	Number	Total Area (m2)	Number	Total Area (m2)
Pedagogical Wing						
Classrooms	20	1240	27	1674	34	2108
Natural and Physical Sciences Laboratory	4	256	4	256	6	384
Preparation Room	2	60	2	60	3	90
Tech Labs	2	96	2	96	3	144
Computer Room	2	144	2	144	2	144
Arts and crafts workshop with the store	1	80	1	80	1	80
Music Education Workshop with the store	1	80	1	80	1	80
Library, Lecture Hall	1	80	1	80	1	80
Multipurpose Room	1	120	1	120	1	120
Amphitheatre	1	160	1	160	1	160
Educational Monitoring Office (on each floor)	3	48	3	48	3	48
Student Restrooms	2	90	2	120	2	150
Movement Area (20%)		491		584		718
Overall Total 1		**2945**		**3502**		**4306**
Administrative Wing						
Principal's Office	1	30	1	30	1	30
Assistant Principal's Office	1	16	1	16	1	16
High School Principal's Office and Secretariat	1	30	1	30	1	30
Education Counsellor's Office	2	32	2	32	2	32
The Vigilante Office	1	16	1	16	1	16
Office of the Economist.	1	16	1	16	1	16
Storage	1	20	1	20	1	20
School Guidance and Counselling Counsellor's Office	1	16	1	16	1	16
School Media and Documentation Room	1	40	1	40	1	40
Teachers' lounge with an automated media space	1	80	1	80	1	80
Meeting Room	1	80	1	80	1	80
Archiv	1	40	1	40	1	40
Storage	1	15	1	15	1	15
Detection and Follow-up Unit	1	98	1	98	1	98
Waiting Room	1	16	1	16	1	16
Guardianship	1	6	1	6	1	6
Restrooms for Teachers and Administrative Staff	2	16	2	20	2	24
Movement Area (10%)		57		57		58
Overall Total 2		**624**		**628**		**633**
Residences	7	550	5	550	5	550
Attached shops	5	166	5	166	5	166
Overall Total 3		**716**		**716**		**716**
Sports facilities and changing rooms						
Playground	1	600	1	600	1	600
The entrance	1	16	1	16	1	16
changing rooms	2	64	2	64	2	64
Teacher's office with changing room	2	24	2	24	2	24
Means Place	1	16	1	16	1	16
The Courtyard	1	16	1	16	1	16
Shoe Wiping Mat	1	8	1	8	1	8
Boiler Room	1	16	1	16	1	16
Overall Total 4		**760**		**760**		**760**
Outdoor Area						
Rest Playground (3m² per school student)	1	1800	1	2400	1	3000
Multi-sports stadium	1	1280	1	1280	1	1280
Green Area and Gardening Area (20 m² for each classroom)	1	300	1	400	1	500
Overall Total 5		**3380**		**4080**		**4780**
Space for future expansion		**825**		**814**		**556**
Overall Total Ground Area		**9250**		**10500**		**11750**

Source: Official journal № 33

1.4.2. Secondary school Spatial programme :

Table 2: Secondary school spatial programme

	Categorie 1		Categorie 2		Categorie 3		Categorie 4	
Halls	**Number**	**Total Area (m2)**	**Number**	**Total Area (m2)**	**Number**	**Total Area (m2)**	**Number**	**Total Area (m2)**
Pedagogical Wing								
Classrooms	6	372	12	744	18	1116	24	1488
Computer Room	1	70	1	70	1	70	1	70
Lecture Hall	1	50	1	70	1	70	1	70
Multipurpose Room	1	40	1	70	1	70	1	70
Student Restrooms	1	28	2	44	2	64	2	84
Movement Area (20%)		112		200		278		356
Overall Total 1		**672**		**998**		**1668**		**2138**
Administrative Wing								
Principal's Office	1	16	1	16	1	16	1	16
Assistant Principal's Office	0	0	1	16	1	16	1	16
Secretariat	1	9	1	9	1	9	1	9
Teachers' Room	1	30	1	50	1	50	1	50
Guardianship	1	6	1	6	1	6	1	6
Waiting Room	1	16	1	16	1	16	1	16
Archiv	1	16	1	20	1	20	1	20
Storage	1	12	1	16	1	16	1	16
Restrooms for Teachers and Administrative Staff	1	6	1	9	1	12	1	12
Movement Area (10%)		11		16		16		16
Overall Total 2		**122**		174		177		177
Residences	1	58	3	225	3	225	3	225
Attached shops	4	44	4	44	4	44	4	44
Overall Total 3		**102**		**269**		**269**		**269**
Restaurant								
Dining Hall	1	90	1	180	1	180	1	270
Entrance with attached facilities	1	20	1	29	1	29	1	37
Storage	1	32	1	42	1	42	1	55
Kitchen	1	33	1	42	1	42	1	51
Washing Basin	1	6	1	10	1	10	1	17
Movement Area (10%)		9		12		12		16
Overall Total 4		**190**		**315**		**315**		**446**
Outdoor Area including Movement Parking (Width: 2 m)								
Rest Playground (18 m × 15 m)	1	540	1	1080	1	1620	1	2160
Playground (18 m × 16 m)	1	288	1	288	1	288	1	288
Green Area and Rest Area (20 m² for each section)	1	120	1	240	1	360	1	480
Overall Total 5		948		1608		2268		2928
Space for future expansion		**439**		**436**		**453**		
Overall Total Ground Area		**2500**		**4000**		**5150**		**6000**

Source : Official journal № 33

1.4.3. Primary school spatial programme

Table 3: Primary school spatial programme

	Categorie 3		Categorie 4		Categorie 5		Categorie 6		Categorie 7	
Halls	**Number**	**Total Area (m2)**	**Number**	**Total Area (m2)**	**Number**	**Total Area (m2)**	**Number**	**Total Area (m2)**	**Number**	**Total Area (m2)**
Pedagogical Wing										
Classrooms	12	744	16	992	20	1240	24	1488	28	1736
Natural and Physical Sciences Laboratory	2	108	2	108	4	216	4	2166	4	216
Preparation Room	1	26	1	26	2	52	2	52	2	52
Computer Room	1	70	1	70	2	140	1	140	2	140
Arts and crafts workshop with the store	1	72	1	72	1	72	1	72	1	72
Music Education Workshop with the store	1	80	1	80	1	80	1	80	1	80
Library, Lecture Hall	1	80	1	80	1	80	1	80	1	80
Multipurpose Room	1	80	1	80	1	80	1	80	1	80
Amphitheatre	1	120	1	160	1	160	1	200	1	200
Educational Monitoring Office (on each floor)	3	36	3	36	3	36	3	48	3	48
Student Restrooms	2	60	2	80	2	90	2	100	2	100
Movement Area (20%)		295		357		449		511		561
Overall Total 1		**1771**		**2141**		**2695**		**3067**		**3365**
Administrative Wing										
Principal's Office	1	20	1	20	1	20	1	20	1	20
Administrative offices	5	12	5	60	5	60	5	60	5	60
Teachers' Room	1	60	1	60	1	60	1	60	1	60
Meeting Room	1	60	1	60	1	60	1	60	1	60
School Media and Documentation Room	1	24	1	24	1	24	1	24	1	24
Archiv	1	20	1	30	1	30	1	30	1	30
Storage	1	20	1	20	1	20	1	20	1	20
Waiting Room	1	16	1	16	1	16	1	16	1	16
Guardianship	1	6	1	6	1	6	1	6	1	6
Restrooms for Teachers and Administrative Staff	2	20	2	30	2	30	2	30	2	30
Movement Area (10%)		31		33		33		33		33
Overall Total 2		**337**		**359**		**359**		**359**		**359**
Residences	5	410	5	410	5	410	5	410	5	410
Attached shops	5	120	5	120	5	120	5	120	5	120
Overall Total 3		**530**		**530**		**530**		**530**		**530**
Sports facilities and changing rooms										
Playground with 5 metres athletics track	1	1280	1	1280	1	1280	1	1280	1	1280
Male changing rooms	1	12	1	12	1	12	1	12	1	12
Female Changing Rooms	1	12	1	12	1	12	1	12	1	12
Professors' changing rooms	1	8	1	8	1	8	1	8	1	8
The entrance	1	5	1	5	1	5	1	5	1	5
Overall Total 4		**1316**		**1316**		**1316**		**1316**		**1316**
Outdoor Area										
Rest Playground (3m² per school student)	1	1080	1	1440	1	1800	1	2160	1	2520
Green Area and Gardening Area (20 m² for each classroom)	1	240	1	240	1	300	1	300	1	420
Overall Total 5		**1320**		**1680**		**2100**		**2460**		**2940**
Space for future expansion		**726**		**725**		**750**		**768**		**491**
Overall Total Ground Area		**6000**		**6750**		**7750**		**8500**		**9000**

Source: Official journal № 33

2. Primary school

2.1. Definition

- in the US, a school for children between five and nine years old, or an elementary school (Primary school , 2025)
- in the UK and other countries, a school for children between five and eleven years old (Primary school , 2025)
- In Algeria, the primary school is a public institution specializing in education and training. It enables students to acquire basic intellectual, moral, and social competencies. It constitutes the basic functional unit of the educational system and compulsory education and is included in the municipality's public property. (Official journal, 2016)

2.2. Primary school categories

- In Algeria, there are five categories of primary school :

Table 4: Primary school categories

Categories	Number of classrooms	Number of students
A	3	90
1	6	180
2	12	360
3	18	540
4	24	720

Source : Official journal № 33

2.3. Urban standers:

Before moving on to designing the interior spaces of the elementary school, some urban standards must be taken into account for its positioning within the area.

1. It is 500 meters away from the residential area

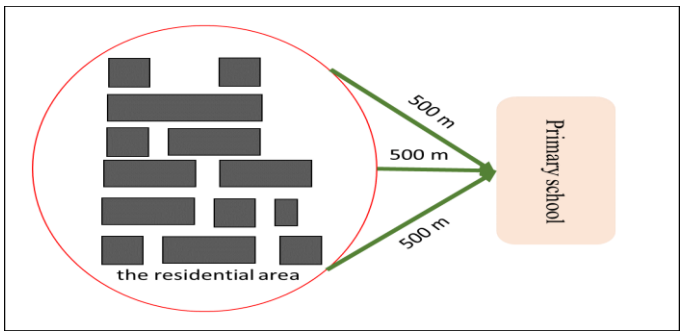


Figure 2: A diagram showing the distance between the residential area and the elementary school.
Source: Student, 2025

1. The time to go to school should not exceed ten minutes
2. The primary school will be located on an area of no less than 0.60 hectares

3. The school overlooks a side street, not a main street (Al-Azhar University Engineering Journal, 2010)

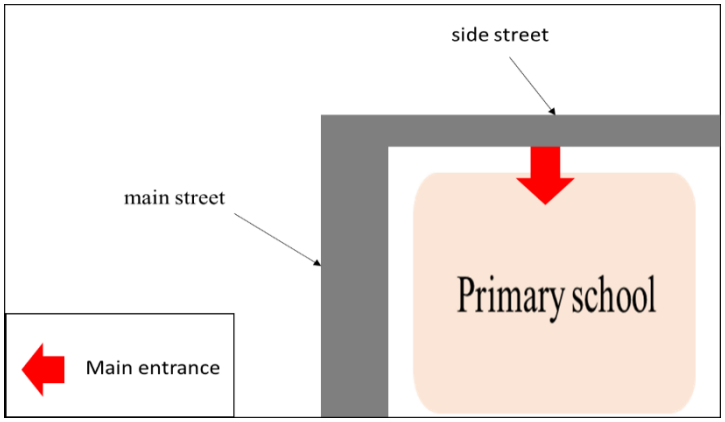


Figure 3: A diagram showing the location of the primary school entrance overlooking the side street

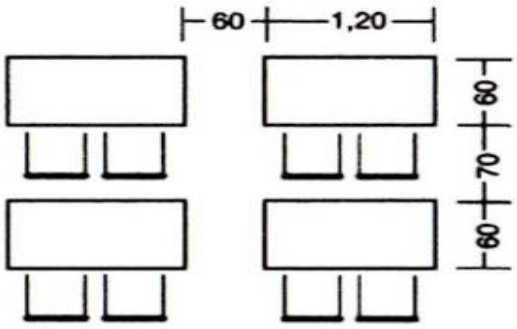
Source: Student, 2025

4. The number of grades should not exceed 3 to 4. Schools for the physically and mentally disabled are designed with 1 or 2 grades at most. (Neufert, 2010)

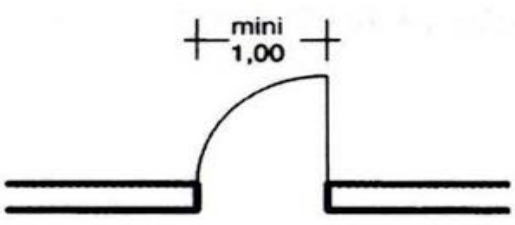
2.4. Architectural standers:

2.4.1 Classrooms :

- Standard classroom space: 50–60 m² for a class of 25–30 students, and each student should have a minimum of 1.8 square meters of space.
(Neufert, 2010)
- Ideal classroom dimensions: 7-8 m (length) x 6-7 m (width). Classrooms should have a rectangular or square shape to optimize visibility for all students. (Neufert, 2010)
- Ceiling height: Classrooms should have a height that is at least half their width and between 3-3.5 m in minimum. (Neufert, 2010)
- Window area: Should be 20-25% of the floor area to provide good natural lighting. Windows should cover approximately 22% of each side wall. Ideally, the light should enter from the left side of the students to avoid shadows obstructing their view. It should be placed at a height above seated students to prevent distractions. (Neufert, 2010)
- Distance between the board and the front seats should be 2–2.5 m, and the last desk should be between 7 and 9 meters from the blackboard. (Neufert, 2010)
- The classroom door should be located near the teacher's desk. (Neufert, 2010)



Picture 2:Minimum dimensions for a normal work table arrangement



Picture 1: Minimum width for classrooms doors

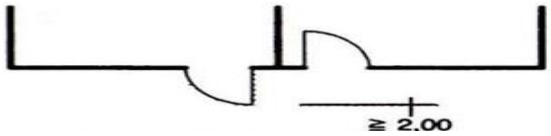
Source: Neufert, 2010

2.4.2 Orientation :

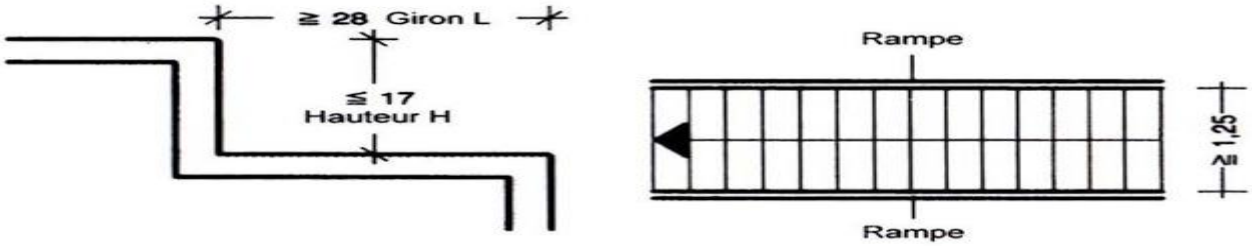
Classrooms should be oriented with their long axis facing north, northeast, or northwest to maximize natural light while minimizing direct sunlight during peak hours. If this orientation is not feasible, a southward orientation with sunshades is acceptable.

2.4.3 Corridors & Entrances

- Main hallway width: 2.5–3 m to allow for comfortable student movement. (Neufert, 2010)
- Staircase width: 1.25 m minimum. (Neufert, 2010)
- Main entrances: Must be wide (≥ 3 m) to avoid crowding. (Neufert, 2010)



Picture 3: Corridors, minimum width of the passageway greater than or equal to 2.00.



Picture 4 : Minimum width allowed in staircase design and staircase dimensions

Source: Neufert, 2010

2.4.4 Sanitary Facilities

Table 5:Indicative values for determining the number of sanitary installations

Number of users	Toilet	Urinal
40 Boys	1	2
20 girls	1	-
15 male teachers	1	1
10 female teachers	1	-

Source: Neufert, 2010

2.4.5 Library

- Library space: 0.35–0.55 m² per student.
- Bookshelf space: 20–30 books per linear meter.
- Reading areas: Tables with an area of 0.6–0.8 m² per student.

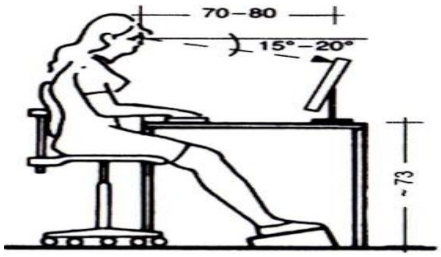
2.4.6 Parking & Transportation

Requires: Adequate access and maneuvering space (12 m wide before school).

Parking: 1 space per teacher/staff + visitor spaces

2.4.7 Computer room :

The layout of computer workstations must follow the guidelines for workstations equipped with monitors. To this end, the top edge of the monitor should be below eye level, so that the head is tilted 15 to 20°.



Picture 5: Proper dimensions for a computer desk
Source: Neufert, 2010

2.5. Primary school class- A Spaciel programme:

Table 6: Primary school class- A Spaciel programme

Halls	Number	Unit Area (m2)	Total Area (m2)
Pedagogical Wing			
Classrooms	3	62	186
Computer Room	1	70	70
Lecture Hall	1	50	50
Multipurpose Room	1	40	40
Student Restrooms	2	8	16
Total			362
Movement Area		20%	72
Overall Total 1			434
Administrative Wing			
Principal's Office	1	16	16
Assistant Principal's Office	0	16	0
Secretariat	1	9	9
Teachers' Room	1	30	30
Guardianship	1	6	6
Waiting Room	1	16	16
Archiv	1	16	16
Storage	1	12	12
Restrooms for Teachers and Administrative Staff	3	2	6
Total			111
Movement Area		10%	11
Overall Total 2			122
Residences			85
Attached shops			44
Restaurant			
Dining Hall	1	90	90
Entrance with attached facilities	1	20	20
Storage	1	32	32
Kitchen	1	33	33
Washing Basin	1	6	6
Total			181
Movement Area		10	9
Overall Total 3			190
Outdoor Area including Movement Parking (Width: 2 m)			
Rest Playground (18 m × 15 m)	1	270	270
Playground (18 m × 16 m)	1	288	288
Green Area and Rest Area (20 m² for each section)	1	60	60
Overall Total 4			618
Space for future expansion			406
Overall Total Ground Area			1900

Source: Official journal № 33

3. The project:

3.1. Definition

"A project is a unique, time- and cost-limited, complex targeted process of logically related tasks that must be accomplished in order to create products or services in accordance with quality standards and customer requirements." (Stare, 2019)

"It is a temporary endeavor to achieve some specific goals at a certain time" (Elaamiry, 2002)

In PMBOK 7th edition the project, define as a temporary endeavor undertaken to create a unique product, service, or result. The temporary nature of projects indicates a beginning and an end to the project work or phase of the project work. Projects can stand-alone or be part of a program or portfolio.

3.2. Project characteristics

The project has many characteristics that distinguish one project from another and allow it to differ. These characteristics are:

3.2.1. Temporariness or Finality: Projects are temporary endeavors. They have a clear beginning and end, meaning they are not ongoing or indefinite. Upon achieving the project goals, the project concludes. This characteristic highlights the project's lifecycle, which includes initiation, planning, execution, monitoring, and closure.
3.2.2. Uniqueness: Each project is unique, meaning it involves specific objectives, deliverables, and stakeholders that set it apart from other projects. Even if the project seems similar to others, factors like different teams, locations, resources, and constraints make it unique.
3.2.3. Goal Orientation: Projects are goal-oriented, meaning they are initiated to achieve specific objectives and outcomes. These goals can vary, such as building a new infrastructure, developing a software application, or launching a marketing campaign. The project's success is measured by how well it achieves its goals.
3.2.4. Limited: Projects are limited in terms of scope, resources, time, and budget. These limitations require careful planning and management to ensure the project stays within these constraints while delivering its intended results.
3.2.5. Complexity: Projects often involve multiple tasks, activities, and processes that need to be coordinated effectively. The complexity can stem from technical requirements, stakeholder involvement, resource allocation, and external factors. Effective project management addresses this complexity to ensure smooth execution.
3.2.6. Connected and Interdependent Project Tasks: Project tasks are interconnected and interdependent; meaning the completion of one task often relies on the initiation or completion of another. Effective project planning and scheduling ensure these dependencies are managed to avoid delays and conflicts.
3.2.7. Conflict: Projects can face various conflicts, such as resource constraints, stakeholder disagreements, and changes in scope. Managing conflicts is essential for project success and requires negotiation, communication, and problem-solving skills.
3.2.8. Riskiness: Projects inherently carry risks due to uncertainties, changes, and unforeseen events. Identifying, assessing, and managing risks are crucial aspects of project management to minimize their impact and increase the likelihood of project success.(Stare, 2019)

3.3. Project type

Project types vary from one field to another and from one perspective to another, but we can summarize the types of projects in the following points: (Stare, 2019)

3.3.1. Investment projects: they are projects aimed at investing resources, primarily capital, to achieve financial returns. These projects can involve the acquisition, creation, or enhancement of assets that generate revenue or appreciate in value over time.
3.3.2. Research and development projects: R&D projects focus on creating new knowledge, products, or processes through systematic investigation and experimentation. These projects aim to innovate and develop cutting-edge solutions to existing problems or create entirely new opportunities.
3.3.3. Organisational projects: Organisational projects involve changes to the structure, processes, or culture of an organization. These projects aim to improve efficiency, effectiveness, and overall performance within an organization

4. Project life cycle:

4.1. Definition

The project life cycle encompasses several phases from inception to completion. It provides project managers with a structured framework for planning, execution, and control. Although there are various versions of the project life cycle, the most common one includes five stages: initiation, planning, execution, monitoring and control, and closure. (Bridges, 2025)

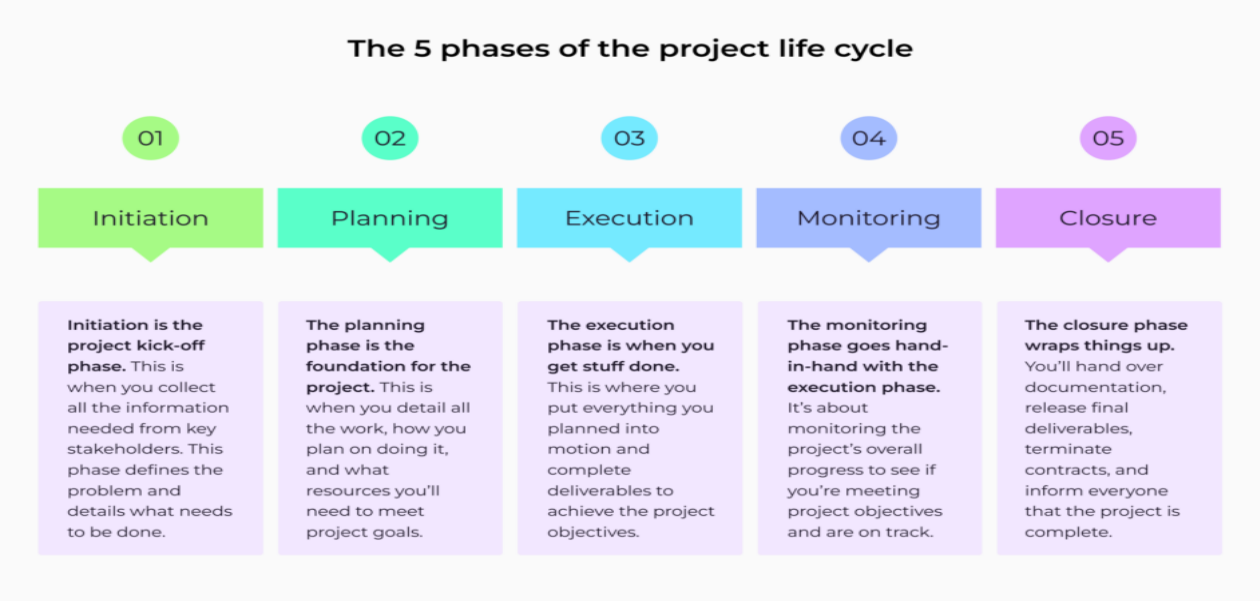
4.2. Type of project life cycle:

There is no single type of project life cycle. This depends on the project manager's choice and desire to manage his project, whether using traditional or modern methods. In other cases, he may prefer to combine the two. The following points enumerate these types: (Bridges, 2025)

4.2.1.1. Predictive (or waterfall) life cycle: The predictive life cycle, often referred to as the waterfall model, is a linear and sequential approach to project management. Each phase of the project must be completed before the next one begins.
4.2.1.2. Iterative life cycle: The iterative life cycle focuses on repetitive cycles, or iterations, where the project is developed incrementally through repeated refinement.
4.2.1.3. Incremental life cycle: The incremental life cycle delivers the project in small, usable sections or increments, each adding value to the final product.
4.2.1.4. Agile (or adaptive) life cycle: The agile life cycle is a flexible and adaptive approach to project management, focused on continuous improvement, customer collaboration, and responding to change.
4.2.1.5. Hybrid life cycle: The hybrid life cycle combines elements from different life cycle models, such as predictive, iterative, and agile; to suit the specific needs of a project.

4.3. Project life cycle phases:

Like any other cycle that has stages, the project life cycle is characterized by a set of phases through which we can know the progress of the project, and these phases are:



Picture 6: Project life cycle phases
Source: ResourceGuru website

5. Project stakeholders

5.1. Stakeholder's definition:

A stakeholder can be an individual, group, or organization affected by the outcome of a project or business venture. They have a vested interest in the project's success and can be either internal or external to the sponsoring organization. Stakeholders are crucial as their decisions can positively or negatively impact the project. Additionally, there are key stakeholders whose support is essential for the project's existence. (Landau, 2025)

Stakeholders can be individuals, groups, or organizations that may affect, be affected by, or perceive themselves to be affected by a decision, activity, or outcome of a portfolio, program, or project. Stakeholders also directly or indirectly influence a project, its performance, or outcome in either a positive or a negative way (Institute, 2021)

5.2. Types of Stakeholders

The stakeholders in the project are diverse and many, we can classify them as follows:

1.2.1 Internal Stakeholders

Internal stakeholders are individuals or groups within the organization who are directly influenced by the project's outcomes. They are associated with the organization that is managing the project and can include employees, owners, board members, project managers, investors, and others. (Landau, 2025)

1.2.2 External Stakeholders

External stakeholders are individuals or groups outside the organization who are indirectly affected by its projects. While they are influenced by the organization's activities, they do not work for it. This category includes suppliers, customers, creditors, clients, intermediaries, competitors, society at large, government entities, and more. (Landau, 2025)

5.3. Construction project stakeholders:

In construction projects, Stakeholders play an important role in its completion, including:

5.3.1. Client/Owner: The client or owner is the entity that initiates the project and provides the funding. They define the project's requirements and expectations. Examples: Private individuals, companies, government agencies.
5.3.2. Project Manager: The project manager oversees the entire project, ensuring it is completed on time, within budget, and to the required quality standards. They coordinate between all stakeholders. Examples: Construction project managers, engineering managers.
5.3.3. Architects and Designers: Architects and designers are responsible for creating the project's design and ensuring it meets the client's needs and regulatory requirements. Examples: Architectural firms, interior designers.
5.3.4. Engineers: Engineers handle the technical aspects of the project, including structural, civil, mechanical, and electrical engineering. Examples: Structural engineers, civil engineers, MEP (Mechanical, Electrical, and Plumbing) engineers.
5.3.5. Contractors and Subcontractors: Contractors and subcontractors are responsible for the actual construction work. They bring the project's design to life by providing labor, materials, and equipment. Examples: General contractors, specialty subcontractors (e.g., plumbing, electrical, HVAC).
5.3.6. Suppliers and Vendorsole: Suppliers and vendors provide the materials, equipment, and services needed for the construction project. Examples: Material suppliers (e.g., concrete, steel), equipment rental companies.
5.3.7. Regulatory Authorities: Regulatory authorities ensure that the project complies with all relevant laws, regulations, and codes. They conduct inspections and grant necessary permits. Examples: Local government agencies, building code officials.
5.3.8. Financial Institutions: Financial institutions provide the necessary funding for the project through loans, mortgages, or other financial arrangements. Examples: Banks, investment firms.
5.3.9. Legal Advisors: Legal advisors handle the legal aspects of the project, including contracts, permits, and dispute resolution. Examples: Lawyers, legal consultants.
5.3.10. Community and Public: The community and public can be affected by the construction project, especially if it impacts the local environment, traffic, or property values. Their input may be sought during the planning stages. Examples: Local residents, community organizations.
5.3.11. Environmental Specialists: Environmental specialists assess and mitigate the project's environmental impact, ensuring sustainability and compliance with environmental regulations. Examples: Environmental consultants, sustainability experts.
5.3.12. Employees/Workers: Employees and workers are involved in the day-to-day activities on the construction site, executing the tasks outlined in the project plan. Examples: Construction workers, site supervisors.

Each of these stakeholders plays a crucial role in the successful completion of a construction project. Effective communication and collaboration among stakeholders are essential to ensure the project meets its objectives and is completed. (Moore, 2024)

6. Project management

6.1. Definition:

It is a dynamic process that uses the appropriate resources of the organization in a targeted and planned manner to achieve some clear goals known as strategic needs and is implemented within the framework of a set of specific controls. (Elaamiry, 2002)

The application of knowledge, skills, tools, and techniques to project activities to meet project requirements. Project management refers to guiding the project work to deliver the intended outcomes. Project teams can achieve the outcomes using a broad range of approaches (e.g., predictive, hybrid, and adaptive). (Institute, 2021)

6.2. Project management knowledge areas:

The 44 project management processes are organised into nine knowledge areas:

6.2.1. Project Integration Management: describes the processes and activities that integrate the various elements of project management, which are identified, defined, combined, unified and coordinated within the Project Management Process Groups. It consists of the Develop Project Charter, Develop Preliminary Project Scope Statement, Develop Project Management Plan, Direct and Manage Project Execution, Monitor and Control Project Work, Integrated Change Control, and Close Project management processes. (PMI, 2004)

6.2.2. Project scope management: "describes the processes involved in ascertaining that the project includes all the work required, and only the work required, to complete the project successfully. It consists of the Scope Planning, Scope Definition, Create WBS, Scope Verification, and Scope Control project management processes." (PMI, 2004)

6.2.3. Project Schedule management: "describes the processes concerning the timely completion of the project. It consists of the Activity Definition, Activity Sequencing, Activity Resource Estimating, Activity Duration Estimating, Schedule Development, and Schedule Control project management processes." (PMI, 2004)

6.2.4. Project Cost Management: "describes the processes involved in planning, estimating, budgeting, and controlling costs so that the project is completed within the approved budget. It consists of the Cost Estimating, Cost Budgeting, and Cost Control project management processes." (PMI, 2004)

6.2.5. Project Quality Management: "describes the processes involved in assuring that the project will satisfy the objectives for which it was undertaken. It consists of the Quality Planning, Perform Quality Assurance, and Perform Quality Control project management processes." (PMI, 2004)

6.2.6. Project Resource Management: describes the processes that organize and manage the project team. It consists of the Human Resource Planning, Acquire Project Team, Develop Project Team, and Manage Project Team project management processes. (PMI, 2004)

6.2.7. Project Communications Management: "describes the processes concerning the timely and appropriate generation, collection, dissemination, storage and ultimate disposition of project information. It consists of the Communications Planning, Information Distribution, Performance Reporting, and Manage Stakeholders project management processes." (PMI, 2004)

6.2.8. Project Risk Management: "describes the processes concerned with conducting risk management on a project. It consists of the Risk Management Planning, Risk Identification, Qualitative Risk Analysis, Quantitative Risk Analysis, Risk Response Planning, and Risk Monitoring and Control project management processes." (PMI, 2004)

6.2.9. Project Procurement Management: "describes the processes that purchase or acquire products, services, or results, as well as contract management processes. It consists of the Plan Purchases and Acquisitions, Plan Contracting, Request Seller Responses, Select Sellers, Contract Administration, and Contract Closure project management processes." (PMI, 2004)

6.2.10. Project Stakeholder Management: "Project Stakeholder Management includes the processes required to identify the people, groups, or organizations that could impact or be impacted by the project, to analyse stakeholder expectations and their impact on the project, and to develop appropriate management strategies for effectively engaging stakeholders in project decisions and execution." (PMI, 2004)

6.3. Project management processes groups

"This standard describes the project management processes employed to meet project objectives. Project management processes are grouped in five Project Management Process Groups:

6.3.1. Initiating Process Group. The process (es) performed to define a new project or a new phase of an existing project by obtaining authorization to start the project or phase.

6.3.2. Planning Process Group. The process (es) required to establish the scope of the project, refine the objectives, and define the course of action required to attain the objectives that the project was undertaken to achieve.
6.3.3. Executing Process Group. The process (es) performed to complete the work defined in the project management plan to satisfy the project requirements.
6.3.4. Monitoring and Controlling Process Group. The process (es) required to track, review, and regulate the progress and performance of the project; identify any areas in which changes to the plan are required; and initiate the corresponding changes.
6.3.5. Closing Process Group. The process (es) performed to formally complete or close a project, phase, or contract." (PMI, PMBOK)

Picture 7: Project management knowledge areas

Source: ProjectSkillsMentor website, 2024

6.4. The project manager

6.4.1. Definition :

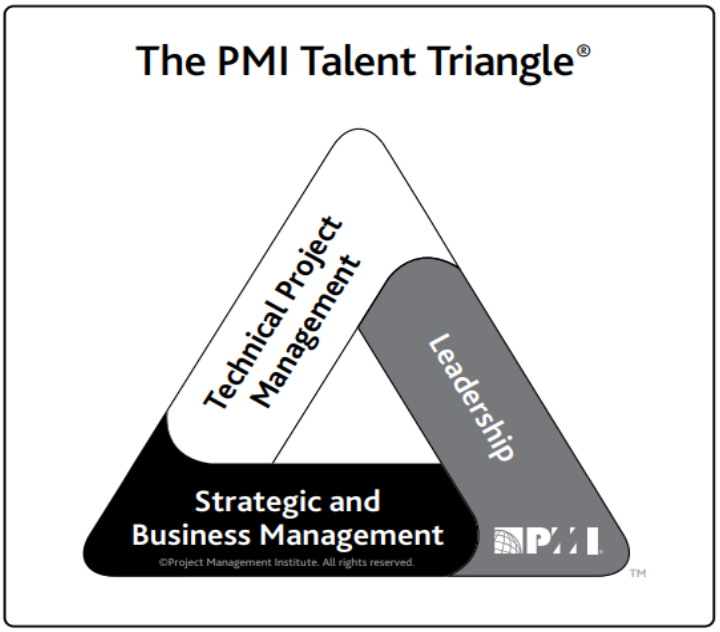
"The project manager is the person assigned by the performing organization to lead the team that is responsible for achieving the project objectives" (PMI, PMBOK)

6.4.2. Project manager role: (PMI, PMBOK)

1. Leadership Role: The project manager leads the project team to achieve the project's objectives.
2. Involvement throughout the Project: Many project managers are involved from the initiation to the closing of a project.
3. Pre-Initiation Activities: In some organizations, project managers participate in evaluation and analysis activities before the project starts.
4. Consultation and Strategic Planning: They may consult with executive and business unit leaders to advance strategic objectives, improve performance, or meet customer needs.
5. Business Analysis and Portfolio Management: Project managers may manage or assist in business analysis, business case development, and portfolio management.
6. Tailored Role: The role of a project manager varies by organization and is tailored to fit the specific needs of the organization and project.

6.4.3. Project manager competence :

1. Technical Project Management: This involves the knowledge, skills, and behaviors specific to project, program, and portfolio management, focusing on the technical aspects of the role.
2. Leadership: This encompasses the knowledge, skills, and behaviors required to guide, motivate, and direct a team, aiding the organization in achieving its business goals.
3. Strategic and Business Management: This refers to the industry and organizational knowledge and expertise that enhance performance and deliver better business outcomes. (PMI, PMBOK)



Picture 8: the PMI Talent Triangle

Source: PMBOK, 2013

7. Project quality management:

7.1. Quality and quality management definitions:

- **Internationale Organization for Standardization (ISO) 9000 :2015 :**

An organization focused on quality promotes a culture that results in the behaviour, attitudes, activities and processes that deliver value through fulfilling the needs and expectations of customers and other relevant interested parties.

The quality of an organization's products and services is determined by the ability to satisfy customers and the intended and unintended impact on relevant interested parties.

The quality of products and services includes not only their intended function and performance, but also their perceived value and benefit to the customer

- **ISO 9000 : 2005:**

The degree to which a set of inherent characteristics fulfill requirements

- **Joseph Juran :**

Juran defines quality as fitness for use in terms of design, conformance, availability, safety, and field use.

- **Project management Body of knowledge :**

Project Quality Management encompasses the processes and activities within the performing organization that define quality policies, objectives, and responsibilities to ensure the project meets its intended needs. It employs policies and procedures to implement the organization's quality management system within the project context and supports ongoing process improvements for the organization. Its goal is to guarantee that all project and product requirements are fulfilled and properly validated.

7.2. Project quality principles:

7.2.1. Customer Focus

Quality management principles are fundamental beliefs, norms, rules, and values that guide an organization in improving its performance and achieving excellence. Here are the seven key principles of quality management:

The primary focus of quality management is to meet customer requirements and strive to exceed customer expectations. It allows:

- Increased customer satisfaction and loyalty.

- Enhanced reputation and market share.

- Improved customer value and repeat business.

7.2.2. Leadership

Leaders at all levels establish unity of purpose and direction and create conditions in which people are engaged in achieving the organization's quality objectives. It allows:

- Clear organizational goals and direction.

- Increased employee engagement and motivation.

- Enhanced organizational performance.

7.2.3. Engagement of People

Competent, empowered, and engaged people at all levels are essential to enhance the organization's capability to create and deliver value. It allows:

- Improved employee satisfaction and retention.
- Enhanced innovation and creativity.
- Better collaboration and teamwork.

7.2.4. Process Approach

Consistent and predictable results are achieved more effectively and efficiently when activities are understood and managed as interrelated processes that function as a coherent system. It allows

- Improved efficiency and effectiveness.
- Better resource management.
- Enhanced ability to achieve desired outcomes.

7.2.5. Improvement

Successful organizations have an ongoing focus on improvement. It allows

- Increased ability to anticipate and react to internal and external risks and opportunities.
- Enhanced organizational performance and competitiveness.
- Continuous improvement of processes and products.

7.2.6. Evidence-Based Decision Making

Decisions based on the analysis and evaluation of data and information are more likely to produce desired results. . It allows

- Improved decision-making accuracy and effectiveness.
- Enhanced ability to measure and track performance.
- Better identification of improvement opportunities.

7.2.7. Relationship Management

For sustained success, organizations manage their relationships with interested parties, such as suppliers, partners, and customers. It allows

- Improved collaboration and communication.
- Enhanced ability to create value for all parties.
- Better risk management and resource optimization.

These principles form the foundation of quality management systems like ISO 9001 and help organizations achieve excellence by focusing on customer satisfaction, leadership, employee engagement, process efficiency, continuous improvement, data-driven decision-making, and strong relationships. (ISO, 2015)

7.3. Project quality pioneers

These pioneers have significantly shaped the field of quality management, and their contributions continue to influence modern quality practices and principles.

7.3.1. W. Edwards Deming

- Known for his work in Japan post-World War II, where he helped improve quality and productivity.
- Developed the "14 Points for Management," which outline key principles of quality management.
- Emphasized the importance of statistical process control and continuous improvement.
- Introduced the PDCA (Plan-Do-Check-Act) cycle. (Institut, 2025).

7.3.2. Joseph M. Juran

- Developed the "Juran Trilogy," which consists of quality planning, quality control, and quality improvement.

- Introduced the Pareto Principle in the quality field, stating that 80% of the effects come from 20% of the causes.

- Authored several influential books on quality management, including "Juran's Quality Handbook." (Kenett, 2007)

7.3.3. Philip B. Crosby

- Emphasized the importance of prevention over inspection in quality management.

- Introduced the concept of "zero defects," aiming to eliminate defects and errors.

- Developed the "Four Absolutes of Quality": conformance to requirements, prevention, zero defects, and the price of non-conformance.

- Authored the book "Quality is Free," promoting the idea that the cost of preventing defects is lower than dealing with them after they occur.

(Philip Crosby: Contributions to the Theory of Process Improvement and Six Sigma, 2025)

7.3.4. Kaoru Ishikawa

- Developed the cause and effect diagram, also known as the "Ishikawa diagram" or "fishbone diagram," used to identify root causes of problems.

- Emphasized the importance of involving all employees in the quality management process.

- Introduced the concept of "total quality control," involving all employees and using data and statistical analysis for continuous improvement.

(Kaoru Ishikawa: Contribution to the Theory of Process Improvement, 2025)

7.3.5. Shigeo Shingo

- Known for his work on the Toyota Production System and Just-In-Time (JIT) manufacturing.

- Developed the concept of "poka-yoke" (mistake proofing) to prevent errors in the production process.

- Emphasized the importance of reducing waste and improving efficiency. (Admin, 2019)

7.4. Quality management processes

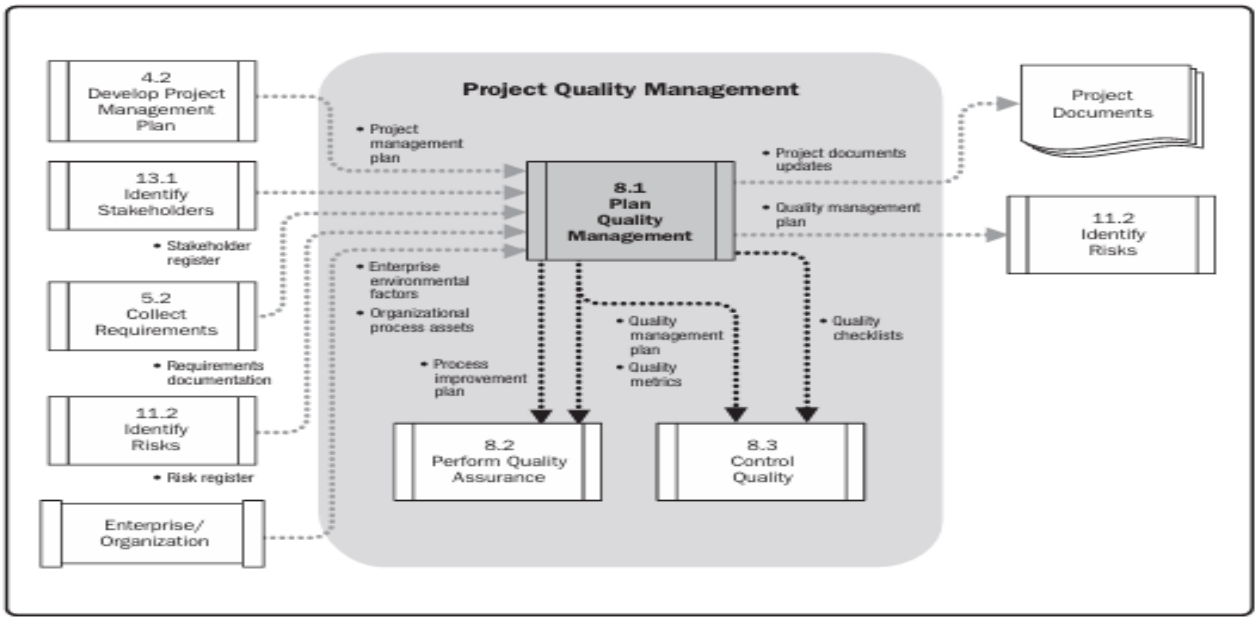
Project Quality Management includes processesand activities to determine quality policies, objectives, and responsibilities to ensure the project satisfies its intended needs. It uses organizational quality management systems and supports continuous improvement activities. The goal is to ensure that project and product requirements are met and validated. Main Processes:

7.4.1. Plan Quality Management :

Quality planning should be performed in parallel with the other planning processes. For example, proposed

changes in the deliverables to meet identified quality standards may require cost or schedule adjustments and a detailed risk analysis of the impact to plans.

The quality planning techniques discussed here are those used most frequently on projects. There are many others that may be useful on certain projects or in some application areas. (PMI, PMBOK Guide, 2013)

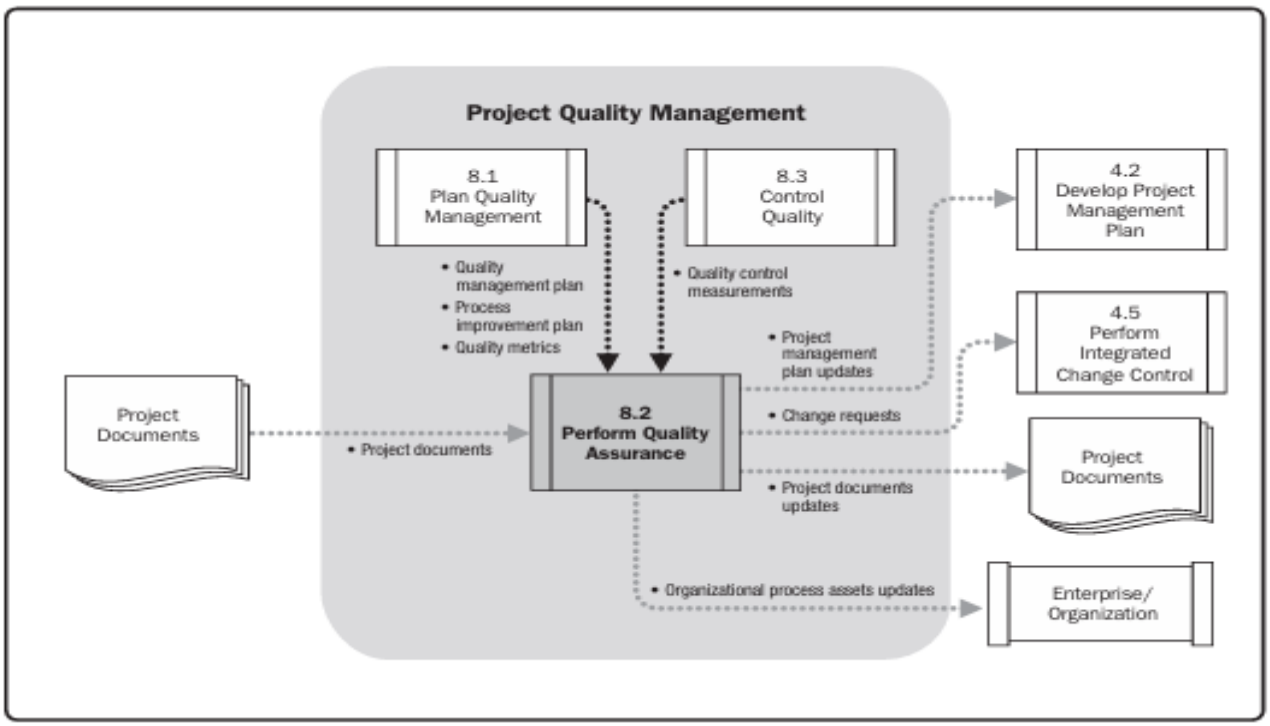


Picture 10: Plan Quality Management data Flow diagram

Source: PMBOK, 2013

7.4.2. Perform Quality Assurance :

Perform Quality Assurance is the process of auditing the quality requirements and the results from quality control measurements to ensure that appropriate quality standards and operational definitions are used. The key benefit of this process is that it facilitates the improvement of quality processes (PMI, PMBOK Guide, 2013)



Picture 9: Perform Quality Assurance data Flow diagram

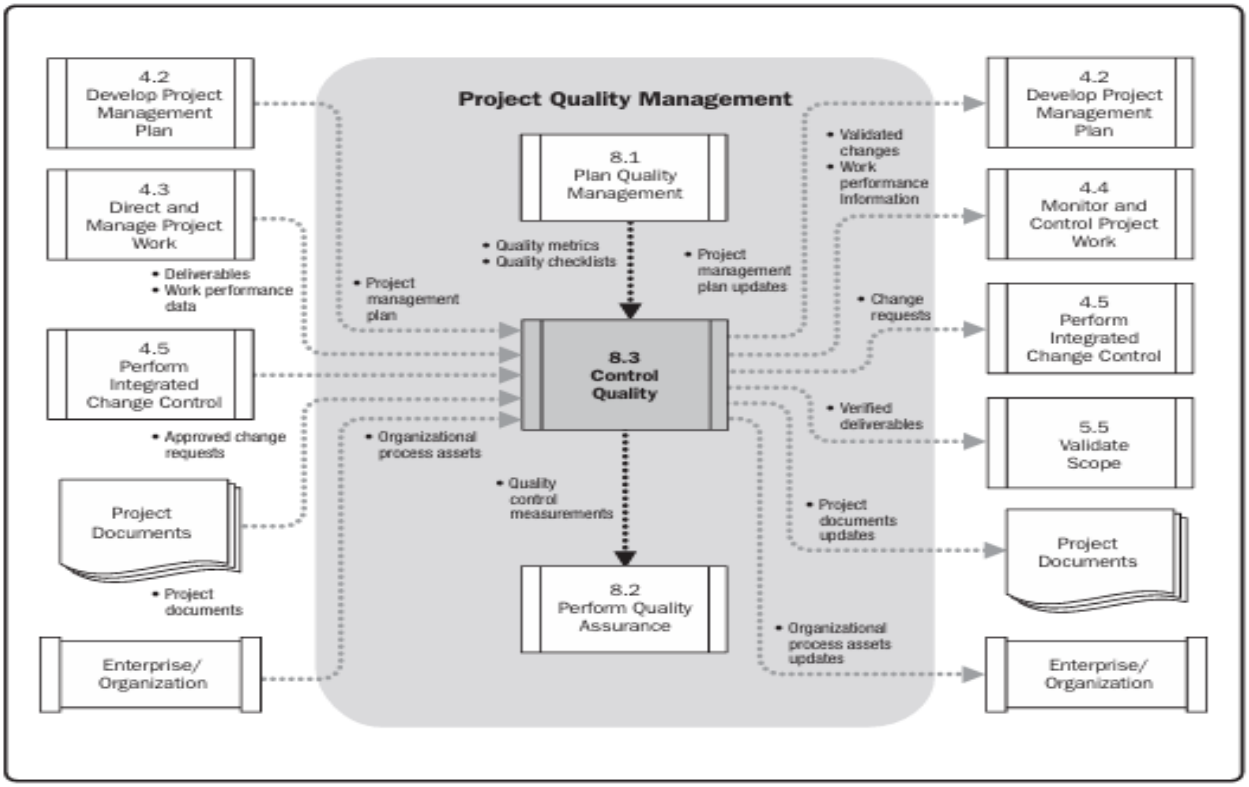
Source: PMBOK, 2013

7.11.1 Control Quality :

Control Quality is the process of monitoring and recording results of executing the quality activities to assess performance and recommend necessary changes. The key benefits of this process include: (1) identifying the causes of poor process or product quality and recommending and/or taking action to eliminate them; and (2) validating that project deliverables and work meet the requirements specified by key stakeholders necessary for final acceptance

The Control Quality process uses a set of operational techniques and tasks to verify that the delivered output will meet the requirements. Quality assurance should be used during the project's planning and executing phases to provide confidence that the stakeholder's requirements will be met and quality control should be used during the project executing and closing phases to formally demonstrate, with reliable data, that the sponsor and/or customer's acceptance criteria have been met. The project management team may have a working knowledge of statistical control processes to evaluate data contained in the control quality outputs. Among other subjects, the team may find it useful to know the differences between the following pairs of terms:

- Prevention (keeping errors out of the process) and inspection (keeping errors out of the hands of the customer).
- Attribute sampling (the result either conforms or does not conform) and variables sampling (the result is rated on a continuous scale that measures the degree of conformity).
- Tolerances (specified range of acceptable results) and control limits (that identify the boundaries of common variation in a statistically stable process or process performance).



Picture 10: control Quality data Flow diagram

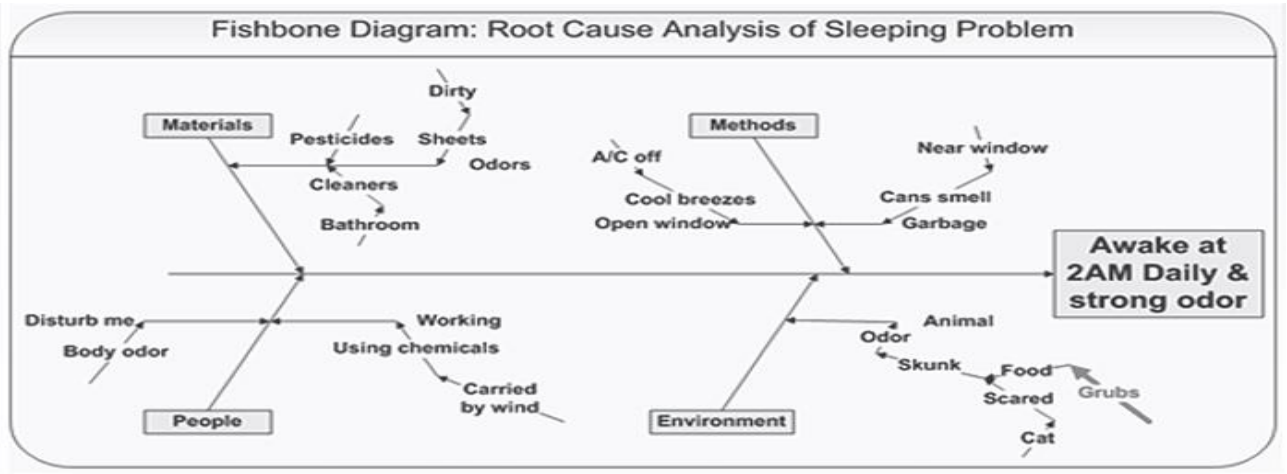
Source: PMBOK, 2013

7.5. Quality management tools and methods

Quality management tools and methods are essential for ensuring that products, services, and processes meet or exceed customer expectations. Here are some of the most commonly used tools and methods:

7.5.1. Seven Basic Quality Tools :

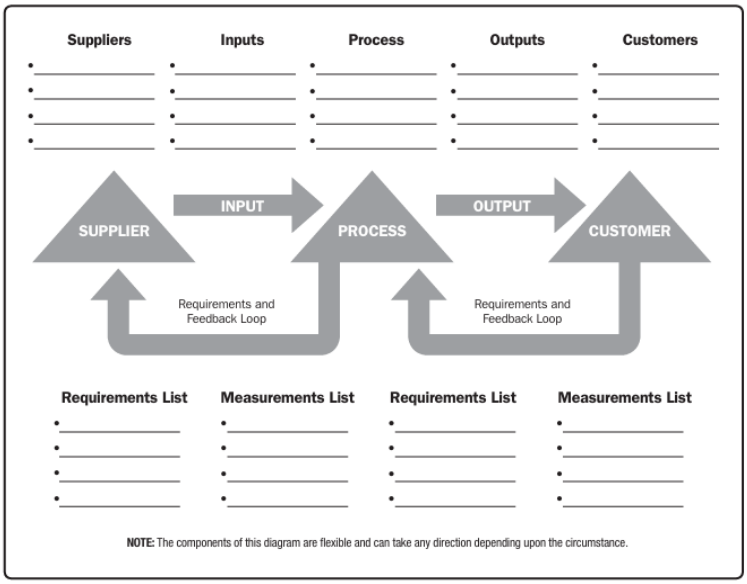
1) Cause-and-effect diagrams, also called fishbone or Ishikawa diagrams, are tools used to identify the root cause of a problem. The problem statement is placed at the "head" of the diagram, and potential causes are systematically traced back by repeatedly asking "why." This process continues until the root cause is actionable or all reasonable possibilities are explored. These diagrams help project teams connect undesirable effects, often identified through control charts, to specific causes, enabling the implementation of corrective actions to eliminate variations. (PMI, PMBOK Guide, 2013)



Picture 11: Cause & Effect Diagram

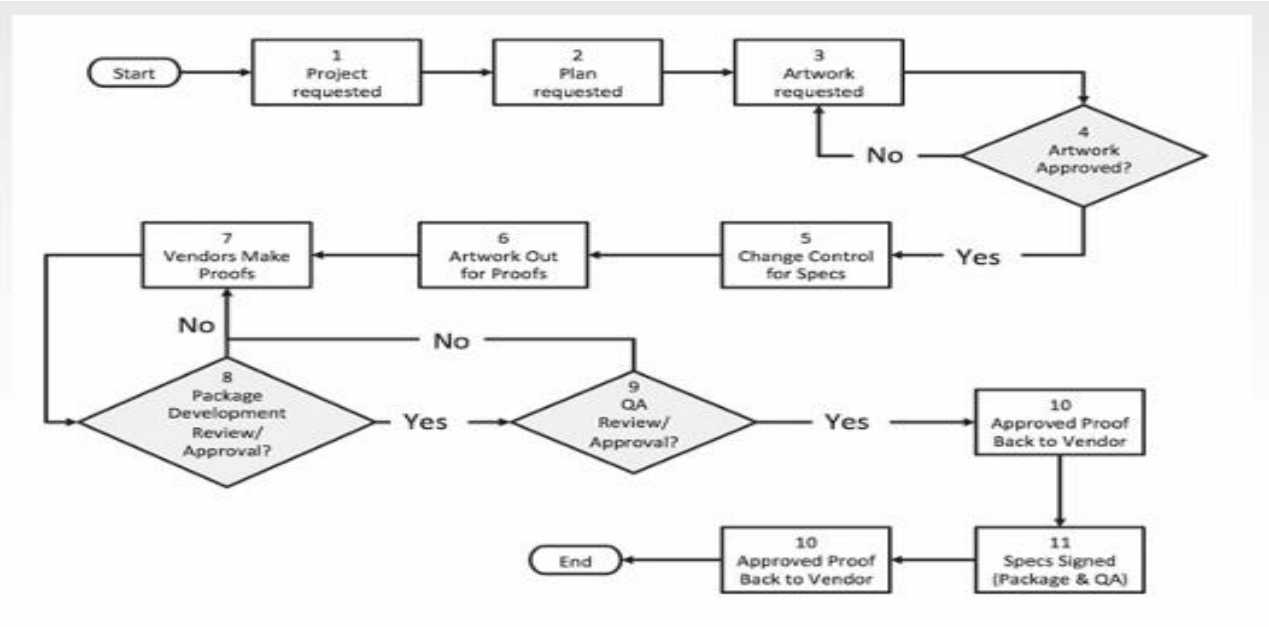
Source : PMBOK, 2013

2) Flowcharts, also known as process maps, illustrate the sequence of steps and potential branching in a process that converts inputs into outputs. They highlight activities, decision points, loops, parallel paths, and the overall workflow, often within a SIPOC model. Flowcharts are valuable for analyzing processes, especially for estimating quality costs. By leveraging branching logic and relative frequencies, they help calculate the expected monetary value for tasks ensuring conformance and addressing nonconformance. (PMI, PMBOK Guide, 2013)



Picture 12: the SIPOC Model

Source: PMBOK, 2013



Picture 13: Flowchart

Source: PMBOK, 2013

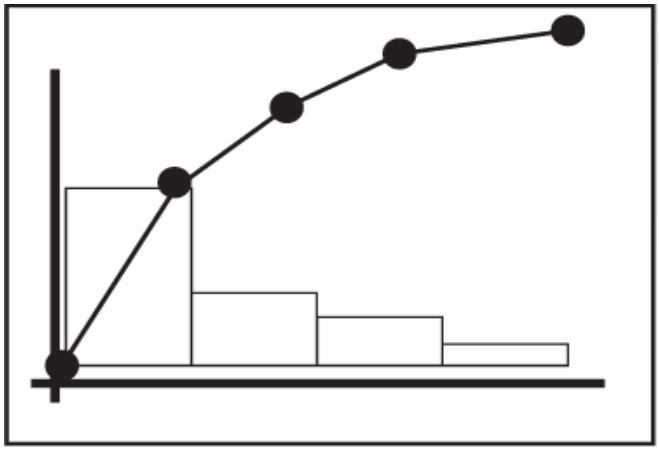
3) Check sheets, also called tally sheets, serve as checklists for organizing and collecting data effectively, particularly when addressing potential quality issues. They are especially helpful in gathering attribute data during inspections to identify defects. For instance, information about defect frequency or impact gathered through checklists is often visualized using Pareto diagrams. (PMI, PMBOK Guide, 2013)

Category	Strokes	Frequency
Attribute 1		
Attribute 2		
Attribute ...		
Attribute n		

Picture 14: Checksheet

Source : PMBOK, 2013

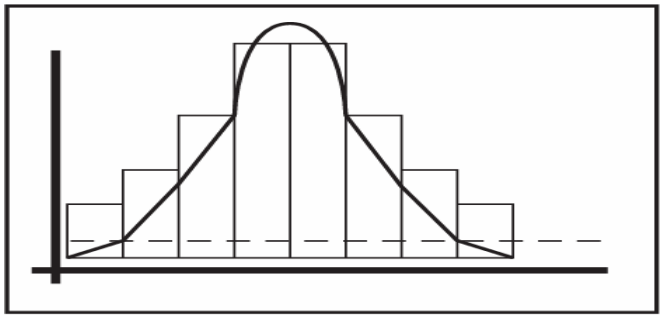
4) Pareto diagrams are a specialized type of vertical bar chart used to highlight the key sources that contribute to the majority of a problem's effects. The categories on the horizontal axis represent a probability distribution, accounting for 100% of observations. The causes are arranged in descending order of frequency or impact, with a default "other" category encompassing unspecified causes. These diagrams typically group data into categories that measure frequencies or consequences. (PMI, PMBOK Guide, 2013)



Picture 15: Pareto Diagram

Source: PMBOK, 2013

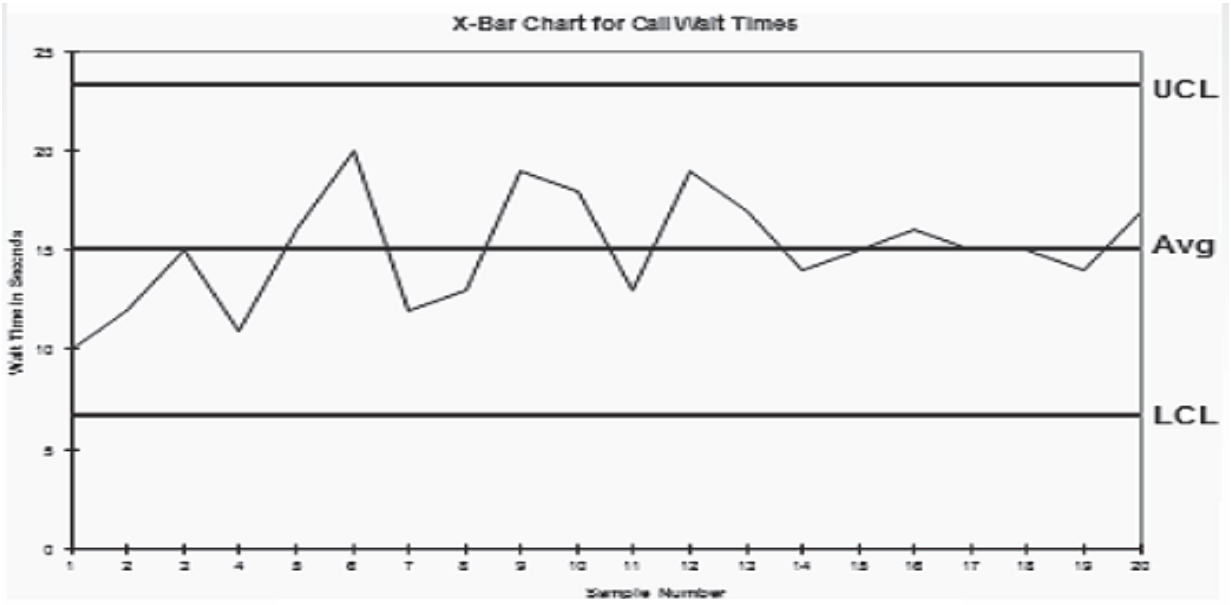
5) Histograms, a unique type of bar chart, are used to illustrate the central tendency, spread, and shape of a statistical distribution. Unlike control charts, they do not account for the impact of time on variations within the distribution. (PMI, PMBOK Guide, 2013)



Picture 16: Histogram

Source: PMBOK, 2013

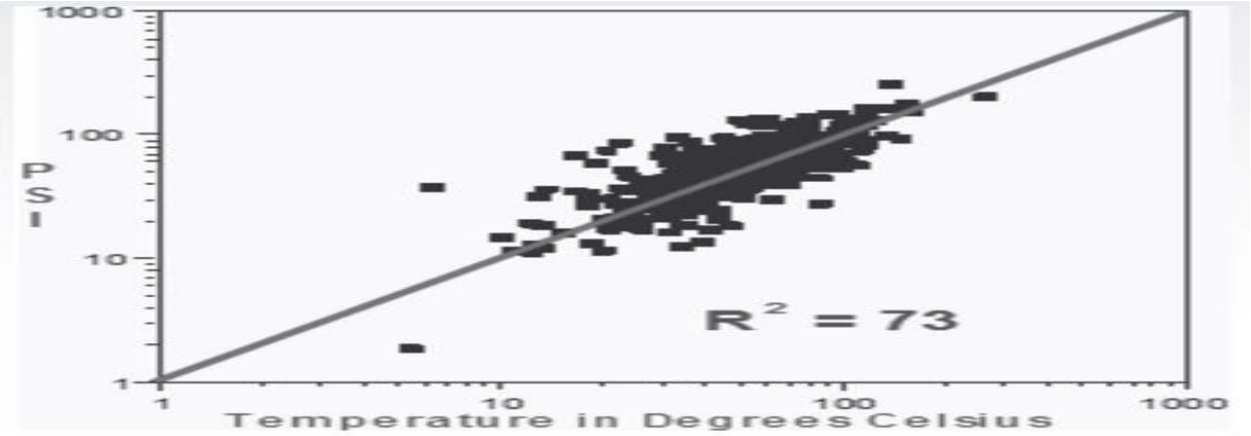
6) Control charts help assess whether a process is stable and performs predictably by using upper and lower specification limits, based on agreement requirements, and control limits, calculated through statistical methods. Control limits identify the natural capability of a stable process and guide when corrective actions are necessary to maintain stability. For repetitive processes, control limits are often set at ±3 standard deviations from the mean. A process is flagged as "out of control" if: (1) a data point exceeds the control limit, (2) seven consecutive points fall above the mean, or (3) seven consecutive points fall below the mean. While typically used for monitoring repetitive manufacturing activities, control charts are also valuable for tracking cost and schedule variances, scope changes, and other project management metrics. (PMI, PMBOK Guide, 2013)



Picture 17: Control Chart

Source: PMBOK, 2013

7) Scatter diagrams, also known as correlation charts, display ordered pairs (X, Y) to investigate how changes in the independent variable (X) affect the dependent variable (Y). The relationship can exhibit positive correlation (proportional change), negative correlation (inverse change), or no correlation at all (zero correlation). When a correlation is identified, a regression line can be calculated to predict how variations in the independent variable influence the dependent variable. (PMI, PMBOK Guide, 2013)

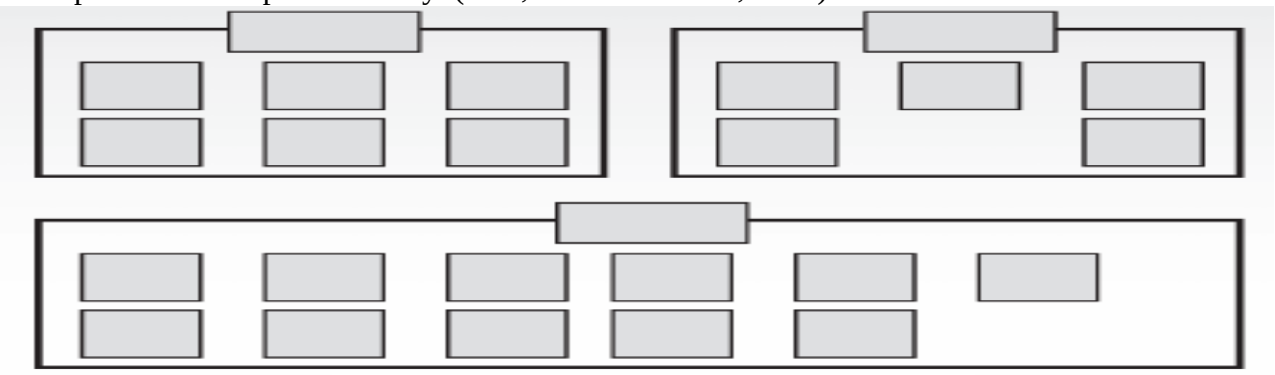


Picture 18: Scatter Diagram

Source: PMBOK, 2013

7.5.2. Quality management and control tools

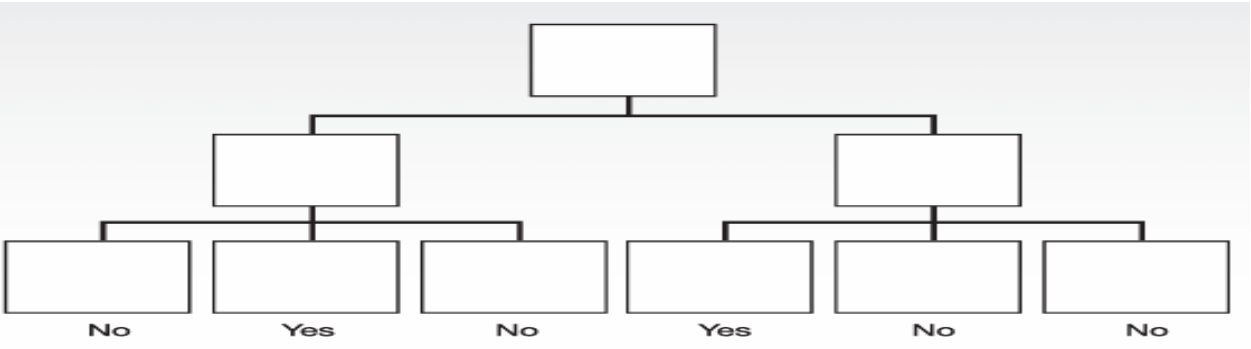
1) Affinity diagrams, akin to mind-mapping techniques, are tools for generating ideas and linking them to form structured patterns of thought about a problem. In project management, they can support the development of the Work Breakdown Structure (WBS) by organizing and structuring the decomposition of scope effectively. (PMI, PMBOK Guide, 2013)



Picture 19: Affinity Diagram

Source: PMBOK, 2013

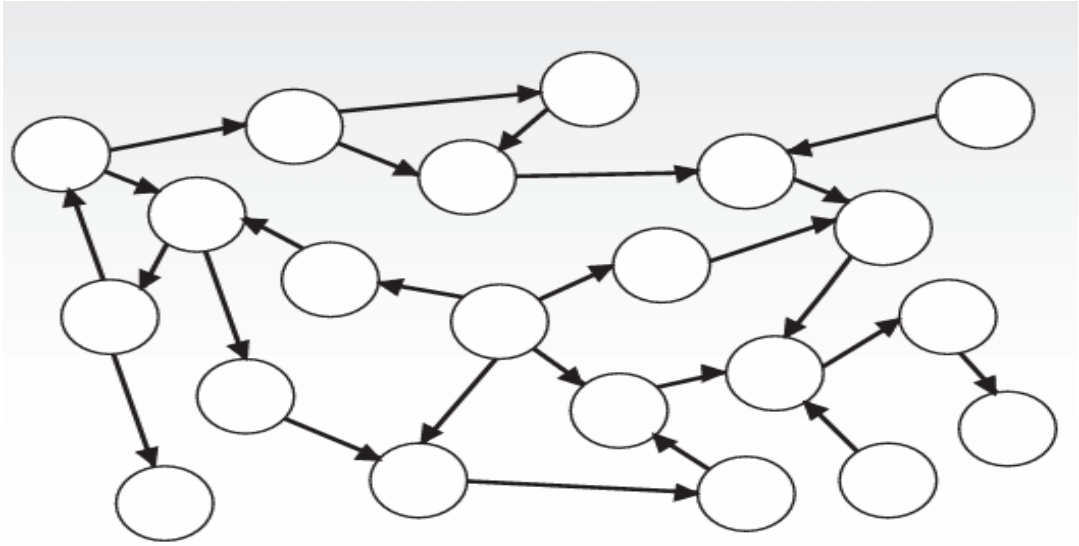
2) Process decision program charts (PDPC) are tools designed to analyze a goal and outline the steps required to achieve it. They are particularly effective for contingency planning, helping teams anticipate intermediate steps that could potentially hinder the achievement of the goal. (PMI, PMBOK Guide, 2013)



Picture 20: PDPC

Source: PMBOK, 2013

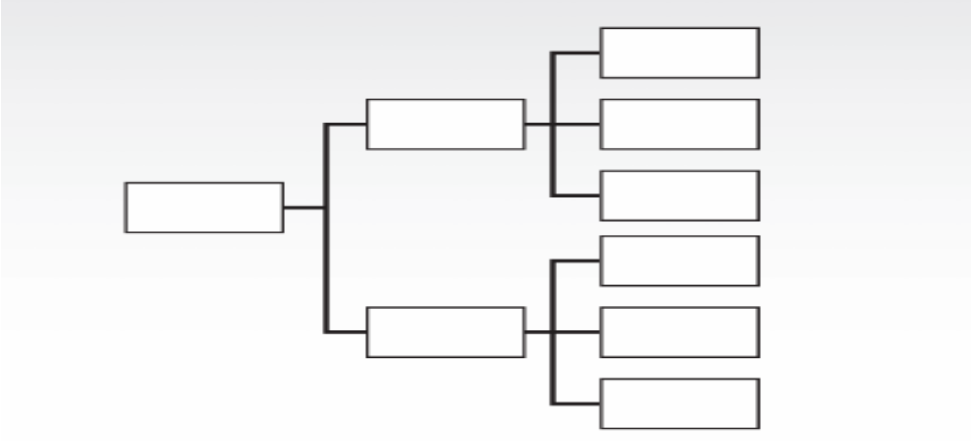
3) Interrelationship digraphs, an adaptation of relationship diagrams, are tools for creative problem solving in moderately complex scenarios with interconnected logical relationships involving up to 50 items. They can be developed using data from other tools such as affinity diagrams, tree diagrams, or fishbone diagrams. (PMI, PMBOK Guide, 2013)



Picture 21: Interrelationship Digraph

Source: PMBOK, 2013

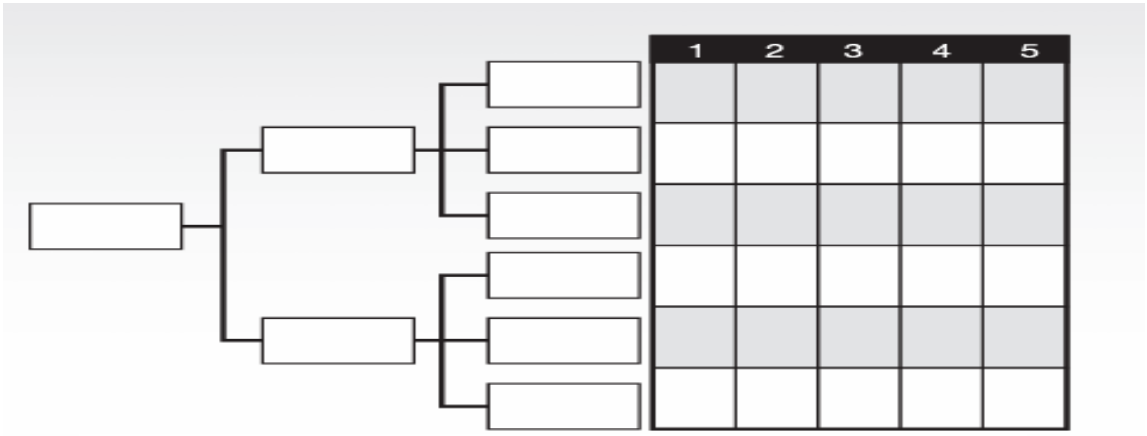
4) Tree diagrams, also known as systematic diagrams, depict decomposition hierarchies, such as the Work Breakdown Structure (WBS), Risk Breakdown Structure (RBS), or Organizational Breakdown Structure (OBS). In project management, they help visualize parent-to-child relationships within hierarchies that follow systematic nesting rules. Tree diagrams can be displayed horizontally, like RBS, or vertically, as seen in team hierarchies or OBS. Their ability to create nested branches leading to a single decision point makes them effective as decision trees for estimating expected values in diagrammed dependent relationships. (PMI, PMBOK Guide, 2013)



Picture 22: Tree Diagram

Source: PMBOK, 2013

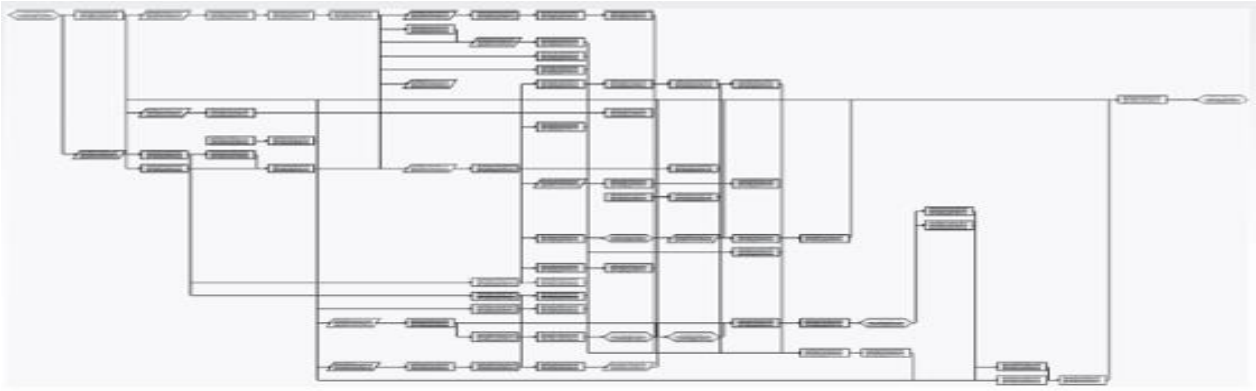
5) Prioritization matrices help identify critical issues and prioritize suitable alternatives for decision-making. By assigning weights to criteria and applying them to the available options, a mathematical score is generated to rank these options. (PMI, PMBOK Guide, 2013)



Picture 23: Prioritization Matrices

Source: PMBOK, 2013

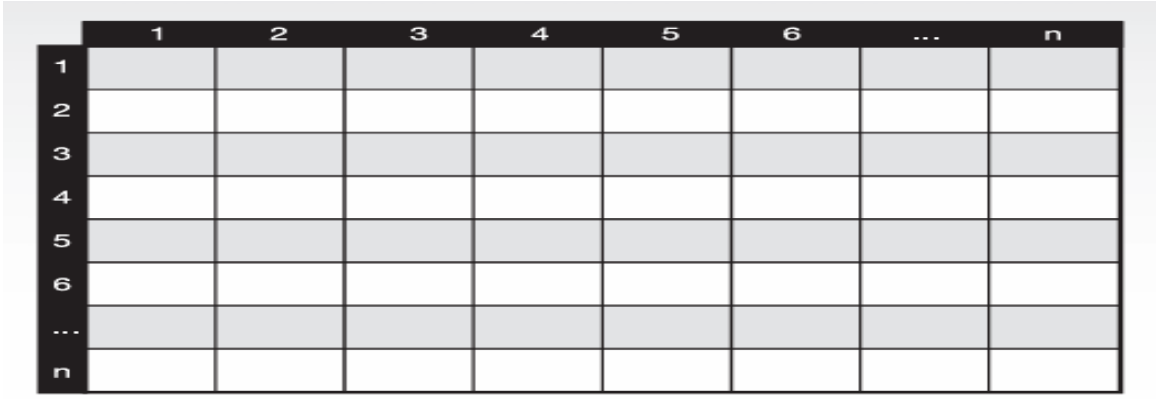
6) Activity network diagrams, formerly called arrow diagrams, include AOA (Activity on Arrow) and the more commonly used AON (Activity on Node) formats. These diagrams are key in project scheduling methodologies such as the Program Evaluation and Review Technique (PERT), Critical Path Method (CPM), and Precedence Diagramming Method (PDM). (PMI, PMBOK Guide, 2013)



Picture 24: Network Diagram

Source: PMBOK, 2013

7) Matrix diagrams are quality management tools used for data analysis within a defined organizational structure. They highlight the strength of relationships between factors, causes, and objectives by organizing them into rows and columns within the matrix. (PMI, PMBOK Guide, 2013)



Picture 25: Matrix Diagramme

Source: PMBOK, 2013

7.5.3. Advanced Quality Management Methods

1) Six Sigma, introduced in 1986 by engineer Bill Smith at Motorola, is a methodology aimed at enhancing business processes. It relies on statistics, financial analysis, and project management to minimize defects and errors, reduce variation, and improve overall quality and efficiency. Its approach follows five key phases, known as DMAIC: Define Measure, Analyze, Improve, and Control, providing a structured path to problem-solving and process optimization. A holistic approach focusing on continuous improvement in all aspects of an organization. (Hayes, 2024)

2) FMEA, or Failure Mode and Effects Analysis, is a method for identifying, analyzing, and prioritizing potential failures in products, processes, or systems. It evaluates risks using severity, occurrence, and detection metrics, generating a Risk Priority Number (RPN) to rank issues for corrective action. This proactive approach enhances reliability, safety, and quality while reducing costs and improving customer satisfaction. (Traeger, 2025)

3) Quality Function Deployment (QFD) is a Total Quality Management tool focused on translating customer needs into product designs. Developed by Mitsubishi in the 1960s, QFD helps ensure products align closely with customer requirements, improving satisfaction and efficiency in development. (Berk & Berk, 2000)

4) Developed in 1984 by Professor Noriaki Kano of the Tokyo University of Science, the KANO methodology emphasizes that products or services are more than just their functional aspects. It highlights that not all features equally influence customer satisfaction. Features are categorized into five types based on their impact on customer satisfaction. (Research, 2022)

Note: These tools and methods can be used individually or in combination to enhance quality management efforts and drive continuous improvement.

8. Project cost management:

8.1. Cost and cost management Definitions:

- For the financial burdens required to implement a project or work. Backlog cost or expenditure represents the total backlog of work to be performed, or completed to this date or the end of the previous fiscal year. The actual cost/expenses are everything that has been invoiced up to this date. (Dictionary of Development Concepts, 2025)
- Product cost is the amount paid by the service provider to manufacture and create the product. In other words, Cost is the total monetary value of inputs used in producing goods or providing services. (piflowTeam, 2023)
- Project Management Institute:

Cost management is the process of planning and controlling the costs associated with running a business. It includes collecting, analyzing, and reporting cost information to effectively budget, forecast, and monitor cost. (cost-management, 2025)

1. Integration: Integrating cost management practices across different departments.
2. Employee Buy-In: Gaining commitment from employees to adhere to cost management practices.

8.2. Basic Principles to Effective Cost Management

8.2.1. Accuracy

The accuracy of cost estimation and budgeting is essential. Reliable financial data minimizes the risk of costly errors by ensuring that decisions are made based on precise information.

8.2.2. Consistency

Utilizing uniform methods and procedures in cost management supports comparison and analysis over time. This consistency aids in recognizing financial trends and making informed decisions.

8.2.3. Transparency

Transparent financial reporting and communication build trust among stakeholders. It ensures that everyone involved comprehends the financial status and the rationale behind cost-related decisions.

8.2.4. Continuous Improvement

The financial landscape continuously evolves. Adapting and refining cost management strategies in response to new information and changing conditions is vital for long-term success. (Experts, 2024)

8.3. Importance of Cost Management

Cost management is essential to strategic business operations, providing a pathway to financial stability and enhanced market competitiveness. Its significance lies in reducing expenses and fostering a culture of efficiency and strategic growth. By understanding the intricate balance of various costs, businesses can make informed decisions that propel them toward their goals. (Experts, 2024)

8.4. Role of Effective Cost Management

Effective cost management is the cornerstone of financial health, ensuring that resources are optimally utilized without compromising quality or business objectives. It involves making every dollar count and aligning spending with strategic priorities. This approach helps navigate financial uncertainties and seize opportunities for expansion and innovation. By focusing on cost management, businesses can tackle complex market dynamics, stay competitive, and position themselves for sustainable revenue growth. (Experts, 2024)

8.5. Best Practices for Cost Management

To achieve success in cost management, businesses should embrace the following best practices:

8.5.1. Accurate Forecasting: Develop reliable methods to predict future costs and revenues. Accurate forecasting is the foundation of sound budgeting and helps set realistic financial targets.

8.5.2. Ongoing Monitoring: Regularly review financial performance against the budget. This helps in quickly identifying variances and taking corrective actions.

8.5.3. Strategic Adjustments: Be prepared to adjust strategies in response to internal changes or external market shifts. Flexibility is key to maintaining financial control.

8.5.4. Transparency and Accountability: Maintain clear communication about financial strategies and outcomes. This builds trust and ensures everyone is aligned with the same financial goals.

8.5.5. Leverage Technology: Utilize modern tools and software for more precise cost tracking and analysis. Technology can provide deeper insights and facilitate more informed decision-making. (Experts, 2024)

8.6. Project cost management processes

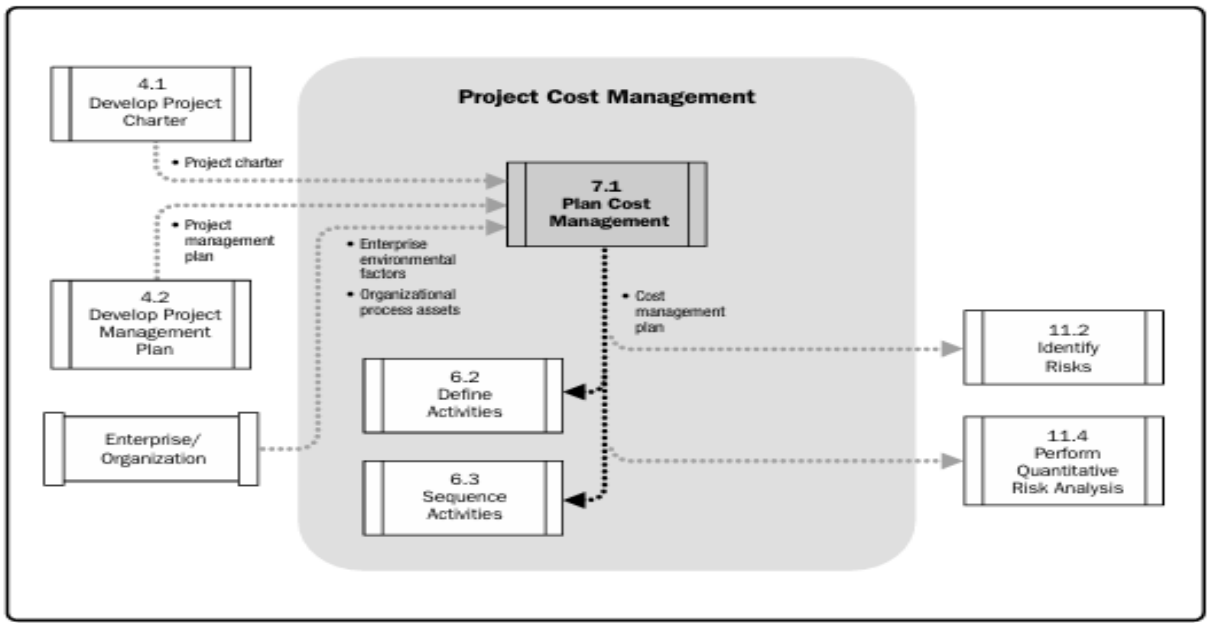
Project Cost Management involves managing costs to meet stakeholder requirements. Different stakeholders measure costs differently at various stages, such as acquisition, order placement, delivery, or accounting.

- Resource Costs: Focuses primarily on the costs of resources needed to complete project activities.
- Recurring Costs: Considers the impact of project decisions on future costs of using, maintaining, and supporting the project's outcome.
- Financial Performance Analysis: In some organizations, financial performance analysis of the project's product is handled outside the project, while in others, it is included within Project Cost Management. This can involve techniques like return on investment (ROI), discounted cash flow, and investment payback analysis.
- Cost Management Planning: Occurs early in project planning and sets the framework for efficient and coordinated cost management processes.
- Project Cost Management ensures the project meets its financial objectives by managing resources effectively and considering both immediate and future costs. (PMI, PMBOK Guide, 2013)

8.6.1. Plan cost Management

Plan Cost Management is the process that establishes the policies, procedures, and documentation for planning, managing, expending, and controlling project costs. The key benefit of

This process is that it provides guidance and direction on how the project costs will be managed throughout the project. The cost management processes and their associated tools and techniques are documented in the cost management plan. The cost management plan is a component of the project management plan (PMI, PMBOK Guide, 2013)



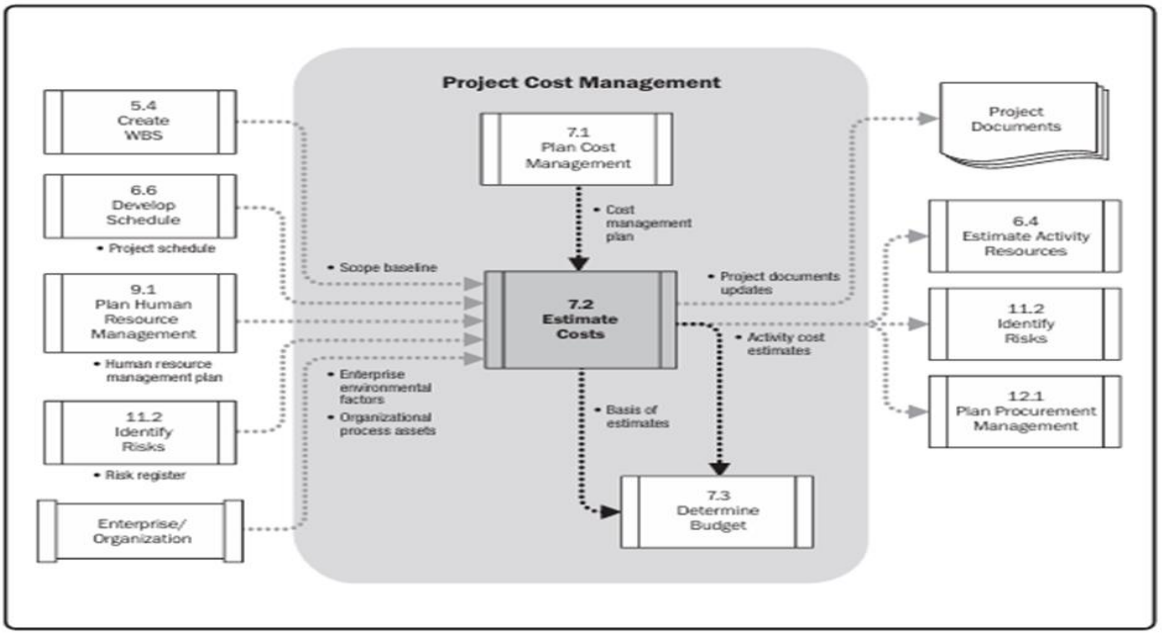
Picture 26: Plan cost Management: data Flow diagram

Source: PMBOK, 2013

8.6.2. Estimate costs

Estimate Costs is the process of developing an approximation of the monetary resources needed to complete project activities. The key benefit of this process is that it determines the amount of cost required to complete project work.

Cost estimates are predictions based on available information, considering alternatives and risks like make vs. buy. They are usually expressed in currency or units of measure and should be reviewed and refined as the project progresses, increasing accuracy over time. Costs are estimated for all resources that will be charged to the project. This includes, but is not limited to, labor, materials, equipment, services, and facilities, as well as special categories such as an inflation allowance, cost of financing, or contingency costs. A cost estimate is a quantitative assessment of the likely costs for resources required to complete the activity. Cost estimates may be presented at the activity level or in summary form. (PMI, PMBOK Guide, 2013)



Picture 27: Estimate costs data Flow diagram

Source: PMBOK, 2013

8.6.3. Determine Budget

Determine Budget is the process of aggregating the estimated costs of individual activities or work packages to establish an authorized cost baseline. The key benefit of this process is that it determines the cost baseline against which project performance can be monitored and controlled

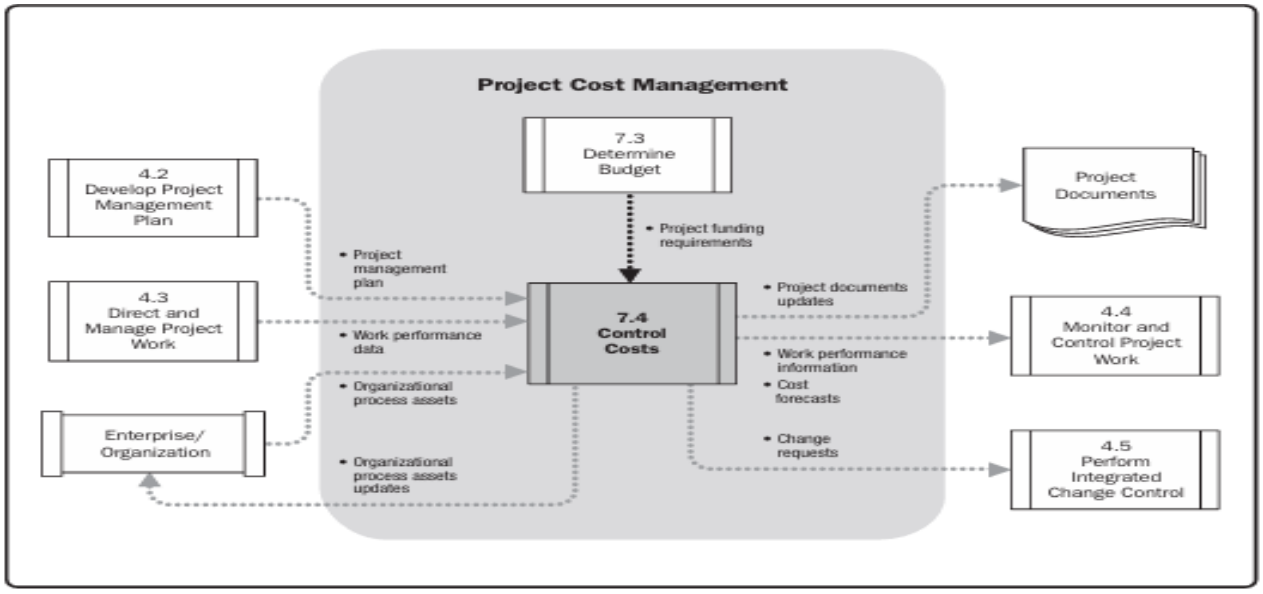
A project budget includes all the funds authorized to execute the project. The cost baseline is the approved version of the time-phased project budget, but excludes management reserves. (PMI, PMBOK Guide, 2013)

8.6.4. control costs

Control Costs is the process of monitoring the status of the project to update the project costs and managing changes to the cost baseline. The key benefit of this process is that it provides the means to recognize variance from the plan in order to take corrective action and minimize risk.

Updating the budget requires knowledge of the actual costs spent to date. Any increase to the authorized budget can only be approved through the Perform Integrated Change Control process Monitoring the expenditure of funds without regard to the value of work being accomplished for such expenditures has little value to the project, other than to allow the project team to stay within the authorized funding. Much of the effort of cost control involves analyzing the relationship between the consumption of project funds to the physical work being accomplished for such expenditures. The key to effective cost control is the management of the approved cost baseline and the changes to that baseline.

- Project cost control includes:
- Influencing the factors that create changes to the authorized cost baseline;
- Ensuring that all change requests are acted on in a timely manner;
- Managing the actual changes when and as they occur;
- Ensuring that cost expenditures do not exceed the authorized funding by period, by WBS component, by
- activity, and in total for the project;
- Monitoring cost performance to isolate and understand variances from the approved cost baseline;
- Monitoring work performance against funds expended;
- Preventing unapproved changes from being included in the reported cost or resource usage;
- Informing appropriate stakeholders of all approved changes and associated cost; and
- Bringing expected cost overruns within acceptable limits (PMI, PMBOK Guide, 2013)



***Picture 28**: control costs data Flow diagram*

Source : PMBOK, 2013

8.7. Cost management tools and methods

Cost management is crucial for ensuring that projects and operations stay within budget while achieving their objectives. Here are some effective tools and methods for managing costs:

8.8.1 Cost Management Tools

1) A cost management plan is a key document used throughout a project to outline how costs will be planned, organized, and controlled. It specifies the processes, roles, responsibilities, and metrics necessary for effective cost management. The plan should align with the project's triple constraints, risk management plans, objectives, stakeholder expectations, and organizational policies. (Kaushalya, 2024)

2) A cost baseline is a tool that outlines the approved project budget, enabling project managers to compare actual costs against planned ones and take corrective measures if necessary. It is derived from cost estimates and the project schedule, reflecting the anticipated cash flow over time. Essential for monitoring project performance, it helps identify deviations and ensures effective cost control to minimize overspending throughout the project's duration. (Kaushalya, 2024)

3) Earned value management (EVM) is a cost management tool that combines project scope, schedule, and cost to evaluate performance. By comparing planned, earned, and actual costs, EVM helps project managers assess cost performance, detect variances, and take corrective actions. Key metrics include:

- Planned Value (PV): Budgeted cost of scheduled work.
- Earned Value (EV): Budgeted cost of completed work.
- Actual Cost (AC): Actual expenditure for completed work.

Using these metrics, managers can calculate:

- Cost Variance (CV): Difference between EV and AC.
- Schedule Variance (SV): Difference between EV and PV.
- Cost Performance Index (CPI): Ratio of EV to AC.
- Schedule Performance Index (SPI): Ratio of EV to PV.

EVM provides a detailed analysis of project performance, helping manage complex projects and prevent issues. Variance analysis complements EVM by comparing actual results with expected ones to identify variances in scope, quality, schedule, risk, or cost. It aids in budgeting, forecasting, and decision-making, ensuring the project's financial health and success. (Kaushalya, 2024)

4) Variance analysis is a valuable tool for comparing actual results with expected outcomes and identifying the causes and effects of discrepancies. It applies to various project aspects, such as scope, quality, schedule, risk, and cost. In cost management, it helps evaluate budget deviations, enabling corrective actions, cost forecasting, status reporting, and project plan adjustments. This analysis is crucial for informed decision-making, financial stability, and achieving project success. (Kaushalya, 2024)

5) Trend analysis is an essential cost management tool that uses historical data and patterns to predict a project's future performance and outcomes. By tracking cost changes over time it helps anticipate risks and opportunities. Project managers can use this method to estimate remaining costs, assess project feasibility, and make data-driven decisions. Tools like graphs, charts, tables, and formulas can aid in creating trend analyses. (Kaushalya, 2024)

6) Reserve analysis is a cost management tool that allocates a portion of the budget for unforeseen events to mitigate risks during project execution. It includes two types of reserves:

- Contingency reserves: Part of the cost baseline, covering known and unknown risks like scope changes, delays, or issues.
- Management reserves: Excluded from the cost baseline, addressing risks such as legal disputes, accidents, or disasters.

This approach ensures sufficient funds for project completion, supports proactive risk management, and enables the project team to handle unexpected events without exceeding the budget. (Kaushalya, 2024)

7) Project management information systems (PMIS) utilize tools like simulation software, spreadsheets, and statistical analysis to support cost estimation. These systems enable quick evaluation of cost alternatives and are also useful for monitoring EVM metrics (planned value, earned value, and actual cost). By displaying graphical trends, they help forecast potential project outcomes efficiently. (Kaushalya, 2024)

8.8.2 Cost Management Methods

1) Life Cycle Costing (LCC) is a cost assessment model that calculates the total costs incurred throughout the lifespan of an asset, service, structure, or system. It evaluates costs related to all involved parties—suppliers, producers, and consumers—while considering external factors that may influence management decisions. LCC is applied in diverse contexts, from analyzing fixed asset costs in projects to assessing organizational structures for strategic decision-making, such as deciding whether to discontinue a production line. The method emphasizes the importance of considering the life cycle costs of products to avoid prioritizing low initial costs that could lead to high maintenance and operating expenses later. Its value lies in improving cost visibility and supporting informed, long-term financial planning for organizations (dos Santos Silva & Silene Alexandre Leite, 2023)

2) Target costing is a cost management system that integrates price, customer needs, and project goals across organizational functions. Its primary aim is to adjust operating costs to achieve a target price and desired profit margins within the company's strategic planning. This approach emphasizes target profit during the product and system design phase, optimizing costs without compromising product quality. The system generates detailed reports on price and cost composition, aiding managers in understanding their market segment. However, successful implementation requires a thorough understanding of product characteristics, production systems, and operational methods. Small companies may face challenges due to limited financial control and limited data availability. (dos Santos Silva & Silene Alexandre Leite, 2023)

3) Total Cost of Ownership (TCO) is a cost management method that evaluates all costs associated with an asset throughout its life cycle, including acquisition, usage, and maintenance. Closely related to Life Cycle Costing (LCC), TCO emphasizes strategic decision-making by analyzing hidden costs, uncertainties, and performance degradation over time. Quantitative models based on historical data or forecasts enhance their accuracy. The benefits of TCO include improved supplier evaluation, communication, and cost analysis, aiding organizations in strategic planning and pricing decisions. However, data reliability, implementation difficulties, and short-term-focused organizational cultures can limit its effectiveness. (dos Santos Silva & Silene Alexandre Leite, 2023)

4) Activity-Based Costing (ABC) is a management accounting tool that evaluates costs incurred during productive activities, focusing on their relationship to income generation and resource consumption. Unlike traditional methods that allocate costs based on production volume, ABC uses cost drivers to assign expenses to activities and then to products, establishing a cause-and-effect relationship.ABC helps identify value-adding activities, optimize resource use, and reduce

operating costs. It provides transparency in cost analysis, enabling continuous system improvement. Unlike traditional models, ABC emphasizes indirect costs and waste reduction, offering a more comprehensive approach to cost management. (dos Santos Silva & Silene Alexandre Leite, 2023)

5) Variable Costing (VC) is a cost allocation method that distinguishes between variable and fixed costs, assigning only variable costs directly to products or services. Fixed costs are treated as period expenses, enabling a clear analysis of each cost component's contribution to the overall value. This approach provides essential managerial insights for decision-making.VC reduces the arbitrariness of fixed cost apportionments, allowing managers to evaluate decisions based on the contribution margin of each product. It supports effective cost control and strategic planning, as demonstrated in

cost-volume-profit (CVP) analyses, such as determining break-even points and operational safety margins in agricultural production. (dos Santos Silva & Silene Alexandre Leite, 2023)

6) Mathematical models are tools designed to evaluate and solve real-world problems by representing systems conceptually and modeling their variables mathematically. These models are particularly useful for addressing complex issues and providing valuable insights to support organizational decision-making. For example, they have been applied in healthcare for pricing strategies, as well as in industries like civil construction, energy generation, supply chains, horticulture, and hotel services. Mathematical models enhance cost management by addressing limitations in traditional methods, facilitating calculations, and offering multidimensional perspectives. However, they require extensive data for validation and often involve simplifications to solve problems effectively. Despite their complexity, these models are instrumental in improving decision-making and operational efficiency across various sectors. (dos Santos Silva & Silene Alexandre Leite, 2023)

Conclusion:

The education sector in Algeria plays a crucial role in sustainable development and building a knowledge-based society. Given its importance in preparing human resources and adapting to global developments, the management of educational projects requires strategic planning to balance quality, cost and time. Managing these projects effectively requires clear objectives and organised implementation to ensure the best results are achieved within the available resources.

Education in Algeria is an organised system run by the Ministry of National Education, which oversees policies to ensure free and compulsory education for children between the ages of 6 and 16. The Ministry runs several institutions that contribute to improving the quality of education: institutes, courses, centres and schools.

Schools in Algeria follow spatial programmes that specify class sizes, laboratory spaces, administrative offices and outdoor spaces. These plans ensure that educational facilities meet the necessary capacity standards and provide students with a well-equipped learning environment. Urban and architectural standards determine the location of schools, taking into account their accessibility and safety, ensuring an efficient educational infrastructure.

A project is an organised effort designed to achieve specific objectives within a specific time frame. All projects have distinct characteristics, including timeliness, uniqueness, goal-orientation and limited resources. They require careful coordination and risk management to meet unforeseen challenges and ensure successful completion. The project lifecycle consists of initiation, planning, execution, monitoring and closure. Each of these phases involves different stakeholders, such as government agencies, engineers, contractors, and financial entities that contribute expertise, funding, and oversight.

Effective project management relies on technical skills, leadership and business acumen. Integration, scheduling, cost management, procurement and risk mitigation are key areas to be addressed. Quality control ensures that projects meet the required standards and objectives. Pioneers in quality management, such as W. Edwards Deming, Joseph M. Juran and Philip B. Crosby introduced key concepts such as total quality control and statistical analysis, which continue to influence modern project management.

Cost management plays a crucial role in project execution, requiring accurate forecasting, monitoring, and adjustments. Methods such as life-cycle costing, total cost of ownership, total cost of ownership, and activity-based costing optimise expenses while maintaining efficiency. Advanced techniques such as earned value management and mathematical modelling assist in financial analysis and strategic planning, ensuring long-term sustainability.

Managing educational projects involves balancing costs, quality and efficiency of delivery. By focusing on structured planning, stakeholder collaboration and strategic decision-making, the country aims to enhance its educational infrastructure and provide sustainable learning environments for future generations. Effective implementation and adherence to international management standards will contribute to achieving these goals and support Algeria's educational development.

Chapter 02:
Analytical Study

Introduction

After the first chapter defined the theoretical framework of the concepts of cost management and quality control and their importance in construction projects, it is necessary to move on to the stage of linking these concepts to their practical applications. It is not enough to understand the theory alone; this knowledge must be tested in the context of real projects to draw practical conclusions and recommendations.

In this chapter, we will review the general framework of the study project by defining its main characteristics and objectives, with a focus on the administrative context in which it is implemented, including planning and control mechanisms. We will also touch on the project's historical origins and composition, which will contribute to a deeper understanding of the factors that shaped its trajectory and influenced cost and quality management decisions.

Through this analysis, we aim to link theoretical aspects with practical application, in preparation for assessing the impact of cost management on the quality of outputs in the later stages of the study.

1. Project presentation:

1.1. Technical sheet:

The project is to establish a Class A school complex in the municipality of Assarek - Orlal, Biskra. The project consists of two parts.

- The Fixed instalment :Administrative Suite + Teaching Suite + VRD + Restaurant
- The conditional installment: Functional Housing F4

Table 7: project technical sheet

Operation	**Study of the follow-up of the completion and equipping of a school complex class A in Assarek Municipality of Orlal**
Operation number	**NE 5.623.4.262.107.21.06**
Project owner	**Public Equipment Directorate**
Construction company	**Construction Works Establishment - all state structures - Farhat Ali -**
Architect	**GROUPEMENT SOLIDAIRE SAHARA**
Technical control	**CTC SUD**
Soil study laboratory	**National Housing and Construction Laboratory**
Tendering method	**Open a national tender with a minimum capacity requirement**
Initial AP	**70.000.000, 00 DA**
Actual AP	**88.884.000.00**
Area	**10000 m2**
Planned duration	**4.5 months**

1.1. Presentation of the participants

➢ The project owner :

- Public Equipment Directorate of Biskra
- batna road near the old SNTV Biskra,Algeria
- 033-07-75-65
- Dep.biskra@gmail.com

➢ Project Architect :

- GROUPEMENT SOLIDAIRE SAHARA
- Mellili Biskra
- 06-60-45-02-19
- Privet company

- The construction company :

- Construction Works Establishment - all state structures - Farhat Ali –
- Biskra, Orlal municipality, tatay Mohamed Sadiq neighbourhood
- 07-81-07-04-71

- Technical control :

- CTC Biskra
- Ben badis,BP 148- Al-amel neighbourhood – Biskra
- 031-51-96-17

- The soil study laboratory :

- 08 Mars Road Biskra
- 033-53-93-76
- Ihc_biskra@live.fr

1.2. Urban reading

1.2.1. Standard conditions for project location:

The project of the pedagogical complex in the municipality of Assarek is a vital project that aims to provide an important facility that will help improve the situation of the city as well as the region's revitalisation, as the project has:

Excellent location: The project land is flat and has no prominent terrain, making it ideal for construction.

Availability of infrastructure: Sewerage and electricity networks are available near the project

Proximity to other facilities: The project is adjacent to a clinic and near residential and vital areas

Picture 29: Project location

Source: Google map, 2025

1.2.2. City location and neighbourhood characteristics

The project is located in a farming area where it is surrounded by farms on all sides, as well as scattered residential communities, and right next to it is a clinic, overlooking an unpaved secondary road.

Picture 30: location of the project in relation to the surroundings
Source: Google map + student's disposal, 2025

1.2.3. Accessibility to the project

There is no specific access to the project as the project is located in an empty space without any specific or paved roads, except for one unpaved secondary road.

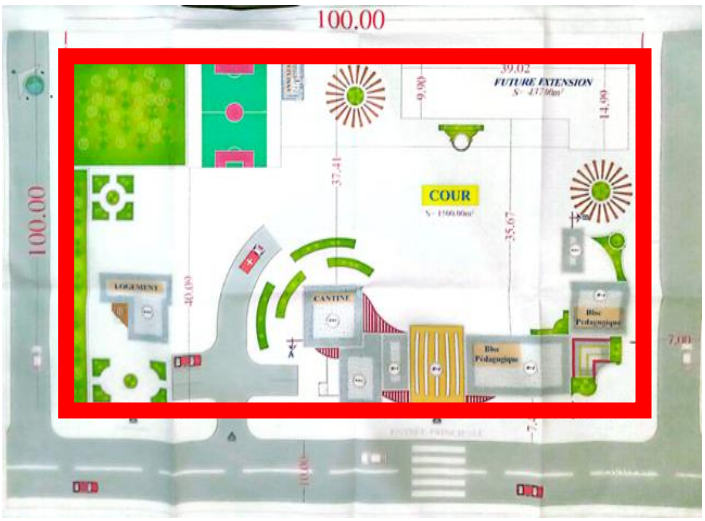
1.2.4. Importance of the project to serve the immediate surroundings

The idea of constructing a primary school in Assarek came after many popular demands and protests, so this facility is a solution to many issues as well as an enrichment for the region, as it will save residents the trouble of transporting their children to neighbouring areas daily, as well as providing other jobs.

1.2.5. The (empty/built) specificity of the project

1.2.5.1. Define spaces :

- Project land: 10000 m^2
- Building: 1291 m^2
- School yard: 1500 m^2
- Residence: 147.55 m^2
- Stadium: 202.5 m^2
- Expansion area: 473 m^2



Picture 31: ground plan with ground delineation

Source: design office +student's disposal

1.2.5.2. Ground shape

The Ground is a regular rectangle bounded by roads from the four directions, as this shape helps to distribute the spheres more freely and to utilise the space properly.

1.2.5.3. Space distribution (empty/structured)

- The empty space: The unbuilt part of the land area represents 68 per cent, which was mainly used to create large green spaces, as well as parking lots and paths, in addition to the future expansion area.
- The Built Space: It represents 32 per cent of the land area and includes the institution's building, schoolyard, residence, and stadium

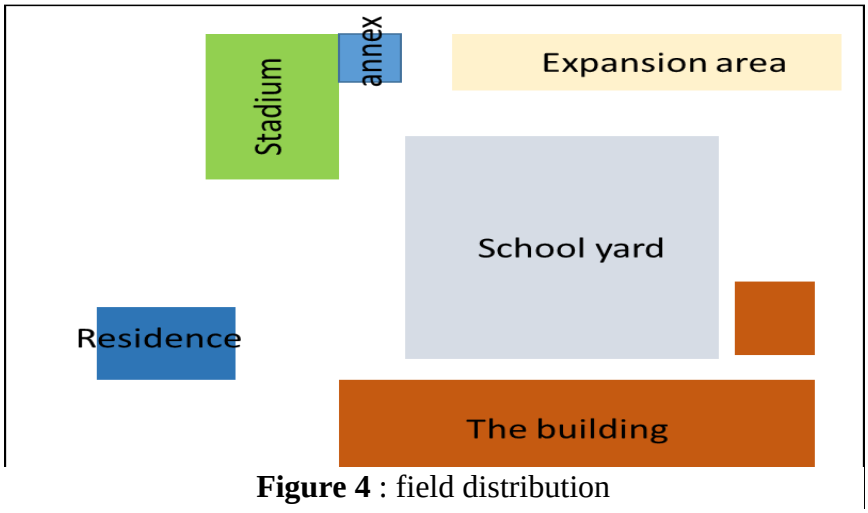


Figure 4 : field distribution

Source: student, 2025

Through the above, we find that the percentage of the empty is twice as large as the percentage of the building. The areas were distributed in an orderly manner; where the building of the Foundation and its annexes were placed on the southern side directly opposite the bypass road, the playground was placed on the northeast side, the expansion area was located on the eastern side and the square was placed in the middle to connect these three areas smoothly. The residence was placed in the northwest and separated from the Foundation by a parking lot.

1.2.6. Quotient Grid

From the picture, we can see that the dimensions of the shares are different, as well as their shape, as each share is characterised by a specific shape and dimensions, so we can say that there is no dimensional and shape compatibility between the shares.

Picture 34: Division of shares in the project area

Source: student, 2025

1.3. Architectural reading

1.3.1. Distribution of services on the floors

Picture 32: a) Spatial organisation on the ground floor /b) Spatial organisation on the first floor

Source: design office +student's disposal

Through the plans, we find that the various departments have been distributed on the ground and first floor in the following manner :

➢ Ground floor :

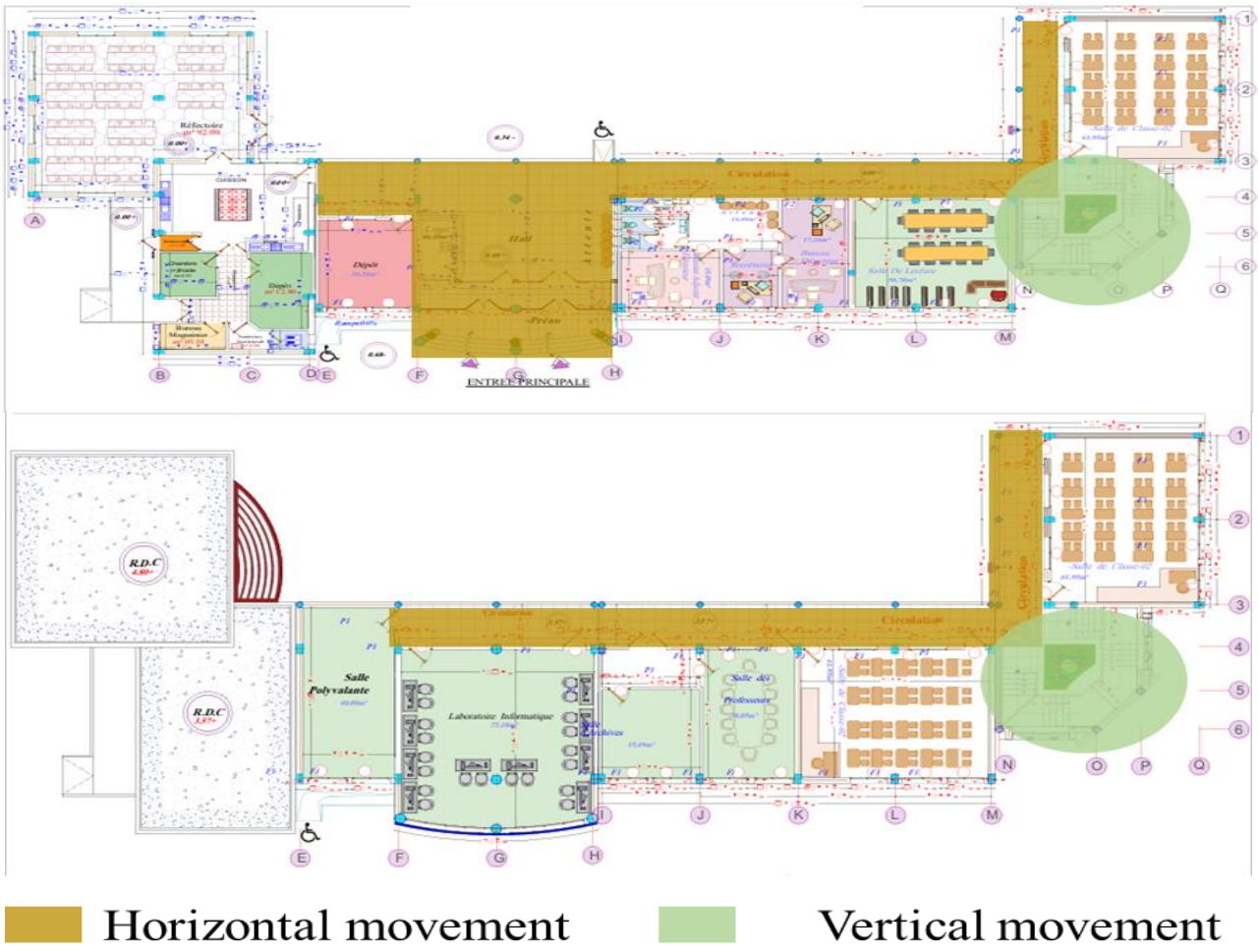
- Classrooms: One (1) classroom/reading room
- Administration: director's office/secretariat/ deputy office director/
- Reception: 1 lobby reception
- Canteen: refectory/cooking/ cold room/ storehouse office / changing rooms
- Other activities: deposit/reading room

➢ First floor :

- Classrooms: two (2) classrooms/computer laboratory
- Administration: Staff room/ archive room
- Other activities: deposit/reading room

From this, we can say that all services are more or less evenly distributed at the two levels.

1.3.2. Movement areas



Picture 33 : a) Ground Floor Movement Areas/ b) 1st Floor Movement Areas

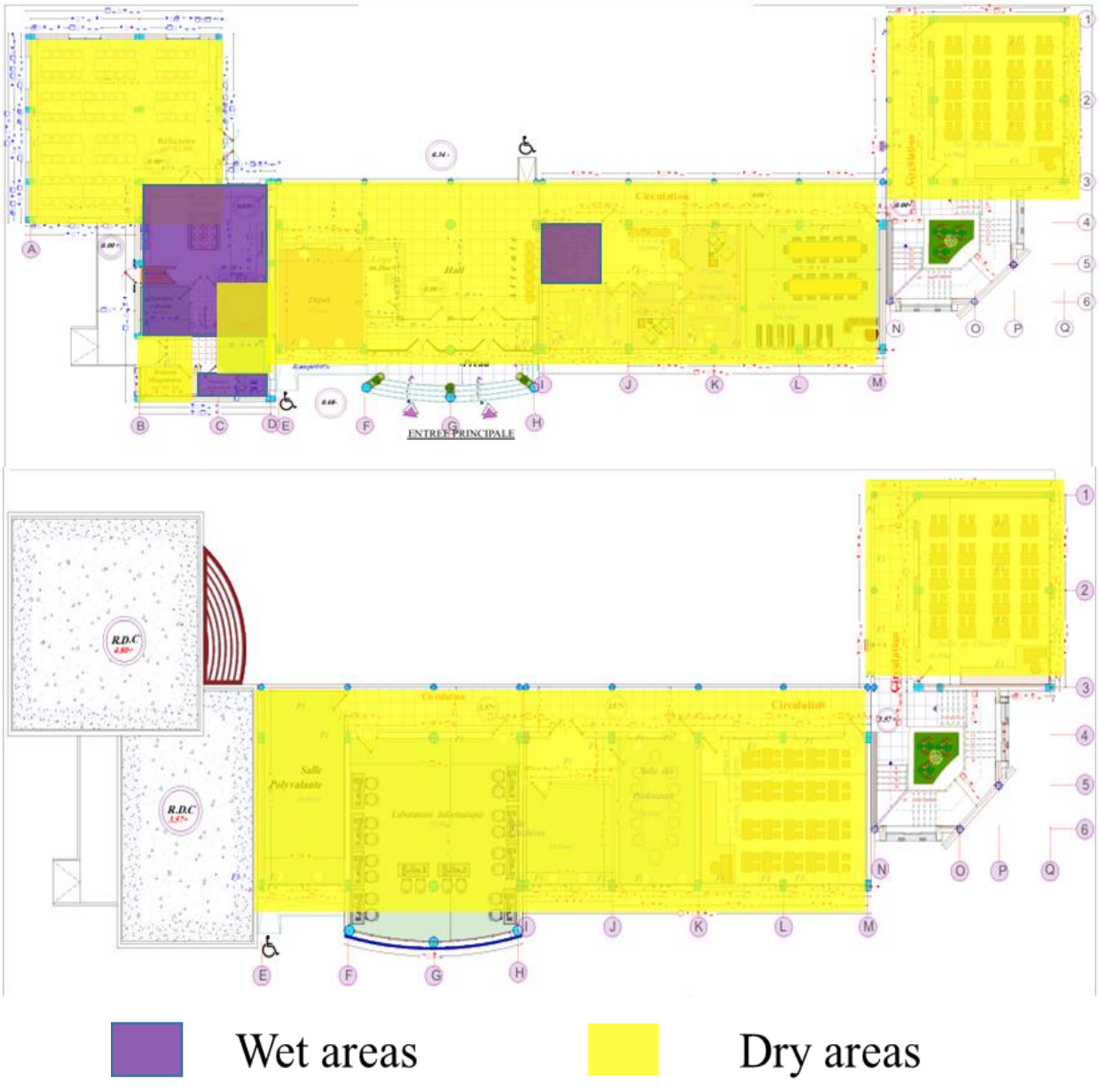
Source: design office +student's disposal

- There are two types of movement in the building: horizontal movement in the corridors and lobby, and vertical movement in the stairwells.

On the ground floor, the distribution of horizontal movement was in the form of the letter 'L' connected to the letter 'I'

As for the first floor, the movement fields were distributed in the form of the letter L only.

1.3.3. Wet and dry areas



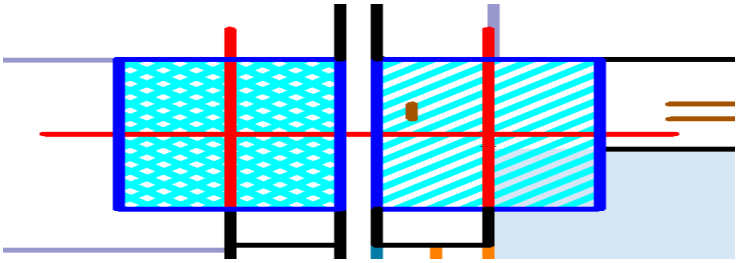
Picture 34 : a) Distribution of wet and dry areas on the ground floor/ b) Distribution of wet and dry areas on the 1 st floor

Source: design office +student's disposal

- The distribution of wet areas on the ground floor is sparse and far fewer in number than the dry areas. On the first floor, there are only dry areas and no wet areas.

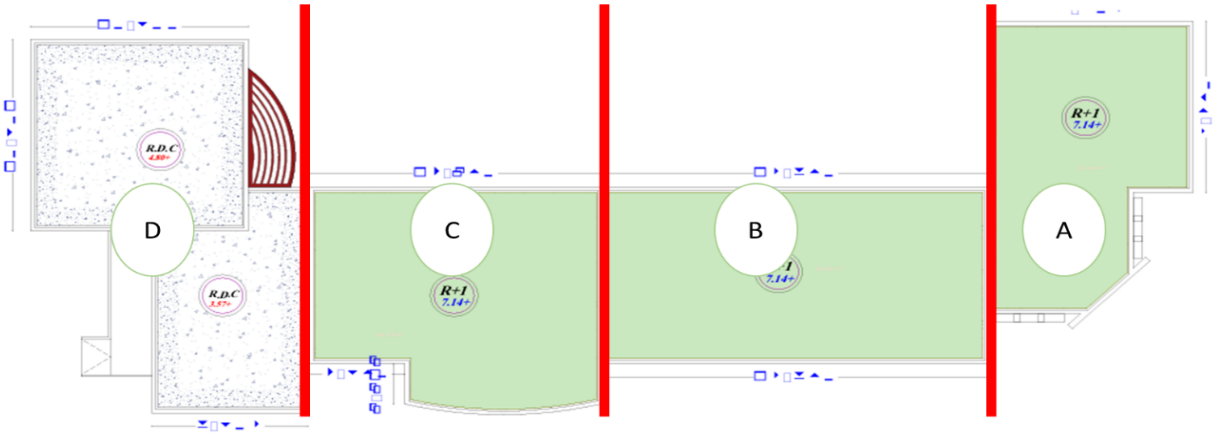
1.3.4. Determine the joints

The building is divided into four parts, and between each part, there is a **thermal expansion distance of 0.05 m**



Picture 35:Cross-section of the thermal expansion joint

Source: design office +student's disposal



PLAN TOITURE

Picture 36: Identify the parts of the building in the roof plan

Source: design office +student's disposal

Part	Length
A	9.90 m
B	18.75 m
C	14.25 m
D	13.52 m

Table 8:Building parts length

Source: student, 2025

1.3.5. Structural system :

1.3.5.1. Structural system type

Table 9:Structural system type

Beams	number	section	length	structural system type
Block 4				
B1	4	0.30 X 0.40	10.23	Column-beam
B2	2	0.30 X 0.60	7.61	Column-beam
B3	4	0.30 X 0.40	2.62	Column-beam
B4	2	0.30 X 0.40	3.35	Column-beam
B5	2	0.30 X 0.40	5.40	Column-beam
Ch1	6	0.30 X 0.30	4.20	Column-beam
Ch2	6	0.30 X 0.30	4.30	Column-beam
Ch3	2	0.30 X 0.30	4.33	Column-beam
Ch4	4	0.30 X 0.30	1.98	Column-beam
Ch5	2	0.30 X 0.30	4.10	Column-beam
Block3				
B6	4	0.30 X 0.40	9.80	Column-beam
B7	6	0.30 X 0.60	9.80	Column-beam
Ch6	6	0.30 X 0.40	4.35	Column-beam
Ch7	6	0.30 X 0.40	4.30	Column-beam
Ch8	6	0.30 X 0.40	4.25	Column-beam
Ch9	6	0.30 X 0.40	4.20	Column-beam
Block 2				
B8	6	0.30 X 0.40	11.95	Column-beam
B9	2	0.30 X 0.40	9.91	Column-beam
Ch10	22	0.30 X 0.35	4.35	Column-beam
Block Kitchen				
B10	3	0.30 X 0.40	7.60	Column-beam
B11	1	0.30 X 0.60	7.60	Column-beam
Ch11	2	0.30 X 0.30	4.28	Column-beam
Ch12	2	0.30 X 0.30	3.80	Column-beam
Ch13	3	0.30 X 0.30	3.25	Column-beam
Restaurent				
B12	4	0.30 X 0.45	6.50	Column-beam
B13	3	0.30 X 0.40	4.20	Column-beam
Ch14	3	0.30 X 0.35	3.80	Column-beam
Ch15	3	0.30 X 0.35	3.43	Column-beam
Ch16	2	0.30 X 0.35	2.15	Column-beam

Source: student, 2025

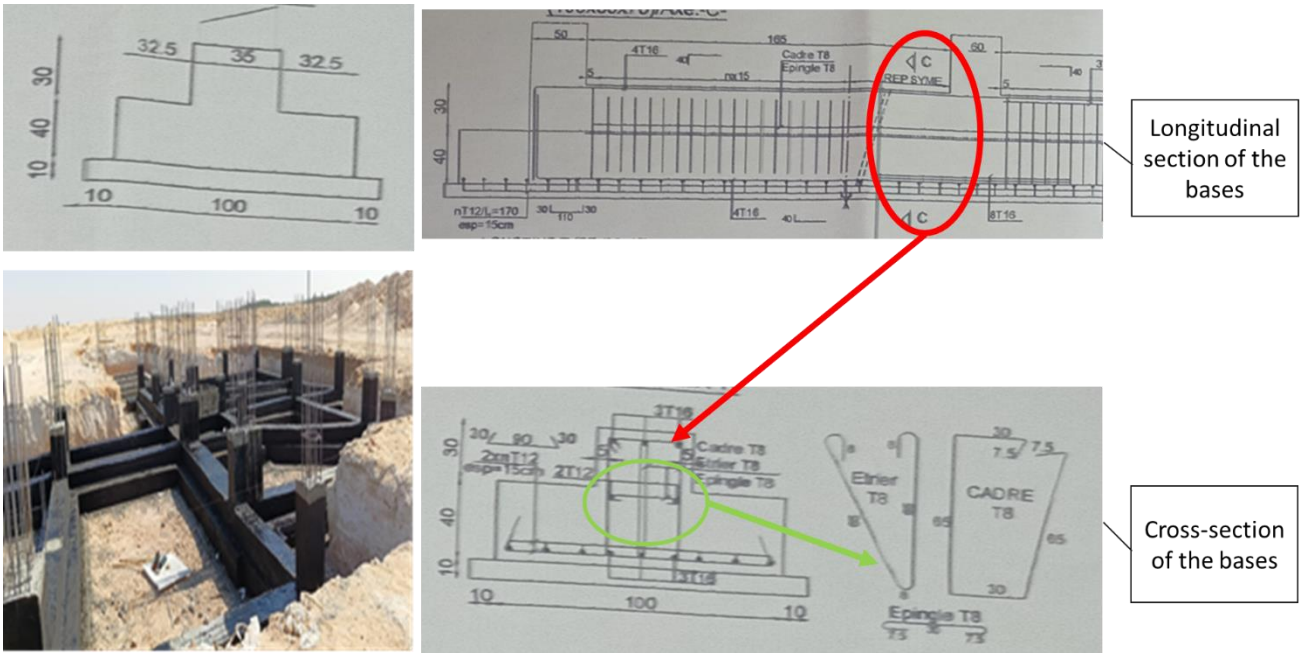
1.3.5.2. Columns type :

Table 10: Columns type

Columns	number	section	length
Block 4			
C1	14	0.30 X 0.30	3,57
C2	12	Ø=0.35	3,57
C3	4	0.60 X 0.35	3,57
Block3			
C4	10	Ø=0.35	3,57
C5	12	0.30 X 0.30	3,57
C6	12	0.60 X 0.30	3,57
Block 2			
C7	8	Ø=0.35	3,57
C8	18	0.30 X 0.30	3,57
C9	10	Ø=0.60	3,57
Kitchen			
C10	9	0.30 X 0.30	3,57
C11	2	0.60 X 0.30	3,57
Restaurent			
C12	9	0.30 X 0.50	4,8
C13	2	0.30 X 0,40	4,8

1.3.5.3. Structural Elements Details

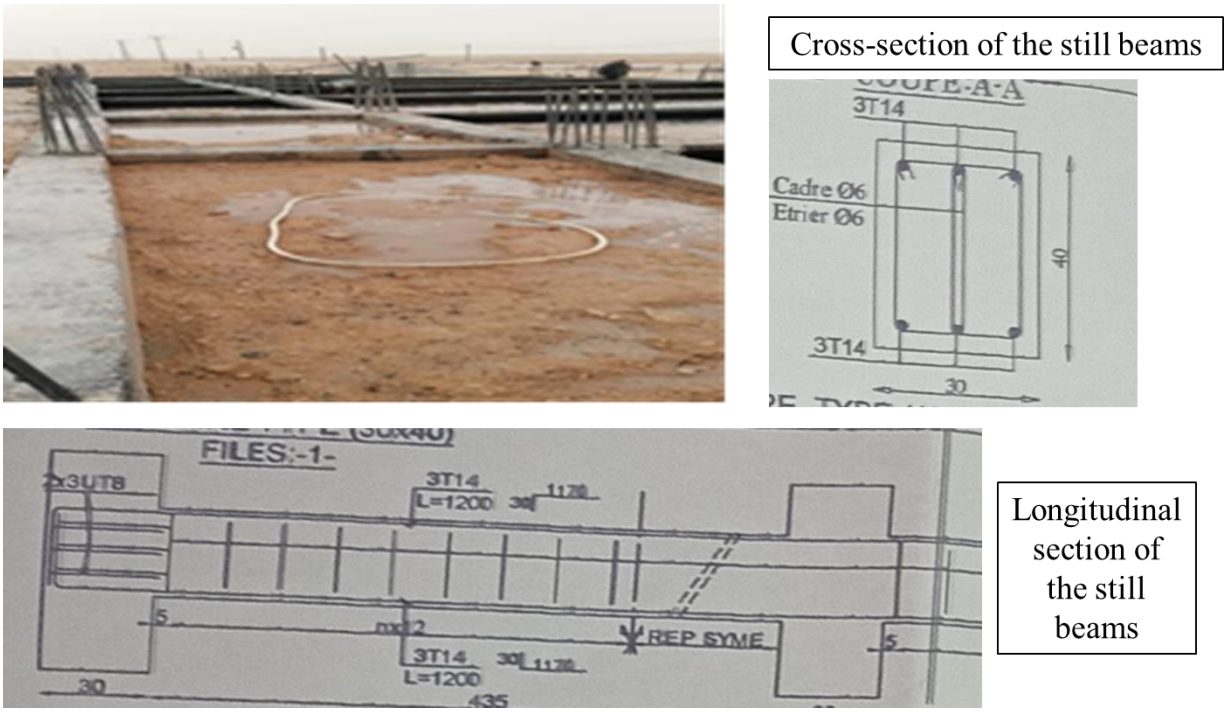
- Bases :



Picture 37 : Base Removal and Armament

Source: design office +student's disposal

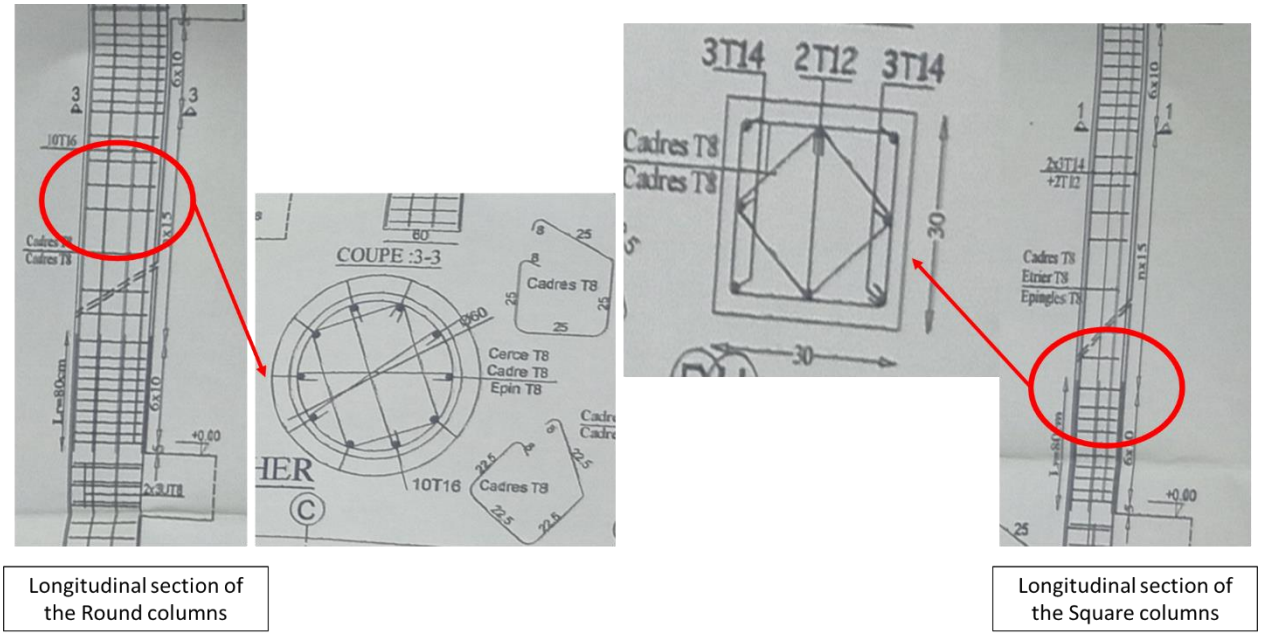
Still beams:



Picture 38: Still beams Removal and Armament

Source: design office +student's disposal

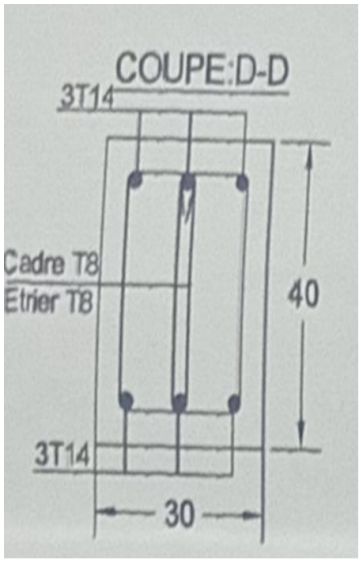
Columns:



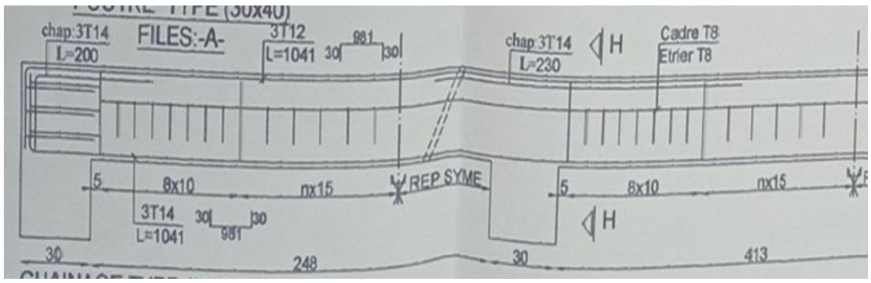
Picture 39: Columns Removal and Armament

Source: design office +student's disposal

Beams:



Cross-section of the beams

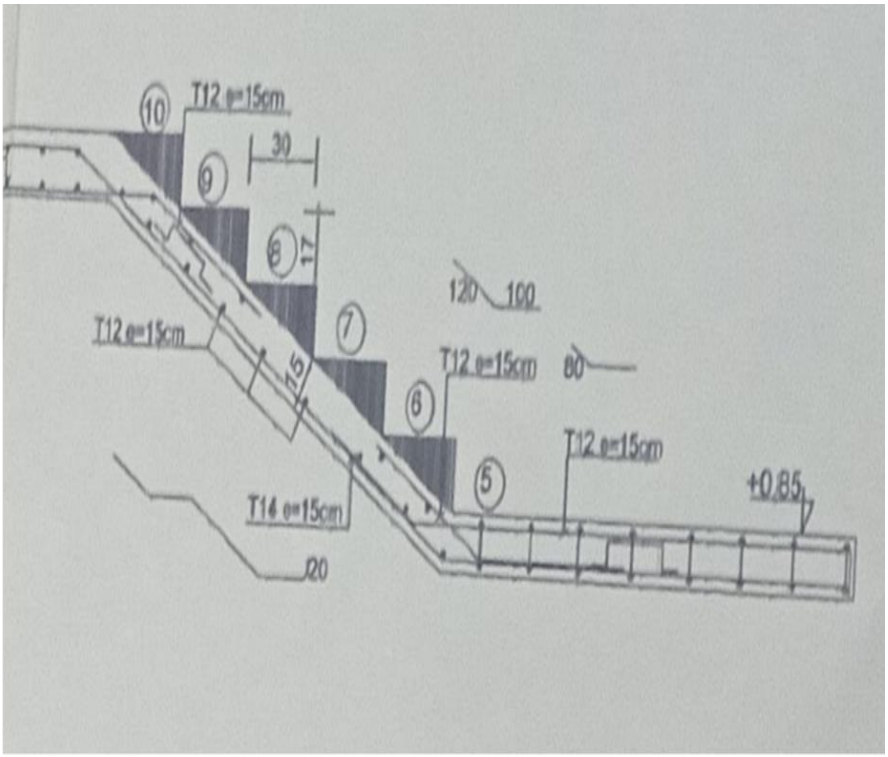


Longitudinal section of the beams

Picture 40 : Beams Removal and Armament

Source: design office +student's disposal

Stairs:



Longitudinal section of the stairs

Picture 41 : Stairs Removal and Armament

Source: design office +student's disposal

1.3.5.4. Concrete and steel specifications :

➢ Concrete :

- Use of special cement dosed at 370 kg/m³
- For CRS elements of the infrastructure (footings, reinforcements, beams)
- The property concrete is dosed at 250 kg/m³ based on C.R.S.
- The leveling concrete is dosed at 250 kg/m³ based on C.R.S.
- The steel reinforcement for the infrastructure is 5 cm thick
- The superstructure concrete is dosed at 370 kg/m³ based on cement C.P.J 45
- The steel reinforcement coating is 13-2.5 cm
- Lay a mattress of dry stones under the platform
- Coating with chlorinated elements, two crossed layers, and watering at the end-coat or coatings in contact with the ground
- The pipeline must be leak-proof.

➢ Steel

- Tor steel of FeE40 type 1
- Mild steel for transverse reinforcements
- FeE24 coating for steels, 5 cm
- Soil stress σ = 1.40 bars / anchorage depth of 1.50 m
- FC28 = 25 MPa for the superstructure
- FC28 = 35 MPa for the infrastructure structure

2. Administrative path of the project

Table 11: synoptic table

phases	Step	Date	Admin
Pre-operationnelle phase	The registration of the operational construction of a school complex class A	04/05/2022	WALI of the state of Biskra
	Choice of land	06/04/2022	Meeting of the Technical Committee
operationnelle phase	Publish the competition notice	20/02/2022	Directorate of Public Equipment (DPE)
	Opening of bids and evaluation of application files	27/02/2022	DPE
	Opening and judgment of technical offers	09/03/2002	DPE
	Opening of bids and evaluation of financial offers	10/03/2022	DPE
	Choice of BET	05/04/2022	DEP
	Signing the deal with the design office	04-06/2022	DEP
	Notification of the order of services to the design office	03/07/2022	DEP
	Submit a soil study report	13/092022	LNHC
	Specifications (CDC) of realization	18/01/2023	GROUPEMENT SOLIDAIRE SAHARA
	Publish the call for tender notice	21/02/2023	DEP
	Opening of bids and evaluation of offers	16/03/2023	DEP
	Announcement of Temporary Grants	09/05/2023	DEP
	Signing the deal with the contractor	17D/08/2023	DEP
	Notification of the order of services to the contractor	21/08/2023	DEP

Source: DPE +student's disposal

3. Project origin and formation

Project development in Algeria follows a structured process, ensuring thorough planning and effective execution at every phase:

1. Assessing the necessity: The demographic and educational conditions are evaluated to establish the need for a new school, addressing the overcrowding in nearby primary institutions.
2. Submitting a request: The mayor or district officials formally apply to the Directorate of Education, highlighting the demand for a new establishment.
3. Reviewing the request: Competent authorities examine the application, verify priorities, and assess available resources. The Ministry of Finance then evaluates funding possibilities before approving.
4. Creating a technical document: The Directorate of Public Equipment in Biskra drafts a technical card outlining the location and key characteristics of the project.
5. Conducting an initial study: A feasibility study is undertaken, incorporating all educational and engineering specifications needed for the project.
6. Defining implementation conditions: A specialized study office prepares a comprehensive specifications document detailing essential standards and requirements.
7. Launching the tender process: A call for bids is issued to identify the institution best suited to carry out the project based on predefined criteria.
8. Selecting a contractor: The most suitable construction firm is chosen based on quality, cost, and timeline considerations, ensuring efficient execution of the project.
9. Initiating construction: Following contract signing, work commences according to the established schedule.
10. Supervising progress: Authorities oversee the construction to ensure compliance with required standards and quality benchmarks.
11. Receiving the completed project: Upon finishing the work, the school will officially receive it, subject to a final inspection to confirm adherence to specifications. Due to certain delays, partial delivery may take place.
12. Equipping and opening the school: The necessary furnishings and supplies are installed, preparing the institution to welcome students.

Conclusion

Chapter two provided a comprehensive analytical study of the Class A school complex project in Assarek, Biskra, bridging theoretical concepts of cost management and quality control with their practical applications. The chapter began by outlining the project's technical specifications, including its location, stakeholders, and key metrics such as area, budget, and timeline. This foundational information set the stage for a deeper exploration of the project's urban and architectural characteristics.

The urban reading highlighted the strategic advantages of the project site, such as its flat terrain, proximity to infrastructure, and accessibility, while also acknowledging challenges like unpaved roads. The project's significance to the community was emphasized, as it addresses long-standing demands for educational facilities and reduces the burden on neighboring schools. The distribution of spaces—68% unbuilt and 32% built—demonstrated a thoughtful balance between functionality and future expansion potential.

Architecturally, the chapter detailed the distribution of services across the building's floors, movement areas, and the separation of wet and dry zones. The structural system, based on a column-beam framework, was analyzed, along with thermal expansion joints to ensure durability. These elements underscored the project's adherence to practical and safety standards.

The administrative path of the project was meticulously documented, tracing each phase from initial assessment to construction and supervision. This section revealed the structured and collaborative efforts of various stakeholders, including the Directorate of Public Equipment, design offices, and contractors, to ensure the project's alignment with educational and engineering standards.

Finally, the chapter explored the project's origin and formation, illustrating the systematic process from identifying the need for the school to its eventual opening. This process highlighted the importance of thorough planning, feasibility studies, and stakeholder coordination in achieving successful project outcomes.

Chapter 03:
Management Study in the Case Study

Introduction

In this third chapter, the management study of the case study will be addressed in depth, with the aim of analysing the different aspects related to project management and assessing its success according to the criteria of effective management.

First, the delivery organisation in question will be introduced, focusing on the available material and human resources, and their impact on the implementation of the project. Then, the reference project will be studied by analysing the key factors associated with the project construction and completion process, taking into account quality control and cost management. A comparison will be made with the case study. This will be followed by an analysis of the reasons and obstacles faced by the studied project, as well as their relevance to the overall context of the study. This analysis will be done according to the management methods followed, focusing on two main aspects: Quality and cost.

Finally, the study's findings will be interpreted, and recommendations and suggestions will be made to ensure improved management performance for future similar projects.

This chapter aims to provide a comprehensive view of effective project management, focusing on the organizational and practical criteria that influence project success to analyse the different aspects related to project management and assess the efficient achievement of their objectives.

1. Presentation of the construction contractor:

The project to complete the Martyr Habashi Mabkhout Primary School was implemented by a contractor from the city of Biskra, and the following table shows the basic information about it:

Table 12: the project contractor information

enterprise name	State Structures Construction Works Enterprise - Farhat Ali –
its location	Biskra, Orlal municipality, tatay Mohamed Sadiq neighbourhood
The legal form of the enterprise	Private
Its Category	Grade 4 Construction and Electrical (main activity Construction)
Working years	2005 to present
Number of completed projects	About 100 projects between big and small projects
Number and date of registration in the Commercial Register	No. 98_A_1214047-07/00 dated 2019/02/19
Number of workers	20 workers
Number of engineers	1 architect 1 civil engineer 1 senior construction technician 1 senior electrical technician
Available equipment	1 concrete mixing station 2 cranes 6 concrete mixer 6 trucks 2 cars

Source: student, 2025

2. Progress of work on the project

The project was expected to be completed in five months, but there were many delays that prevented the initially set schedule from being achieved. In the following table, we will detail each stage of construction in the project:

Table 13: Project task process

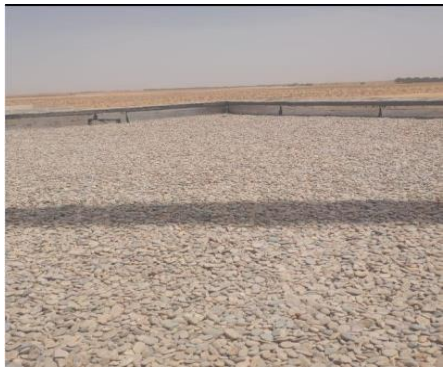
Construction works	**Start date**	**Duration**	**Quality**	**Cost (DA)**	
Groundworks	23/08/2023	7 days	• Complete the task on time • Full commitment of workers • Providing only the basics inside the workshop	237 826,00	 The pit for laying the longitudinal foundation  Backfilling a foundation pit

Infrastructure	30/08/2023	50 days	• Complete the task on time • Providing all necessary equipment • Administrative licensing runs smoothly • The results are consistent with the drawings	6 786 513,00	 Base molding and casting process  Asphalt the bases  Completion of ground beams

Superstructure	20/10/2023	100 days	• Completion of the task was delayed by about a month • Providing all necessary equipment • Workers work in unsafe conditions	7 678 500,00	 Completion of columns and beams for the ground floor  Concrete pouring for the ground floor roof  Completion of ground floor columns

Masonry - Rendering	24/12/2023	160 days	• Completion of the task was delayed • Providing all necessary equipment • Workers work in unsafe conditions	3 859 270,00	  Construction of interior and exterior walls   Interior and exterior wall cladding

Covering	20/03/2024	130 days	• Make up for the small delay in this task • Providing all necessary equipment • Workers work in unsafe conditions • Use local products	2 009 635,00	  Tiling floors and stairs   Cladding part of the walls with ceramics

Waterproofing	15/05/2024	15 days	• Make up for the small delay in this task • Providing all necessary equipment • Workers work in unsafe conditions • Use imported products	1 633 600,00	 Slope shape molding for Waterproofing  Laying down insulating materials and layers  Laying the gravel layer  Waterproofing efficiency test

PAINT	21/05/2024	60 days	• Use good-quality paints • Make up for the small delay in this task • Providing all necessary equipment • Workers work in unsafe conditions	1 741 647,50	  Painting the interior walls   Painting the facades Painting the exterior walls

Source: design office student's disposal

3. The Comparison:

Through this element, we will compare the quality and cost standards and practices applied in the Habashi Mabkhout primary school construction project with other international standards.

In terms of quality, we have chosen the most widespread and well-known international standards to compare with those applied in the first-class school complex construction project. This comparison was made in three aspects: the management of the construction site, the cost of quality, and the duration of the tasks performed in the project.

We have selected a set of international standards such as ISO, ACC and European standards for comparison in terms of construction workshop management and cost.

Regarding the duration of the tasks, we chose the Allenstown Elementary School project[1] as the reference project. Allenstown Elementary School is a public elementary school in Allenstown, New Hampshire, serving students in kindergarten through fourth grade. It is part of the Allenstown School District, and typically enrolls about 200 students and has a student-teacher ratio of about 11:1. The school was restored, and new annexes were built to expand and include teaching students up to the eighth grade. They were opened in this year.

Regarding the cost, we compared the prices of some basic raw materials and building materials with which the study project was completed with the prices of the same raw materials and materials for the year 2023 in the State of Egypt.

Construction information from the Arab Republic of Egypt was chosen as a reference example to be compared to the construction of the Martyr Habachi Mbkhout Elementary School in Algeria, based on a set of objective and methodological considerations. First, the economic and social context between the two countries is similar, with the construction sector in both Algeria and Egypt facing common challenges related to infrastructure, lack of resources, bureaucracy, and limited quality control, making the comparison more realistic and meaningful.

Second, Egypt provides accurate and up-to-date data on the prices of building materials through official bulletins issued by the Ministry of Housing, which is not available at the same level in Algeria. The bulletin issued in December 2023 was relied upon as a reliable source of basic material prices, allowing for an accurate quantitative comparison of costs.

Finally, the selection of Egyptian bulletins is not intended to make a perfect comparison, but rather to explore possible gaps in performance and identify opportunities for improvement. This approach is a step towards building a regional reference knowledge base that supports more effective decision-making in the management of educational construction projects in Algeria.

These prices were published in the building prices bulletin[2] issued by the Central Administration for Building Materials of the Ministry of Housing, Utilities and Urban Communities (December 2023 bulletin), and we took the average prices for January as a main reference because it corresponds to the period of submission of the conditions books for the project to complete the Martyr Habashi Mabkhout Primary School.

[1] https://www.education.nh.gov/sites/g/files/ehbemt326/files/inline-documents/sonh/manual-for-planning-and-construction-of-school-buildings.pdf

[2] https://img.mhuc.gov.eg/images/d6d99bf6-3d90-4e1b-8b88-6ad4d7679010.pdf

3.1. Quality aspect:

Table 14: comparison of applied quality standards

Quality aspects	Quality standards applied in the study project	Global quality standards	Criticism
Construction Site Management	A site installation plan has been completed and approved by the authorities.	Develop a site installation plan for the workshop before the start of the work and have it approved by the authorities. This plan includes equipment installation areas, material storage areas, administrative offices, workers' rest areas, roads inside the workshop, electricity, water, and sewage supplies etc.	Although the plan was completed, there was no focus on providing all its requirements within the workshop, such as preparing rooms for workers to rest and eating places etc. This is what should have been focused on, especially since the jobsite was in a relatively isolated area. This led to a decrease in the quality of the site and the work within it.
	There was no clear implementation of any practice stipulated in ISO 9001 in terms of documenting these practices in official documents.	Implementation of ISO 9001 through: • Analysing activities and identifying key processes within the workshop • Documenting procedures and building a quality management system • Training and awareness for workers within the workshop • Applying agreed procedures and conducting internal audits and corrective actions • Continuous improvement of activities and conditions within the workshop	The application of international quality laws in construction sites in Algeria is not common, especially in small projects. Some practices stipulated by these laws may exist but are undocumented or in an unstructured form. This leads us to consider launching awareness campaigns about the necessity and benefits of these practices.

	• Workers inside the workshop do not wear protective headgear. • Reinforcement and molding workers work barehanded. • Firefighting equipment is available. • Expected hazards were not taken into account when completing the schedule.	Implementation of the ISO 45001 standard in the aspect of health and occupational safety procedures for workers and identification of hazards	Safety regulations within our workshops must be developed and strictly enforced, especially since workers operate under unsanitary conditions, which increases the risk of accidents and illnesses within the workshop. Furthermore, the concept of identifying risks must be taken for granted and taken for granted, especially since it can save us from significant losses, both material and human.
	There is a protective fence around the workshop. Fire-fighting equipment is provided.	International building codes issued by the International Code Council (ICC) that regulate safety and security standards within the worksite	As we mentioned before, we must take security and safety measures more seriously and try to catch up with the world in this regard.
	• There is a workshop manager assigned by the construction company. • A workshop supervisor from the engineering office makes daily site visits. • An inspector assigned by the technical construction control authority comes in on specific days only. • 20 workers are assigned to complete various works.	Establish a construction site management office consisting of a Construction Site Manager, a Construction Site Supervisor, a Construction Site Engineer, a Construction Site Inspector, and Construction Workers.	Although there is no independent construction site office, all the active elements are present within the sites in Algeria and carry out their assigned role.

Cost	Prevention costs	Limited or variable investment due to budget constraints	High investment in training, advanced systems	There is no official documentation of quality costs for buildings in our country, but by comparing activities and practices in Algeria and other countries of the world, we find that these costs are almost eliminated from the total project expenses within our country.
	Appraisal Costs	Adoption of manual and traditional methods of inspection	Utilise modern technologies and automate testing	
	External Failure Costs	Relatively high due to weak control systems	Relatively low due to continuous process improvement	
	External Failure Costs	May rise due to non-compliance with international and national laws	Less with the assurance of delivering a high-quality building	
Duration	Groundworks	7 days	28 days	The noticeable difference in durations between the two projects is because the reference project had a great focus on the completion of tanks and ventilation and heating centers, but despite this, we note that there is a convergence between the durations, especially if we take into account the difference in geographical area, market, and administrative transactions between the two projects.
	Infrastructure	50 days	60 days	
	Superstructure	100 days	130 days	
	Masonry - Rendering	160 days	190 days	
	Covering	130 days	169 days	
	Waterproofing	15 days	/	
	Paint	60 days	90 days	

Source: student, 2025

3.2. Cost aspect

Table 15: compare costs

Construction materials	Unit	The costs in the case study project	The costs in the Egyptian price bulletin	Criticism
concrete	m^3	6 000,00	7 835,26	The large difference in the price of building materials between the case study project and the Egyptian price bulletin is due to several main reasons. The first is the difference in sources of supply and quality of materials, as the project may have obtained cheaper deals from specific suppliers. Secondly, project materials are purchased in bulk, which usually means substantial discounts, which individual prices do not show in the price bulletin. Thirdly, prospectus prices may include additional costs such as VAT or transport, or reflect more recent market prices influenced by inflation, while project costs are based on older fixed contracts. Finally, regional differences in distribution costs and the project's occasional use of alternative materials also play a role in these perceived price gaps.
reinforced concrete	m^3	35 000,00	10 045,87	
mortar	m^3	600,00	7 115,83	
MonoWall	m^2	900,00	1 504,27	
double wall	m^2	1 500,00	3 008,53	
Ceiling of hollow bodies	m^2	3 000,00	1 831,28	
tile	m^2	1 350,00	915,64	
ceramic	m^2	1 500,00	1 046,45	
Low-quality paint	m^2	150,00	130,81	
High-quality paint	m^2	180,00	183,13	

Source: student, 2025

3.3. General criticism

The construction sector in Algeria faces serious challenges in aligning quality standards with cost management, as comparisons with global standards reveal a significant gap in three basic aspects: construction site management, quality cost, and task completion time. This gap is not only technical, but a methodology that reflects the absence of an integrated vision linking quality and cost in the project life cycle.

On the practical side, we note that excessive focus on reducing direct costs leads to neglecting the indirect costs that appear later. For example, using cheap building materials may save some initial costs, but later translates into high costs for maintenance and repairs, not to mention potential construction risks. This wrong equation reflects negatively on the quality of facilities and their lifespan.

At the institutional level, the problem lies in the absence of a binding legislative framework and effective oversight. Although some projects apply parts of international standards, this application

Remains optional and unsystematic. This situation creates a heterogeneous environment, where quality standards vary greatly from one project to another, making performance evaluation and accounting difficult.

To get out of this dilemma, a comprehensive reform is required that starts with the updating of legislation to make international standards a mandatory part of major project contracts. Investment must also be made in building human capabilities through specialized training programs in total quality management. The importance of an incentive system that encourages contractors to adopt high-quality standards cannot be overlooked.

In conclusion, improving quality management in construction projects is not a luxury option, but rather an imperative necessity to ensure safe and sustainable construction. Investing in quality today saves costs tomorrow, and it is the equation that developed countries are aware of and are working hard to apply in every construction project.

4. Obstacles and incidental causes that faced the study project

The project faced a group of obstacles and problems, and through the following points, we will detail the problems that were related to the quality aspect and the obstacles that were related to the cost aspect

4.1. Problems related to project quality

1. Lack of continuous technical supervision due to the remoteness of the site and the difficulty of daily access for engineers and observers.
2. Failure to strictly implement established standards due to weak oversight.
3. Poor storage of materials (such as cement and iron) as a result of exposure to weather factors (rain, humidity, sun).
4. Weak skills of local workers and a lack of field training programs.
5. Lack of a clear quality control plan for the project.
6. The contractor's leniency and laxity in applying specifications to reduce costs.

4.2. Problems associated with project cost

1. Increased transportation costs due to the location's distance from supply centers and quarries.
2. Delayed financial payments from the owner, which leads to disruption of purchases and delay of work.
3. High operating costs, such as providing electricity generators or water tankers, due to the lack of infrastructure.
4. Waste of materials as a result of poor planning or inappropriate storage.
5. Costs of rework due to errors in implementation or non-conformity with specifications.
6. Inaccurate estimation of initial costs due to a lack of site field studies.

4.3. Analysis of problems and obstacles:

Through this element, we will analyze a group of the previous reasons through one of the quality and cost management tools

4.3.1. Analysis of the problem of low quality of implementation in the project:

We will analyze this problem using the Ishikawa diagram. The latter is one of the famous tools in the world and is named after one of the famous pioneers of quality management, Kaoru Ishikawa. This diagram is in the shape of the spine of a fish, and therefore, it is also called the fish diagram in addition to the cause and effect diagram.

4.3.1.1. Define Ishikawa diagram elements

1. The main problem: Low quality of implementation in the school complex project (class A)
2. Main branches and sub-causes:

- Human factors (40% impact)

Lack of technical expertise among workers

Inadequate engineering supervision

Frequent worker absenteeism

Poor training on quality standards

- Structural materials (30% impact)

Using materials without specifications (low cement percentage, non-conforming iron)

Incorrect storage of materials (exposure to rain and sun)

The arrival of materials was delayed, which led to the use of poor alternatives

- Planning and management (15% impact)

Lack of a clear quality control plan

Unrealistic budget allocation for quality

Lack of documentation and daily follow-up

- Environment and location (10% impact)

Difficulty transporting heavy equipment to the isolated site

Influence of weather factors (rain, humidity)

- Standards and control (5% impact)

Failure to apply international standards

Lack of oversight from guardian authorities

No penalties for violations

4.3.1.2. Drawing an Ishikawa diagram

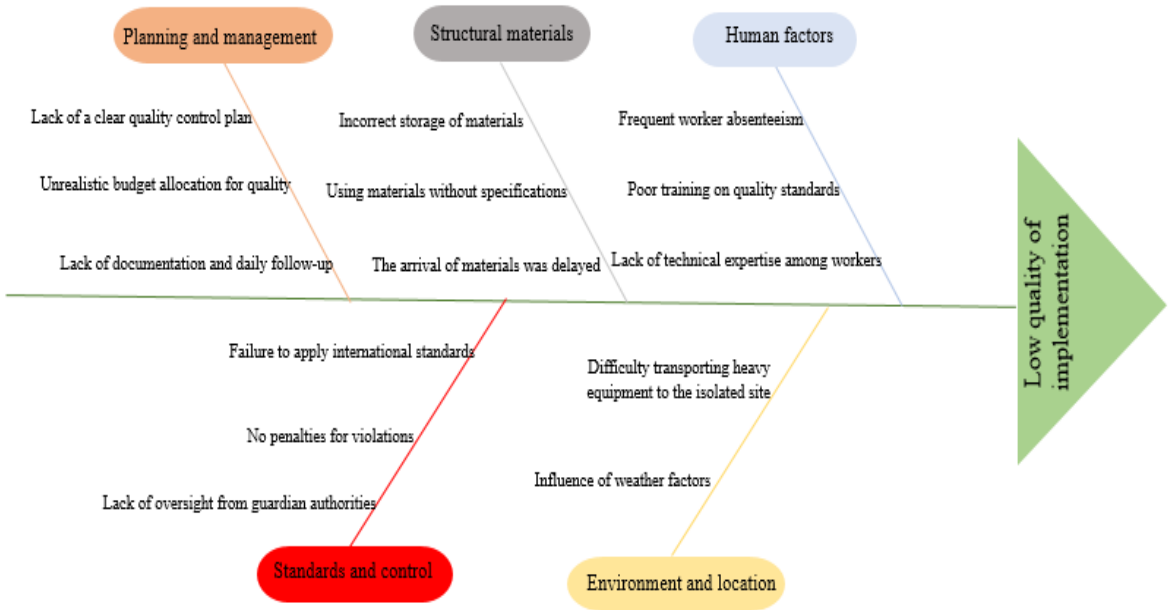


Figure 5: Ishikawa diagram

Source: student, 2025

4.3.1.3. Diagram Analysis

The decline in the quality of implementation is the result of the integration of several interconnected factors. The human element constitutes the largest part of the problem, which requires improving training programs and activating advanced supervision mechanisms. Ensuring that construction materials conform to standards and careful planning are among the main pillars of avoiding delays and redoing work. Ultimately, a rigorous control system is required that includes all aspects and responds to the site and environmental challenges of the project.

General improvement requires adopting a comprehensive strategy that integrates the efforts of the technical, administrative, and logistical departments in continuing to monitor quality, defining clear performance indicators, and developing contingency plans to confront any potential deviations or delays. Thus, the final results of the project can be improved in line with international quality standards and local requirements for the Class A school complex.

4.3.2. Project costs analysis :

To analyze project costs, we will use the variance analysis method, as this method helps us monitor deviations and differences between the planned and actual costs.

4.3.2.1. Complete the table of values

Table 16: Variance analysis of the project cost

construction works	Planned Cost (DA)	actual cost (DA)	deviation (DA)
Groundworks	244 754,00	370 655,45	125 901,45
Infrastructure	7 217 880,00	7 239 355,90	21 475,90
Superstructure	7 678 500,00	7 678 500,00	-
Masonry - Rendering	3 859 270,00	3 859 270,00	-
Covering	2 009 635,00	2 009 635,00	-
Waterproofing	1 633 600,00	1 633 600,00	-
Paint	1 741 647,50	1 741 647,50	-

Source: design office + +student’s disposal

4.3.2.2. Table Analysis

Through the comparison table between planned costs and actual costs, we note that most of the construction work items were carried out according to the established plans without deviation, which indicates regular implementation and the technical teams' commitment to financial specifications and estimates. Key items such as superstructures, brickwork and finishing, waterproofing, and painting were simply carried out to meet planned costs with no significant overruns.

In contrast, Groundworks emerged as a special case, with the actual cost allocated to this item exceeding the planned cost by a margin of 125,901.45. This increase is due to a number of reasons, including the emergence of additional work that was not previously calculated and taken into account.

As for infrastructure, it recorded a small deviation of only 21,475.90, which reflects the accuracy of planning and implementation in this aspect due to minor adjustments resulting from small price differences. This result shows that the estimates were accurate and that cost control was well done during the implementation phases.

In general, we can say that project management in terms of adherence to budget estimates in most items was successful, with the clear exception of the flooring item, which witnessed a significant increase.

5. Interpretation of results

The analytical study of the project resulted in a set of important results, which were reached through the comparison we conducted and the analysis of the obstacles facing the approved project. These results showed the following:

A specific weakness in the quality system: the absence of documented and actual application of international standards such as ISO 9001 and ISO 45001, as some good practices existed but were not organized and not based on official documents, which negatively affected the work environment and the safety of users.

Absence of a quality cost control system: A clear system for prevention, evaluation, and rework costs has not been adopted, unlike reference projects that place quality at the core of financial planning mechanisms.

The workshop conditions are inadequate: although there was an organizational plan for the workshop, its application on the ground was deficient. Lack of rest facilities and ignoring aspects of occupational health and safety have reduced production performance and increased the possibility of accidents.

Relative success in cost control: Despite the lack of quality cost control, the project maintained almost complete adherence to the allocated budget, except for ground works, which witnessed a significant deviation as a result of additional unprogrammed works.

Clear time delay: Comparing deadlines showed that the project suffers from noticeable delays, especially in structure and preparation, which indicates a defect in time planning and in the effective distribution of human resources.

Environmental and regulatory obstacles: Among the most prominent obstacles counted were: the distance of the site from supply centers, delayed financial payments, and weak support infrastructure, which created additional costs and operational obstacles that affected the quality of implementation.

6. Guidance and solutions (proposals and recommendations)

Based on the previous results and the problems analyzed using quality tools such as the Ishikawa diagram and cost variance analysis, the following recommendations can be made in a detailed and integrated manner:

- Improve the quality of work in the workshop :

-Equipping the workshop in an integrated manner includes rest areas for workers, sanitary facilities, and safety equipment.
-Enforce the wearing of personal protective equipment such as helmets and work gloves.
-Organizing awareness-raising and training courses for workers on occupational health and safety standards.

- Secondly, the integration of quality systems

-Adopting an internal quality management system based on ISO 9001, including:
-Document processes and procedures.
-Appointment of a field quality officer.
-Implement internal audits and periodic corrections.

- Third: Adopting a cost control plan

- Divide quality costs into preventive, evaluative, internal, and external failure.
- Including the cost of quality within the project budget and following it up during all stages of completion.
- Create a reference database of quality costs in previous projects to audit future estimates.

- Fourth : Restructuring time planning

- Adopting advanced software for planning human and material resources, such as MS Project or Primavera.
- Inclusion of a time margin for unforeseen risks associated with location and climate.

- Fifth : Fixing the site problem

- An in-depth field study before the start of the project to determine the actual cost of transportation and services.
- Prior coordination with the authorities to provide support infrastructure (water, electricity, roads).

- Sixth: Reforms at the legislative and institutional levels

- Amending the specifications books to include mandatory respect for international standards in public projects.
- Integrating a financial incentive system for contractors who are committed to high quality without exceeding costs and deadlines.

In the following table, we list a set of practical actions that can be implemented in a primary school realisation project :

Table 17: practical actions

Action	Responsible party	Execution time	Success Indicator
Prepare rest areas and sanitary facilities for workers from the first month of the project.	Contractor Farhat Ali	Throughout the project	Field visit reports indicating increased productivity and speed of work
Organising awareness sessions for workers on workshop hazards and distributing protective equipment	The contractor, in partnership with the studies office headed by Bourjouh Adel.	During the first two weeks of the project.	A decrease in the number of accidents recorded in workshop reports
Use software such as MS Project or Primavera to set tasks, resources, and risks.	The studies office is headed by Bourjouh Adel.	Before the start of the works.	Provide an up-to-date electronic timeline and an automated weekly progress and deviation report.
Identify 3 key indicators (progress rate, financial deviation rate, safety indicators).	Follow-up team.	Starting from the second week.	Have regular KPI reports and analyse them in weekly evaluation meetings.

Source: Student, 2025

Conclusion

This chapter provided a comprehensive management study of the Martyr Habashi Mabkhout Primary School project, evaluating its adherence to quality control protocols, cost management efficiency, and alignment with international standards. Through comparative analysis with global benchmarks (e.g., the Allenstown Elementary School project and Egypt's 2023 building materials bulletin), alongside diagnostic tools like the Ishikawa diagram and variance analysis, critical insights emerged. The project exhibited significant deviations in quality standards, particularly in occupational safety (e.g., workers operating without protective gear) and documentation practices. While cost control was largely maintained in phases like superstructure and masonry rendering, substantial overruns occurred in groundworks due to unplanned additional works and logistical constraints.

Furthermore, the variance analysis highlighted systemic weaknesses in quality cost integration, where preventive and appraisal costs were overlooked, leading to reactive spending on rework. Human factors—identified as the primary root cause (40% impact) via the Ishikawa diagram—compounded delays and compromised output quality. Geographical obstacles, including the remote site location and inadequate infrastructure, exacerbated project delays and inflated operational expenses. Crucially, the absence of enforceable legislative frameworks** for **international standards (e.g., ISO 9001, ISO 45001) underscored institutional gaps in mandating best practices.

To address these challenges, the chapter proposes integrated reforms adopting quality management systems (e.g., documented ISO procedures and onsite quality officers), embedding quality costs into budgetary planning, and leveraging project management software for realistic scheduling. Legislative amendments to specifications books should enforce compliance with global standards, while financial incentives could reward contractors achieving quality-time-cost equilibrium. Ultimately, investing in preventive quality measures—from rigorous site installation plans to worker safety protocols—proves essential to curbing external failure costs and ensuring sustainable project outcomes.

This analysis reaffirms that quality management is not ancillary but foundational to cost efficiency and project success. Aligning Algeria's construction practices with global paradigms will mitigate risks, optimize resource allocation, and deliver infrastructure resilient to both operational and environmental demands.

General conclusion

This dissertation explored the complex interplay between quality management and cost control in construction projects. The research demonstrated that project success depends not solely on minimizing costs but on integrating robust quality management practices throughout the project lifecycle. It emphasized that maintaining high-quality standards leads to long-term cost savings and enhances project sustainability.

The early chapters established key project management concepts, highlighting the dual challenge of balancing costs with quality. Theoretical analysis introduced international standards such as ISO 9001 and ISO 45001, revealing a significant gap between these benchmarks and their implementation in local contexts. This discrepancy was shown to adversely affect timelines, safety, and overall performance in construction projects.

A detailed case study of a Class A school complex illustrated real-world challenges. Technical data—including spatial plans, material requirements, and cost estimates—provided a foundation for analyzing variances. The study identified budget overruns, particularly in groundworks, due to unforeseen conditions. These findings reinforced the need for proactive cost control and flexible financial planning.

Quality issues were analyzed using tools like the Ishikawa diagram, which helped map out root causes of performance deficiencies. Factors such as inadequate supervision, poor adherence to standards, and human error were identified as major contributors to subpar quality. These insights led to strategic recommendations focused on training, supervision, and compliance with documented procedures.

The management evaluation compared the case study to international benchmarks, such as the Allenstown Elementary School project. While some cost-control practices were effective, shortcomings in quality control integration were evident. The analysis underscored that staying within budget is not enough—projects must also achieve lasting value through quality-driven planning and execution.

Environmental and logistical factors, such as the remote site location, unpaved access roads, and delayed payments, were also found to increase project costs. Weak logistical coordination and stakeholder communication further magnified these issues, illustrating the need for comprehensive administrative and environmental planning.

To address these challenges, the dissertation proposed a fully integrated quality management system, with features such as routine audits, structured training, and strict occupational health and safety protocols aligned with international standards. These measures would reduce rework, improve efficiency, and cut indirect costs.

Additionally, the adoption of advanced project planning tools like MS Project or Primavera was recommended. These tools would support better scheduling, risk assessment, and resource allocation. Establishing contingency budgets and transparent cost-control mechanisms would also enable quicker responses to unexpected developments.

The dissertation also advocated for legislative reform in Algeria to enforce the mandatory application of international quality standards in public projects. Incentivizing contractors who comply with these standards could raise overall industry performance, improve safety, and ensure the delivery of durable public infrastructure.

In conclusion, the study highlights the crucial relationship between quality and cost management. It calls for a paradigm shift that treats quality not as optional but as central to effective project delivery. By adopting integrated systems, leveraging technology, and fostering a culture of continuous improvement, construction projects can achieve better outcomes in terms of efficiency, longevity, and societal impact.

The research findings offer valuable guidance for future construction management, both locally and globally. If its recommendations are adopted, they can lead to more accountable, structured, and sustainable project execution. Ultimately, the study affirms that excellence in construction depends on collective commitment—from decision-makers to on-site personnel—to integrate cost efficiency with uncompromising quality standards, thereby securing long-term benefits for all stakeholders.

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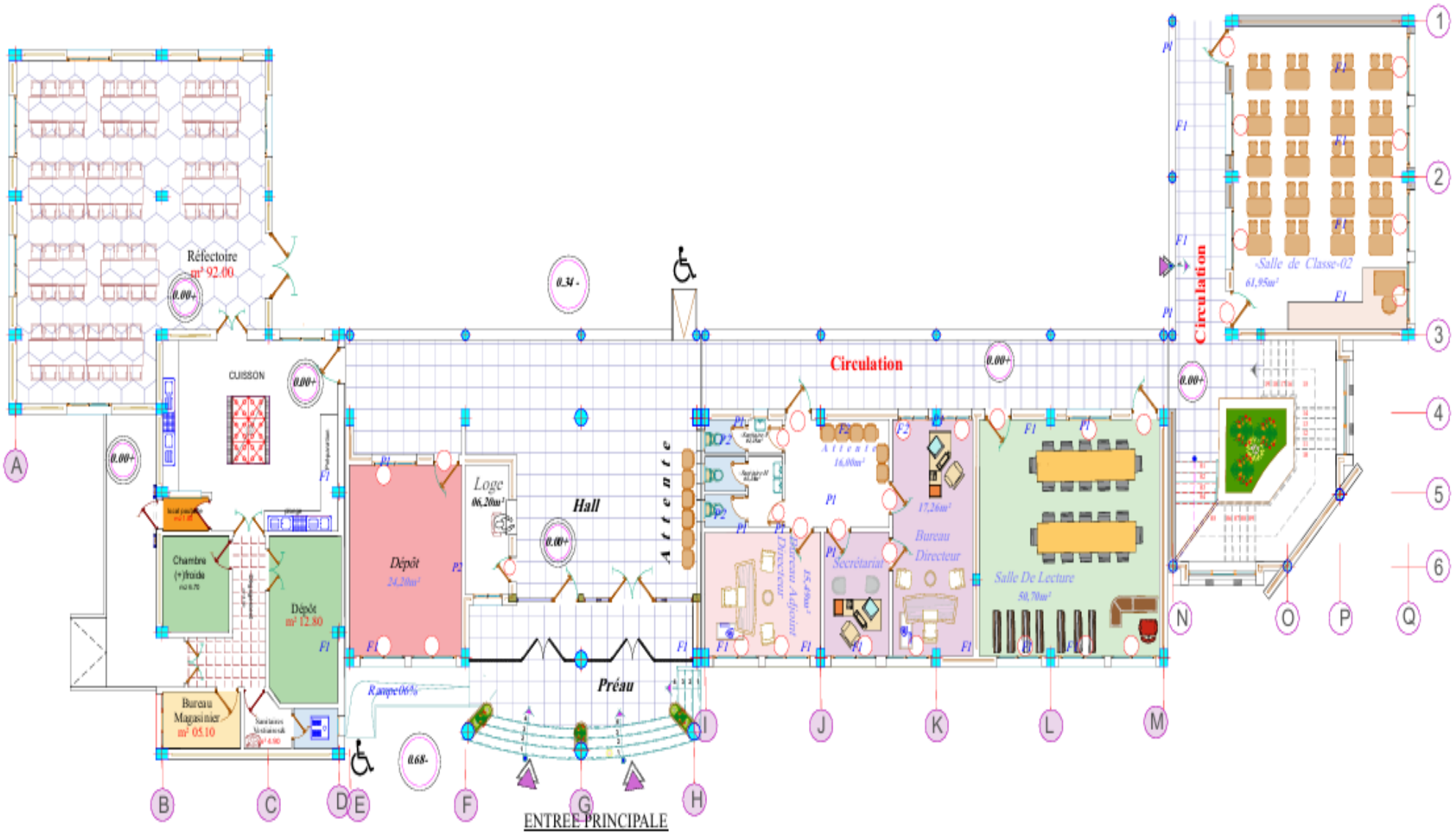
التعليم المتوسط دروس اختبارات تمارين .(2025) .موقع الدراسة الجزائريhttps://eddirasa.com/ens-cm .

Google Maps. (2025, March 7). Google Maps. https://www.google.com/maps/@34.5645432,5.5515175,730m/data=!3m1!1e3

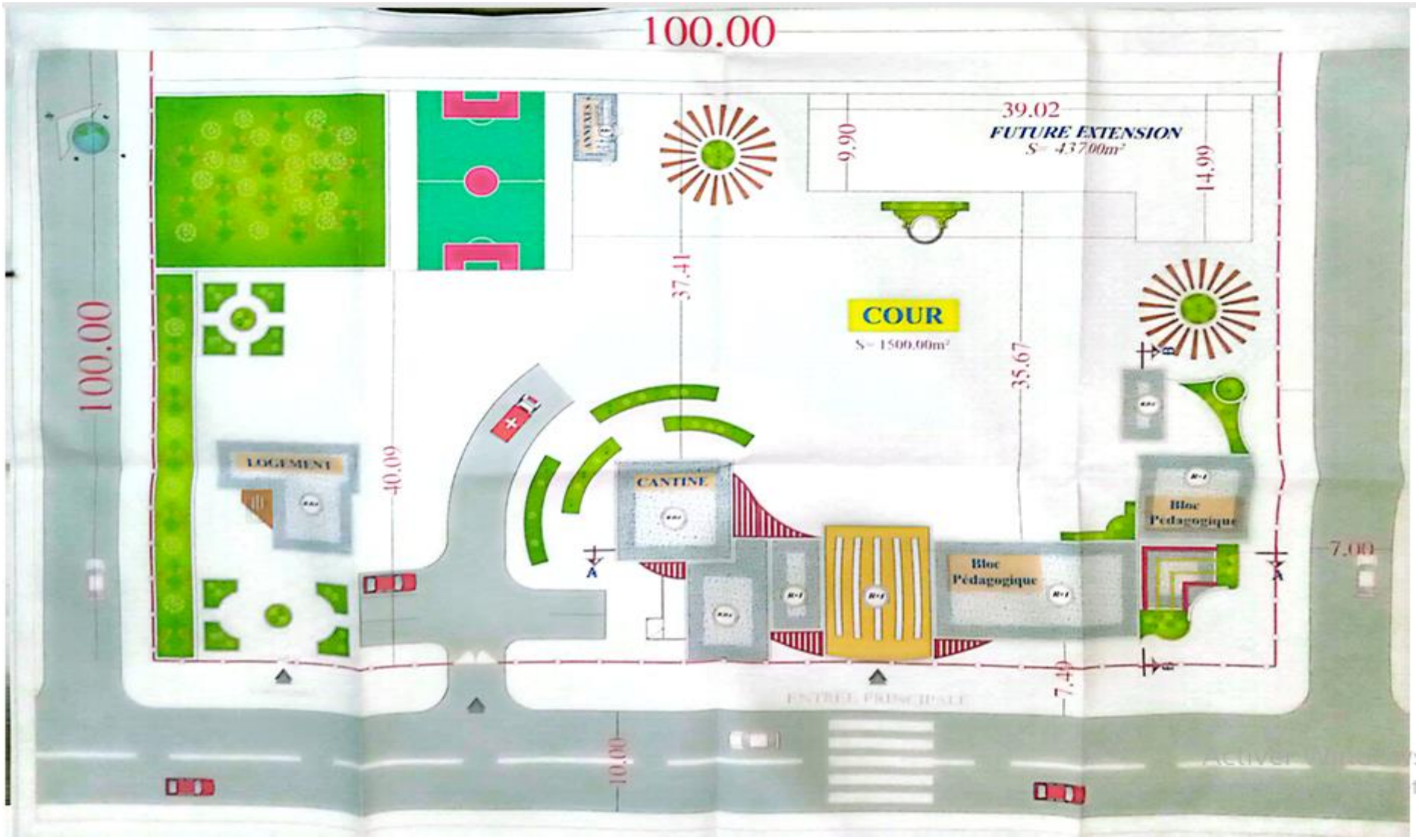
Annexes



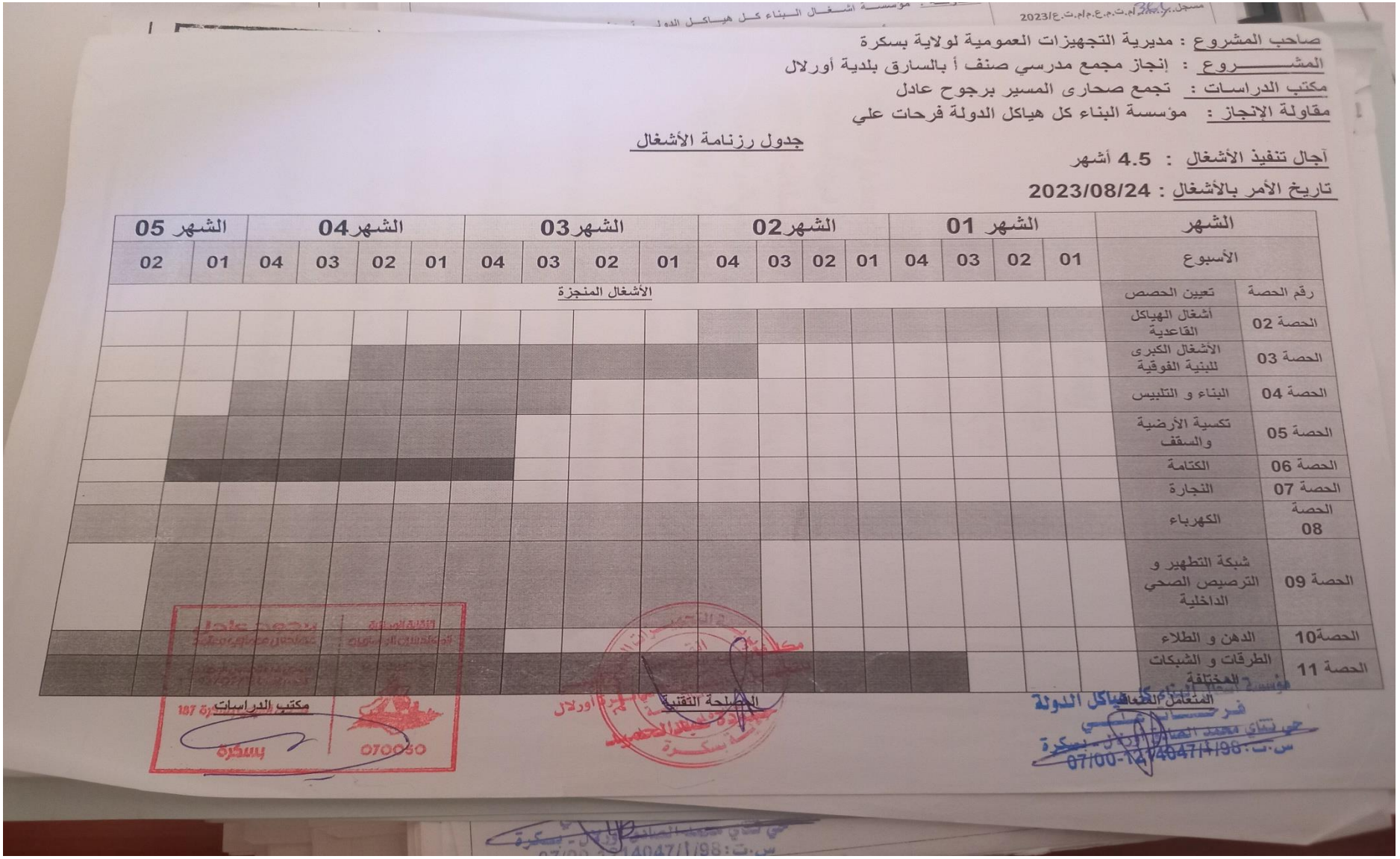
Ground floor plan

First floor plan

Main Interface


100.00
39.02
FUTURE EXTENSION
S= 437.00m²
9.90
14.99
37.41
COUR
S= 1500.00m²
35.67
100.00
LOGEMENT
40.00
CANTINE
Bloc Pédagogique
Bloc Pédagogique
7.00
7.49
ENTREE PRINCIPALE
10.00

Ground plan



صاحب المشروع : مديرية التجهيزات العمومية لولاية بسكرة

المشـــــــروع : إنجاز مجمع مدرسي صنف أ بالسارق بلدية أورلال

مكتب الدراسات : تجمع صحارى المسير برجوح عادل

مقاولة الإنجاز : مؤسسة البناء كل هياكل الدولة فرحات علي

جدول رزنامة الأشغال

آجال تنفيذ الأشغال : 4.5 أشهر

تاريخ الأمر بالأشغال : 2023/08/24

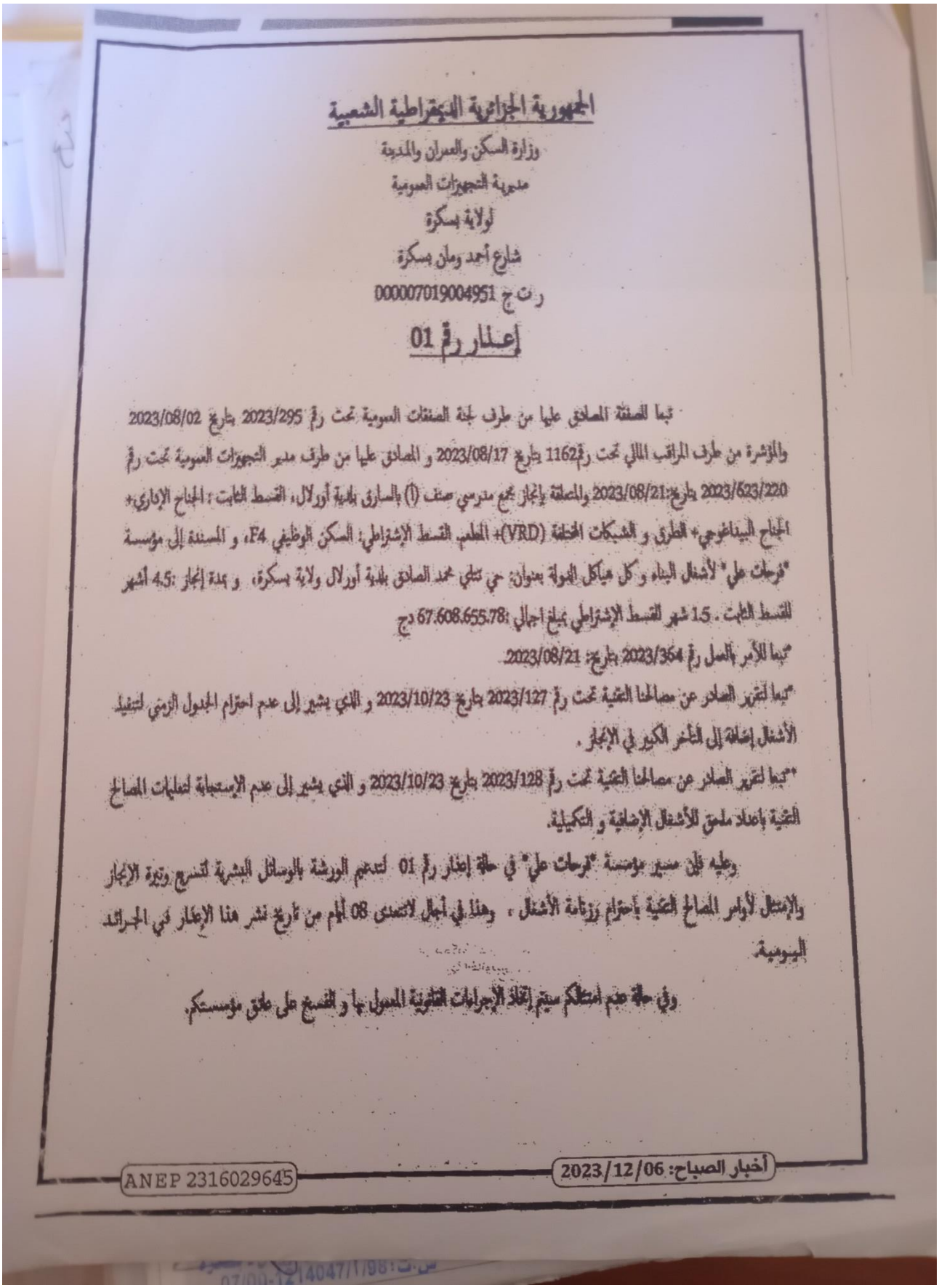
الشهر		الشهر 01				الشهر02				الشهر03				الشهر04				الشهر 05	
الأسبوع		01	02	03	04	01	02	03	04	01	02	03	04	01	02	03	04	01	02
رقم الحصة	تعيين الحصص	الأشغال المنجزة																	
الحصة 02	أشغال الهياكل القاعدية																		
الحصة 03	الأشغال الكبرى للبنية الفوقية																		
الحصة 04	البناء و التلبيس																		
الحصة 05	تكسية الأرضية والسقف																		
الحصة 06	الكتامة																		
الحصة 07	النجارة																		
الحصة 08	الكهرباء																		
الحصة 09	شبكة التطهير و الترصيص الصحي الداخلية																		
الحصة10	الدهن و الطلاء																		
الحصة 11	الطرقات و الشبكات المختلفة																		

المتعامل المتعاقد

مكتب الدراسات

المصلحة التقنية

Project planning



الجمهورية الجزائرية الديمقراطية الشعبية

وزارة السكن والعمران والمدينة

مديرية التجهيزات العمومية

ولاية بسكرة

شارع أحمد رمان بسكرة

ر ت ج 000007019004951

إعذار رقم 01

تبعا للصفقة المصادق عليها من طرف لجنة الصفقات العمومية تحت رقم 2023/295 بتاريخ 2023/08/02 والمؤشرة من طرف المراقب المالي تحت رقم1162 بتاريخ 2023/08/17 و المصادق عليها من طرف مدير التجهيزات العمومية تحت رقم 2023/623/220 بتاريخ:2023/08/21 والمتعلقة بإنجاز تجمع مدرسي صنف (1) بالسارق بلدية أورلال، القسط الثابت : الجناح الإداري+ الجناح البيداغوجي+ الطرق و الشبكات المختلفة (VRD)+ المطعم القسط الإشتراطي: السكن الوظيفي F4، و المسندة إلى مؤسسة "فرحات علي" لأشغال البناء و كل هياكل الدولة بعنوان: حي تيلي محمد الصادق بلدية أورلال ولاية بسكرة، و بمدة إنجاز :4.5 أشهر للقسط الثابت . 1.5 شهر للقسط الإشتراطي بمبلغ اجمالي :67.608.655.78 دج

"تبعا للأمر بالعمل رقم 2023/364 بتاريخ: 2023/08/21.

"تبعا لتقرير العاجز عن مصالحنا الفنية تحت رقم 2023/127 بتاريخ 2023/10/23 و الذي يشير إلى عدم احترام الجدول الزمني لتنفيذ الأشغال إضافة إلى التأخر الكبير في الإنجاز .

"تبعا لتقرير العاجز عن مصالحنا الفنية تحت رقم 2023/128 بتاريخ 2023/10/23 و الذي يشير إلى عدم الإستجابة لتعليمات المصالح الفنية بإعداد ملحق للأشغال الإضافية و التكميلية.

وعليه فإن مسير مؤسسة "فرحات علي" في حالة إعذار رقم 01 لتدعيم الورشة بالوسائل البشرية لتسريع وتيرة الإنجاز والإمتثال لأوامر المصالح الفنية بإحترام رزنامة الأشغال ، وهذا في أجل لاتتعدى 08 أيام من تاريخ نشر هذا الإعذار في الجرائد اليومية.

وفي حالة عدم امتثالكم سيتم إتخاذ الإجراءات القانونية المعمول بها و الفسخ على عاتق مؤسستكم.

ANEP 2316029645

أخبار الصباح: 2023/12/06

Formal notice

الجمهورية الجزائرية الديمقراطية الشعبية

ولايـــة بسكرة
مديـــريـــة التجهيـــزات العمـــوميـــة

تأشيرة المراقب المالي
رقم: 1162 تاريخ:
بسكرة في:
2023 أوت 17

295 / 2023

صـفقـــــــــة

المشروع: إنجاز مجمع مدرسي صنف (أ) بالسارق بلدية أورلال
القسط الثابت : الجناح الإداري + الجناح البيداغوجي + الطرق والشبكات المختلفة (VRD) + المطعم.
القسط الإشتراطي : السكن الوظيفي F4.

عمليـة رقـم : NE.5.623.4.262.107.21.06

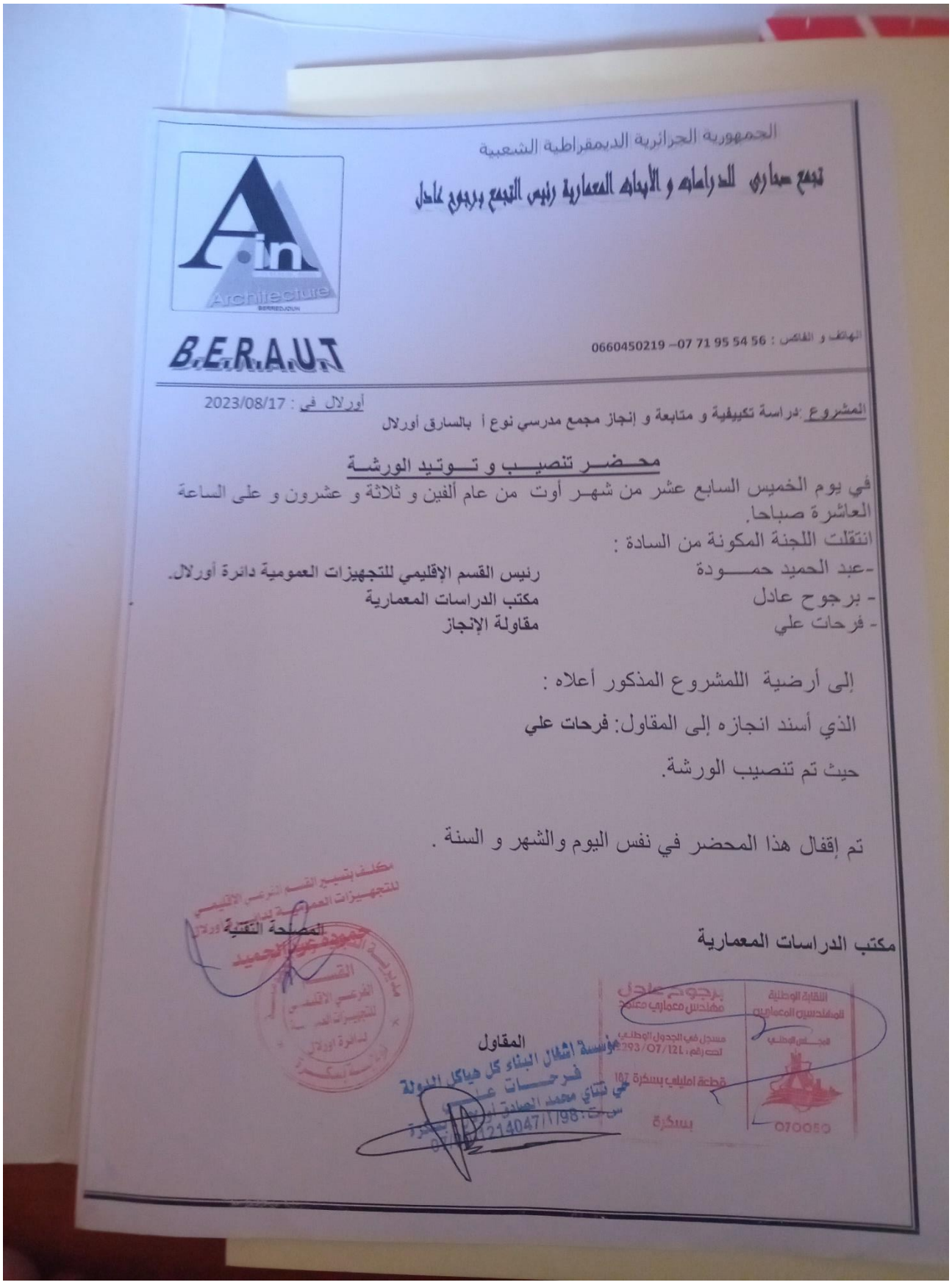
تسمية العملية: دراسة، متابعة، إنجاز وتجهيز مجمع مدرسي صنف "أ" بالسارق بلدية أورلال

تاريخ الجلسة
02 أوت 2023

تأشيرة اللجنة الولائية للصفقات
رقم: 295../2023
بتاريخ: 02 أوت 2023

﴿ مـؤسســة أشغـــال البناء كل هياكل الدولـــــــة ﴾
فرحـــــات علـــي

Project deal



الجمهورية الجزائرية الديمقراطية الشعبية

تجمع حضاري للدراسات و الأبحاث المعمارية رئيس التجمع برجوح عادل

B.E.R.A.U.T

الهاتف و الفاكس : 0660450219 –07 71 95 54 56

المشروع :دراسة تكييفية و متابعة و إنجاز مجمع مدرسي نوع أ بالسارق أورلال

أورلال في : 2023/08/17

محـــضـــر تنصيـــب و تـــوتيد الورشـــة

في يوم الخميس السابع عشر من شهـر أوت من عام ألفين و ثلاثة و عشرون و على الساعة العاشرة صباحا.

انتقلت اللجنة المكونة من السادة :

-عبد الحميد حمـــــودة	رئيس القسم الإقليمي للتجهيزات العمومية دائرة أورلال.
- برجوح عادل	مكتب الدراسات المعمارية
- فرحات علي	مقاولة الإنجاز

إلى أرضية اللمشروع المذكور أعلاه :

الذي أسند انجازه إلى المقاول: فرحات علي

حيث تم تنصيب الورشة.

تم إقفال هذا المحضر في نفس اليوم والشهر و السنة .

المصلحة التقنية

مكتب الدراسات المعمارية

المقاول

Worksite installation and consolidation minutes

Summary

This dissertation examines the critical role of project management—and particularly process management—in the construction sector. It begins by establishing a theoretical framework that defines key concepts such as the nature of projects, the specific challenges of construction, and the importance of coordinating various stakeholders. The study reviews internationally recognized practices (e.g., ISO 9001 and ISO 45001) and discusses their limited implementation in local projects. Through a detailed case study of a Class A primary school project, the work illustrates how cost management and quality control are interdependent elements essential for success.

The dissertation is structured in several parts. The first section provides an overview of project management in construction, outlining the project life cycle and the knowledge areas as described by the PMBOK and other standards. The second part presents the technical and managerial aspects of a specific school project in terms of planning, design, execution, and subsequent monitoring. Comprehensive diagnostic tools are employed, including variance analysis and the Ishikawa diagram, to identify key challenges such as inadequate process documentation, workforce shortcomings, and environmental constraints.

In the latter sections, the study proposes strategic recommendations aimed at integrating quality and cost management practices. This includes establishing robust quality management systems with clear documentation, implementing continuous training for workers, leveraging modern project planning software, and advocating for legislative reforms that enforce adherence to international standards. Ultimately, the research demonstrates that a well-integrated management approach not only minimizes cost overruns but also enhances long-term project sustainability and performance.

Keywords: Quality – Cost - Primary school - management

الملخص

تتناول هذه المذكرة الدور الأساسي لإدارة المشاريع، لا سيما إدارة العمليات، في قطاع الإنشاءات. تبدأ الدراسة بإرساء إطار نظري يُعرّف المفاهيم الأساسية مثل طبيعة المشروع والتحديات الخاصة بقطاع البناء وأهمية تنسيق الأطراف المعنية. كما تستعرض المذكرة الممارسات العالمية المعترف بها) مثل ISO 9001 و (ISO 45001وتوضح قلة تطبيقها في المشاريع المحلية. من خلال دراسة حالة مفصلة لمشروع إنشاء مدرسة ابتدائية من الفئة (أ)، يتم إبراز الأهمية التبادلية لإدارة التكاليف ومراقبة الجودة كعناصر حاسمة لنجاح المشروع.

تنقسم المذكرة إلى عدة أجزاء؛ حيث يقدم الجزء الأول نظرة عامة عن إدارة المشاريع في مجال الإنشاءات، موضحًا دورة حياة المشروع ومناطق المعرفة وفقًا لمعايير PMBOK وغيرها من المعايير الدولية. يتناول الجزء الثاني الجوانب الفنية والإدارية لمشروع المدرسة من حيث التخطيط والتصميم والتنفيذ والمتابعة اللاحقة. وتُستخدم أدوات تشخيص شاملة مثل تحليل الفروق (Variance Analysis)ومخطط إيشيكاوا لتحديد التحديات الرئيسية مثل ضعف توثيق العمليات، ونقص الكوادر الفنية، والقيود البيئية.

في الأقسام اللاحقة، تقترح الدراسة توصيات استراتيجية تهدف إلى دمج ممارسات إدارة الجودة والتكاليف بصورة متكاملة. ويتضمن ذلك إقامة نظم لإدارة الجودة موثقة، وتنفيذ برامج تدريبية مستمرة للعمال، واستخدام برمجيات حديثة للتخطيط، والمطالبة بإصلاحات تشريعية تُلزم باستخدام المعايير الدولية. وتُظهر الدراسة في ختامها أن تبني نهج متكامل في الإدارة لا يساهم فقط في تقليل التجاوزات في التكاليف وإنما يعزز أيضًا استدامة المشروع وأدائه على المدى الطويل.