Industrial Engineering Degree Thesis

GPM Fit into a Chinese Environment

Oriol Vaquer Arnau

Universitat Politècnica de Catalunya

北京交通大学

Collaborators:

Tianqiao Tang (唐天巧)
Jesús Hernández Aguirre

Spring 2014
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Spring 2014
To my brother,

who is getting married in September

Moltes Felicitats Gerard!
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Preface
Dear reader, the thesis you are holding in your hands is a project management guide. The writer performed it in Spring 2014 at the capital city of China: Beijing.

The writer was in China due to an agreement among Universitat Politècnica de Catalunya (UPC) and Beijing Jiaotong University (北京交通大学). On top of that, he was also doing an internship in a local consulting company called Gold Millennium Group (金色千年咨询有限公司) in its Beijing Office doing an specific project.

During this preface, the reader is going to know about the thesis structure, what is project management, some certifications of this discipline and a description of the company, as well as the writer’s project in GMG.

This thesis has been supervised by Gold Millennium Group managing director, Mr. Hernández; and Professor Tang (唐天巧) from Beijing Jiaotong University.

The thesis structure

The thesis that the writer is holding is structured by three modules; module A, B and C.

The title of Module A is "China and Environment". In this section the reader is going to get a quick overview of how China is structured and the environmental problems that the country has; from how water resources are affected by the growth of Chinese population to how China contributes to climate change. The reader will also be informed on the ongoing environmental policy of Chinese Government. On top of that, one issue will be studied in detail: pollution. Furthermore, the writer is going to breakdown the ten major causes of pollution, as well as perform a six-month air quality index (AQI) analysis of Beijing. Eventually, GPM is going to be briefly introduced leading the path to the next module.

Next module is B, whose title is "The Discipline of Project Management ". In this module, the reader is going to learn tools and techniques of Project Management and, specially, Green Project Management; in short, GPM®. The writer decided Module B to be structured following the Project Management standard guideline; ISO21500. Because of the previous fact, the first chapter is going to introduce Sustainability and the project management standard and, from then on, each chapter is going to cover one phase of the project, explaining the most important tools and techniques of it. Nevertheless, in order not to loose the focus, some of those techniques will be explained in an
extra final chapter. Once the project phases are covered, ISO21500 Organizational Structure will follow them.

The last, module C, is a project example where will be used module B’s tools and techniques. While the writer was doing the thesis, he was also working in a Chinese local company called Gold Millennium Group, from now on GMG.

Project Management

Project management is the process and activity of planning, organizing, motivating; and controlling resources, procedures and protocols to achieve specific or daily problems. A project is a temporary endeavor designed to produce a unique product, service or result with a defined beginning and end (usually time-constrained, and often constrained by funding or deliverables), undertaken to meet unique goals and objectives, typically to bring about beneficial change or added value.

The temporary nature of projects stands in contrast with business as usual (or operations), which are repetitive, permanent or semi-permanent functional activities to produce products or services. In practice, the management of these two systems is often quite different, and as such requires the development of distinct technical skills and management strategies.

The main challenge of project management is to achieve all of the project goals and objectives while honoring the preconceived constraints. The primary constraints are scope, time, quality and budget. The secondary, and more ambitious, challenge is to optimize the allocation of necessary inputs and integrate them to meet pre-defined objectives.

As Project Management was taking an important role in business lines, the International Standardization Organization (ISO) built up ISO21500 which is a project management guideline explaining the organizational structure as well as the project phases (Planning, Executing, Controlling and Closing).

Furthermore, in 1960s the Project Management Institute (PMI) was created and, this institute, was supposed to certify project managers following PMBOK®.
Project Management Institute, PMBOK® and PMP®.

The Project Management Institute (PMI) is a not for profit professional organization for the project management profession with the purpose of advancing project management.

The Project Management Institute offers a range of services to the project management profession such as the development of standards, research, education, publication, networking-opportunities in local chapters, hosting conferences and training seminars and maintaining multiple credentials in project management.

PMI creates industry standards. Such as "A Guide to the Project Management Body of Knowledge", also known as PMBOK [32] which has been recognized by the American National Standards Institute (ANSI).

PMI history began back to 1960s when the field of project management; emerged in aerospace, construction and defense industries. People from these industries and the academics initiated the Project Management Institute (PMI) that was founded in October 1969 at the Georgia Institute of Technology. Later, in 1980s project management was maturing as a field, and efforts were made to standardize its procedures and approaches. PMI contributed to the cause by presenting the first edition of Project Management Body of Knowledge (PMBOK) in 1986. Late 1990s the number of members tripled to 90,000 from 120 countries around the globe. In 2008 the number of members tripled again to 260,000 from 150 countries. In 2013 was launched the 5th edition of PMBOK.

In 1984 PMI’s first credential, PMP®, was launched. It has since become a de facto standard certification, along with PRINCE2 certification, in project management. Over 500,000 people now hold the PMP® credential.

Nowadays, PMI offers the following credentials:

- Certified Associate in Project Management (CAPM®)
- Project Management Professional (PMP®)
- Program Management Professional (PgMP®)
- Portfolio Management Professional (PfMP®)
- PMI Agile Certified Practitioner (PMI-ACP®)
- PMI Risk Management Professional (PMI-RMP®)
- PMI Scheduling Professional (PMI-SP®)
GPM Global, PRiSM® and GPM-b®

GPM Global is a sustainability based project management organization that accredits professionals and programs. It adheres to the highest management standards and support courses and certifications based on industry specific competences.

Green Project Management, from now on GPM, provides innovation to the project management discipline by enhancing the already established project management framework defined by the five major process groups and ten primary subject areas. GPM presents a foundational enhancement the concept of PRiSM “Project integrating Sustainable Methods” which is a green project management delivery method and conceptual curriculum basis. It leverages the wisdom and standards set forth in the established books of knowledge, such as PMI PMBOK, used by project managers throughout the world and integrate an applicable framework of sustainability derived from several international standards.

As GPM Global main goal is seeking to maximize value in the long term for project management.

As a representative data is that in just six years, Green and Sustainable Project Management using PRiSM methodology can be trained in over 128 countries.

GPM Global also certifies individuals. Here follows the certifications that offers:
  ✓ GPM-b certification (based on PRiSM)
  ✓ GPM certification
  ✓ GPM-m certification
Gold Millennium Consulting Group (金色千年咨询有限公司)

Gold Millennium Group Ltd. (金色千年咨询有限公司) is a global consulting company established in China in 2006. With a diverse network of over 80 dedicated professionals collaborating to provide a wide range of services such as incorporation of companies in China and Hong Kong, consultancy and advisory services, accounting and auditing, intellectual property, investment strategy and strategic communication services, import-export services, negotiation, due diligence and Project Management consulting and training under the PMI® and GPM® standards.

With over nine years of experience of advising our Clients with their investments in the People’s Republic of China and helping hundreds of companies to successfully set up in China’s development zones, the firm’s efforts have been directed to firmly position itself strategically as a partner capable of providing added value to the client-advisor relationship. GMG helps its clients minimize the risks of investing in China.

In the Project Management area, GMG covers the three levels in terms of consulting; Project, Program and Portfolio consulting. Some GMG consultants seat in project steering committees for Chinese companies that want to do projects abroad. Some GMG consultants head PMO for multinational companies while others participate as project consultants or project staff support.

GMG has helped certify hundreds of participants in Project Management certifications in China in the last nine years.
The Project

As Green Project Management is a breaking methodology really concerned about Corporate Social Responsibility and Sustainability but bearing in mind a professional project management background; GMG decided to offer its clients trainings based on this methodology.

Before offering a training of any kind, GMG must develop the training materials, and train its trainers. Because of the previous fact, the writer was supposed to learn about Project Management and, specially, in GPM®; as well as develop both trainees and trainers training materials.

At the same time, as this thesis project had to be done, the writer was also writing it with the collaboration of both, Professor Tang (唐天巧) from Beijing Jiaotong University and Jesús Hernández from GMG.

In order to perform this project, Pr. Tang provided a Time deadline and Mr Hernández resource and scope constraints to the project. Both provided support and supervision of the project plan, and helped going through some constraints in the project.

All the project Planning phase and some of the project outputs can be found at the end of the thesis in Module C and the Annexes respectively.

The project result has been successfully achieved after a pilot training has been conducted and several improvements have been implemented to have a finalized GPM® training program that is currently being marketed by the sales team of GMG in China.
Module A
China and Environment
1. Introduction to China

People’s Republic of China, from now on PRC, is a sovereign state located in East Asia. It is the world’s most populated country up to more than 1.35 billion. The PRC is a single-party state governed by the Communist Party, with its seat of government in its capital: Beijing. It exercises jurisdiction over 22 provinces, five autonomous regions, four direct-controlled municipalities and two special administrative regions (see Fig. A-1, 2). The PRC also claims Taiwan, which is controlled by the Republic of China (ROC), as its 23rd province, a controversial claim due to Taiwan’s complex political status.

![Fig. A-1: Map of China](image)

<table>
<thead>
<tr>
<th>Provinces</th>
<th>Autonomous Regions</th>
<th>Municipalities</th>
<th>Special Administrative Regions</th>
<th>Claimed Province</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anhui</td>
<td>Henan</td>
<td>Guangxi</td>
<td>Beijing</td>
<td>Taiwan</td>
</tr>
<tr>
<td>Fujian</td>
<td>Hubei</td>
<td>Inner Mongolia</td>
<td>Chongqing</td>
<td></td>
</tr>
<tr>
<td>Gansu</td>
<td>Hunan</td>
<td>Ningxia</td>
<td>Hong Kong</td>
<td></td>
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<td>Guangdong</td>
<td>Jiangsu</td>
<td>Sichuan</td>
<td>Macau</td>
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<td>Guizhou</td>
<td>Jiangsu</td>
<td>Sichuan</td>
<td>Shanghai</td>
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<td>Hainan</td>
<td>Jiangxi</td>
<td>Sichuan</td>
<td>Shanghai</td>
<td></td>
</tr>
<tr>
<td>Hebei</td>
<td>Jilin</td>
<td>Yunnan</td>
<td>Tianjin</td>
<td></td>
</tr>
<tr>
<td>Heilongjiang</td>
<td>Liaoning</td>
<td>Zhejiang</td>
<td>Tainan</td>
<td></td>
</tr>
</tbody>
</table>

![Fig. A-2: Political Regions in China categorized by type](image)
China is the world’s second-largest country by land area, covering approximately 9.6 square kilometers, and either the third or fourth largest in total area, depending on the method of measurement.

China’s landscape is vast and diverse:

- Ranging from forest steppes and the Gobi and Taklimakan deserts in the arid north to subtropical forests in the wet south.
- The Himalaya, Karakorum, Pamir and Tian Shan mountain ranges separate China from South and Central Asia.
- The Yangtze and Yellow Rivers, the third and sixth largest in the world, run from the Tibetan Plateau to the densely populated eastern seaboard.
- China’s coastline along the Pacific Ocean is 14,500 kilometers long and is bounded by the Bohai, Yellow, East and South China Seas.

The history of China goes back to one of the world’s most ancient civilizations that flourished in the fertile basin of the Yellow river in the North China Plain. For millennia, China’s political system was based on hereditary monarchies, known as dynasties, beginning with the semi-mythological Xia of the Yellow River basin (2000 BCE).

Since 221 BCE, when the Qin dynasty first conquered several states to form a Chinese empire, the country has expanded, fractured and been reformed numerous times. The Republic of China (ROC) overthrew the last dynasty in 1911 and ruled Chinese mainland until 1949.

After the defeat of the Empire of Japan in World War II, the Communist Party defeated the nationalist Kuomintang in Mainland China and established the People’s Republic of China in Beijing on 1st October 1949, while the Kuomintang relocated the ROC government to its present capital of Taipei [1].

The economic history of China stretched over thousands of years and has undergone alternating cycles of prosperity and decline. China was for a large part of the last two millennia the world’s largest and most advanced economy. Since the introduction of economic reforms in 1978, China has become one of the world’s fastest-growing major economies. As of 2013, it is the world’s second-largest economy by both nominal total GDP and purchasing power parity (PPP), and is also the world’s largest exporter and importer of goods [2].

China is a recognized nuclear weapons state and has the world’s largest standing army, with the second-largest defense budget. The PRC has been a UN member since 1971, when it replaced the ROC as a permanent member of the UN Security Council.
2. Environmental Issues in China

China has many environmental issues, severely affecting human health as well as its biophysical environment. Rapid industrialization as well as lax environmental oversight have contributed to the problems.

According to Thomas V. Harwood III [3], 16 out of the 20 most polluted cities are in China. The Chinese Government has recognized the problems and made various responses, resulting in some improvements. Nonetheless, during 2012 had been a citizen activism increase due to Government decisions are perceived as environmentally damaging. As a consequence of that, there was up to more than 50,000 environmental protests in that year [4].

Bearing this Chinese population concern in mind, in this section, we are going to cover the environmentally policy that the government applied and a description of nowadays China’s environmental issues.

2.1. China’s Environmental Policy

The Center for American Progress has described China’s environmental policy as similar to the one applied by the United Stated before 1970.

As said in A-2 section, since 2012, the number of complaints to the environmental authorities increased by 30% every year, reaching 600,000 in 2004. In the meanwhile, the number of mass protests caused by environmental issues grew by 29% every year since that time.

The growing attention upon environmental matters caused the Chinese Government to display an increased level of concern towards environmental issues and the creation of sustainable growth. For instance, in his annual address in 2007, Wen Jiabao, the Premier of the PRC in that time, made 48 references to environment, pollution and environmental protection, and stricter environmental regulations were subsequently implemented. Some of the subsidies for polluting industries were cancelled, at the same time that some polluting industries were closing. Nevertheless, although the promotion of clean energy technology occurred, many environmental targets were missed.

After Wen Jiabao address, polluting industries continued to receive inexpensive access to land, water, electricity, oil and black leans; while market-oriented measures, like surcharges on fuel and coal, were not considered by the Government despite their proven success in other countries.

In response to a challenging environmental situation due to corruption among other variables, the new Premier of The PRC, Hu Jintao, implemented the “Green GDP project”, the program lost official influence in spring 2007 though.

In 2014 China amended its protection laws to help fight pollution and reverse environmental damage in the country.
2.2. Issues

In this section we are going to cover the most harming variables to the environment.

2.2.1. Water resources

The water resources in China are affected by both severe water quantity shortages and severe water quality pollution. A growing population and rapid economic development as well as lax environmental oversight have increased water demand and pollution. China has responded by measures such as rapidly building out the water infrastructure and increasing regulation as well as exploring a number of further technological solutions.

![Fig. A-3: Annual Region Precipitation in China and Taiwan map [5]](image)

China's water resources include 2,711 Km$^3$ of mean annual run-off in its rivers and 829 Km$^3$ of groundwater recharge. As pumping water draws water from nearby rivers, the total available resource is less than the sum of surface and groundwater; and thus is only 2,821 Km$^3$. Nonetheless, 80% of these resources are in the South of China (see Fig. A-3).

Total water withdrawals were estimated at 554 Km$^3$ in 2005 from about 20% of renewable resources. The water demand by sector was as follows:

- 65% in agriculture
- 23% in industry
- 12% in domestic use

The quality of groundwater and surface water is a major problem in China, be it because of man-made water pollution or natural contamination.
Deterioration of drinking water quality continues to be a major problem in China. This is a consequence, among others, of:

- A continuous emission from industries; which is the largest contributor to non-drinkable water in the PRC
- The excessive use of agricultural fertilizers and pesticides

Nevertheless, not all the causes are human made; there is also natural contamination. Large portions of China’s aquifers suffer from arsenic contamination of groundwater. Arsenic poisoning occurs after long-term exposure to contaminated groundwater through drinking. This phenomenon was first detected in the 50s but, to date, China has more than 30,000 reported cases with about 25 million people exposed to high levels in their drinking water.

Water supply and sanitation in the PRC is undergoing a massive transition, while facing numerous challenges such as a rapid urbanization and a widening economic gap between urban and rural areas. From 1990 to 2005 there have been major financial investments in water infrastructure.

To sum up, the water resources of China are affected by both severe water quantity shortages and water quality pollution. An increasing population and rapid economic growth, as well as lax environmental oversight, have increased water demand and pollution. China has responded by measures such as rapidly building out the water infrastructure and increased regulation as well as exploring a number of further technological solutions [5].

According to Chinese Government in 2014, almost 60% of groundwater sites are poor or extremely poor quality.

### 2.2.2. Deforestation

Even though China’s forest area covers only the 20% of the total territory, the country has some of the largest expanses of forested land in the world; making it a top target for forest preservation efforts.

In 2001, the UN Environment Program (UNEP) listed China among the top 15 countries with the most closed forest, being this concept defined as virgin, old growth forest or naturally regrown woods. 12% of China’s land area (111 million hectares) is closed forest. Nevertheless, UNEP also estimated that 36% of China’s closed forests are facing pressure from high population densities, making preservation efforts crucial. In 2011 Conservation International listed the forests of Sichuan (south-west China – see Fig. A-1) as one of the ten most threatened forest regions in the world [6].

According to Chinese Government website, between 1998 and 2001, the Central Government invested more than 40 billion Chinese Yuan on protected vegetation, farm subsides and conversion of farm into forests. Between 1999 and 2002, China turned 7.7 million hectares of farmland into forest.
2.2.3. Desertification

Desertification remains a serious issue, consuming an area greater than the one taken by farmlands. Even though desertification has been curbed in some areas, it is expanding at a more than 67 Km$^2$ every year rate.

- 90% of China’s desertification occurs in the west of the country
- Approximately 30% of China’s surface area is desert
- The Gobi desert in the north currently expands by about 2,500 Km$^2$ per year

In 2001, China initiated a “Great Wall China project” that consisted on creating a 4,500 km green belt to hold back the encroaching desert. The first phase of the project, to restore 36,000 Km$^2$ of forest, was completed by 2010 at an estimated cost of USD8 billion. The Chinese government believes that by 2050, it can restore most desert land back to forest. The project is possibly the largest ecological project in history.

2.2.4. Climate Change

The position of the Chinese Government on climate change is contentious. China has ratified the Kyoto Protocol, but as a non-Annex country, so that, is not required to limit greenhouse gas emission under terms of the agreement.

In 2002 China overpassed the United States as the world’s larger emitter of CO$_2$, putting out 7,000 million tones, in comparison with America’s 5,800 million.

<table>
<thead>
<tr>
<th>Country</th>
<th>% of World’s CO$_2$ Emissions</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>25.4%</td>
</tr>
<tr>
<td>United States</td>
<td>17.8%</td>
</tr>
<tr>
<td>India</td>
<td>5.3%</td>
</tr>
<tr>
<td>Russia</td>
<td>5.2%</td>
</tr>
<tr>
<td>Japan</td>
<td>3.6%</td>
</tr>
</tbody>
</table>

*Fig. A-4: Top 5 Fossil Fuels’ Emissions of CO$_2$ by Country 2009 [7]*

<table>
<thead>
<tr>
<th>Country</th>
<th>% of World’s CFC gas Emissions</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>16.4%</td>
</tr>
<tr>
<td>United States</td>
<td>15.7%</td>
</tr>
<tr>
<td>Brazil</td>
<td>6.5%</td>
</tr>
<tr>
<td>Indonesia</td>
<td>4.6%</td>
</tr>
<tr>
<td>Russia</td>
<td>4.6%</td>
</tr>
<tr>
<td>India</td>
<td>4.2%</td>
</tr>
<tr>
<td>Japan</td>
<td>3.1%</td>
</tr>
<tr>
<td>Germany</td>
<td>2.3%</td>
</tr>
<tr>
<td>Canada</td>
<td>1.8%</td>
</tr>
<tr>
<td>Mexico</td>
<td>1.6%</td>
</tr>
</tbody>
</table>

*Fig. A-5: Top 10 Greenhouse Gas Emissions by Country in 2009 [7]*
China can suffer the effects of global warming, including sea level rise, glacier retreat and air pollution.

Recently, China’s Ministry of Science and Technology (MOST) released the first National Assessment of Global Climate Change. It states that China already suffers from the environmental impact:

- Increase of surface and ocean temperature four times faster than anywhere else.
- Rise of sea level.

The increase of the temperature would intensify the risk of water shortage for agricultural production in the north while floods in the south, due to its rainfall abundance weather.

The rise of sea level is a really alarming trend because China has a very long and densely populated coastline, with some of the most economically developed cities (Shanghai, Tianjin and Guangzhou) situated there. A Chinese research estimated that a one-meter rise in sea level would inundate 92,000 Km² of China’s coast, thereby displacing 67 million [8].

Moreover, climate change will worsen the unequal distribution of water resources in China. In essence, a water shortage is indeed a large concern for the country.

Eventually, climate change could put in danger human health by increasing outbreaks of disease and their transmission. After floods, for instance, infectious diseases like cholera and diarrhea are more likely to infect China’s population.

Because of the previous facts, both International and within The PRC, there has been an ongoing debate over China’s economic responsibilities for climate change mitigation so the PRC’s Government defined the following measures:

- China is open to talk and multilateral environment negotiations.
- China claim to take environmental challenges seriously but is pushing the developed world to help developing countries.
- Respect Kyoto terms even though is not mandatory for China.
- The national Government announced in November 2008 the carbon-trading scheme to enforce a compulsory carbon emission-trading scheme across the country’s provinces as part of its strategy to create a “low carbon civilization” [9].
- Premier Wen Jiabao in 2004 promised to use an “iron hand” to make China more energy efficient.
- China has surpassed the rest of the world as the biggest investor in wind turbines, solar panels and other renewable energy technology.
- With USD34.6 billion invested in 2009, China is the world’s leading investor in renewable technologies.
- Nuclear power is planned to be rapidly expanded.
- Push electric cars to curb China’s dependence on imported petroleum.
- Coal is predicted to remain the most important power source in the near future but China has been seen as the world leader in clean coal technology. We must bear in mind that Coal Industry is responsible for the highest level of air pollution (19%).
2.2.5. Population

A large population with a relatively small youth division identifies demographics in PRC, which is partially a result of China’s one-child policy. The billion borderline was overpassed in 1982.

China’s population is over 1.351 billion, the largest of any country in the world. According to the 2010 census, 91.51% of the population was of the Han Chinese and 8.49% were minorities. Nevertheless, China’s population growth rate is only 0.47% making it the 159th in the world.

We must bear in mind that China’s population data are from a census made every ten years by the PRC’s Government.

As it has been stated before, China is the most populated country in the world and its national population density (137 people per Km²) is similar to those of Switzerland and the Czech Republic. Nevertheless, the overall population density of China conceals major regional variations. The western and northern part has a few million people while eastern half has about 1.3 billion (see Fig. A-7). Most of China’s population lives near the east in major cities.

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Fig. A-6: China’s Population by millions (1961 – 2008) [10]

Fig. A-7: China’s Population Density map [10]
2.2.6. Energy Efficiency

Energy efficiency improved greatly from 1980 to 2000. Nevertheless, in 1997, due to fears of a recession, tax incentives and state financing were introduced for rapid industrialization. This may have contributed to the rapid development of very energy inefficient heavy industry.

- Steel factories used one fifth more energy per ton than the international average.
- Cement needed 45% more power than the average.
- Ethylene needed 70% more than the average.
- Chinese buildings rarely had thermal insulation and used twice as much energy to heat and cool as those in Europe and the United States in similar climates.
- 95% of new buildings did not meet China’s own energy efficiency regulations.

A 2011 report by a project given by Word Resources Institute stated that the 11th five-year plan (2005 – 2010) in response to worsening energy intensity in the 2002-2005 period, set a goal of a 20% improvement of energy intensity. The report stated that this goal likely was achieved or nearly achieved. The next five-year plan set a goal of improving energy intensity by 16%.

2.2.7. Pollution

Pollution is the introduction of contaminants into the natural environment that causes adverse change. It can take the form of chemical substances or energy, such as noise, heat or light. Pollutants, the components of pollution, can be either foreign substances / energy or naturally occurring contaminants.

Various forms of pollution have increased as China has industrialized, which has caused widespread environment and health problems. According to World Bank in 2007, 16 of the world’s 20 most polluted cities are in China [3].

In the previous figure (Fig. A-8) the reader can appreciate a comparison picture from Beijing on a 2005 day after rain (left picture) and a sunny but smoggy day (right picture).
2.2.7.1. Types of Pollution

Even though there is a wide range of types of pollution, in this thesis we are going to cover the following types:

- Waste
- River exploitation and deforestation
- Electronic Waste
- Industrial Pollution
- Water Pollution
- Particulates
- Lead
- Persistent Organic Pollutants
- Dust
- Air Pollution

2.2.7.1.1. Waste

The small level of environmental awareness has hindered the development of proper recycling systems in China’s cities as the amount of waste increases.

As population was increasing in China (see Fig. A-6), so did waste. Because of this fact, the PRC’s Government pushed people to a more sustainable lifestyle. Nevertheless, as it didn’t work, some of its organizations start performing more sustainable policies like the one that follows:

Giving out free plastic bags was a forbidden action by all supermarkets, department stores and shops throughout all China from the beginning of June 2008. This was a measure from the State Council calling for a return to cloth bags and shopping baskets. However, this ban didn’t include the use of paper shopping bags at clothing stores or the use of plastic bags at restaurants for takeout foods. Since the State Council ban, 10% fewer bags had been thrown away.

Fig. A-9: Beijing Waste Burn Plant
2.2.7.1.2. River exploitation and deforestation [5]

As has been introduced before, river exploitation and deforestation is a big concern to Chinese Government.

In 2008, China began an infrastructure and real estate construction campaign. Rivers are often exploited for rock and soil. To do this, treed and grassland along a given river are removed, then a few dozen meters deepen the riverbed. The river is usually littered with numerous small deep lakes and sand/rock heaps. 5 meters in nearby villages can easily reduce the ground water level. Excavators and crushers work all day and night kicking up dust and making noise pollution a problem. Factories may dump their chemical emissions into river, or inject it into the groundwater. This practice is so widespread that many rivers in northern China are dry, with many rivers in southern China being polluted to the point of toxicity. The complete ruin of rivers and forests in many parts of China underscores the current severe pollution. Youth in China are beginning to show their resentment towards mistreatment of the environment, accompanied by an exodus of wealthy Chinese. It is unknown whether the latter is caused by environmental problems on a large scale.

2.2.7.1.3. Electronic Waste

Electronic waste (e-waste from now on) is a serious environmental issue. The huge amount of e-waste is increasing due to rising economies such as China and India; and a higher demand of electronic devices combined with a shorter economic lifespan in the Western countries.

Even though e-waste from the western world is responsible for a large portion of it, the biggest threat comes other regions like China, Thailand and India. In fact, 70% of the global e-waste ends up in China. Because of the previous fact, China has to deal with the health problems and environmental damage as a consequence of the increasing amount of e-waste. The major cause to the previous problems is that the 60% of e-waste is processed in informal recycling centers by unskilled equipped manual labour.

In the local China case, in 2011 was the second largest producer of e-waste up to 2.3 million tones. Nevertheless, this amount is expected to keep growing as well as the Chinese economy does. Moreover, large amounts of foreign e-waste are also imported in order to create jobs by recycling valuable metals, but also, harming the surrounding human health and environment by releasing pollutants.

The main region where e-waste is shipped to is Guangdong province (China’s South-East coast – see Fig. A-1). From there, it is expanding to other provinces, such as, Zhejiang, Shanghai, Tianjin, Hunan, Fujian and Shandong. As the reader may have noticed, all these regions are located along China’s east coast. Guiyu, in Guangdong province, is the location of the largest amount of e-waste in the world.

Regarding to the procedure of recycling e-waste, the reader must bear in mind that in China there is a formal and informal collecting system.

- The informal one; also called “cherry picking” which uses only recyclable appliances and sells the reusable pieces to the local second-hand market.
- The formal one; consists in some collecting projects put in place.
Furthermore, the e-waste recycling process contains many toxic substances and, as this procedure is done by burning and heating to extract the valuable materials, it ends up as a really harming method for human health and environment. Because of the previous fact, we can state that e-waste is directly responsible for deteriorating health and environment in China’s east coast.

Nonetheless, the reader has also to bear in mind that as informal recycling generally uses primitive processes; it does not harm neither health nor environment.

Because of the big problem that e-waste face towards China, this country came up with the following solutions [18]:

✔ **Attempts to control the informal sector**
In the regions of Newbury Park, Tianjin, Taicing, Ningbo, Taizhou and Zhangzhou, local recycling parks have been built in which informal laborers still work as manual recyclers, but then under production and pollution management.
In Guiyu, a different solution was found. There, the government promoted technical upgrade in the informal workshops by replacing coal-fired grills with electrical heaters when taking out components from circuit boards.

✔ **Basel Convention**
The UN Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal is the most far-reaching regulation that exists on a global scale to address e-waste. However, the lucrative business that is created by e-waste recycling is responsible for the undermining of this convention in areas where e-waste is transported to.

✔ **Chinese legislation**
Initially there was a complete ban on improper recycling but this was quickly dropped. They have now issued a variety of environmental laws, regulations, standards, technical guidance and norms related to electronic product production and e-waste management.

Nevertheless, laws and regulations put in place by the Chinese government lack of adequate resources to enforce them. Moreover, the financial windfall associated with e-waste makes these laws and regulations weak.

In 2008, The Chinese State Council also approved a "draft regulation on the management of electronic waste." This regulation was intended to promote the continued use of resources through recycling and to monitor the end-of-life treatment of electronics.
Under the new regulations, recycling of electronics by the consumer is mandated. It also requires the recycling of unnecessary materials discarded in the manufacturing process.

The Management Regulations for Recycling and Disposing of Consumer Electronics and Electronic Waste, intended to be effective January 1, 2011, bans import of toxic e-waste, requires treatment of e-wastes to have license, and treatment plants to treat pollution.
One of the most successful policies is probably the Extended Producer Responsibility (EPR). EPR makes manufacturers responsible for electronics collection and recycling. Therefore, the producer is more involved in the life cycle of a product.

✓ Provincial Chinese programs
There are different examples in the region of Qingdao, Hyrule, Beijing and the Sichuan provinces, where the current projects are developed.

A big issue can be found in the Sichuan Province, close to the Tibetan border, where people, who's bodies were ready, had a habit of throwing waste in rivers and nature. Local leaders, among others monks and village representatives, decided to call for help from Norlha to design a region specific program. Monks have been informed about the proper way to dispose of e-waste, which they could pass through in religious celebrations.

At the same time posters have been handed out to the communities and children have been informed by the NGO in their schools. Moreover, in 5 villages waste collections systems and storage points for e-waste have been created.

Another project is the "Home Appliance Old for New Rebate Program", which was first launched in nine cities and provinces who are considered as economically developed regions. It is a recycling system, where only accredited collectors who usually work in the retail industry can collect and take back old appliances from consumers and reward these actions with discount coupons. Since only authorized collectors were participating in the process, it gives the possibility to pay the consumers a higher price for their e-waste.

✓ Corporate initiatives
Many companies, like Nintendo, are aware of the problem of e-waste and are developing their own initiatives. Companies joined forces by creating a collective e-waste reclamation campaign. But that does not solve the whole problem.

In response to low incentives some companies, like Dell, started to provide compensations to consumers in Beijing and Shanghai of USD0.15 per Kg of old computer. In order to receive the incentive consumers had to bring their used computers to local Dell stores at their own expense. The project failed because the financial gains of returning their computer to formal recyclers were lower than the gains from selling computers to informal collectors.

![Fig. A-10: Guiyu (Guangdong province) e-waste warehouse](image)
2.2.7.1.4. Industrial Pollution

In 1997, the World Bank performed a report targeting China’s policy towards industrial pollution [11]. In this report, it was stated that hundreds of thousands of premature deaths and incidents of serious respiratory illness had been caused by exposure to industrial air pollution. As industry had polluted many of China’s waterways, humans could not directly use those. Nonetheless, environmental policies and industrial regulations had had some effect, so that, continued environmental reforms were likely to have a large effect at a modest cost.

A 2007 New York Times article about China’s pollution problem [12] stated that environmental degradation is now so severe, with such stark domestic and international repercussions, that pollution poses not only a major long-term burden on the Chinese public, but also an acute political challenge to the ruling Communist Party.

The same article [12] also shared the following data:

- A 2007 World Bank report conducted with China’s national environmental agency found that outdoor air pollution was already causing 350,000 to 400,000 premature deaths per year. Indoor pollution contributed to the deaths of an additional 300,000 people, while 60,000 died from diarrhea, bladder and stomach cancer and other diseases that could be caused by water-borne pollution. They also said that China’s environmental agency insisted that the health statistics would be removed from the published version of the report, citing the possible impact on social stability.
- In 2003, the Chinese Academy of Environmental Planning had an internal and unpublished report in which was estimated that 300,000 people die each year from ambient air pollution, mostly of heart disease and lung cancer.
- Chinese environmental expert in 2005 issued another report, estimating that annual premature deaths attributable to outdoor air pollution were likely to reach 380,000 in 2010 and 550,000 in 2020.
- The population has spread internationally: SO$_2$ and nitrogen oxides fall as acid rain on Seoul, South Korea, and Tokyo; and according to the Journal of Geophysical Research, the pollution even reaches Los Angeles in USA.
- A large area of the ocean is without marine life because of massive algal blooms caused by the high nutrients in the water.
- Lead poisoning or other types of local pollution continue to kill many Chinese children.
- Only a 1% of the country’s 560 million city dwellers breathe air considered safe by the European Union, because all of its major cities are constantly covered in a toxic grey dome. Before and during the 2008 Summer Olympics, Beijing was frantically searching for a “magic formula”, a metrological deus ex machina, to clear its skies.
- According to the Chinese Ministry of Health, industrial pollution has made cancer China’s leading cause of death.
- Every year, ambient air pollution alone killed hundreds of thousands of citizens.
- 500 million people in China are without safe and clean drinking water.

A World Bank and SEPA report stated in 2007 that up to 760,000 people died prematurely each year in China because of air and water pollution. Chinese officials asked that some of results should not be published in order to avoid social unrest.

- High levels of air pollution in China’s cities caused to 350,000 – 400,000 premature deaths.
- 300,000 died because of indoor air of poor quality.
60,000 premature deaths each year because of water poor quality.

Nevertheless, China has achieved some improvements in environmental protection during the very recent years. China is one of a few countries in the world that have been rapidly increasing their forest cover as well as managing to reduce air and water pollution, according to the World Bank.

The 2009 Review of Environmental Economics and Policy, however, noted the wide discrepancy between the reassuring view in some Chinese official publications and the exclusively negative view in some Western sources such as the NYT article commented above. The review also stated that:

- Although China is starting from a point of grave pollution, it is setting priorities and making progress that resemble what occurred in industrialized countries during their earlier stages of development.
- Quality of surface water in the south of China was improving and particle emissions were stable.
- NO\textsubscript{2} emissions were increasing rapidly and SO\textsubscript{2} emissions had been increasing before decreasing in 2007.

![Chinese factory at Yangtze River](image)

**Fig. A-11: Chinese factory at Yangtze River**

### 2.2.7.1.5. Water Pollution

This section has mostly been covered when explaining the water resources in China in (A-2.2.1).

To sum up, the water resources of China are affected by both, severe water quality pollution and quantity shortages. An increasing population and rapid economic growth as well as lax environmental oversight have increased water demand and pollution. As a consequence of the previous fact, China’s Government took measures such as:

- A rapidly built out a water infrastructure
- Increased water pollution regulation
- Exploring a large number of further technological solutions
2.2.7.1.6. **Particulates**

In 2004, The PRC’s cities with the highest levels of particulate are Tianjin, Chongqing and Shenyang according to a Government study in which were studied the major cities in the country. Nevertheless, in 2012 a stricter air pollution monitoring of ozone and PM2.5 (most harming pollutants to humans) were gradually implemented so that by 2015 all but the smallest cities would be included. State media recognized the role of environmental campaigners in causing this change.

In this Particulates’ section, the reader is going to share some interesting data about Particulates reading from different sources and different but highlighting dates.

On 18th November 2010, the US embassy in Beijing described the PM2.5 measurement as quoting “crazy bad” after registering a reading in excess of 500 for the first time (see AQI section A-2.2.7.1.10.1).

In June 2012, following strongly divergent disclosures of particle levels between the Observatory and the US Embassy, Chinese authorities asked to foreign consulates to stop publishing “inaccurate and unlawful” data [14]. Officials said to US embassy that it was not scientific to evaluate the air quality of an area with results gathered from just only one point inside the area; but from the writer’s point of view, neither it is showing a wide area mean result as the Chinese official version.

By January 2013 the pollution had worsened showing an average figure over 300 and readings of up to 700 at individual spots according to Beijing official data; while US Embassy recorded 800 in January 1st and 800 by January 12th.

On October 21st 2013, smog record closed the Harbin Airport (North-East corner of China – see Fig. A-1) along with all schools in the area due to daily particulate levels of more than 50 times the World Health Organization recommended daily level were reported in parts of the municipality.

2.2.7.1.7. **Lead Poisoning**

In 2001, lead poisoning was described as one of the most common pediatric health problems in China. A 2006 review of existing data suggested that one out of three Chinese children suffer from elevated blood lead levels.

These are the most common responsible of lead high levels:
- A fast growing battery industry.
- Pollution from metal smelters.

Because of the high levels of lead in 2011, there were riots in Zhejiang Haijju Battery factory from angry parents whose children received permanent neurological damage from lead poisoning. The central Government realized about the previous fact and took measures:
- Suspending battery factories; but some people see the Government response as inadequate so that, some local authorities, try to silence criticisms.
- Banning lead gasoline in 2000.
- Controlling lead poisoning was described as a long-term mission.
2.2.7.1.8. Persistent Organic Pollutants (POP)

China is a signatory nation of the Stockholm Convention, which tries to control and phase out major persistent organic pollutants (POP). Because of the previous fact, China performed a plan of action for 2010, which included in their objectives:

- Eliminating production, import and use of the pesticides covered under the convention
- Implementation of an accounting system for PCB containing equipment
- For 2015 China has planned establish an inventory of POP polluted sites and remediation plans.

It is a big challenge for China to control and eliminate POPs since they often are the cheapest way; or they are unintentionally produced and then simply released into the environment to save on treatment costs.

2.2.7.1.9. Yellow Dust

Yellow dust or Asian dust is a seasonal dust cloud that affects North-East Asia during late winter and springtime. The dust originates in the deserts of Mongolia, northern China and Kazakhstan where high-speed surface winds and intense dust storms kick up dense clouds of fine, dry soil particles. These clouds are then carried eastward by prevailing winds as pass over Northern China into Korea and Japan (see Fig. A-12).

Fig. A-12: Dust Clouds leaving Mainland China travelling towards Korea and Japan
(13th March 2006 at 4:30am)
As stated in desertification chapter (see A-2.2.3); this phenomenon has been intensified in China. As 1,740,000 Km² of land is dry, it disrupts the lives of 400 million people and causes direct economic losses of 54 billion Chinese Yuan per year.

Yellow dust storms come with these harming elements [15]:
- Sulfur; acid rain component.
- Soot
- Ash
- CO
- Toxic pollutants, including heavy metals; Mercury, Cadmium, Chromium, Arsenic, Lead (see Lead’s consequences in A-2.2.7.1.7), Zinc and Copper)
- Other; viruses, bacteria, fungi, pesticides, antibiotics, asbestos, herbicides, plastic ingredients, combustion products as well as hormone mimicking phthalates.

2.2.7.1.10. Air Pollution

In 2012, the president of China Medical Association, Zhong Nanshan, warned that air pollution could become the biggest health threat. Here follows some of the data given from Mr. Zhong:
- Lung cancer and cardiovascular disease were increasing because of factory and vehicle air pollution and tobacco smoking.
- Lung cancer was twice or three times more common in cities than in the countryside despite similar ratings of tobacco smoking.
- Despite transparency had increased in recent years, much more information was needed and, Mr. Zhong, focused on calling for detailed epidemiological research.

Mr. Zhong also questioned official data stating that air pollution was decreasing. One important fact to be beard in mind is that until these recent years, the government air quality index, from now on AQI, did not include ozone and PM2.5, despite the fact of being the most dangerous to human health [13].

Measurements in January 2013 showed levels of air pollution, as measured by particulate density smaller than 2.5μm in size, was literally out of the chart (higher than the maximum 755μm the US Embassy’s equipment can measure). Smog from Mainland China has reached as far as Los Angeles (California), as stated in Industrial Pollution section (A-2.2.7.1.4).

For more Air Pollution interesting data please go to Industrial Pollution section (A-2.2.7.1.4) in the NYT article section.
2.2.7.1.10.1. AQI

Air Quality Index, from now on AQI, is a number used by government agencies to communicate to the public how polluted the air is currently or how polluted is the forecast to become. As the AQI increases, an increasingly large percentage of the population is likely to suffer an increasing severe adverse health effects.

Different countries have their own AQIs or, even more, they use different names for their indexes like; Air Quality Health Index, Air Pollution Index and Pollutant Standards Index.

In Mainland China, China’s Ministry of Environmental Protection (MEP) is the responsible for measuring the level of air pollution. In China called Air Pollution Index (API). Since 1\textsuperscript{st} January 2013, MEP monitors daily pollution level in its 163 major cities. The AQI level is based on the level of the following six atmospheric pollutants:

- Sulfur dioxide; \(\text{SO}_2\)
- Nitrogen dioxide; \(\text{NO}_2\)
- Suspended particulates smaller than 10 \(\mu\)m in aerodynamic diameter; \(\text{PM}_{10}\)
- Suspended particulates smaller than 2.5 \(\mu\)m in aerodynamic diameter; \(\text{PM}_{2.5}\)
- Carbon monoxide CO
- Ozone; \(\text{O}_3\)

Nevertheless, on 30\textsuperscript{th} December 2013, HongKong replaced the API with a new index called Air Quality Health Index. This index is on scale of 1 to 10+ and considers the following four air pollutants:

- Ozone; \(\text{O}_3\)
- Nitrogen dioxide; \(\text{NO}_2\)
- Sulphur dioxide; \(\text{SO}_2\)
- Particulate matter; including \(\text{PM}_{10}\) and \(\text{PM}_{2.5}\)

Nevertheless, in this thesis we are going to analyze Mainland China Air Quality Index. Here follows the range of this index:
<table>
<thead>
<tr>
<th>AQI</th>
<th>Health Effects Statement</th>
<th>Cautionary Statement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good (0 – 50)</td>
<td>Air pollution poses little or no risk</td>
<td>None</td>
</tr>
<tr>
<td>Moderate (51 – 100)</td>
<td>Unusually sensitive individuals may experience respiratory symptoms</td>
<td>Unusually sensitive people should consider limiting prolonged outdoor exertion.</td>
</tr>
<tr>
<td>Unhealthy for Sensitive Groups (101 - 150)</td>
<td>Increasing likelihood of respiratory symptoms in sensitive individuals, aggravation of heart or lung disease and premature mortality in people with cardiopulmonary disease and the elderly.</td>
<td>Active children and adults, and people with respiratory disease, such as asthma, should limit prolonged outdoor exertion.</td>
</tr>
<tr>
<td>Unhealthy (151 – 200)</td>
<td>Increased aggravation of heart or lung disease and premature mortality in people with cardiopulmonary disease and the elderly; increased respiratory effects in general population.</td>
<td>Active children and adults, and people with respiratory disease, such as asthma, should avoid prolonged outdoor exertion; everyone else, especially children, should limit prolonged outdoor exertion.</td>
</tr>
<tr>
<td>Very Unhealthy (201 – 300)</td>
<td>Significant aggravation of heart or lung disease and premature mortality in people with cardiopulmonary disease and elderly; significant increase in respiratory effects in general population.</td>
<td>Active children and adults, and people with respiratory disease, such as asthma, should avoid all outdoor exertion; everyone else, especially children, should limit outdoor exertion.</td>
</tr>
<tr>
<td>Hazardous (301 – 500)</td>
<td>Serious aggravation of heart or lung disease and premature mortality in people with cardiopulmonary disease and the elderly; serious risk of respiratory effects in general population.</td>
<td>Everyone should avoid all outdoor exertion.</td>
</tr>
</tbody>
</table>

Fig. A-13: Air Quality Index (AQI) values and its health effects and cautionary statements
2.2.7.1.10.2. Beijing AQI Analysis

In order to reinforce AQI section and get the reader realize about how polluted is Chinese air; as the writer is staying in Beijing, he proceeded on performing a Beijing Quality Air analysis.

To do so, he gathered AQI PM$_{10}$ data available in order to perform a more accurate analysis. Because of the previous fact, he decided to use the Chinese Government data [19], as it is the official one. Nevertheless, the reader must bear in mind that US Embassy data is also convenient and every datum is from 30 to 50% higher than the Chinese official one.

Official data was only available from 5$^{th}$ of December 2013. Because of the previous fact, the writer decided to frame a half-year analysis, so it is bounded from 5$^{th}$ December 2013 to 4$^{th}$ June 2014.

As the writer thinks that mean values hide information; he decided to pick from the official database, a random observatory and a random time to make the analysis more accurate. At the end, he decided to perform the analysis at Beijing Tuanxugou (鏄屽钩) at 1pm.

![Fig. A-14: Beijing PM$_{10}$ AQI at 1pm from Dec. 2013 to June 2014](image-url)

(The reader may find the data used [19] in Annex A1 at the end of the thesis)

In the previous figure, the reader may realize about an overall scenario of how polluted was Beijing air from 5$^{th}$ December 2013 to 4$^{th}$ June 2014. The reader may also find handy the AQI level table found in the previous page (A-2.2.7.1.10.1).
The reader may have noticed that when AQI rises above the “Very Unhealthy” section, it is drastically reduced in the following day. This phenomenon may be due to the following factors:

- Strong Wind; that blows pollution away to other parts of China, Mongolia or Korea and Japan; depending on the wind-blow direction.
- Rain; so the water drops absorb the air pollution particulates pouring down on ground, so it leads eventually on a reduction of Air Pollution.
- Cloud Seeding; also called “fake rain” by the authorities (see A-2.2.7.1.10.3).

![Graph showing days and percentage of Beijing PM\textsubscript{10} AQI at 1pm from Dec. 2013 to June 2014 by AQI level.](image)

*Fig. A-15: Days and percentage of Beijing PM\textsubscript{10} AQI at 1pm from Dec. 2013 to June 2014 by AQI level.*  
(The reader may find the data used [19] in Annex A1 at the end of the thesis)

According to the previous figure, we can realize that only the 8.24% of the days, Beijing Air was Good in pollution terms. Nevertheless, Moderate level can be considered also secure for population; therefore we can enhance that the 35.16% of the days, Beijing air was considered as secure.

On the other hand, the other 64.84% of the days also needs to be analyzed. The reader must bear in mind that nearly a quarter of the days were considered as Unhealthy for Sensitive Groups and, as Beijing is a huge and high dense populated city, this collective should be highly taken into consideration.

Moreover, healthy people are affected by air pollution more than 40% of the days (almost half of the days); being more than 17% of the days considered as Very Unhealthy and; even worse, 11% as Hazardous, the worst of the levels. In those conditions, everyone should avoid all outdoor exertion.

One point to be underlined is that there were more days in Hazardous (nearly 11%) than Good level (8.24%), in other words, there were more “worst days” than “best ones”.
Once taken an overview analysis, the writer wanted to get deeply in every-month case.

In the following figure, the reader may compare how many days were in each AQI level by month.

![Graph showing days of Beijing PM10 AQI at 1pm from Dec. 2013 to June 2014 by AQI level and month.](image)

*Fig. A-16: Days of Beijing PM10 AQI at 1pm from Dec. 2013 to June 2014 by AQI level and month. (The reader may find the data used [19] in Annex A1 at the end of the thesis)*

In the previous area plot the reader may realize that in wintertime, there are more Very Unhealthy and Hazardous days than in summer time (the writer do not consider Spring because in Beijing spring weather just last for a couple of weeks). Nevertheless, there are also more Good days in winter. The reader may wonder why did that happened; and it is because when pollution rises over Unhealthy level the government cloud seed (A-2.2.7.1.10.3) and that reduces way a lot the pollution.

The reader may also realize about the big difference of Moderate days between summer and wintertime.

A stunning fact to be underlined in that in April there were not Good level days in all the month. Nonetheless, in May there was just one Very Unhealthy day and none were Hazardous and that is an optimistic point to be underlined.
As we realized before, we can see that May was the least polluted month as nearly 50% of its days were under Moderate and Good AQI levels. These data shows that, even the best of months is in a terrible scenario.

On the other hand, there is February. In this month there were the same amount of days in Hazardous and Very Unhealthy (7 days each) making nearly half of the month in those conditions. This is a terrible data according to the fact that in Hazardous everyone should avoid all outdoor exertion and in Very Unhealthy should limit it as much as possible. The reader may wonder how would be staying half of a month enclosed at home.

According to the terrible circumstances, December and March were not that bad; and January and April were really bad as well.

Eventually, the writer want to enhance that he used the official Chinese Government data and that monitors from 30 to 50% less than the US Embassy ones.

To sum up, Beijing is not one of the worst polluted cities in China, who has 16 of the 20 most polluted cities in the world [3]; and this analysis shows a terrible scenario to Beijing citizens, who have to deal with it every day.
2.2.7.10.3. Cloud seeding

Back in 2,150 BC, Emperor Yu sealed his place in China’s history of eminent rulers by controlling the Yellow River’s annual flood, saving waterlogged crops. Today China’s rulers face the opposite problem: It’s water scarcity that threatens farms. So instead of the Yellow River, the Chinese government is controlling the rain.

It does that by “cloud-seeding,” the colloquial term for rocket-launching chemicals into clouds, accelerating the creation of ice crystals that eventually become rain (China uses military aircraft too). This meteorological enema isn't just handy for combating the country’s increasingly severe droughts and, supposedly, preventing hail. Local governments use “weather modification” to clear away lingering billows of air pollution.

China’s come a long way since 1958, when Russia brought cloud seeding to the Middle Kingdom. It’s now the most trigger-happy cloud-seeder in the world. In 2011, China spent USD150 million in a single regional artificial rain program; it’s unclear how much other local governments spend. The US, by comparison, spends around USD15 a year [20].

With its horrendous air pollution and acute water shortage, China is a natural contender to be the world’s leading cloud-seeder.

Fig. A-18: One of China’s cloud-splitters [20]
2.2.7.2. Economic costs of Pollution

In 2007, The World Bank made Economic Estimation of the Physical costs of pollution in China [16]. Here follows some of their conclusions:

- Pollution in 2004 cost of 3.05% of the nation’s economy.
- Cost of water and air pollution in 2003 up to 2.68% or 5.78% of GDP depending if using a Chinese or Western method of calculation.
- Total economic cost of pollution between 2-10% of GDP in 2009.

Nevertheless, a 2012 environmentally pessimistic study also stated that pollution had little effect on economic growth because China’s case was largely dependent on physical capital expansion and increased energy consumption due to the dependency on manufacturing and heavy industries. China is predicted to keep growing using energy-inefficient and polluting industries. While growth may continue, the rewards of this growth may be opposed by the harm from the pollution unless environmental protection is increased [17].
3. Sustainability in our Projects: GPM

Once concerned about environmental issues in China, we must meditate about how enterprises, and its managers, can help in their actual business lines.

We live in a changing world, and its companies have to ride into this changing scenario. Because of this fact, companies set up a wide range of projects in order to add added value, create new business lines, improve a section in the company, etc. Projects are the pre-step for operations. The reader must bear in mind that a project is defined as a planned set of interrelated tasks to be executed over a fixed period and within certain cost and other limitations.

On account of what stated above; projects are important, so we have to perform them in the most effective way. Nevertheless, in this Chinese environment scenario it is mandatory to do it in a sustainable way.

GPM Global is an organization committed to making a difference in the way we manage projects by integrating sustainable methods to the discipline. Sustainable development is their main concern as their whole methodology looks forward to improving delivery capability without compromising the ability of future generations to meet their own needs.

Their sustainability based project delivery method, Projects integrating Sustainable Method (PRiSM), contains the main elements for our discipline to become really aligned with the needs of our global context and development challenges. Projects move the world and we need to direct them towards the creation of a society where the social, economic and environmental approaches converge.

The tools and techniques of the GPM methodology complement the discipline by providing a guide to make the above, possible. Traditional phases and best practices of project management are enhanced with globally accepted standards and the Green Project Management expertise.

GPM combines the core content of project management with the sustainable development, corporate social responsibility, the ISO standards certification system and other new elements. At present, GPM already had been recognized by several union organizations, including the European Union, Airbus, Air France, Microsoft, Audi, Thomson Reuters, Standard Chartered bank, Intel, etc.

GPM is the largest world's professional development organization that focuses on sustainable development in the field of project management. Currently, it stretches its business in 126 countries around the world. It has been operating in China for eight years and has launched the first phase of the training course in 2013. Lots of big foreign companies settled in China are also constantly adding it into their training plan. In April 2014, the first customized GPM course launched in Guangzhou.

Here follows some of GPM advantages:

- Compared with the traditional project management, GPM integrating innovation with project management determines its absolute advantage.
- Improving the level of project management and integrating new concepts o
sustainability and corporate social responsibility bridge global and China economic development.

- Strictly aligned with Project Management ISO21500 but with its sustainable tools and techniques added value.
Module B
The Discipline of Project Management and Sustainability
1. Sustainability

In ecology, sustainability is how biological systems endure and remain diverse and productive. Long-lived and healthy wetlands and forests are examples of sustainable biological systems. More recent accounts have broadened the idea of sustainability to include social wellbeing, resilience and adaptation across four domains: ecology, economics, politics and culture. In economics-centered accounts, sustainability requires the reconciliation across the "three pillars" of sustainability: economic demands, environmental resilience, and social equity.

The word sustainability is derived from the Latin sustinere (tenere, to hold; sus, up). Sustain can mean "maintain", "support", or "endure". Since the 1980s sustainability has been used more in the sense of human sustainability on planet Earth and this has resulted in the most widely quoted definition of sustainability as a part of the concept sustainable development, that of the Brundtland Commission of the United Nations on March 20, 1987: "sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs." [21]

1.1. What sustainability is about

- Balancing or harmonizing social, environmental and economic interests.
- Both the short term and the long term.
- Local and global.
- Consuming income, not capital.
- Transparency and accountability.
- Personal values and ethics.

1.2. CSR: Corporate Social Responsibility

CSR, also called corporate conscience, corporate citizenship, social performance, or sustainable responsible business, is a form of corporate self-regulation integrated into a business model. CSR policy functions as a built-in, self-regulating mechanism whereby a business monitors and ensures its active compliance with the spirit of the law, ethical standards, and international norms. CSR is a process with the aim to embrace responsibility for the company's actions and encourage a positive impact through its activities on the environment, consumers, employees, communities, stakeholders and all other members of the public sphere who may also be considered as stakeholders.

Companies today face increasing demands for corporate social responsibility (CSR). Correspondingly, they have important new opportunities to build business value through judicious choices and actions to improve social and environmental conditions in the communities in which they do business. Whereas firms once might have been able to prosper by concerning themselves almost exclusively with financial results, most now find it at least prudent— and many are finding it directly valuable— to manage a wider array of the impacts that they generate (or can influence), from environmental conditions to employee health and safety to social conditions like the quality of public education.
1.3. Sustainability Reporting: GRI

The Global Reporting Initiative (GRI) is an organization whose purpose is to promote the development of sustainability reporting in all types of organizations.

GRI produces a comprehensive framework for the preparation of Sustainability Reports, which are widely used worldwide. The Framework, including the Guide for the preparation of reports, sets out the principles and indicators that organizations can use to measure and disclose their economic, environmental and social.

Sustainability reporting is a broad term considered synonymous with others used to describe reporting on economic, environmental, and social impacts (E.g., triple bottom line, corporate responsibility reporting, etc.). A sustainability report should provide a balanced and reasonable representation of the sustainability performance.

To sum up, GRI has a pioneering nonprofit propose framework for sustainability reporting. Companies use this report to inform its shareholders and consumers through their performance of economic, social and environment.

Fig. B-1: GRI Summary [22]

Reports can be used for the following purposes, among others:

- Benchmarking and assessing sustainability performance with respect to laws, norms, codes, performance standards, and voluntary initiatives
- Demonstrating how the organization influences and is influenced by expectations about sustainable development
- Comparing performance within an organization and between different organizations over time.
1.4. **Why do we need guidance on Social Responsibility?**

If organizations take the green lead, in a mid-long term they could achieve the following statements:

- Relationship with Companies, Governments, Media and Suppliers
- Employee morale, Commitment and Productivity
- View of Investors, Donors, Sponsors and Financial Community
- Peers, Customers and the Community in which it operates
- Reputation
- Competitive Advantage
- Ability to attract and retain workers or members, customers, clients or users

To sum up, if organizations take CSR into consideration when designing their projects schedule, it would increase their benefits as well as taking care of its social and earth environment.
1.4.1. Accenture and CSR

“Sustainability is increasingly being seen as a source—even a primary source—of revenue and business growth for companies intent on becoming high-performance businesses. New research from Accenture looks at how leading companies see this link between sustainability and commercial success.” [23]

1.4.2. Harvard Business Review and CSR

“Executives behave as though they have to choose between the largely social benefits of developing sustainable products or processes and the financial costs of doing so. But that’s simply not true. We’ve been studying the sustainability initiatives of 30 large corporations for some time. Our research shows that sustainability is a mother lode of organizational and technological innovations that yield both bottom-line and top-line returns. Becoming environment-friendly lowers costs because companies end up reducing the inputs they use. In addition, the process generates additional revenues from better products or enables companies to create new businesses. In fact, because those are the goals of corporate innovation, we find that smart companies now treat sustainability as innovation’s new frontier...” [24]

1.4.3. KPMG and CSR

Article: Prepare for the future: Sustainability as a business driver [25]

Key insights

✓ 62 percent of companies polled have a strategy for corporate sustainability.
✓ Between 2001 and 2010, an equity portfolio of sustainability leaders outperformed a portfolio of sustainability laggards by more than 30 percent.
1.4.4. GA Institute and Reporting Trends

The Governance & Accountability Institute, Inc. is a global research, news and trend monitoring, editorial services / publishing, analysis, and advisory organization serving leaders and boards of organizations in the corporate (private), public and social/institutional sectors. In their 2012 Report, the S&P 500 has realized significant increases in corporations reporting on Sustainability.

**Report:** Helping leaders and organizations recognize, understand and address critical ESG Factors to build more Sustainable enterprises in the corporate, social and public sectors.

"At this point our latest findings from this research effort show that around 53% of the S&P 500 Index companies are currently disclosing ESG information, compared to about 19-20% of the S&P 500 reporting in 2010. Put another way, this is a little more than one out of two companies included in the S&P 500 Index that are publishing progress reports on their sustainability efforts. What this means is if a company is in the S&P 500 and is not publishing a Sustainability report, it is now in the minority, and most likely their peers and competitors are already reporting and enjoying certain benefits and advantages."

At the end of the “Analysis of S&P 500® Companies’ ESG Reporting Trends & Capital Markets Response, and Possible Associations with Desired Rankings & Ratings” market research [26], we can find out the following chart:

<table>
<thead>
<tr>
<th>Application Level</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0</td>
<td>1</td>
<td>3</td>
<td>5</td>
<td>9</td>
<td>19</td>
</tr>
<tr>
<td>A+</td>
<td>0</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>B</td>
<td>1</td>
<td>8</td>
<td>16</td>
<td>19</td>
<td>25</td>
<td>48</td>
</tr>
<tr>
<td>B+</td>
<td>0</td>
<td>1</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>17</td>
</tr>
<tr>
<td>C</td>
<td>0</td>
<td>2</td>
<td>9</td>
<td>15</td>
<td>15</td>
<td>25</td>
</tr>
<tr>
<td>C+</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>Undeclared</td>
<td>25</td>
<td>14</td>
<td>6</td>
<td>4</td>
<td>3</td>
<td>52</td>
</tr>
<tr>
<td>Undecl. (%)</td>
<td>96,15%</td>
<td>46,67%</td>
<td>13,63%</td>
<td>7,69%</td>
<td>4,61%</td>
<td>31,13%</td>
</tr>
<tr>
<td>Total</td>
<td>26</td>
<td>30</td>
<td>44</td>
<td>52</td>
<td>65</td>
<td>167</td>
</tr>
</tbody>
</table>

*Fig. B-2: GA Institute Reporting trends report data table (2006-2010)*

We can sum the previous data up into the following plot. Then, we will be able to take some conclusions about the previous analysis made by GA Institute.
In the previous analysis we can appreciate the following statements:

- Every time there are less Undeclared companies in Fortune 500.
- Every time there are a higher total of companies in the study.
- The application level of the enterprises is better as time goes by.

We conclude that nowadays enterprises take CSR more into consideration than they did before, and we can appreciate that in its application level.
1.5. The UN Global Compact

- **Human Rights**
  - Businesses should support and respect the protection of internationally proclaimed human rights.
  - Make sure that they are not complicit in human rights abuses.

- **Labour**
  - Businesses should uphold the freedom of association and the effective recognition of the right to collective bargaining.
  - The elimination of all forms of forced and compulsory labour.
  - The effective abolition of child labour.
  - The elimination of discrimination in respect of employment and occupation.

- **Environment**
  - Businesses should support a precautionary approach to environmental challenges.
  - Undertake initiatives to promote greater environmental responsibility.
  - Encourage the development and diffusion of environmentally friendly technologies.

- **Anti-Corruption**
  - Businesses should work against corruption in all its forms, including extortion and bribery.
1.6. Rio declaration in 1992

The 1992 Rio Declaration on Environment and Development defines the rights of the people to be involved in the development of their economies, and the responsibilities of human beings to safeguard the common environment. The declaration builds upon the basic ideas concerning the attitudes of individuals and nations towards the environment and development, first identified at the United Nations Conference on the Human Environment (1972).

The Rio Declaration states that long-term economic progress is only ensured if it is linked with the protection of the environment. If this is to be achieved, then nations must establish a new global partnership involving governments, their people and the key sectors of society. Together human society must assemble international agreements that protect the global environment with responsible development.

There are a number of principles to the Rio Declaration.

- People are entitled to a healthy and productive life in harmony with nature.
- Development today must not threaten the needs of present future generations.
- Nations have the right to exploit their own resources, but without causing environmental damage beyond their borders.
- Environmental protection shall constitute an integral part of the development process.
- Eradicating poverty, and reducing disparities in living standards in different parts of the world are essential if we are to achieve sustainable development whilst meeting the needs of the majority of the people.
- Environmental issues are best handled with the participation of all concerned citizens.
- The polluter should, in principle, bear the cost of pollution.
- Sustainable development requires better scientific understanding of the problems. Nations should share knowledge and technologies to achieve the goal of sustainability.

Nonetheless, during the following years, world’s population has increased exponentially and so, its natural resources consumption, pollution emission, etc. In the following chart we show to the reader the exceeded limits in several statements that the international community follows closely.
Some research states that by 2050 human global population will reach 9 Billion (million of millions). Moreover, at 2009 we exceeded the limits in:

- Climate Change
- Biodiversity Loss
- Biochemistry Nitrogen Cycle.
- Chemical pollution and atmospheric aerosol loading were not yet quantified in the research.

*Data took from Rockstrom et al. Nature (2009) and ida Kabiszewsky/Solutions*

We understand Biochemistry Nitrogen Cycle as the reintroduction of Nitrogen. Despite the abundance in the atmosphere, nitrogen is often the most limiting nutrient for plant growth. This problem occurs because N\(_2\) gas is not biochemically usable by plants. Plants can only take up N\(_2\) in the form of ammonium ion (NH\(_4^+\)), nitrate ion (NO\(_3^-\)), or, less common, as amino acids.

### 1.7. Guidelines and Standards

ISO (International Organization for Standardization) is the world’s largest developer of voluntary International Standards. International Standards give state of the art specifications for products, services and good practice, helping to make industry more efficient and effective. Developed through global consensus, they help to break down barriers to international trade.

ISO develops International Standards. It was founded in 1947, and since then has published more than 19 500 International Standards covering almost all aspects of technology and business. From food safety to computers, and agriculture to healthcare, ISO International Standards impact all our lives.
ISO International Standards ensure that products and services are safe, reliable and of good quality. For business, they are strategic tools that reduce costs by minimizing waste and errors and increasing productivity. They help companies to access new markets, level the playing field for developing countries and facilitate free and fair global trade.

### 1.7.1. ISO 26000 (CSR)

As it was said in the previous section, ISO 26000 is a Guideline and not a Normative Standard, so here it goes a differentiation of what is and what its not.

<table>
<thead>
<tr>
<th>ISO 26000 IS</th>
<th>ISO 26000 IS NOT</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓ Intended to assist organizations in contributing to Sustainable Development.</td>
<td>✓ A management system standard.</td>
</tr>
<tr>
<td>✓ Intended to promote common understanding in the field of CSR.</td>
<td>✓ Intended or appropriate for certification purposes or regulatory or contractual use.</td>
</tr>
<tr>
<td>✓ Intended to complement other instruments and initiatives for CSR and not to replace them.</td>
<td>✓ Intended to provide a basis for legal actions, complaints, defenses or other claims in any international, domestic or other proceeding.</td>
</tr>
<tr>
<td>✓ Intended to provide organizations with guidance concerning CSR and can be used as part of public policy activities.</td>
<td>✓ Intended to be cited as evidence of the evolution of customary international law.</td>
</tr>
<tr>
<td></td>
<td>✓ Intended to prevent the development of national standards that are more specific, more demanding, or of a different type.</td>
</tr>
</tbody>
</table>

One remarkable statement that confirms that ISO 26000 is not a normative is that it contains no requirements and therefore the word “shall”, which indicates a requirement in ISO language, is not used but does contain 386 “should”. 

![ISO 26000](image)
1.7.2. ISO 14000 Family and EMS (Environmental)

ISO 14000 family is a series of guidance documents and standards to help organizations address environmental issues. Here we proceed introducing them.
What is environment?
Surroundings in which an organization operates, including air, water, soil, natural resources, flora, fauna, humans and their interrelation. [29]

ISO 14001 Key Elements
 ✓ Policy Statement
 ✓ Identification of Significant Environmental Impacts and Environmental Legal Requirements
 ✓ Establishing Environmental Programs, Objectives and Targets
 ✓ Emergency Plan
 ✓ Operating Control to meet the Environmental Objectives and Targets
 ✓ RRHH’s Role and Responsibilities. Training. Communication
 ✓ Internal Assessments. Corrective actions.
 ✓ Management Review (by Directors)

ISO14001 is concerned about Environmental Management Systems (EMS). Hence, here proceeds an EMS description.
 ✓ Systematic way of managing an organization’s environmental affairs
 ✓ Based on Plan-Do-Check-Act Model (PDCA)
 ✓ Focused on Continual Improvement of system
 ✓ Addresses immediate and long-term impact of an organization’s products, services and processes on the environment.
 ✓ A tool to improve environmental performance.

Why do Companies need to implement EMS?
 ✓ Helps to identify the causes of environmental problems.
   • Better to make a product right the first time
   • Cheaper to prevent a spill or other accident
   • Cost effective to prevent pollution
 ✓ Trade and competitive issues
   • Inconsistency in environmental regulation and enforcement
     Many individual parts may already be in place – just need to unify under the EMS umbrella!
1.7.2.1. Deming Cycle: PDCA

Deming introduced the concept of continuous improvement by describing the PDCA methodology. It stands for Plan – Do – Check – Act.

**PLAN**

Establish the objectives and processes necessary to deliver results in accordance with the expected output (the target or goals). By establishing output expectations, the completeness and accuracy of the specification is also a part of the targeted improvement. When possible start on a small scale to test possible effects.

**DO**

Implement the plan, execute the process, make the product. Collect data for charting and analysis in the following "CHECK" and "ACT" steps.

**CHECK**

Study the actual results (measured and collected in "DO" above) and compare against the expected results (targets or goals from the "PLAN") to ascertain any differences. Look for deviation in implementation from the plan and also look for the appropriateness and completeness of the plan to enable the execution, i.e., "Do". Charting data can make this much easier to see trends over several PDCA cycles and in order to convert the collected data into information. Information is what you need for the next step "ACT".

**ACT**

Request corrective actions on significant differences between actual and planned results. Analyze the differences to determine their root causes. Determine where to apply changes that will include improvement of the process or product. When a pass through these four steps does not result in the need to improve, the scope to which PDCA is applied may be refined to plan and improve with more detail in the next iteration of the cycle, or attention needs to be placed in a different stage of the process.
1.7.3. ISO 50001 (Energy)

ISO 50001 gives organizations the requirements for energy management systems (EnMS)

ISO 50001 establishes a framework for industrial plants; commercial, institutional, and governmental facilities; and entire organizations to manage energy.

Targeting broad applicability across national economic sectors, it is estimated that the standard could influence up to 60% of the world’s energy use.

This estimate is based on information provided in the section, “World Energy Demand and Economic Outlook”, in the International Energy Outlook 2010, published by the US Energy Information Administration. This cites 2007 figures on global energy consumption by sector, including 7% by the commercial sector (defined as businesses, institutions, and organizations that provide services), and 51% by the industrial sector, (including manufacturing, agriculture, mining, and construction). As ISO 50001 is primarily targeted at the commercial and industrial sectors, adding the above figures provides an approximate total of 60% of global energy demand on which the standard could have a positive impact.

Why is ISO50001 Important?

- Improved energy performance can provide rapid benefits for an organization by maximizing the use of its energy sources and energy-related assets, thus reducing both energy cost and consumption.
- The organization will also make positive contributions toward reducing depletion of energy resources and mitigating worldwide effects of energy use, such as global warming.
1.7.4. ISO 9001

"Project Quality Management includes the processes and activities of the performing organization that determine quality policies, objectives, and responsibilities so that the project will satisfy the needs for which it was undertaken. Project Quality Management uses policies and procedures to implement, within the project’s context, the organization’s quality management system and, as appropriate, it supports continuous process improvement activities as undertaken on behalf of the performing organization. Project Quality Management works to ensure that the project requirements, including product requirements, are met and validated."


The Principles of Quality Management in ISO9001 are the following,
- Customer Focus
- Leadership
- Involvement of people
- Process Approach
- System approach to management
- Continuous Improvement
- Factual approach to decision making
- Mutually beneficial supplier

These principles embodied in ISO 9001 have been developed with the intention that management can lead the organization towards improved performance.

ISO9001 Internal Audits
What must be assessed during an audit? [31]

- That process has been operating as planned: sequence of activities, conformity procedures, and operational control.
- Those critical resources of each of the processes are under control: HR, environment and equipment.
- That the documents of each of the processes are under control: management manual, procedures, instructions, and records.
- Processes that are under control and produce the expected results: process indicators, monitoring and control, and control variables. Corrective and preventive actions.
- Processes are being improved and will reach planned objectives: objectives and policy, plan management, monitoring and review.

1.7.5. Project Management and ISO 21500

"Organizational strategy should provide guidance and direction to project management—especially when one considers that projects exist to support organizational strategies. Often it is the project sponsor or the portfolio or program manager who identifies alignment or potential conflicts between organizational strategies and project goals and then communicates these to the project manager.

If the goals of a project are in conflict with an established organizational strategy, it is incumbent upon the project manager to document and identify such conflicts as early as possible in the project. At times, the development of an organizational strategy could be the goal of a project rather than a guiding principle. In such a case, it is important for the project to specifically define what constitutes an appropriate organizational strategy that will sustain the organization" [32]

ISO 21500:2012 provides high-level description of concepts and processes that are considered to form good practice in project management.

- Projects are placed in the context of programs and project portfolios.
- The ISO does not provide detailed guidance on the management of programs and project portfolios.
- Topics pertaining to general management are addressed only within the context of project management.
- The ISO is 36 pages and was developed over the course of five years.
- The Project Management Institute served as secretariat of the ISO committee.
ISO21500 is targeted to the following collectives:

- Senior managers and project sponsors
- Project managers, project management teams and project team members
- Developers of national or organizational standards, for use in developing project management standards, which are consistent at a core level with those of others.

**Scope of ISO21500**

This International Standard provides guidance for project management and can be used by any type of organization, including public, private or community organizations, and for any type of project, irrespective of complexity, size or duration. This International Standard provides high-level description of concepts and processes that are considered to form good practice in project management. Projects are placed in the context of programs and project portfolios; however, this International Standard does not provide detailed guidance on the management of programs and project portfolios. Topics pertaining to general management are addressed only within the context of project management.

**ISO21500 Process Groups (Project Life Cycle)**

![ISO21500 Project Phases diagram](image)

*Fig. B-5: ISO21500 Project Phases diagram [33]*

The process groups are normally repeated within each project phase to drive the project to completion. All or some of the processes within the process groups may be required for a project phase. Nevertheless, not all interactions will apply to all project phases or projects. In practice, the processes within the process groups are often concurrent, overlapping, and interacting in ways that are not shown in the figure above.
Process Group Interactions

The Group Interactions will be explained using the next figure.

![Diagram of ISO21500 Project Phases inputs and outputs diagram]

*Fig. B-6: ISO21500 Project Phases inputs and outputs diagram [33]*

- Each subject group consists of processes applicable to any project phase or project.
- These processes are defined in terms of purpose, description and primary inputs and outputs and are interdependent.
- Subject groups are independent of application area or industry focus.
- Not all process interactions are shown.
- Any process may be repeated.
2. Pre Project – Initiation Phase

We start by showing an overview activities diagram of the initiation phase.

![GPM Initiation Phase Activities Flowchart](image)

The pre project phase is one where the ideas are formulated and the business reviews whether this is a feasible project or element of a project to be included within the portfolio of projects that it is currently running.

The key deliverable within this phase is the *Project Charter* or *Business Case* that will show the value of the sustainability element within the full project document. In addition, to support the charter, the delivery has to be leveled against the organization’s environmental management system allowing it therefore to develop further its Sustainability Management Plan (SMP) for the future. It must keep in mind:

- Justification of the project
- Obtain authorization for the project and its funding
- Used to give direction to a project team
- Baseline document for phase and stage reviews
- Used in evaluation of change requests
- Baseline document for benefits reviews
- Used by organization to facilitate lessons learned

**Contents of a Business Case**

Taking into consideration that the Business Case is the driving force behind the project and so at every review must be present for consideration as to whether or not the project should proceed or be halted as the justification or benefit cannot now be realized.

The BC must content the following statements:
A statement of success and acceptance criteria should be shown within the business case to allow the PM to identify from these the Quality Standards that he or she will be expected to achieve in their project goals.

The identification of what benefits the organization will gain by the project so that anyone reading the document can see the reason and result of the project within one area.

The PM will also need to know what they are being asked to produce as an end product. The project’s product needs to be clear and precise so that a scope of work to match the deliverables can be developed.

An investment appraisal, which will give financial support to the project giving the true value of a project to the organization.

Furthermore, following GPM criteria, the BC should include references to Corporate Sustainability Governance, Regulatory Compliance and Goals and Objectives. PM’s should always review the Business case or charter from a CSR perspective by leveling the deliverables against the EMS or together with the CSR officer.

Following the Initiation Phase diagram

As a PM, we recommend that when you review the project charter; always level it against the corporate EMS. Meaning, does the request align with corporate targets and objectives already in place? Don’t leave it up to the project sponsor or anyone who handles the charter before it touches your hands to do so.
2.1. The Triple Bottom Line

John Elkington, the founder of a British consultancy called SustainAbility [34], first coined the phrase “the triple bottom line” in 1994. His argument was that companies should be preparing three different (and quite separate) bottom lines.

- One is the traditional measure of corporate profit—the “bottom line” of the profit and loss account.
- The second is the bottom line of a company’s “people account”—a measure in some shape or form of how socially responsible an organization has been throughout its operations.
- The third is the bottom line of the company’s “planet” account—a measure of how environmentally responsible it has been.

The triple bottom line (TBL) thus consists of three Ps: profit, people and planet. It aims to measure the financial, social and environmental performance of the corporation over a period of time. Only a company that produces a TBL is taking account of the full cost involved in doing business.

This doesn’t deal very easily with project management. That’s why the new discipline that we are analyzing in this project (GPM) created P5.

2.2. The GPM P5 Concept (Initiation Phase)

P5 stands for People, Planet, Profit, Process and Product. It comes from joining the concepts of TBL (Planet, Profit and People) with Project Management (Process and Products).
The GPM P5 is a tool that supports the alignment of Portfolios, Programs, and Projects with organizational strategy for Sustainability and focuses on the Impacts of Project Processes and Deliverables on the Environment, Society, the corporate bottom line and the local economy.

The simplest way to explain P5 is that it is bonds between the triple bottom line approach, project processes and the resulting products or services.

P5 serves as the sustainability framework that the methodology is built on and leverages ISO standards the GRI G4 indicators and the UN Global Compact Ten Principles.

The methodology provides inroads to expand the capabilities of organizations to provide a complete cradle-to-cradle report by including project processes and their products as critical elements through qualitative and quantitative measurements using the P5 Standard that is used as a tool that structures the main elements of a project and highlights the linkage between them.

To sum up, P5 takes into consideration the following statements:

- Five measurable elements to sustainability
- Each measured individually and as a complete package
- Planet (Environmental aspect)
- People (Social aspect)
- Profit (Financial aspect)
- Process (Governance aspect)
- Product (Technical aspect)

Moreover, some examples of potential areas of impact would be:

- Project context
- Stakeholders
- Project content
- Business Case
- Materials and procurement
- Project Reporting
- Risk Management
- Project Team
- Organizational learning

This following diagram shows how Process and product Impact the Categories, Sub-Categories, and Elements.
Fig. B-9: P5 Categories, subcategories and elements diagram [22]
2.2.1. P5 Product

A "product" defined to be any tangible or intangible service, good(s), change, resource, business result or outcome undertaken by an organization using the project management processes as the method to create, update, expand, maintain and eventually dispose of the products, with the objective to use the "product" to provide future benefit to the organization.

Products commonly follow these four stages as shown in the figure:

- **Introduction**: A product is introduced to the market
- **Growth**: The product starts to grow in the market
- **Maturity**: The product is established, sales increase and eventually stabilize
- **Decline**: The stage where the product begins to decline and either the market for the product is no longer there

![Product lifecycle phases diagram](image)

*Fig. B-10: Product lifecycle phases diagram [21]*

P5 looks at the product life cycle from a different perspective. The product’s impact from a social, environmental, and economic perspective during each of these phases should be accounted for in the product’s project from the time that the idea for the product is conceived until it is handed off in its final form.
2.2.2. P5 Process

According to ISO 21500, a process is a set of interrelated activities. Processes used in projects are generally categorized into three major types:

- Project management processes, which are specific to project management and determine how the activities selected for the project are managed.
- Delivery processes, which are not unique to project management, which result in the specification and provision of a particular product, service or result, and which vary depending on the particular project deliverable.
- Support processes, which are not unique to project management and which provide relevant and valuable support to product and project management processes in such disciplines as logistics, finance, accounting and safety.

2.2.3. P5 Social Bottom Line

P5 views the social or “people” bottom line categorically and is based on internationally recognized universal standards, including:

- United Nations Universal Declaration of Human Rights
- United Nations Convention: International Covenant on Civil and Political Rights
- Convention on the Elimination of all Forms of Discrimination against Women (CEDAW)
- ILO Declaration on Fundamental Principles and Rights at Work
- The Vienna Declaration and Program of Action.

2.2.3.1. Social - Labor Practices and Decent Work

This sub-category covers project governance policies as they pertain to labor practices, the relationship to policy set forth in organizational strategy, and operations, its hiring and staffing policies and procedures, treatment of employees, and their well-being.

- **Employment**
  
  Employment and sourcing practices of the individuals who comprise the project organization ranging from the project steering committee or board to the project team name and can be measured by: Employment type (full time or contract), Gender, Age, ...

- **Labor Management Relations**
  
  An organization’s approach as it relates to the project owner/sponsor/stakeholders with regards to interfering with each other’s legitimate and human rights, policies for addressing issues, risks, and performance, and procedures for fair mediation.
Health and Safety
An organization’s approach and procedures regarding health and safety and emergency management as it relates to the project team, the project environment during the project life cycle, and the environment that the product will inhabit when it is put into production.

Training and Education
An organization’s approach to skills management and learning that support the ability of project personnel to carry out project activities, maximizing value to the project and having a positive contribution to their career.

Organizational Learning
An organization’s approach to knowledge management that enhances its collective ability to accept and make use of, new knowledge to benefit the organization’s advancement and mitigate risk.

Diversity and Equal Opportunity
An organization’s approach and policy on non-discrimination of project personnel and resources based on age group, gender, minority group, and other indicators of diversity.

Trained Professional Emigration
The impact on a local society whereby the labor demographics change due to a portfolio, program, or project.

2.2.3.2. Social - Society and Customers
This sub-category covers the impacts of a portfolio, program, or project on the society in which the project’s product will impact the end users or customers that will make use of it.

Community Support
The level of support by the community that the project will have impact on directly and indirectly – from a local, regional, national, and global perspective.

Public Policy/ Compliance
The project must be abided by the rule of law, public policies and regulatory compliance.

Customer Health and Safety
The adherence to measures that ensure that the project does not endanger or cause harm to the end user.

Products Labeling and Services Labeling
The labeling of the project’s product and service information to ensure accuracy of content, safe use, disposal, and any factors that may have environmental or social impacts.
Market Communications and Advertising
The company must report any incidents pertaining to the project’s regulatory compliance, human rights, laws or public policies.

Customer Privacy
The organizational policies and procedures to that pertain to the handling of customer information, complaints, regulatory issues, or loss of customer information.

Social - Human Rights
This sub-category covers project process and product impacts as they pertain to human rights.
Among the human rights issues included are non-discrimination, gender equality, freedom of association, collective bargaining, child labor, forced or compulsory labor.
The international legal framework for human rights is comprised of a body of law made up of treaties, conventions, declarations and other instruments. The corner stone of human rights is the United Nations (UN) International Bill of Rights, which is formed by three instruments:
- United Nations (UN) Declaration, 'Universal Declaration of Human Rights', 1948
- United Nations (UN) Convention, 'International Covenant on Civil and Political Rights', 1966

These are the first reference points for any organization reporting on human rights.

Non Discrimination
Organizational policy for non-discrimination because of race, color, national or ethnic origin, age, religion, disability, sex, sexual orientation, gender identity and expression, veteran status, or any other characteristic protected under applicable law.

Freedom of Association
Organization must have policies and processes that ensure rights if personnel join or leave groups of a person's own choosing, and for the group to take collective action to pursue the interests of members.

Child Labor
Organizational policies and measures that safeguard against child labor, and young workers being exposed to hazardous work either directly or through supplier channels.

Forced or Compulsory Behavior
Organizational policies and measures that safeguard against forced or compulsory labor practices, either directly or through supplier channels.
2.2.3.4. Social - Ethical Behavior

This sub-category covers project process and product impacts as they pertain to ethical behavior and focuses on three areas: Investment and Procurement, Bribery and Corruption, and Anti-Competition.

Each element in this sub-category extends beyond a behavioral competence to organizational culture in how conscious leadership and higher purpose are cornerstones to successful projects and ultimately stronger business.

✓ **Investment and Procurement Practices**
  The organization must own processes of selecting which project to invest in and the procurement practices that will supply the project with resources.

✓ **Bribery and Corruption**
  An organization must own a policy and practice, and transparent communications with regards to forms of corruption including extortion and bribery.

✓ **Anti-Competitive Behavior**
  A organization’s policy and actions and reporting on anti-competitive behavior, including any legal action or complaints from regulatory organizations

2.2.4. P5 Environmental Bottom Line

The environmental aspect of sustainability concerns portfolio, program, or project’s impact on living and non-living natural systems, including land, air, water and ecosystems.

2.2.4.1. Environmental - Transport

This sub-category covers project process and product impacts as they pertain to transport and focuses on four areas: Local Procurement, Digital Communication, Traveling, and Transport.

While each element in this category are categorized under environmental, each have significant social and economical impacts that should be accounted for when considering overall impact.

✓ **Local Procurement**
  An organization should own policies and procedures to procure goods and services from local sources in order to reduce environmental impact. (Also serves to improve social and economic impacts).

✓ **Digital Communication**
  An organization should own policies and procedures to utilize technology for communication in order to reduce the consumption of non-renewable resources.
2.2.4.2. Environmental - Energy

This sub-category covers project process and product impacts as they pertain to energy resources and focuses on three primary areas: Energy used, Emissions / CO₂, and Clean Energy Return.

- **Energy Used (Consumed)**
  The type of energy and amount of energy consumed throughout the project life cycle and the amount of energy the project’s product will consume during its life span.

- **Emission / CO₂**
  The amount of carbon emissions that will be emitted during the project life cycle as well as air quality impact during the project’s product life cycle.

- **Clean Energy Return**
  The type of and amount of renewable energy that can be generated by the project or project’s product that can be returned and re-allocated.

2.2.4.3. Environmental – Water

This sub-category covers project process and product impacts as they pertain to water resources and focuses on three primary areas: Water Quality, Water Consumption, and Water Displacement.

- **Water Quality**
  The impact on water quality that the project and or the project’s product will have, the habitats and species affected.

- **Water Consumption**
  The amount of water that will be withdrawn by the project and or project’s product during its life-cycle.

- **Water Displacement**
  The amount of water that will be displaced from the natural water table as a result of the project or project’s product.
2.2.4.4. Environmental - Waste

This sub-category covers project process and product impacts as they pertain to waste that during the extraction of raw materials, the processing of raw materials into intermediate and final products, the consumption of final products and focuses on five primary areas: Recycling, Water Disposal, Reusability, Incorporated Energy, and Waste.

- **Recycling**
  The organization’s policy and practice regarding the sourcing and use of recycled products and materials, the project’s adherence to recycling practices.

- **Disposal**
  The organizational policy for disposal of resources, assets, and the impact of the project’s product end of life disposal on society and the environment.

- **Reusability**
  The organizational policy to reuse materials in the creation of new products and the project’s product’s reusability at end of life.

- **Incorporated Energy**
  The amount of energy from renewable sources that is incorporated into the project’s product and the consumption of renewable energy during the project life-cycle.

- **Waste**
  The organizational policy and practices with regard to waste disposal, the handling of waste during the project life-cycle, as well as the type and amount of waste created by the project’s product.

2.2.5. P5 Financial Bottom Line

P5 views the economic returns on portfolio, program, and projects to include external costs when calculating returns.

The categories and elements allow for sustainability based decision-making process from the viewpoint of portfolios, programs and projects, to maximizing return for as many of them as possible.
2.2.5.1. Financial - Return on investment (ROI)

P5 views Return on Investment (ROI) from a financial aspect as the direct financial gain to be realized for investing in a portfolio, program, or project. This sub-category covers the financial gain and net present value of an individual project.

- **Direct Financial Benefits**
  The financial gain to be realized by the organization as a result of the project.

- **Net Present Value**
  The total that results when the discounted value of the expected cost of an portfolio, program, or project is deducted from the discounted value of the expected gains.

2.2.5.2. Financial - Business Agility

P5 views business agility as the ability of an organization to adapt from a financial perspective in response to changes in the portfolio, program, or project in order to meet project outcomes from a sustainability perspective. This sub-category focuses on two elements, flexibility/optionality in the project, and increased business flexibility.

- **Flexibility / Optionality in the Project**
  Flexibility in the project to adjust requirements to achieve a higher degree of sustainability to increase social benefit and improve environmental impacts.

- **Increased Business Flexibility**
  The amount of flexibility an organization gains as a result of a project.

- **Economic Stimulation**
  P5 views economic stimulation as the financial stimulation that occurs as a result of the project. The two elements that are measures are Local Economic Impact and Indirect Benefits.

- **Local Economic Impact**
  The impact to the local economy as a result of the portfolio, program, or project.

- **Indirect Benefits**
  The financial benefits to the economy that are realized as a result of the portfolio, program, or project that are not defined in the business plan but materialize as a result of the investment.
2.3. The Sustainability Management Plan (SMP) (Initiation Phase) [22]

Sustainability in Project Management in short addresses the impact of a project on the environment. There have been several theories identified over the past several years but none that can be adopted as repeatable processes that provide governance and deliver consistent results.

In order for GPM to take a permanent foothold a new set of activities that focus strictly on the sustainable aspects of an initiative through project governance is required.

The sustainability management plan (SMP) addresses these needs by determining how green the project delivery will be and how it aligns with organizational standards set forth in the environmental management system and or regulatory compliance standards document. The SMP is a true method to measure the impacts -long and short term- to organizational goals such as waste reduction, resource consumption, and energy efficiency.

The SMP is used to govern the benefits of the project and so therefore belongs either as part of or as an attachment to the business case. When it is accepted that the business case is the driving document of all projects, then it would be remised to believe that sustainability could exist without some sort of impact with the business case.

With the understanding that the business case must align itself with the strategy of the organization or company, then having a SMP and Environmental Management System in place ensures that the organization’s approach meets the strategy laid out within that. That is not to say that the business case has to ensure that it produces green projects each and every time, but that the elements or subjects within the business case also ask or investigate the five measureable aspects of sustainability to gain the full understanding, direction, costs and benefits available within this area for the organization.

In short, a Sustainability Management Plan (SMP) ...

- Provides the framework to address impacts short and long term to sustainability objectives as they pertain to the project with an emphasis on Environmental, Social, and Economic impacts.
- Determines how green / sustainable the project delivery will be and how it will align with organizational strategy through governance
- Outlines the processes to manage and mitigate a project’s negative socio-eco-environmental impact.
The VALUE of SMP

✓ Enhances the focus to the shared connections with the next projects in the queue.
✓ Highlight opportunities for external stakeholder communication identifying increased controls in process as well as social, environmental and economic impacts.
✓ Reinforces that sustainability equates to profitability!
✓ As a project foundational document to promote visibility and governance.
✓ Establish the communication plan to broadcast the gains in management of finite resources and minimizing waste.
✓ Indicate and enhance focus to the shared connections with the next projects in the queue.

What to include in an SMP

The typical SMP layout would have the following structure.

1. Table of Contents
2. Document Control
   ✓ Version History and recipients list
3. Purpose
   ✓ A brief on what the document is
4. Executive Summary or Brief
   ✓ An outline of the sustainability factors in the project
5. List Project Sustainability Objectives
   ✓ Derived from the P5 Impact Analysis
6. Outline Key Measures and Performance Indicators (Qualitative and Quantitative)
7. The P5 Impact Assessment Score (and updates)
8. Scope Exclusions
9. Sustainability Reviews and Reporting
10. Checklist

Examples of Key Measures and Performance Indicators (P5)

✓ Environmental → Energy, Waste, Transport, Water Usage, Materials and Resources
✓ Financial → Return of Investment, Business agility
✓ Products → Lifespan of product, Servicing of product
✓ Processes → Maturity of a process, Efficiency and fairness of process
✓ Personal → Labour practices and Decent work, Human Rights, Society and Costumers, Ethical Behavior
Here follows a Document Control and Document Distribution example.

1. Document Control
   1.1. Revision History
   
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<tr>
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<th>Author</th>
<th>Reason For Issue</th>
<th>Date</th>
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   1.2. Document Distribution
   
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<tr>
<th>Number</th>
<th>Owner</th>
<th>Location</th>
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</tbody>
</table>

   *Fig. B-11: Document Control's template*

Where does SMP interface with the project?

*Fig. B-12: SMP and ISO21500 project phases’ inputs and outputs diagram [33]*
2.4. Stakeholder Management and Organization Roles

The project stakeholders, including the project organization, should be described in sufficient detail to enable project success. The roles and responsibilities of stakeholders should be defined and communicated based on the organization and project goals.

In order to get an overview of the possible Stakeholders in a project, we thought it might be handy to take a look to the ISO standard for a project organization diagram.

![Fig. B-13: ISO21500 Project Organization diagram [33]](image)

Stakeholder interfaces should be managed within the project through the project management processes.

The project organization is the temporary structure that includes project roles, responsibilities, and levels of authority and boundaries that need to be defined and communicated to all stakeholders of the project. The project organization may be dependent on legal, commercial, interdepartmental or other arrangements that exist among project stakeholders.
The project organization may include the following roles and responsibilities:

- **Project Manager** → Leads and manages project activities and is accountable for project completion.
- **Project Management Team** → Supports the PM in leading and managing the project activities.
- **Project Team** → Perform project activities.

Project governance may involve

- **Project Sponsor** → Authorizes the project, makes executive decisions, and solves problems and conflicts beyond the project manager’s authority.
- **Project steering committee or board** → Contributes to the project by providing senior level guidance to the project.

Additional Stakeholders

- **Customers or customer representatives** → Contribute to the project by specifying project requirements and accepting the project deliverables.
- **Suppliers** → Contribute to the project by supplying resources to the project.
- **PMO** → Activities: Governance, Standardization, PM training, project planning and monitoring.
2.4.1. Individuals and Groups with a Vested Interest in the Project

Stakeholder analysis establishes the individuals and groups with a vested interest in the project, and prioritizes their relative importance in terms of interest (needs) and power (degree of influence) on key decisions and activities. It may also prioritize stakeholders according to the degree they are affected by the project or its outcome.

Stakeholders may have varied interests and influence on the project. Some may be opposed to the project whilst others are for it. Some stakeholders may introduce threats and others provide opportunities. Stakeholders’ involvement may be passive or active.

It is becoming increasingly important to recognize and manage the way stakeholders participate in projects in order to reduce negative impacts and enhance opportunities. Stakeholder Management can be regarded as management of people risks and should consider external and internal stakeholders at all levels in the project.

In the following figure we can appreciate how to act towards each kind of stakeholder (Motivate, Encourage, Tell or Sell) depending on its involvement (Passive or Active) and its interests (Backer or Blocker). We also must take into consideration the power of influence of each stakeholder in our project.

*Fig. B-14: Stakeholder Matrix 1*
2.4.2. Stakeholder Analysis Process

Stakeholder Management is a pre-requisite for many planning activities including integration, communication, information management and risk management.

The process involves identifying the stakeholders, and gathering information on their interest (needs, aims) and power (influence) on the project.

The various interests and power levels are evaluated in order to establish the potential effect on the project. Stakeholders may be prioritised to show those that have greater power or interest in the project. This analysis helps with response planning, in particular communication management.

Action plans are developed and implemented to deal with each stakeholder appropriately. These are monitored and controlled to ensure effectiveness.

The composition and influences of project stakeholders continually change as the project progresses, and more significantly at the boundaries of key phases and stages. The process is therefore applied continuously.

![Stakeholder Analysis Process diagram](image-url)
Framework for stakeholder analysis

Interest may be positive or negative. Potential negative interests may be viewed as possible risks. The level of interest can be scored using a simple qualitative scale for example high or low. A complete analysis would typically show appropriate actions to involve stakeholders positively in the activity, or in the case of negative interests, to apply countermeasures to eliminate or reduce any possible threat.

Fig. B-16: Stakeholder Analysis Matrix 2 [22]
Projects
- A project consists of a unique set of processes consisting of coordinated and controlled activities with start and end dates, performed to achieve project objectives. Achievement of the project objectives requires the provision of deliverables conforming to specific requirements. A project may be subject to multiple constraints.
- Although many projects may be similar, each project is unique. Project differences may occur in: deliverables provided; stakeholders influencing; resources used; constraints; and the way processes are tailored to provide the deliverables.
- Every project has a definite start and end, and is usually divided into phases.

Project Management
- PM is the application of methods, tools, techniques and competencies to a project.
- PM includes the integration of the various phases of the project life cycle.
- PM is performed through processes. The processes selected for performing a project should be aligned in a systemic view. Each phase of the project life cycle should have specific deliverables. These deliverables should be regularly reviewed during the project to meet the requirements of the sponsor, customers and other stakeholders.
2.5. Governance Environment

Governance of project management is a responsibility of corporate management requiring the support of project sponsors, project managers and project teams. Effective governance of project management will ensure that the organization’s projects are aligned to organization’s strategic objectives delivered efficiently / sustainable.

The activities involved in the governance of project management are a subset of corporate governance. Most project management activities are outside the responsibility of corporate governance. This suggests that the control of projects must be shared between corporate governance and project management.

Here we proceed listing the principles of governance:

- Board has overall control
- Roles, responsibilities and performance criteria clearly defined
- Discipline arrangements, methods and controls throughout Project Life Cycle
- Coherence and Support between Business Strategy and Project Portfolio
- All Projects have approved plans and Review checkpoints
- Delegated Authorization Bodies need appropriate levels of authority and competence
- Business Case fully supported with realistic information
2.6. Project Sponsors

The typical activities performed by the Project Sponsor during the project life cycle include:

- Developing and maintaining the Business Case, assigning the Project Manager and authorizing the project management plan and any updates.
- Monitoring the project environment for risks, communicating with the Project Manager and other project stakeholders to identify any changes required.
- Reviewing progress against critical success criteria and checking that the planned business benefits will be achieved. Depending on progress the sponsor may decide to stop, change or continue the project.
- Accepting the project deliverables, signing off the project and handing the products to the operating authority.
- Conducting benefits realization reviews during the Operations Phase.
3. The Planning Phase

The planning phase is the moment when the project starts to come to life. Here the project manager needs to gain a real understanding of what the client or organization is looking to achieve so that they can plot the best way to deliver the project, its main deliverables and the planned benefits in the most sensible and safest manner to benefit all parties involved.

We follow by showing an overview activities diagram of the planning phase.

![GPM Planning Phase Activities Flowchart](image)

*Fig. B-19: GPM Planning Phase Activities Flowchart [22]*

Project management can be said to comprise of two elements, planning and control. In the first, we decide what we intend to do and how we intend to do it, whilst in the second, we actually carry this out. Planning is the foundation of control. Without any plans we have nothing to control and no targets to aim for. Because planning is such a major and fundamental part of project management there are numerous opinions about how it should be structured and performed.
Plans are the project manager’s “faithful serving men”. They explain the what, where, when, why, how and who of the project. Plans are statements of intent, they define what the project is intended to achieve and how we intend to achieve it. That simple statement means that they have to cover a great deal of information. However, remember a plan is exactly that at a Project Manager should be prepared and flexible enough to change and update it as the project progresses.
3.1. Scope Management

3.1.1. Defining the Scope

In order to define the scope, the project manager has to answer the 7 W's (Why, What, How, How much, Who, When and Where) as it is necessary to understand the project’s scope before planning. The following figure shows some examples of elements that should be answered in each "W".

![Seven W's Scope Definition diagram](image)

*Fig. B-21: Seven W's Scope Definition diagram [22]*

3.1.2. Acceptance Criteria

Acceptance Criteria are the requirements of the Customer by which the project’s delivery success will be gauged. They must be measureable and unambiguous. The Project Manager identifies them as early as possible so that it will help with accuracy when planning work and estimating costs and schedules. The use of loose descriptions or phrases will inevitably lead to disputes over the interpretation of the product delivery at some stage during the project. Criteria must be achievable within the scope and budget of the project. They will be unique to the project.

The acceptance criteria must be:
- Defined as part of requirements gathering
- Reviewed constantly but rigorously in the early phases
- Agreed between the customer and the Project Manager
- Approved by the Project Sponsor within project plan
- Planned process of acceptance
3.1.3. **Product Breakdown (PBS)**

The Product Breakdown Structure (PBS) is a hierarchical breakdown of the products that are to be produced by the project. Typically the final solution for the project is shown at the highest level, with major products that make up that solution shown at the next highest level. The components of each product (or sub products) will typically be shown at lower levels. The higher levels are used to support development of the Work Breakdown Structure, asking what needs to be done to complete each product. Products are easily identified on a breakdown structure, as they are nouns or naming words. The PBS also used in the identification of the items to be used in configuration management and on change impact assessments. The PBS provides a high level view of the key products and is useful for the project stakeholders who are more likely to be focused on products than the work to be accomplished.

The following figure shows an example of PBS of the project of Complete a Garden.

![Product Breakdown Structure Example](image)

**Fig. B-22: PBS example**

3.1.4. **Work Breakdown (WBS)**

The Work Breakdown Structure (WBS) provides a hierarchical structure showing the tasks to be undertaken in a project. The preferred and most common form is based on the breakdown of products as shown in the figure. Once this has been done, task decomposition breaks the products into manageable units of work.

The decomposition is continued until an appropriate level is reached. This level is decided by the Project Manager dependent upon the team he has and the experience they have. This will allow him to decide what level of control he will need to take and therefore the depth of detail in which the WBS must be taken. Elements at the lowest level in any branch are called the work packages. The elements are easily recognized by the use of verbs (action words) to describe them, rather than the nouns found in a PBS.

The WBS should enable members of the project team to define their tasks to a meaningful level of detail.
The main benefits of the WBS are as follows:

- Enables breakdown of work into easily definable and manageable units (chunks) of work
- Provides a structure for defining the statement of work at each level including, requirements, budgets, and deliverables.
- Helps to define relationships with the organization and cost management systems
- Provides a framework for communicating throughout the project including performance reporting and escalation of issues
- Enables assignment of single point accountability and supports allocation of resources
- Supports risk identification and assessment showing relationships between tasks
3.1.5. Organizational Breakdown (OBS)

OBS is one structure derived from the WBS. This is regularly seen as an Organization Chart in most industries, as shown in the figure below. It shows the roles and titles of the team members (related to the work they are managing), their span of control and the approved reporting structure.

The project OBS is used with the WBS to form the Responsibility Assignment Matrix (see 3.6).

To produce the Organization Breakdown Structure, the work breakdown and tasks are analysed. Typically, team leaders or co-ordination roles are assigned to individuals in order to manage groups of tasks. The criteria used to decide on management levels for groups may be:

- Size and nature of the tasks
- Complexity in terms of interdependencies
- Criticality and risks

The Project OBS identifies key decision making authorities and ownership of work areas. It therefore supports communications, performance monitoring, control, and reporting.

Fig. B-24: OBS layout diagram
3.1.6. Responsibility Assignment Matrix (RACI)

The RACI is used to define the accountability, role and responsibility of each team member. Combining the WBS and the OBS develops it.

![RACI Matrix layout diagram]

**Fig. B-25: RACI Matrix layout diagram**

- **Responsible**: The individual(s) / committees who performs the task, responsible for the action / implementation
- **Accountable**: The individual / committee who is ultimately accountable
- **Consulted**: The individual / committee to be consulted prior to an action being taken or a final decision made
- **Informed**: The individual / committee who need to be informed after an action has been taken, or a decision made

- The “Doer”
- “Supervises “R” ”
- “Get all the facts”
- “Keep in the picture”

- The degree of responsibility is defined by the Accountable person
- “R’s” can be shared
- Has Yes / No power, as well as power of veto
- Only one “A” can be assigned to a process step / activity
- Encourages two-way communication
- “C’s” can be shared
- “I’s” can be shared
Here it follows an example on how RACI matrix would be like:

![RACI Matrix example](image)

**Fig. B-26: RACI Matrix example [22]**

- A RACI needs an owner. This should be established when the RACI is completed.
- There can only be one person responsible for a task or activity.
- People who need to make decisions must have the authority to do so.
- Someone must be responsible to do the work.
- 'A' should sit with the person who is closes to the activity.
- Ensure the people who are consulted (C) and informed (I) are those who need to know and/or are impacted by the change.
- All roles and responsibilities must be documented on a RACI chart and communicated.
3.1.7. Cost Breakdown (CBS)

Another useful breakdown that can be derived from the WBS is the Cost Breakdown Structure (CBS). It important that costs for each work package are broken into elements since different types require different monitoring and control processes.

The Cost Breakdown Structure is derived from the company system of allocating costs and the WBS. Typically, budgets (estimates) for each work package are broken down into cost elements corresponding to the company system of accounts. Actual costs charged to each work package are detailed at cost element level. This enables work package managers to compare actual costs with baseline work package budgets to pinpoint variances and problem areas, allowing them to take any corrective action.

![Fig. B-27: CBS layout diagram [22]](image-url)
3.2. Estimating Accuracy

Estimates in projects are quantified assessments of resources and time required to complete part or all of a project. They are used to support Investment Appraisal and support project Go/No Go decisions. They are also used throughout the project to support performance assessments and predictions.

Estimating accuracy will vary through the project lifecycle depending on the level of uncertainty and the quality and availability of information. Generally, information during the concept stage is likely to include only high-level designs and strategies, consequently its accuracy is likely to be in a ‘rough order of magnitude’ due to the uncertainties and lack of defined information.

As more data becomes available during definition, estimating accuracy should be sufficient for the approval of the business case. Accuracy will continue to improve at the beginning of implementation as detailed designs, scope of work and detailed plans are produced. This is necessary to control cost, time and performance during implementation since unreliable estimates could cause management problems and reduce team morale. Estimating accuracy should improve throughout implementation sub stages as more details and results of work are defined and recorded. At the end of each sub stage, information and lessons learned will help to improve estimating accuracy by the use of these actual costs and tasks being completed.

The reliability of estimates is likely to influence decisions to continue or terminate the project at the end of each project stage and sub stage.

Remember, cost and time always remains an estimate up until the final day of the project when it is closed. At no time should a Project Manager guarantee what their costs or timescales are going to be.
3.3. Resource Management

Resource management consists of resource planning, with the identification and allocation of resources with the appropriate capabilities. It also includes optimizing the way resources are utilized in the time schedule, their impacts as well as the continuous controlling of these resources according to what is outlined in the Sustainability management plan.

There are two main types of resource, those that can be consumed during work and those that can re-use and are non-consumable. For example, the fuel that goes into a car is a consumable while the car is re-usable.

It is important to keep in mind that the most valuable resource that you will ever have is your people, so ensure you lead them and care for them well as they are the most re-useable assets that any Project Manager will ever have.

It is also important to understand the impact that resources have on the project’s outcome from a directly objective perspective and from a sustainability point of view.

3.3.1. Resource Process

A resource is anything required to complete the work of an activity. It could be people, equipment or materials. Resource management ensures that the right resources have been identified and made available when necessary.

The sequence of steps during the resource process is as follows:

Once activities have been scheduled, resources are allocated to each activity. This enables the total requirements to be determined against the project timescale.

Resource requirements are totalled to determine the level of resources required for each timescale period. This is typically shown as a histogram.

It is unlikely that the availability of resource requirements will fit exactly into the requirements (or demand). Such constraints are applied to the resource requirements and an optimised schedule is determined. This may require activities to be delayed, extended and perhaps de-scoped.
The effective application of Resource Management by the PM increases the opportunity for the project to:

- Be more efficient in the utilization of resources, this is vitally important when the resource is specialized or scarce.
- Have greater confidence that the schedule is more realistic in what is really required and how it fits in terms of the resources available.
- Have early indication of any resource bottlenecks or conflicts that will need managing.
- Support the businesses approach to environmental challenges, using the UN Global Compact’s Ten Principles.
- Undertake initiatives to promote greater economic, social, and environmental responsibility (P5).
- Encourage the development and usage of environmentally friendly technologies and techniques for resource consumption.

For Human Resource Management and Procurement Management, please go to chapters 7.1.1 and 7.1.4 respectively.

### 3.4. Quality Management (Planning Phase)

#### 3.4.1. Introduction to Quality

Project Quality Management includes the processes and activities of the performing organization that determine quality policies, objectives, and responsibilities so that the project will satisfy the needs for which it was undertaken. It implements the quality management system through policy and procedures with continuous process improvement activities conducted throughout, as appropriate.

To start with, we must define three key points that must to be considered during Quality Management:

- The requirements for quality are defined in measurable terms as acceptance criteria.
- Outputs and processes can only be fit for purpose if the purpose is understood.
- Definition of requirements enables the PM to trade-off between scope, time, cost and quality.

The reader also may take into consideration PMI’s concept of Quality Management has two main areas of focus:

- Product Quality
- Process Quality

Nevertheless, as it will be explained in the following lines, we must focus in Process Quality because, if the process has achieved a good quality, the product will do as well (as it is the process result).
Management Responsibility
A really important thing to be considered is that success requires the participation of all members of the team, but it remains the responsibility of management to provide the resources needed to succeed.
Without the Management commitment it is not possible to achieve the expected quality.

3.4.2. Quality Standards and Regulations

Standards are voluntary while Regulations are mandatory. Project Managers must be aware and comply with the standards and regulations that are imposed for their projects.

International Organization for Standardization (ISO) is a worldwide federation of national standards bodies concerned with consistent rules or guidelines of technical specifications. The ISO 9000(1) is the one concerned about quality management and as it has been exposed in the chapter 1.7.4 of the present project, we proceed on remembering its principles:

- Costumer Focus
- Leadership
- Involvement of People
- Process Approach
- System approach to Management
- Continuous Improvement
- Factual approach to decision making
- Mutually beneficial supplier (w2w)

Nonetheless, as it is exposed in ISO10006, section 5, and Quality in project management processes; here we proceed on listing some quality responsibilities.

- Management responsible for creating an environment for achieving project quality (organization & project)
- Organization responsible for improving project processes – learning from experience (continuous improvement)
- Quality covers products and management processes

The objectives, responsibilities, processes and methods for achieving quality at an organizational level are typically defined in the organization’s Quality Management System.

The Project Manager is responsible for creating and implementing a quality management system for the project. This is defined in a Project Quality Management Plan.

The Plan sets out specific quality practices, resources and the sequence of quality management activities required to achieve the project objectives. It will also refer to processes and requirements defined in the organization’s quality management system.
3.4.3. Quality Gurus

During the history, quality has had several gurus. Here we proceed on listing them and remarking why they are considered as gurus.

- **Philip B. Crosby**
  - Developed the zero defects practice. To achieve that the work must be done right the first time.
  - The key to Crosby’s theory is prevention.
  - “You have to prevent the defect from occurring in the first place”
  - Rework will be the cause of not performing quality up front, and this will affect productivity.

- **Joseph M. Juran**
  - Juran defined quality as fitness for use.
  - He preached meeting or exceeding Stakeholders’ and customers’ expectations.
  - Juran differentiated between quality and grade. “Do not confuse grade with quality”. Low quality is generally not acceptable.

- **W. Edwards Deming**
  - 4-Step Cycle to improve Quality: Plan, Do, Check, Act (PDCA)
  - For Deming the cost of quality is a management problem. You need the management support to achieve quality.

- **Kaoru Ishikawa**
  - Ishikawa developed the Cause and Effect Diagrams also called Fishbone Diagrams. This is an easy tool for not quality experts.
  - Ishikawa also believed that senior management has the main responsibility for quality.

- **Genichi Taguchi**
  - He created a formula to demonstrate the cost of lack of quality, the Taguchi Loss Function.
  - In DOE he reinforced the robust criteria when optimizing.
  - Taguchi stresses the need of contingency plans.
3.4.3.1. Noriaki Kano model

Do we have to over-satisfy our consumers’ demands?

![Noriaki Kano Model diagram](image)

According to Kano model, we do not have to over-satisfy our consumers needs because then, in the future, they will be expecting the same thing as well.

3.4.4. Kaizen, Continuous Improvement and JIT

The Deming cycle PDCA (plan-do-check-act) is the basis for quality improvement.

Kaizen is the Japanese word used for small continuous improvements with respect to quality, and it has been spread internationally.

Just in Time (JIT) is a methodology that tries to significantly reduce or eliminate inventory. Achievement of zero inventories is very difficult so with JIT companies try to reduce the amount of inventory to a minimum. It was promoted by Toyota.
3.4.5. Quality Environment

The quality environment essentially covers four processes:

I. **Quality Planning**
   Defining standards, criteria to be achieved, appropriate actions to ensure the required quality is achieved. The Quality Plan provides guidance to project stakeholders on how quality management will be performed on the project. It includes a statement on stakeholder expectations, success criteria, and standards applicable, how they will be applied and how quality will be assured through specific actions, e.g. auditing.

II. **Quality Assurance**
   This involves pre-planned, regular reviews and independent audits to verify that work is being carried out consistently in accordance with defined procedures, and to provide confidence to stakeholders that the project will satisfy relevant quality requirements and standards.

III. **Quality Control**
   The process of monitoring project results, evaluation to verify results are compliant with relevant standards and taking corrective action to eliminate causes or address unsatisfactory performance. Typically includes visual inspection, testing or trials to verify that the project deliverables conform to specification, that they are fit for purpose and meet stakeholder’s expectations.

IV. **Continuous Improvement**
   Focusing on specifying requirements tightly and meeting them as effectively and efficiently as possible. In order to measure success organizations use maturity models.
3.4.6. Introduction to Quality Tools

The seven basic tools of quality is a designation given to a fixed set of graphical techniques identified as being most helpful in troubleshooting issues related to quality. They are called "basic" because they are suitable for people with little formal training in statistics and because they can be used to solve the vast majority of quality-related issues.

The designation arose in postwar Japan, inspired by the seven famous weapons of Bankei (samurai). It was possibly introduced by Kaoru Ishiwaka who in turn was influenced by a series of lectures W. Edwards Deming had given to Japanese engineers and scientists in 1950. At that time, companies that had set about training their workforces in statistical quality control found that the complexity of the subject intimidated the vast majority of their workers and scaled back training to focus primarily on simpler methods which suffice for most quality-related issues.

![Fig. B-31: Seven Basic weapons of a Bankai picture [35]](image)

The Project Management Institute (PMI) referenced the seven basic tools in the PMBOK as an example of a set of general tools useful for planning and controlling project quality.

We proceed on listing them and adding in brackets at what stage of the project they are more useful. There are some projects that are set up in several stages, this seven quality tools are reused in each of them.

- Cause and Effect, fishbone or Ishikawa diagram – (Planning phase)
- Check sheet - (Design in Planning phase, used in Control phase)
- Control chart – (Control phase)
- Histogram - (Control phase)
- Pareto chart - (Control phase)
- Scatter diagram - (Control phase)
- Stratification, alternately flow chart or run chart - (Planning phase)

As most of them are designed in the Planning phase, we can appreciate the alignment with Prevention over Inspection concept. Nonetheless, the seven basic tools stand in contrast to more advanced statistical methods such as survey sampling, acceptance sampling, statistical hypothesis testing, design of experiments (DOE), multivariate analysis, and various methods developed in the field of operations research.
3.4.6.1. Planning Quality Tools

As it has been stated before (point 3.4.6) there are three basic quality tools used in the planning phase, which are Ishikawa diagram, check sheet and the flow chart.

✓ Ishikawa, Fishbone or Cause and effect diagram

In some cases, when a problem come up we tend to confuse his solving with the erase of the effects that produces it. Acting this way will bring bad consequences (as it is explained in Ishikawa’s book “What is Total Quality Control?”)

To solve any problem, we need to focus on detecting the causes and eliminate them. Don’t focus on the effects; if we handle the causes, then the effects will be corrected by themselves.

Detecting a problem’s causes it’s not that easy. Because of that, to do so, it’s convenient to follow a methodology and build the cause and effect diagram.

For building it, the follow steps can be followed:

I. Identify clearly the effect (the problem, quality characteristic, ...) that want to be studied.
II. Brainstorm of the possible causes that may cause this effect by joining in a meeting people that can come up with interesting ideas of the origin of the problem.
III. Reselect the causes came up with in (II)
IV. Build the diagram. The diagram must be built by an expert on the problem’s field, it’s a mistake building the diagram altogether.

In the diagram, the causes are shown in a structured way, grouping them into 4 or 6 big groups being called "main causes". From each main cause, branch some secondary cause and so on. Here it follows an example of an Ishikawa diagram.

![Fig. B-32: Fishbone diagram example](image-url)
Check sheet

According to Check sheets must be said that the design of them must be done in the Planning Phase, while its use must be done at the Controlling Phase. Nevertheless, we should spend some time thinking the best way to lay it out, so the writer decided to explain it in the Planning Phase.

The check sheet is a form (document) used to collect data in real time at the location where the data is generated. The data it captures can be quantitative or qualitative. When the information is quantitative, the check sheet is sometimes also called tally sheet.

The defining characteristic of a check sheet is that data are recorded by making marks ("checks") on it. A typical check sheet is divided into regions, and marks made in different regions have different significance. Data are read by observing the location and number of marks on the sheet.

Check sheets typically employ a heading that answers the Five Ws:

- Who filled out the check sheet
- What was collected (what each check represents, an identifying batch or lot number)
- Where the collection took place (facility, room, apparatus)
- When the collection took place (hour, shift, day of the week)
- Why the data were collected

Kaoru Ishikawa identified five uses for check sheets in quality control:

I. To check the shape of the probability distribution of a process
II. To quantify defects by type
III. To quantify defects by location
IV. To quantify defects by cause (machine, worker)
V. To keep track of the completion of steps in a multistep procedure (in other words, as a checklist)

These are some examples on how a check sheet could be like:

![Frequency distribution for film coating](image)

Fig. B-33: Different samples of Check sheets [21]
Flow Chart

As happened in the Check sheet, Flow Charts are designed in the Planning phase, while used in the controlling. Nonetheless, as it helps to design the process layout, its an interesting tool to be considered during the planning phase.

A flowchart is a type of diagram that represents an algorithm, workflow or process, showing the steps as boxes of various kinds, and their order by connecting them with arrows. This diagrammatic representation illustrated a solution to a given problem. Flowcharts are used in analyzing, designing, documenting or managing a process or program in various fields.

Sterneckert (2003) suggested that flowcharts can be modeled from the perspective of different user groups (such as managers, system analysts and clerks) and that there are four general types:

- **Document flowcharts**, showing controls over a document-flow through a system
- **Data flowcharts**, showing controls over a data-flow in a system
- **System flowcharts** showing controls at a physical or resource level
- **Program flowchart**, showing the controls in a program within a system

Notice that every type of flowchart focuses on some kind of control, rather than on the particular flow itself.

Any software-drawing program can be used to create flowchart diagrams, but these will have no underlying data model to share data with databases or other programs such as project management systems or spreadsheets. Some tools offer special support for flowchart drawing. Many software packages exist that can create flowcharts automatically, either directly from source code, or from a flowchart description language. On-line web-based versions of such programs are available.

**3.4.7. DOE**

Design of Experiments (DOE) is a statistical method for identifying which factors may influence specific variables of a product or process under development or in production. It also plays a role in the optimization of products or processes.
3.4.8. Costs of Quality

Whether it is technical excellence or customer satisfaction there must be some cost in achieving high standards.

The often heard slogan “quality is free” goes back to the book written by Crosby (see 3.4.3) in the late seventies. The principle is that the money invested in quality up front will produce a reduction in costs longer term.

Quality costs are broken down into the three following categories, prevention, failure and appraisal.

![Cost of Quality diagram](image)

**Prevention**

These are the costs associated with any action designed to reduce the incidence of defects and failures. The correct training of an individual and the use of suitable and well-maintained equipment help with this.

**Failure**

This can be further broken down into internal failure and external failure. **Internal failure** costs are those of investigating the cause, wasted materials, repairs and rework. **External failure** costs relate for example to the damage to reputation, your customer relationships and liability costs.

**Appraisal**

This is also called inspection costs, these relate to the costs of sampling and testing products, checking specifications and supervising staff.

**To sum up: Prevention over Inspection**

The cost of preventing mistakes is generally much less than the cost of correcting them, as revealed by inspection. That is why PMI recommends a larger investment in Preventing than in Inspecting.
3.5. Sustainability and Quality Components [22]

In Quality Management, Project Managers utilize constraints that will deliver the intended result. Quality Management "involves determining quality policies, objectives, and responsibilities so that the project will satisfy the need for which it was undertaken". In a simpler description, Quality Management is accountable for making sure that any work performed is done so correctly to first time to avoid rework and wasted energy or resource. ISO 14000 and EMS convergence points are contained within each process of the quality management knowledge area.

The Quality Planning activity defines the inputs and controls for quality assurance activities. The inputs from ISO 14000 and the EMS set the level of influence that the standards will have on defining "quality".

Quality standards will be used in the development of a baseline and as the basis for monitoring within the Quality Assurance and Quality Control processes. The EMS and PMIS systems will monitor thresholds set by the quality management plan and help in developing changes for the change management process.

Quality Management has a direct relationship with Green Project Management. Ensuring that the right standard or specification to a product or a piece of work is carried, first time all of the time; means that your wastage costs are minimized. Quality typical falls into three costs brackets; the first of these is the cost of prevention. Preventing failure or reducing the number of quality review failures means that by prior planning and a strong control regime, all project work is given greater confidence in its ability to be delivered to the needs of the client in the most cost efficient manner.

The second of the cost elements is that of quality appraisal, or the checking of the products or procedures as the project progresses through its full lifecycle. By ensuring that the right people do the right checks when it is most beneficial to carry out the checks, means that the organization will keep strong supervision and accountancy for the delivery without having excess resource wasted. The third and final cost for quality is that of the cost of failure, both internally and externally. What is the cost to a company if it has products being returned or being subjected to enquiries? Cost of failure goes beyond the wasted material and the time needed for re-work, all the way to the cost of reputation and therefore future contracts and repeat work.
3.6. Time Management

Project time management includes the processes required to manage the timely completion of the project. The Project Time Management processes are the following.

i. Plan Schedule Management
ii. Define Activities
iii. Sequence Activities
iv. Estimate Activity Resources
v. Estimate Activity Durations
vi. Develop Schedule
vii. Control Schedule

The next figure provides an overview of them.

Fig. B-35: Project Time Management Overview [32]
3.6.1. Plan Schedule Management

Plan Schedule Management is the process of establishing the policies, procedures, and documentation for planning, developing, managing, executing, and controlling the project schedule.

Meetings
Project teams may hold planning meetings to develop the schedule management plan. Participants at these meetings may include the project manager, the project sponsor, selected project team members, selected stakeholders, anyone with responsibility for schedule planning or execution, and others as needed.

3.6.2. Define Activities

Defining Activities is identifying the specific actions to be performed to produce the project deliverables.
Activity List
A documented tabulation of schedule activities that shows the activity description, activity identifier, and a sufficiently detailed scope of work description so project team members understand what work is to be performed.

Activity Attributes
Multiple attributes associated with each schedule activity that can be included within the activity list. Activity attributes include activity codes, activity description, predecessor activities, successor activities, logical relationships, leads and lags, resource requirements, imposed dates, constraints, and assumptions.

Milestone
A significant point or event in the project, such as an event restraining future work or marking the completion of a major deliverable. A schedule milestone has zero duration. Sometimes called a milestone activity.

WBS graphical representation

Fig. B-36: WBS and Activity List diagram
3.6.3. Sequence Activities

To sequence activities means identifying and documenting relationships among the project activities.

<table>
<thead>
<tr>
<th>INPUTS</th>
<th>TOOLS and TECHNIQUES</th>
<th>OUTPUTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓ Schedule Management Plan</td>
<td>✓ Precedence diagramming method (PDM)</td>
<td>✓ Project schedule network diagrams</td>
</tr>
<tr>
<td>✓ Activity list</td>
<td>✓ Dependency determination</td>
<td>✓ Project document updates</td>
</tr>
<tr>
<td>✓ Activity attributes</td>
<td>✓ Leads and lags</td>
<td></td>
</tr>
<tr>
<td>✓ Milestone list</td>
<td></td>
<td></td>
</tr>
<tr>
<td>✓ Project scope statement</td>
<td></td>
<td></td>
</tr>
<tr>
<td>✓ Enterprise environment factors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>✓ Organizational process assets</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Project Schedule Network Diagram**

Any schematic display of the project’s logical relationships among the project schedule activities. Always drawn from left to right to reflect project work chronology.

![Network diagram example](image)

*Fig. B-37: Network diagram example*
3.6.4. Estimate Activity Resources

Estimating the type and quantities of material, human resources, equipment, or supplies required to perform each activity.

**Resources**
Skilled human resources (specific disciplines either individually or in crews or teams), equipment, services, supplies, commodities, materiel, budgets, or funds.

**Activity Resource Requirements**
Identifies the types and quantities of resources required for each schedule activity in a work package.

**Resource Breakdown Structure**
The resource breakdown structure (RBS) is a hierarchical representation of resources by category and type.

**Example of RBS**

1.0 Project Resources
   1.1 Equipment
   1.2 Material
   1.3 Personnel
      1.3.1 Consultant
         1.3.1.1 Expert Consultant
         1.3.1.2 Senior Consultant
         1.3.1.3 Junior Consultant
      1.3.2 Technical Engineer
         1.3.2.1 Expert Engineer
         1.3.2.2 Senior Engineer
         1.3.2.3 Junior Engineer
3.6.5. Estimate Activity Durations

Estimating the number of work periods needed to complete individual activities with estimated resources.

**Analogous Estimating / Top down**
Uses parameters such as duration, budget, size, weight, and complexity, from previous, similar projects, as the basis for estimating the same parameter or measure for a future schedule activity.

It is frequently used to estimate project duration when there is a limited amount of detailed information about the project for example, in the early phases of a project. Analogous estimating uses historical information and expert judgment.

**Bottom Up Estimating**
Bottom Up estimating requires that a WBS has been previously developed.

The resource needs of each lower, more detailed piece of work are estimated, and these estimates are then aggregated into a total quantity for each of the schedule activity’s resources.

**Parametric Estimating**
Estimating the basis for activity durations can be quantitatively determined by multiplying the quantity of work to be performed by the productivity rate.

Example: productivity rates can be estimated on a software project by the number of lines coded times labor hours per program.
Three-Point Estimate (PERT)
A technique used to estimate cost or duration by applying an average of optimistic, pessimistic and most likely estimates, when there is uncertainty with the individual activity estimates.

\[
PERT = \frac{P + 4M + O}{6}
\]

\[
O \equiv \text{Optimistic}
\]

\[
M \equiv \text{Most Likely}
\]

\[
P \equiv \text{Pessimistic}
\]

\[
\text{Std.Dev } PERT = \frac{P - O}{6}
\]

\[
\text{Variance of a Task } PERT = \left(\frac{P - O}{6}\right)^2
\]

Group Decision-Making Techniques
Team-based approaches, such as brainstorming, the Delphi or nominal group techniques, are useful for engaging team members to improve estimate accuracy and commitment to the emerging estimates. By involving a structured group of people who are close to the technical execution of work in the estimation process, additional information is gained and more accurate estimates obtained.

Delphi Technique
A method used to obtain expert opinions in schedule estimates, cost estimates or risk. The Delphi technique is a method for obtaining forecasts from a panel of independent experts over two or more rounds. Experts are asked to predict quantities.

Monte Carlo Analysis
A technique that computes, or iterates, the project cost or project schedule many times using input values selected at random from probability distributions of possible costs or durations, to calculate a distribution of possible total project cost or completion dates.

Activity Duration Estimates
Activity duration estimates are quantitative assessments of the likely number of time periods that are required to complete an activity. Activity duration estimates may include some indication of the range of possible results.
3.6.6. Develop Schedule

Developing Schedule means analyzing activity sequences, durations, resource requirements, and schedule constraints to create the project schedule.

**Critical Path Method (CPM)**
A method used to estimate the minimum project duration and determine the amount of scheduling flexibility on the logical network paths within the schedule model. This schedule network analysis technique calculates the early start, early finish, late start, and late finish dates for all activities without regard for any resource limitations by performing a forward and backward pass analysis through the schedule network.

**Critical Chain Method**
A schedule method that allows the project team to place buffers on any project schedule path to account for limited resources and project uncertainties. It is developed from the critical path method approach and considers the effects of resource allocation, resource optimization, resource leveling, and activity duration uncertainty on the critical path determined using the critical path method.
**Resource Optimization Techniques**

**Resource Leveling:** A technique in which start and finish dates are adjusted based on resource constraints with the goal of balancing demand for resources with the available supply.

**Resource Smoothing.** A technique that adjusts the activities of a schedule model such that the requirements for resources on the project do not exceed certain predefined resource limits.

**Schedule Compression**
Techniques are used to shorten the schedule duration without reducing the project scope, in order to meet schedule constraints, imposed dates, or other schedule objectives.

Schedule compression techniques include, but are not limited to:

- **Crashing**
  A specific type of project schedule compression technique performed by taking action to decrease the total project schedule duration after analyzing a number of alternatives to determine how to get the maximum schedule duration compression for the least additional cost.

- **Fast Tracking**
  A specific project schedule compression technique that changes network logic to overlap phases that would normally be done in sequence, such as the design phase and construction phase, or to perform schedule activities in parallel.

**Project Schedule**
The project schedule is an output of a schedule model that presents linked activities with planned dates, durations, milestones, and resources. At a minimum, the project schedule includes a planned start date and planned finish date for each activity.

**Baseline**
The approved version of a work product that can be changed only through formal change control procedures and is used as a basis for comparison.
3.6.7. Control Schedule

Controlling the schedule means monitoring the status of project activities to update project progress and manage changes to the schedule baseline to achieve the plan.

**Performance Reviews**
Performance reviews measure, compare, and analyze schedule performance such as actual start and finish dates, percent complete, and remaining duration for work in progress. Various techniques may be used, among them:

- Trend Analysis
- Critical path method
- Critical chain method
- Earned Value
### 3.6.8. Time Management Summary

| **Plan Schedule Management** | Establishing the policies, procedures, and documentation for planning, developing, managing, executing, and controlling the project schedule. |
| **Define Activities** | Identifying the specific actions to be performed to produce the project deliverables. |
| **Sequence Activities** | Identifying and documenting relationships among project activities. |
| **Estimate Activity Resources** | Estimating the type and quantities of resources required to perform each schedule activity. |
| **Estimate Activity Durations** | Approximating the number of work periods needed to complete individual activities with estimated resources. |
| **Develop Schedule** | Analyzing activity sequences, durations, resource requirements, and schedule constraints to create the project schedule. |
| **Control Schedule** | Monitoring the status of the project to update project progress and manage changes to the schedule baseline. |
4. Executing and Controlling Phase

As we have been doing during the pre-project and planning phases, we proceed to introduce the next phase as ISO21500 called Executing (or Implementing) and controlling phase.

We follow by showing an overview activities diagram of this phase.

Executing or implementing processes means to perform the planned activities from the planning phase, and to support the provision of the project’s deliverables according to the project plan.

The controlling processes are used to monitor, measure, and control project performance against the project plan, so preventive and corrective actions may be taken and change requests made when necessary to enable the achievement of project objectives.

4.1. Requirements Lifecycle

The existence of a product specification is essential at the commencement of the implementation stage. This may initially only define requirements such as physical features, performance aspects and key acceptance criteria. To ensure the development of the design will achieve the objectives and benefits a series of reviews are conducted. This enables the design to be compared to the requirements in order to identify and address any deviations or shortcomings. A requirements review may be conducted during design to check that designers understand and can achieve the stated requirements.

As the product design develops, further reviews are carried out to check that the design will meet the product requirements. At the end of development the design is reviewed prior to build. As the design develops further, acceptance criteria, plans and methods are fully defined. These, the designs and production readiness are typically reviewed prior to the release of the design to production. This will check that the test methods are appropriate and will ensure that the product is adequately tested in line with the requirements.
Tests and inspections are typically carried out during the acceptance stage to verify that the deliverable products meet the requirements. If satisfactory, the product is formally accepted and signed off.

Throughout the development, the requirements, product specification and associated documentation are controlled using a formal change control and configuration management process.

The requirements management process facilitates the opportunity to provide confidence to the Project Team and the Stakeholders during the life cycle that the product is more likely to achieve the project objectives and its proposed benefits.

4.2. Risk Management

4.2.1. Introduction to Risk

4.2.1.1. What is Risk?

Risks are present in all projects, whatever their size or complexity and whatever industry or business sector. Risks exist as a consequence of uncertainty (see 4.1). In project management terms, risks are those factors that may cause a failure to meet the project’s objectives.

"The exposure to a potential event that could impact adversely on business benefits or project critical success criteria."

While risks are, according to the dictionary, associated with the possibility of failure, they may also be associated with opportunities. Risk management should balance the upside opportunities with downside risks, doing so in an open, clear and formal manner. A wider definition of risk is therefore:
“Combination of the probability or frequency of the occurrence of a defined threat or opportunity and the magnitude of the consequences of that occurrence”

The definition indicates a relationship between risks and opportunities. Both factors are possible future events and therefore have degrees of uncertainty.

### 4.2.1.2. Levels of Risk

Risk occurs at every level and in all aspects of any organization. Risks from one level can affect other levels and it can be difficult to identify precisely at what level a risk should be managed. The reason for allocating different levels of risk is to clearly assign who is best placed to take responsibility for its management.

*Fig. B-40: Levels of Risk Pyramid [22]*

<table>
<thead>
<tr>
<th>LEVEL</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>STRATEGIC</td>
<td>All companies face risks to their business strategy. This can range from currency fluctuations to threat or opportunity of takeovers. The Board of Directors typically handles risks of this level.</td>
</tr>
<tr>
<td>PROGRAM</td>
<td>Major changes that are required to realise the business strategy are often achieved through the management of many diverse projects as a program. Risks that occur at this level can be due to factors such as the interdependencies of component projects, resource conflicts or project priorities. The Program Management Team manages these risks.</td>
</tr>
<tr>
<td>PROJECT</td>
<td>Risks at this level are threats to the achievement of the objectives agreed for time, cost and quality. These may well arise from threats or opportunities at another level, but must be placed at this level so that they can be managed by the Project Management Team.</td>
</tr>
<tr>
<td>OPERATIONAL</td>
<td>Day to day activities have their own risks such a Health and Safety or Industrial relations. The whole emphasis of projects and programs is to bring about change and so this may introduce new or eliminate existing risks from the work place. The operational readiness to change will affect the project or program risks. The operational managers must manage pure operational risk but they should always be working closely with the relevant project and program management teams.</td>
</tr>
</tbody>
</table>
4.2.2. Sustainability in Risk Management

In the Risk Management knowledge area, a Project Manager will identify any and all possible risks to the project and establish an effective method to address them. Risk Management involves “planning, identification, analysis, responses, monitoring and control”. In other words, it is the Project Manager’s responsibility to address the possible detractors, identify the causes and situations of the risk, analyze the hurt or impact it will create should it occur and then develop work around to protect the project in the best manner. Risk Management Planning, Risk Identification, and Risk Monitoring and Control process areas are the convergence point for ISO 14000 and EMS within risk management environment.

The objective of the Risk Management Planning process area is to define and document how the project will deal with risk, set tolerance levels, thresholds, reporting requirements, roles and responsibilities. So what risks exist within GPM; how can something that can help the planet be a risk to the project?

The objective of the Risk Identification process is to identify, classify and rank the risks that could both negatively and positively affect the project. That said, perhaps GPM is way of identifying the positive elements of risk within a project. These positive elements of risk are also known as Opportunities. The information that is captured in the Risk Identification process is used to develop an effective risk response plan and to define action items, thresholds and metrics for the Risk Monitoring and Control process. The risk data captured within the Risk Identification process can also be used to estimate the project’s impact and likelihood of risk occurrence. ISO 14000 and EMS will guide the Project Manager through identifying environmental issues that can be affected by the risks in the complete life cycle.

4.2.3. Risk Balance vs. Sustainability [22]

The benefits of Risk Management are significant, but it is often the case that it is the drawbacks that people focus on.

Benefits can be broken down into two styles.

**Hard**

These comprise direct benefits to the project plan such as having the ability to make better more informed decision making, being less likely of accepting unsound projects, increased likelihood of project adherence to its plan and provision of data that assists with future lessons learned.

**Soft**

The softer benefits are less tangible but include a better understanding of the project by the stakeholders, being able to have the management team focus on the most significant risks and to assist in the distinction between being a good manager and a lucky one.

The drawbacks of Risk Management are also broken down into two specific aspects.
4.2.4. Risk Management Process

Project Risk Management includes the processes of conducting risk management planning, identification, analysis, response planning, and controlling risk on a project. The objectives of project risk management are to increase the likelihood and impact of positive events, and decrease the likelihood and impact of negative events in the project.

![Risk Management Process Diagram]

*Fig. B-41: Risk Management Process diagram*

According to this last figure, there are the following phases in the risk management process.

- Plan Risk Management
- Identify Risks
- Perform Qualitative Risk Analysis
- Perform Quantitative Risk Analysis
- Plan Risk Responses
- Control Risks
4.2.4.1. Plan Risk Management

Planning Risk Management is defining how to conduct risk management activities for a project.

**Risk**
Risk is defined as an uncertain event or condition that, if it occurs, has a positive or negative effect on one or more project objectives.

**Trigger Condition**
The trigger condition is an event or situation that indicates that a risk is about to occur. Its WHEN it happened.

**Analytical techniques**
Analytical techniques are used to understand and define the overall risk management context of the project. Risk management context is a combination of stakeholder risk attitudes and the strategic risk exposure of a given project based on the overall project context.

**Expert Judgment**
To ensure a comprehensive establishment of the risk management plan, judgment, and expertise should be considered from groups or individuals with specialized training or knowledge on the subject area, such as:
- Senior management
- Project stakeholders
- Project managers who have worked on projects in the same area (directly or through lessons learned)
- Subject matter experts (SMEs) in business or project area
- Industry groups and consultants
- Professional and technical associations.

**Meetings**
Project teams hold planning meetings to develop the risk management plan. Attendees at these meetings may include the project manager, selected project team members and stakeholders, anyone in the organization with responsibility to manage the risk planning and execution activities, and others, as needed.
## Risk Management Plan

<table>
<thead>
<tr>
<th>Methodology</th>
<th>Defines the approaches, tools, and data sources that will be used to perform risk management on the project.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roles and Responsibilities</td>
<td>Defines the lead, support, and risk management team members for each type of activity in the risk management plan, and clarifies their responsibilities.</td>
</tr>
<tr>
<td>Budgeting</td>
<td>Estimates funds needed, based on assigned resources, for inclusion in the cost baseline and establishes protocols for application of contingency and management reserves.</td>
</tr>
<tr>
<td>Timing</td>
<td>Defines when and how often the risk management processes will be performed throughout the project life cycle, establishes protocols for application of schedule contingency reserves, and establishes risk management activities for inclusion in the project schedule.</td>
</tr>
<tr>
<td>Risk Categories</td>
<td>Provide a means for grouping potential causes of risk.</td>
</tr>
<tr>
<td>Definitions of risk probability and impact</td>
<td>The quality and credibility of the risk analysis requires that different levels of risk probability and impact be defined that are specific to the project context. General definitions of probability levels and impact levels are tailored to the individual project during the Plan Risk Management process for use in subsequent processes.</td>
</tr>
<tr>
<td>Probability and impact matrix</td>
<td>A probability and impact matrix is a grid for mapping the probability of each risk occurrence and its impact on project objectives if that risk occurs. Risks are prioritized according to their potential implications for having an effect on the project’s objectives.</td>
</tr>
<tr>
<td>Revised stakeholders’ tolerances</td>
<td>Stakeholders’ tolerances, as they apply to the specific project, may be revised in the Plan Risk Management process.</td>
</tr>
<tr>
<td>Reporting formats</td>
<td>Describes the content and format of the risk register.</td>
</tr>
<tr>
<td>Tracking</td>
<td>Tracking documents how risk activities will be recorded for the benefit of the current project and how risk management processes will be audited.</td>
</tr>
</tbody>
</table>
4.2.4.2. Identify Risks

Identifying risks means determining which risks may affect the project and documenting their characteristics.

**Documentation Reviews**
A structured review of the project documentation may be performed, including plans, assumptions, previous project files, agreements, and other information. The quality of the plans, as well as consistency between those plans and the project requirements and assumptions, may be indicators of risk in the project.

**Information gathering techniques**
Examples of information gathering techniques used in identifying risk can include:

- **Brainstorming**
  Brainstorming is a general data gathering and creativity technique that can be used to identify risks, ideas, or solutions to issues by using a group of team members or subject-matter experts.
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- **Delphi techniques**
  An information gathering technique used as a way to reach a consensus of experts on a subject. Experts on the subject participate in this technique anonymously. A facilitator uses a questionnaire to solicit ideas about the important project risks. The Delphi technique helps reduce bias in the data and keeps any one person from having undue influence on the outcome.

- **Interviewing**
  Interview stakeholders and experts to identify risks and possible responses. Strengths: relatively quick and inexpensive; often provides information on preventive actions. Weaknesses: may not be relevant to current situation; requires good interviewing technique.

- **Root cause analysis**
  Analyze the cause of a problem, just like a Fishbone diagram but in Risk.

- **Prompt and Check lists**
  Open some specific structured questions to identify risks. Strengths: useful for gathering information; reduces need for expert involvement; easy to use. Weaknesses: may not include new risks; may not be relevant, therefore, unproductive.

- **Post Project Reviews**
  Use of historical records that describe how a risk has been handled previously. This can be beneficial if the risk is similar again although the context of the project must be taken into consideration before the response is selected.

**Assumption Analysis**
Every project and its plan is conceived and developed based on a set of hypotheses, scenarios, or assumptions. Assumptions analysis explores the validity of assumptions as they apply to the project. It identifies risks to the project from inaccuracy, instability, inconsistency, or incompleteness of assumptions.

**Diagramming Techniques**
Risk diagramming techniques may include:
- Cause and effect diagrams
- System or process flow charts
- Influence diagrams

**SWOT Analysis**
This technique examines the project from each of the strengths, weaknesses, opportunities, and threats (SWOT) perspectives to increase the breadth of identified risks by including internally generated risks.
Risk Register
The Risk register is a document in which the results of risk analysis and risk response planning are recorded.

- **List of identified Risks**
  The identified risks are described in as much detail as is reasonable. The root causes of those risks may become more evident.

- **List of potential Responses**
  Potential responses to a risk may sometimes be identified during the Identify Risks process.

### 4.2.4.3. Perform Qualitative Risk Analysis

When performing quantitative risk analysis, we prioritize risks for further analysis or action by assessing and combining their probability of occurrence and impact.

**Risk probability and Impact Assessment**
Risk probability assessment investigates the likelihood that each specific risk will occur. Risk impact assessment investigates the potential effect on a project objective such as schedule, cost, quality, or performance, including both negative effects for threats and positive effects for opportunities.

\[
RS = P \times I
\]

**RS** ≡ **Risk Score**
**P** ≡ **Probability of Occurrence**
**I** ≡ **Impact of Risk Occurrence to the project**
Probability and Impact Matrix
Risks can be prioritized for further quantitative analysis and planning risk responses based on their risk rating.
Ratings are assigned to risks based on their assessed probability and impact. Evaluation of each risk’s importance and priority for attention is typically conducted using a look-up table or a probability and impact matrix.

These categories represent ranges. For instance, a high cost impact might be greater than CNY1000K, a medium between CNY500-1000K, and a low impact less than CNY500K. The purpose of these definitions is to ensure consistency throughout project team in risk estimates.

The benefits of probability impact matrix are:
✓ Useful for plotting and comparing risks in order to decide priorities
✓ Can show cost, time and quality factors
✓ Provides bands for escalation
✓ Provides bands for RAG reporting
✓ Scales are directly related to project critical success criteria
✓ Highlights the difference between Low impact – High probability and High impact – Low probability risks
✓ Visual easy to understand
✓ Ensures consistency
4.2.4.4. Perform Quantitative Risk Analysis

Performing the quantitative analysis is when we numerically analyze the effect of identified risks on overall project objectives.

Data Gathering and Representation Techniques

- **Interviewing**
  Interviewing techniques draw on experience and historical data to quantify the probability and impact of risks on project objectives

- **Probability distributions**
  Continuous probability distributions, which are used extensively in modeling and simulation, represent the uncertainty in values such as durations of schedule activities and costs of project components

Quantitative Risk Analysis and Modeling Techniques

- **Sensitivity Analysis**
- **Expected Monetary Value (EMV) Analysis**
  A statistical concept that calculates the average outcome when the future includes scenarios that may or may not happen. A common use of this type of analysis is in decision tree analysis.

\[ EMV = P \times I = USD \]
\[ EMV = P \times I = Time \]

- **Decision Tree Analysis**
  Decision tree analysis is usually structured using a decision tree diagram that describes a situation under consideration, and the implications of each of the available choices and possible scenarios.
Modeling and Simulation

A project simulation uses a model that translates the specified detailed uncertainties of the project into their potential impact on project objectives. Iterative Simulations are typically performed using the Monte Carlo technique.

4.2.4.5. Plan Risk Responses

When plan risk responses phase, we develop options and actions to enhance opportunities and reduce threats to project objectives.

<table>
<thead>
<tr>
<th>INPUTS</th>
<th>TOOLS and TECHNIQUES</th>
<th>OUTPUTS</th>
</tr>
</thead>
</table>
| ✓ Risk management plan
  ✓ Risk register | ✓ Strategies for negative risks of threats
  ✓ Strategies for positive risks or opportunities
  ✓ Contingent response strategies
  ✓ Expert judgment | ✓ Project management plan updates
  ✓ Project documents updates |

Response plans can be developed and implemented once the risks have been assessed and prioritized. There are a number of generic response strategies.
Risk Threat Responses

Avoidance
Project team acts to eliminate the threat or protect the project from its impact. It usually involves changing the project management plan to eliminate the threat entirely. The project manager may also isolate the project objectives from the risk's impact or change the objective that is in jeopardy.

Transfer
Project team shifts the impact of a threat to a third party, together with ownership of the response. Transferring the risk simply gives another party responsibility for its management—it does not eliminate it. Transferring does not mean disowning the risk by transferring it to a later project or another person without his or her knowledge or agreement. Risk transference nearly always involves payment of a risk premium to the party taking on the risk.

Reduction
Risk mitigation implies a reduction in the probability and/or impact of an adverse risk event to be within acceptable threshold limits. Taking early action to reduce the probability and/or impact of a risk occurring on the project is often more effective than trying to repair the damage after the risk has occurred.

Accept
Risk acceptance implies Project team decides to acknowledge the risk and not take any action unless the risk occurs. This strategy is adopted where it is not possible or cost-effective to address a specific risk in any other way. This strategy indicates that the project team has decided not to change the project management plan to deal with a risk, or is unable to identify any other suitable response strategy. This strategy can be either passive or active.

Risk Opportunity Responses

Exploit
This strategy may be selected for risks with positive impacts where the organization wishes to ensure that the opportunity is realized. This strategy seeks to eliminate the uncertainty associated with a particular upside risk by ensuring the opportunity definitely happen.

Enhance
This strategy is used to increase the probability and/or the positive impacts of an opportunity. Identifying and maximizing key drivers of these positive-impact risks may increase the probability of their occurrence.

Share
Sharing a positive risk involves allocating some or all of ownership of the opportunity to a third party who is best able to capture the opportunity for the benefit of the project.

Reject
This is a response that can be chosen should the situation not be right for the project at the time for financial or perhaps storage reasons and so no matter the fact that a saving could be made it is over on this occasion.
4.2.4.6. Monitor and Control Risks

In the controlling phase, we are supposed to implement risk response plans, tracking identified risks, monitoring residual risks, identifying new risks and evaluating risk process effectiveness throughout the project.

**Risk Reassessment**
Monitor and Control Risks often result in identification of new risks, reassessment of current risks, and the closing of risks that are outdated. Project risk reassessments should be regularly scheduled. The amount and detail of repetition that are appropriate depends on how the project progresses relative to its objectives.

**Risk audits**
Risk audits examine and document the effectiveness of risk responses in dealing with identified risks and their root causes, as well as the effectiveness of the risk management process.

**Variance and Trend Analysis**
Trends in the project's execution should be reviewed using performance information. Earned value analysis and other methods of project variance and trend analysis may be used for monitoring overall project performance. Outcomes from these analyses may forecast potential deviation of the project at completion from cost and schedule targets.

**Meetings**
Project risk management should be an agenda item at periodic status meetings. The amount of time required for that item will vary, depending upon the risks that have been identified, their priority, and difficulty of response.
The more often risk management is practiced, the easier it becomes. Frequent discussions about risk make it more likely that people will identify risks and opportunities.
4.2.4.7. Risk Management Summary

<table>
<thead>
<tr>
<th>Plan Risk Management</th>
<th>A Risk Management plan is developed to provide guidance on how risk management will be carried on the project.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identify Risks</td>
<td>Aims to identify all significant risks that may impact on project objectives, and gather all relevant information for analysis. The possibilities of new risks are investigated throughout the life of the project.</td>
</tr>
<tr>
<td>Perform Qualitative Risk Analysis</td>
<td>Qualitative methods are typically used to determine the probability and impact of each risk. This information is used to prioritize risks and decide appropriate responses.</td>
</tr>
<tr>
<td>Perform Quantitative Risk Analysis</td>
<td>Quantitative methods are used to determine the effects of uncertainties and risks on project objectives.</td>
</tr>
<tr>
<td>Plan Risk Responses</td>
<td>Appropriate responses are considered, selected on the basis of overall benefit, authorized and implemented.</td>
</tr>
<tr>
<td>Monitor and Control Risks</td>
<td>Current risks are monitored and corrective action taken for adverse trends. Action Plans are monitored to ensure progress and effectiveness. The overall process is audited and reviewed typically at end of phases to ensure effectiveness.</td>
</tr>
</tbody>
</table>
4.3. Issue Management

An issue is defined as a threat to the project objectives that cannot be resolved by the Project Manager. Issues should be differentiated from problems, which are the day to day concerns that a Project Manager has to deal with case by case. In addition, risks should not be confused with issues. Risks are uncertain in that an event may not occur, whereas issues have already occurred and are therefore not uncertain.

The importance of Issue Management in projects is that issues are outside the direct control of the Project Manager. It is the Project Manager’s responsibility to ensure that all issues are escalated to the Project Sponsor, who can then assess and decide on the next course of action. If the Project Sponsor deems that it requires further escalation then they can further escalate the issue to the Project Steering Group.

Issues that remain unaddressed or unresolved are the cause of many project failures. Therefore, it is the Project Manager’s responsibility to ensure all issues are correctly identified, registered, appropriately escalated and then resolved.

**Issue Escalation Route**

![Issue Escalation Route Diagram]

Fig. B-43: Issue Escalation Route Diagram

Problems and risks are managed on a day-to-day basis by the project team.

A concern that threatens the project objectives becomes an issue when the project manager cannot control it. In such situations, the project manager must escalate the issue to the project sponsor. The sponsor will then seek a resolution by engaging the stakeholders as appropriate and/or involvement of the project steering group.

Issue management is a fundamental purpose of the steering group and the appropriate membership of the group will impact on their ability to resolve issues.
The project manager performs reporting on the development or progress of an issue until it has been successful concluded. Common problems in issue management are:

- The PM incorrectly identifying problems as issues and therefore diverting senior management’s attention away from other important tasks.
- Failing to escalate issues in a timely manner when the resolution owner has been unable to resolve the issue.

### Contents on the Issue-log

<table>
<thead>
<tr>
<th>No</th>
<th>Description</th>
<th>Raised by:</th>
<th>Date of Issue</th>
<th>Impacts</th>
<th>Possible resolution</th>
<th>Resolution owner</th>
<th>Final outcome</th>
<th>Closure date</th>
</tr>
</thead>
</table>

*Fig. B-44: Issue-log template [22]*

The issue log is used to communicate and track progress through life, support project reviews and lessons learned exercises.

It should be maintained throughout the whole of the Project Life Cycle and then should be closed off formally by the PM as part of the closure of the project and only outstanding actions or issues transferred to the product owner within the Operations phase.

### 4.4. Quality Management

As the reader may remember, Quality Management has already been developed in 3.4. That chapter covers:

- Introduction to Quality
- Quality Standards and Regulations
- Quality Gurus
- Kaizen, Continuous Improvement and JIT
- Quality Environment
- Introduction of Quality tools
- Planning Quality tools.
- Design of Experiments (DOE)
- Costs of Quality
- Sustainability and Quality Components

Because of that reason, the controlling quality tools will be introduced in the following chapter because the writer wanted them to be in the Controlling phase chapter.
4.4.1. Controlling Quality Tools

The Quality tools in the Controlling phase are, as follows, the Control chart, Histograms, Pareto chart and Scatter Diagram.

✓ Control Chart

Control charts, also known as Shewhart charts or process-behavior charts, in statistical process control are tools used to determine if a manufacturing or business process is in a state of statistical control. Because of that, its purpose is to determine whether a process should undergo a formal examination for quality-related problem.

A control chart consists of:
✓ Points representing a statistic (mean, range, proportion, ...) of measurements of a quality characteristic in samples taken from the process at different times.
✓ The mean of this statistic using all the samples is calculated.
✓ A centerline is drawn at the value of the mean of the statistic.
✓ The standard error of the statistic is also calculated using all the samples.
✓ Upper and lower control limits indicate the threshold at which the process output is considered statistically “unlikely” and there are drawn typically at three standard errors from the center line.

An out of control process is detected in the control chart when:
✓ At least one point is out of control and must be evaluated.
✓ Seven or more consecutive points are below or above the average line.
✓ Seven or more consecutive points are going upwards or downwards

![Control Chart Example](image)
Histogram
A histogram is a graphical representation of the distribution of data; actually, it is an estimation of the probability distribution of a continuous variable.

Fig. B-46: Histogram example

Pareto Chart
A Pareto chart is a specific type of histogram, ordered by frequency of occurrence. A relatively small number of causes will typically produce a large majority of the problems or defects. This is commonly referred to as the 80/20 principle, where 80 percent of the problems are due to 20 percent of the causes. Pareto diagrams also can be used to summarize all types of data for 80/20 analyses.

The left vertical axis is the frequency of occurrence, but it can alternatively represent cost or another important unit of measure. The right vertical axis is the cumulative percentage of the total number of occurrences, total cost, or total of the particular unit of measure. Because the reasons are in decreasing order, the cumulative function is a concave function. To take the example above, in order to lower the amount of late arriving by 78%, it is sufficient to solve the first three issues.

The purpose of the Pareto chart is to highlight the most important among a (typically large) set of factors. In quality control, it often represents the most common sources of defects, the highest occurring type of defect, or the most frequent reasons for customer complaints, and so on. Wilkinson (2006) devised an algorithm for producing statistically based acceptance limits (similar to confidence intervals) for each bar in the Pareto chart.
Scatter Diagram

A scatter plot, scatterplot, or scattergraph is a type of mathematical diagram using Cartesian coordinates to display values for two variables for a set of data.

The data is displayed as a collection of points, each having the value of one variable determining the position on the horizontal axis and the value of the other variable determining the position on the vertical axis. This kind of plot is also called a scatter chart, scattergram, scatter diagram or scatter graph.

Fig. B-48: Scatter Plot example [35]

4.4.2. Six Sigma distribution

Six Sigma is a set of techniques and tools for process improvement. It was developed by Motorola in 1986, coinciding with the Japanese asset price bubble which is reflected in its terminology. Today, it is used in many industrial sectors.

Six Sigma seeks to improve the quality of process outputs by identifying and removing the causes of defects (errors) and minimizing variability in manufacturing and business processes. It uses a set of quality management methods, including statistical methods, and creates a special infrastructure of people within the organization ("Champions", "Black Belts", "Green Belts", "Yellow Belts", etc.) who are experts in these methods. Each Six Sigma project carried out within an organization follows a defined sequence of steps and has quantified value targets, for example: reduce process cycle time, reduce pollution, reduce costs, increase customer satisfaction, and increase profits. These are also core to principles of Total Quality Management (TQM) as described by Peter Drucker and Tom Peters (particularly in his book "In Search of Excellence" in which he refers to the Motorola six sigma principles).

The term Six Sigma originated from terminology associated with manufacturing, specifically terms associated with statistical modeling of manufacturing processes. The maturity of a manufacturing process can be described by a sigma rating indicating its yield or the percentage of defect-free products it creates. A six sigma process is one in which 99.99966% of the products manufactured are statistically expected to be free of defects (3.4 defective parts/million), although, as discussed below, this defect level corresponds to only a 4.5 sigma level. Motorola set a goal of "six sigma" for all of its manufacturing operations, and this goal became a by-word for the management and engineering practices used to achieve it.
4.5. Change Control

Uncontrolled change is seen as one of the major causes of project failure. It is inevitable that changes to the project will be required because the environment has changed or that a better solution to the original problem has been identified.

Change should not be stifled but it should be controlled. Uncontrolled changes will undermine the validity of baseline plans and forecasting. Any proposed and authorised changes should be clearly and swiftly communicated to the stakeholders to ensure that there is no misunderstanding on what versions or what specifications the project is working to. This is why Change Control is so closely linked with Configuration Management.

This is why we need to control the changes that occur in a project process:

- To control adverse impact of uncontrolled changes
- To enable beneficial changes
- To communicate changes to stakeholders
- To maintain baselines for effective control

Here follows $4\sigma$, $6\sigma$, $8\sigma$, $10\sigma$ and $12\sigma$ over a normal distribution showing the non-defects percentage.

*Fig. B-49: $\pm 2\sigma$, $\pm 3\sigma$, $\pm 4\sigma$, $\pm 5\sigma$ and $\pm 6\sigma$ non-defects percentage over normal distribution [35]*
4.5.1. Roles and Functions

The Roles and Functions in Change Control are shown in the following figure as well as a brief description of them.

<table>
<thead>
<tr>
<th>Role</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Sponsor</td>
<td>Has overall responsibility for authorising changes internal changes and for co-ordinating external changes. External changes may be raised by clients, or arise through a change in the organization's overall business strategy through other external stakeholders such as regulators. The sponsor may delegate some authority to a Change Control Board or the project manager.</td>
</tr>
<tr>
<td>Change Control Board</td>
<td>In complex projects involving many key stakeholders it may be appropriate to establish a team with responsibility for approving or evaluating changes and making recommendations for approval.</td>
</tr>
<tr>
<td>Project Manager</td>
<td>Is responsible for defining the change and configuration management process for the project and for agreeing authorization limits, tolerances and priority categories with the sponsor. The project manager will co-ordinate and control changes throughout the implementation phase.</td>
</tr>
<tr>
<td>Project Team</td>
<td>May raise changes where appropriate to address problems, be involved in change management activities such as assessment and will implement the changes as approved.</td>
</tr>
<tr>
<td>Project Support Office</td>
<td>Are likely to carry out the day to day change management processes, provide support during impact assessment, planning and implementation.</td>
</tr>
</tbody>
</table>
4.5.2. Change Control Process

Every company has its Change Control Procedures; nevertheless most of them are variants from the following figure.

Fig. B-51: Change Control’s Activities Flow Chart

| Request       | May come from any project stakeholder. Changes requested by external stakeholders may be subject to contract conditions or agreements. |
| Registration  | Requests are usually formally made on a change request form and recorded in a change register (log). This records key information such as requestor, date, description of change and priority. |
| Assessment    | Changes are assessed for impact on project objectives using the Project Management Plan and the Business Case as a baseline, and effects on configuration items (through the Configuration Management Process). The costs of processing the change itself should be taken into account. This stage will produce an estimate of cost, time and quality impacts. |
| Acceptance    | The change is evaluated, accepted, rejected or deferred. The authority for this decision may rest with a special group called the Change Control Board – a group of stakeholders that may be given responsible for approving, rejecting or recommending changes. The terms of reference for this group should be defined in the Change Management Plan. Changes may be authorised by the Project Sponsor, the Project Manager or others as defined in the terms of reference and depending on the nature, priority and impact of a change. |
| Update Plan and Implement | Baseline plans are updated to record changes to management and implementation documents, and the approved change is implemented. |
4.6. Configuration Management

According to PRiSM, Configuration Management purposes are as follows:

- To define the physical and functional characteristics of deliverable and management products, including their components and related documentation.
- To control changes to products and their components to ensure physical and functional compatibility and integrity.
- Ensure integrity of the products in terms of their description (specifications), their physical form and their functionality.

Configuration Management begins as the first products are identified and produced and continues throughout the life of the product. Configuration Management continues through the Implementation, Operational and Termination stages of project.

Configuration Management Plan

Owned by the project manager, and developed as part of the Project Management Plan to provide guidance on the configuration policy, objectives and processes.

Configuration management is undertaken alongside the change control process and involves four main activities: Identification, Control, Status Accounting and Auditing.

<table>
<thead>
<tr>
<th>Identification</th>
<th>Products that are to be controlled are called configuration items. The PBS is used to identify configuration items. Each item is given a unique reference number.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>Once the configuration item comes under control, it is “Frozen”. This commonly used term means that the change process must be applied before the configuration of the item can be changed. Changes will only be made if authorised. This prevents ad hoc changes and ensures that changes can be traced during the life of the configuration item.</td>
</tr>
<tr>
<td>Status Accounting</td>
<td>Once a change is approved the status of the product is recorded as it changes through any modification or changes. A log is used for the purpose of recording and tracking the history of all changes to the item. A configuration librarian normally performs the task.</td>
</tr>
<tr>
<td>Auditing</td>
<td>This involves quality checks to ensure that all items conform to each other. For example, that each product conforms to a technical specification; each component in a system is compatible with others. It also ensures consistency and that relevant quality assurance procedures have been implemented.</td>
</tr>
</tbody>
</table>
4.7. Information Management

Reliable information is required by project stakeholders to enable them to make effective decisions, anticipate and respond to future events such as risks and opportunities and take into account uncertainties and current problems.

Information management is required to ensure that appropriate information relevant to and generated in the course of a project, is made available to project stakeholders in a timely manner to help with more improved decision-making.

Because of that, the purpose of Information Management is to,
- Ensure information is available to support decision making in a timely manner
- Control the quality, use and maintenance of information throughout the project life cycle and after it.
- Supports communication processes

Project Information Plan
A project information management plan defines how information will be managed during the life and after the project, the purpose and scope of information products, their ownership, formats, distribution, control, processing, storage and disposal.

This plan is structured as follows:
- Information Management Objectives
- Rules and responsibilities
- The process
- Documentation and Information Product specifications
- Links to the communication plan and process

![Information Process Dataflow](image)

Fig. B-52: Information Process Dataflow
5. Closure Phase and Reviews

As it has already been done in the previous stages, we proceed to introduce the last, but not least, phase in ISO21500 called Closure Phase. In this final phase, the reader will also take into account the reviews that need to be done before taking the project as closed.

We proceed showing the overview diagram of the Closure phase.

![Fig. B-53: GPM Closure Phase Activities diagram](image)

The final phase of the project is the closure phase. The project manager has many activities to deliver in this phase and must ensure that they have planned the closure in a structured and organized manner to ensure that everything is truly accounted for within the project.

Carrying out a review of the project once it has been delivered is essential for learning for future development. The green matters of the project should be included as part of the project review, however early maturity or highly mature organizations may choose to hold the sustainability element of the review separately from the remainder of the post project review. This is a personal choice, however the most important thing is that a review is carried out, the lessons are captured and that the organization then use these lessons to develop in the future.

However, the story does not stop there. Ensuring that the product or service is used in a sustainable manner throughout its full life allows the continuance of sustainability into operations and then through to its demise and disposal in a clean and sustainable way.

A remarked stage to be taken into consideration is the meeting with CSR Officer after all the activities have been closed, but before the performance of the End of Project report. This fact is for the simple reason that perhaps CSR officer has something to say in that report.
5.1. Handover Milestone

The Handover milestone is a significant point in the project life cycle since it allows the project to enter into an operational environment. At this point the ownership of all project deliverables is transferred from the project manager to the sponsor and user.

This is the most commonly used procedure:

I. Product Delivery.
II. Acceptance Criteria.
III. Transfer to Ownership.
IV. Handover and Acceptance Process.
V. Key Stakeholders present.
VI. Start up requirements and operator training.
VII. Review of risks and issues to be transferred into operations phase with deliverable.

Here follows a key stakeholder list in the handover milestone.

<table>
<thead>
<tr>
<th>KEY STEAKHOLDERS IN HANDOVER MILESTONE</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM</td>
</tr>
<tr>
<td>Project Sponsor</td>
</tr>
<tr>
<td>Project Team</td>
</tr>
<tr>
<td>Quality Assurance</td>
</tr>
<tr>
<td>Users</td>
</tr>
</tbody>
</table>

The handover plan will include tasks to be undertaken by the project implementation team to complete acceptance and delivery of the products, and tasks that need to be carried out by the sponsor and stakeholders, to receive, start up and operate the deliverables safely in their final operation mode. Handover may be an instantaneous, gradual or phased process.

The handover stage also includes the transfer of any live risks, actions or issues associated with the product. This allows the customer or the Project Sponsor to have a defined and precise view of potential problems that may exist with the product throughout its whole life cycle.
5.2. Closure

Project closeout will normally occur when all of the products have been delivered and the implementation stage is complete. In certain circumstances such as changes in viability or requirements, projects may be closed before planned completion.

This is the most commonly used procedure:

I. Closure Report
   a. Compared to Success Criteria
   b. Transfer/close outstanding Risks and Issues
II. Carry out audits, close documentation.
III. Contract review and closure
IV. Asset disposal and team redeployment
V. Carry out Post Project Review
VI. Project Sponsor Formal Sign Off

A closure report is produced by the project manager to record the final outcome of the project against the Success Criteria, any issues outstanding and actions arising from closure.

Here follows some specific actions to be done within the closure phase:

- Contract and purchase order closure and arrangements for any continuing contractual obligations such as technical support during operation.
- Identification and disposal of non-deliverable materials and documents. (e.g. product design data may need to be achieved to enable retrieval at a later date).
- Demobilization, including arrangements for disbanding the project team and supporting infrastructure; conducting performance appraisals; completion of technical and quality audits.
- All project accounts are finalized.
- Write a lessons learned document.

5.3. Reviews

As it has been stated before, during the closing phase some reviews must be written. It is really important to get the project definitely closed and write the lessons learned document. Because of that these are the most commonly written and important reviews:

5.3.1. Project Reviews

Reviews allow the PM and the Project Team to reflect objectively on the current performance and any forthcoming work.

Project Reviews take place throughout the Project Life Cycle to check the likely or actual achievement of the objectives specified within the Project Management Plan (PMP) and the benefits detailed in the Business Case called “during the project reviews”.

Additional reviews will take place following handover to ensure that the benefits are being realised by the Organization called “after the project reviews”.
The objectives of Project reviews are as follows:

- Evaluate the Project Management processes used.
- Establish Lessons Learned and actions arising from them.
- Raise any concerns and agree corrective actions.
- Review the likely technical success of the Project.
- Validate overall progress against the plan, schedule, budget, resources and quality.
- Consider Stakeholders relationships and perceptions.
- Sustainability Manager to hold separate review.
- Ensure sustainability part of Post-project review.
- Complete a throughout Findings Report.
- Ensure findings disseminated throughout the business to enhance lessons learned.

5.3.2. Quality Reviews

The fifth review is one of the most important even though is the most forgotten as well.

After a point of testing for a product or as a request from the Project Sponsor or Project Manager, a review of the quality of the product that has been tested or of the project’s ability to follow the processes is held.

In this review, the findings of the audit or test are explained and the PM can gain a clearer understanding of how their project and their team is progressing.

There are typically three outcomes from a Quality Review:

i. First that the tested item or the assessed team has passed and that everything should continue as planned.

ii. Second, the item or team could still pass the review, however a few minor defects or areas for improvement have been identified and must be carried out to ensure that all quality requirements are adhered to.

iii. The third and final option is that the item or team has failed the test or assessment and will not be allowed to proceed until the areas of failure have been rectified and have been re-tested and have passed another formal review.
5.3.3. Post Project Reviews (Evaluation)

The post project review or Evaluation is a structures audit and review of how the project went. The output is a report with all the lessons learned for the future including recommendations for process improvement and training.

The Post Project Report must cover the following fields:

<table>
<thead>
<tr>
<th>Field</th>
<th>Explanation</th>
</tr>
</thead>
</table>
| **Review Objectives** | ✓ Identify strengths and weaknesses in the performance of the project  
✓ Establish the key lessons learnt  
✓ To make recommendations for improvements (methods and competences) |
| History of the Project | What major problems occurred during the project and how well they were dealt with? |
| Performance | How well the organization and team performed? Areas such as decision-making, team leadership and development, team working, single point accountability. |
| Effectiveness of the project strategy | How well it was implemented? – What went wrong and what went well? |
| Estimating Accuracy | How accurate was the original estimate? Were sufficient provisions made to cover uncertainties, changes and risks? |
| Effectiveness of specific Processes | Such as change control, risk management, control and co-ordination. How well did these processes control specific aspects of the project? |
### Review Preparation

The project manager is typically responsible for organising the meeting and ensuring that any preliminary audits and reviews are carried out. The Project Sponsor and Project Manager typically decide stakeholder attendance. The review meeting should aim to get views from as many stakeholders as possible, both within the project team and from outside. It is not always practical for all stakeholders to attend the review. In such cases, their contributions may be obtained prior to the meeting through for example, interviews, workshops or correspondence. These inputs may then be included in the meeting.

### Implementation

Ideally an independent facilitator should chair the meeting to prevent the review from being dominated by subjective and ‘blaming’ issues. Facilitators are often provided by functions within the organization with responsibility for improvement and maintenance of standards, for instance Quality Assurance or Project Support Office.

During the meeting it is necessary to document the review and record the results and actions that arise. An individual from the Project Support Office typically undertakes this.

### Findings

The project manager or facilitator is typically responsible for co-ordinating and issuing the report covering the lessons learned and recommendations for improvement to relevant stakeholders. Distribution may include the project team, other project managers within the organization, the internal organization, external sponsors, and external suppliers.

### 5.3.4. Stakeholder Reviews

![Fig. B-54: Post-Project review’s Key Members representation [22]](image-url)
Now we proceed to review each key stakeholder functions.

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Chair</strong></td>
<td>Maintains focus on review objectives; ensures objectivity/no blame process; ensures effective participation of stakeholders.</td>
</tr>
<tr>
<td><strong>User</strong></td>
<td>Inputs on aspects such as: how well users were involved; quality of product specifications; change implementation; product acceptance and handover.</td>
</tr>
<tr>
<td><strong>Quality Assurance</strong></td>
<td>Quality planning and execution processes; audits and reviews; conformance to standards &amp; procedures; quality variances; etc.</td>
</tr>
<tr>
<td><strong>Implementer</strong></td>
<td>Successes and problems arising in the planning and execution of work; the technical strategy; changes; risks and issues; team working; motivation; etc.</td>
</tr>
<tr>
<td><strong>Project Sponsor</strong></td>
<td>Quality of requirements definition; accuracy of estimates; quality of reporting; involvement; quality of decision making; management of stakeholders and environmental factors; achievement of objectives; issues, changes, variances and risks.</td>
</tr>
<tr>
<td><strong>Project Manager</strong></td>
<td>Achievement of the objectives; decision making processes; project planning and control including issues, changes and risks; effectiveness of the project strategy; management processes; leadership and team working</td>
</tr>
<tr>
<td><strong>Supplier</strong></td>
<td>Procurement processes; supplier performance in meeting specifications, cost and time requirements; supplier risk management</td>
</tr>
<tr>
<td><strong>PMO</strong></td>
<td>Effectiveness of project planning and control methods; issue management; change implementation; reporting processes and risk management.</td>
</tr>
<tr>
<td><strong>CSR Officer</strong></td>
<td>Prepares and presents the CSR report for the company and regulator financial statements, helps to implement an open, transparent communication policy that serves to formulate the company’s management policies.</td>
</tr>
</tbody>
</table>
6. Organizational Structure

Once ISO21500 phases have been covered, we are going to face towards how it sees the Organizational structure.

In the previous figure we can appreciate the external project flow chart. According to ISO21500 the Organizational Strategy (Steering Committee) detects some Opportunities. Nevertheless, they just have some resources available, so they build a portfolio up. Programs and Projects settle up this portfolio. Every project has a Project Manager that together with a Sponsor build up the Business Case (see 2.0) where they negotiate some project objectives. Once this objectives are already defined, they proceed on developing the project (Initiation, Executing, Controlling and Closing), so it gets some deliverables that are used in Operations. At its appropriate time this procedure gets some benefits gathered by the Organizational Strategy and finishes the loop.

However, we have to bear in mind that not all projects end in success. This is the point we are going to cover in the next step.
Definition of some of the new concepts of the previous figure:

**Stakeholders**
Stakeholders are people or organizations (e.g., customers, sponsors, performing organization, or the public) that is actively involved in the project, or whose interests may be positively or negatively affected by execution or completion of the project. A stakeholder may also exert influence over the project, its deliverables and the project team members.

**Project Governance**
Project Governance is an oversight function that is aligned with the organization’s governance model and that encompasses the project life cycle. Project governance framework provides the project manager and team with structure, processes, decision-making models and tools for managing the project, while supporting and controlling the project for successful delivery.

**Project Team**
Includes the project manager and the group of individuals who act together in performing the work of the project to achieve its objectives, including:
- Project Management staff
- Project staff
- Supporting experts
- User or Customer Representatives
- Sellers
- Business partner members
- Business partners

### 6.1. Project Success

Success criteria are the specific parameters that will be used to judge the project's success. They must be measurable and unambiguous. Use of subjective phrases will inevitably lead to disputes over interpretation at some stage of the project. Criteria must be achievable within the scope of the project. They will be unique to the project and derived from the stakeholders needs.

In summary, effective success criteria will be:
- Defined as part of the business case
- Reviewed at the end of each phase or stage
- SMART (Specific, Measurable, Achievable, Realistic and Time bound)
- Agreed between the Sponsor and the Project Manager
- Inclusive of tolerances
- Related to the benefits within the Business Case

#### 6.1.1. What is success?

"The person who succeeds is not the one who holds back, fearing failure, nor the one who never fails... but rather the one who moves on in spite of failure. Far better to dare mighty things, to win glorious triumphs, even though checkered by failure, than to take rank with those poor spirits who neither enjoy much nor suffer much because they live in the grey twilight that knows not victory or defeat”.

*Theodore Roosevelt*
It is convenient to think of four main areas where a project may be judged to be a success or failure and a fourth result or benefit that can be achieved by these successes.

**Product Delivery**
This is the area that has been historically recognised as being the judge of whether a project has been a success or not. It is concerned with the delivery of the final product within the budget set, within the timescales agreed and to the required specification.

**Business Objectives**
It is important to define and quantify benefits that are derived from the project in line with corporate strategy. These benefits are realised mainly after the project’s end product has been delivered and the project team disbanded. Even if the project has done all it was asked to do in terms of the end product, the project may still be regarded as a failure if we do not eventually get the benefits that were used to justify the project in the first place.

**Product Delivery**
Delivering the project within its specific constraints is one aspect of success, but delivering it using the defined processes within a governed system and administering the project in a set prescribed manner is another. Imagine a long car journey that gets you to the correct destination on time and within budget, but the driver takes very rough dusty roads, almost has an accident and never stops for a comfort break. The driver may consider the journey a great success as it achieved its product delivery objectives. But feeling dusty, car sick and tired in the back, you may have a very different view.

**Continuous Improvement**
The three previous areas of potential success relate to individual projects. This area is about achieving success time after time as efficiently as possible.
6.1.2. Success Criteria

The Project Management success criteria are based traditionally by the triple constraint that is a framework for evaluating competing demands. The triple constraint is often depicted as a triangle where one of the sides or one of the corners represent one of the parameters being managed by the project team, it is also called the Iron Triangle. This constrains are Time, Cost and Scope and the area inside the triangle is Quality so, if one constraint differs from the expected, quality will get affected.

**Fig. B-56: Traditional and GPM Success Criteria Comparison diagram**

Green Project Management added an extra constrain, the Environmental Impact.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time</td>
<td>This parameter is the simplest but you should just bear in mind that sometimes delivering the product early can be as undesirable as delivering it late. Some sources refer to this parameter as the schedule.</td>
</tr>
<tr>
<td>Cost</td>
<td>The cost of a project is the thing that costumers most often want to fix. But it is also the parameter that is most often exceeded. This inevitably occurs because people do not understand the relationship between the project cost and the other two parameters. One of the major reasons for project cost overrun is a lack of understanding of the true scope of the work involved.</td>
</tr>
<tr>
<td>Scope</td>
<td>This parameter is given various names by various sources. Traditionally it has been called Quality and more recently Performance or Specification. Whatever you call it, it is fundamentally about the definition of the end product. The early stages of requirements management are crucial in understanding the needs of the customer. The use of the term Scope fits better with the modern approach to the subjects of Scope Management and Quality that deals with a lot more than just the specification of the end product.</td>
</tr>
<tr>
<td>Environmental Impact</td>
<td>Environmental Impact is the new parameter added by Green Project Management and the aim of it is to plan the Project considering, not only Scope, Time and Cost, but also its Environmental Impact at the same level.</td>
</tr>
</tbody>
</table>
All this constrains to achieve success in a project are managed by:

- Tools
- Knowledge
- Skills
- Techniques

### 6.1.3. Success Factors

Success factors are elements of the project context, or environment, and management processes that will enable success – or reduce the chance of failure.

Some research suggests that the absence of such factors is more likely to lead to failure and, therefore, the project sponsor and PM should identify and address any weaknesses and build on their and the team’s existing strengths.

Some success factors would be, for instance:

- Senior management support
- Clearly defined goals
- Good communications
- Team motivation
- Strong leadership
- Supports the direction of the organization
  - Financial, Environmental and Social (TBL)

### Measuring Sustainable Success

As has stated before, it is really important to measure the project achievements, especially that ones related to the success criteria.

I. **Cost** The easiest to measure, the financial department will do it for you.
II. **Time** Check if the project has followed the WBS that the PM designed.
III. **Scope** Check if the project accomplished the objectives in the Business Case.
IV. **Environmental Impact**

This is the hardest to measure. Nevertheless, PRISM goes with GPM-Calculator template that makes it really easy to measure. Nevertheless, this part is going to be explained in the last section (C) of the thesis on a real example.
6.2. Benefits Management

The benefit of a project is the quantified and measured improvement resulting from completion of the project deliverables. This will typically be in monetary values but not necessarily. Again, project stakeholders will judge the success of the project in meeting the planned benefits.

Examples of these are:
- Increased market share
- Increased turnover and profit
- Greater output capacity
- Larger product portfolio
- Improved security
- Increased staff satisfaction
- Higher Brand position
- Decrease in Carbon Footprint

The next figure shows the Benefits Management procedure:

**Fig. B-57: Benefit Management Procedure diagram**

Benefits realization is generally the responsibility of organizational management, which may use the deliverables of the project to realize benefits in alignment with the organizational strategy. The project manager should consider the benefits and their realization as they influence decision making throughout the project life cycle.

6.2.1. Benefits Management Plan

Benefits Management are documented in the Benefit Management Plan. The typical contents of it are as follows:

<table>
<thead>
<tr>
<th>Benefits</th>
<th>The results expected from project deliverables during operation. These should be tangible, quantifiable and measureable.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benefits Profile</td>
<td>Showing when, where and how the benefits will be realised</td>
</tr>
<tr>
<td>Roles and Responsibilities</td>
<td>The sponsor is responsible overall for achievement of benefits, however other stakeholders will be involved including those working in the business as usual activities. The plan defines the specific roles and responsibilities of each participant.</td>
</tr>
<tr>
<td>Tracking and Controlling</td>
<td>Once the roles and responsibilities are clear, we must track and control that everyone is follow them.</td>
</tr>
<tr>
<td>Benefits realization reviews</td>
<td>After the controlling phase, we must perform a review.</td>
</tr>
<tr>
<td>Supporting methods</td>
<td>Extra methods</td>
</tr>
</tbody>
</table>
7. More PM Skills and Techniques

Once covered ISO21500 Phases and Organization Structure, the writer wanted to add some tools and techniques taken from PMI PMBOK that considered that should be in this thesis.

These have been structured in two big blocks.
- Resource Skills (following from B-3.3)
- Social Skills

7.1. Resource Skills

As the name stands, in this section we will find some tools and techniques that will help the reader how to manage the project resources. As can be found resources of different natures, the writer decided to split them up in two big bocks: Human Resources and Procurement. Also considered interesting to add a Cost management chapter.

7.1.1. Human Resource Management

Human Resources Management is about the best allocation of resources and how to manage them effectively. This knowledge verify that the appropriate people are placed in the right positions due to their knowledge and experience so that they have the right tools they need to succeed. Human resources management involves:

Organizing and managing the project team

This element of project and man management involves developing the suitable roles and responsibilities for each project team member by identifying the needs and qualification requirements of a particular post to manage their work to be completed.

These requirements are completed in:
- Human Resources Planning
- Project Team Acquisition
- Development and Management process areas.

The primary role from an environmental or a green project management standpoint is to provide input and guidance for the areas of training and the qualifications of the right person to manage environmental concerns based on your EMS and the guidelines set forth in ISO 14000 in the following stages:

I. Acquire Project Team
II. Develop Project Team
III. Manage Project Team
IV. Control Project Team
7.1.1.1. Acquire Project Team

This very first stage is about confirming human resource availability and obtaining the team necessary to complete project assignments.

In this area can be applied the following tools and techniques:

**Pre-assignments**
When project team members are selected in advance, they are considered pre-assigned.

**Negotiations**
Staff assignments are negotiated. In many projects, the PM team may need to negotiate with:
- Functional Managers, other Project Managers. External organizations, vendors, suppliers, contractors, etc.

The project management team’s ability to influence others plays an important role in negotiating staff assignments, as do the politics of the organizations involved.

**Acquisition**
When the performing organization is unable to provide the staff needed to complete a project, the required services may be acquired from outside sources. This can involve hiring individual consultants or subcontracting work to another organization.

**Virtual Teams**
The use of virtual teams creates new possibilities when acquiring project team members. Virtual teams can be defined as groups of people with a shared goal who fulfill their roles with little or no time spent meeting face to face.

**Project Staff Assignments**
The project is staffed when appropriate people have been assigned to the team.
The documentation of these assignments can include a project team directory, memos to team members, and names inserted into other parts of the project management plan, such as project organization charts and schedules.

**Resource Calendars**
Resource calendars document the time periods that each project team member can work on the project. Creating a reliable schedule depends on having a good understanding of each person’s schedule conflicts, including vacation time and commitments to other projects, to accurately document team member availability.
7.1.1.2. Develop Project Team

This second stage is about improving the competencies, team interaction, and the overall team environment to enhance project performance.

In this area can be applied the following tools and techniques:

**Interpersonal Skills**
Interpersonal skills, sometimes known as “soft skills” are behavioral competencies that include proficiencies such as communication skills, emotional intelligence, conflict resolution, negotiation, influence, team building, and group facilitation. These soft skills are valuable assets when developing the project team.

**Training**
Training includes all activities designed to enhance the competencies of the project team members. Training can be formal or informal.

**Team-Building Activities**
Team-building activities can vary from a five-minute agenda item in a status review meeting to an off-site, professionally facilitated experience designed to improve interpersonal relationships.

<table>
<thead>
<tr>
<th>Stage</th>
<th>Form</th>
<th>Storm</th>
<th>Norm</th>
<th>Perform</th>
<th>Transition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Team</td>
<td>No conflict</td>
<td>No clear purpose</td>
<td>Members trying to define the tasks</td>
<td>Competition</td>
<td>Clique</td>
</tr>
<tr>
<td>PM</td>
<td>Social talk</td>
<td>Mission statement</td>
<td>Role definition</td>
<td>Direct Team</td>
<td>Create positive environment</td>
</tr>
</tbody>
</table>

*Fig. B-59: Stages of Team Development Table [32]*

**Ground Rules**
Ground rules establish clear expectations regarding acceptable behavior by project team members. Early commitment to clear guidelines decreases misunderstandings and increases productivity.
Co-Location
Colocation, also referred to as “tight matrix,” involves placing many or all of the most active project team members in the same physical location to enhance their ability to perform as a team. Colocation can be temporary, such as at strategically important times during the project, or for the entire project.

Recognition and Rewards
Part of the team development process involves recognizing and rewarding desirable behavior. The original plans concerning ways in which to reward people are developed during the Develop Human Resource Plan process. Award decisions are made, formally or informally, during the process of managing the project team through project performance appraisals.

Team Performance Assessment
As project team development efforts such as training, team building, and co-location are implemented, the project management team makes formal or informal assessments of the project team’s effectiveness. Effective team development strategies and activities are expected to increase the team’s performance, which increases the likelihood of meeting project objectives.

7.1.1.3. Manage Project Team

This third stage is about tracking team member performance, providing feedback, resolving issues, and managing changes to optimize project performance.

In this area can be applied the following tools and techniques:

Observation and Conversation
Observation and conversation are used to stay in touch with the work and attitudes of project team members. The project management team monitors progress toward project deliverables, accomplishments that are a source of pride for team members, and interpersonal issues.

Motivational Theories
As motivation is an effective human resource managing techniques, there are plenty of theories about it. Here we are going to explain seven of the most famous of them.

i. Victor Vroom [36]
Vroom’s theory postulates that people think about the effort they should put into a task before they do it. If workers believe their efforts are going to be successful and rewarded, they will tend to be highly motivated and productive.
ii. McGregor’s Theory X and Y [37]

McGregor’s theory postulates that all workers can be classified into two groups; X and Y. The PM should act differently depending on its team members types.

<table>
<thead>
<tr>
<th>Theory X</th>
<th>Theory Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓ People need to be constantly watched</td>
<td></td>
</tr>
<tr>
<td>✓ People are not capable</td>
<td></td>
</tr>
<tr>
<td>✓ Evade responsibilities</td>
<td></td>
</tr>
<tr>
<td>✓ Evade work whenever possible</td>
<td></td>
</tr>
<tr>
<td>✓ People are willing to work without supervision</td>
<td></td>
</tr>
<tr>
<td>✓ People are achievers</td>
<td></td>
</tr>
<tr>
<td>✓ People can direct their own effort</td>
<td></td>
</tr>
</tbody>
</table>

*Fig. B-60: McGregor’s Theory X and Y reference table*

iii. Ouchi’s Theory Z [38]

Ouchi’s Theory Z postulates that workers need to be motivated. High levels of trust, intimacy, confidence and commitment to workers will result to high motivation and productivity from them.

iv. Friderik Herzberg [39]

Herzberg stands in his theory that motivating people is best done by rewarding them and let them grow. He also describes how Hygiene factors and motivating agents affect to motivation.

<table>
<thead>
<tr>
<th>Hygiene Factors</th>
<th>Motivating Agents</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓ Poor hygiene factors may destroy motivation, but improving them, will not improve motivation.</td>
<td></td>
</tr>
<tr>
<td>✓ Hygiene factors are not enough to motivate people (salary, status, working conditions, security, etc.)</td>
<td>People are motivated by interesting work including:</td>
</tr>
<tr>
<td></td>
<td>✓ Opportunity for personal growth.</td>
</tr>
<tr>
<td></td>
<td>✓ Achievement and recognition.</td>
</tr>
<tr>
<td></td>
<td>✓ Self-actualization.</td>
</tr>
</tbody>
</table>

*Fig. B-61: Herzberg’s Hygiene Factors and Motivating Agents*

v. Mashlow’s Hierarchy of Needs [40]

Mashlow build up in his theory a pyramid that shows the needs for people to get motivated. One cannot advance up to the next level until the levels below are not satisfied.

*Fig. B-62: Mashlow’s Pyramid of Needs*
vi. McClelland’s Theory of Needs [41]
McClelland postulates in his theory that everyone has one out of these three needs:

<table>
<thead>
<tr>
<th>Need</th>
<th>Best for</th>
</tr>
</thead>
<tbody>
<tr>
<td>Need for achievement</td>
<td>PM</td>
</tr>
<tr>
<td>Need for authority and power</td>
<td>Team members</td>
</tr>
<tr>
<td>Need for affiliation</td>
<td></td>
</tr>
</tbody>
</table>

*Fig. B-63: McClelland’s needs theory*

vii. Halo Effect [42]
The Halo Effect theory stands that when a person is perceived as good (or bad) in one category, people are likely to make a similar evaluation in other categories. (Tang is a great software engineer, therefore we will use him as an architect in this project and he will perform well).

Leadership Styles
Leadership styles will be explained in Leadership section in Social skills chapter (7.2.6).

Interpersonal influences
In the following chart the reader may read the different interpersonal influence power that a project team member (or stakeholder) may have:

<table>
<thead>
<tr>
<th>Influence Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formal Power</td>
<td>Based on the person’s position on the organization</td>
</tr>
<tr>
<td>Reward Power</td>
<td>Based on positive effects that the person can offer</td>
</tr>
<tr>
<td>Penalty Power</td>
<td>Based on negative effects that the person can offer</td>
</tr>
<tr>
<td>Referent Power</td>
<td>Based on person’s charisma or follow someone’s role</td>
</tr>
<tr>
<td>Expert Power</td>
<td>Based on person’s expertise</td>
</tr>
</tbody>
</table>

*Fig. B-64: Different Interpersonal influence power*

7.1.1.4. Control Project Team
The very first we need to bear in mind is why do we have to control the project team. Because of the previous, this section will be structured first, explaining the principles of controlling the project team followed by a simple controlling process.

7.1.1.4.1. Project Controls Principles

*Fig. B-65: Why is monitoring important*
Variances are useful in showing where the project is at any point in time and how far away the project is from the baseline plan. Variances alone will not show how well the project will meet its objectives.

By comparing the current variance with the plan the pro rata effect on the overall parameters can be assessed allowing the completion dates, costs and quality to be forecasted. However, this assumes that the past performance will continue. Also the simple analysis may be misleading if the intervals between measurements are too large [22].

By tracking performance more frequently, trends can be developed and these may give a more realistic view of performance, allowing the development of corrective action plans. Earned Value Analysis to be discussed later, is a particularly useful method since it provides variances, trends and allows the development of what if scenarios.

### 7.1.1.4.2. Project Control Process

Effective control involves the comparison between actual performance and the baseline plan. Changes to baseline plans must therefore be controlled (see Change Control B-4.5).

The purpose of monitoring is to establish deviations and evaluate their impact. Tolerances may be set to enable work to continue with minor deviations.

Control and co-ordination involves the planning and implementation of corrective actions to address adverse situations. Alternatively, it may involve re-planning if the original plans appear to be unworkable or unrealistic. On completion of all project work, the project is formally accepted.

![Project Control Process](image)

*Fig. B-66: Project Control Process*
7.1.2. Procurement Management

Procurement is the acquiring products and new services process. It covers:

- Financial appraisal of the options available
- Development of the procurement or acquisition strategy
- Preparation of contract documentation
- Selection and acquisition of suppliers
- Pricing
- Purchasing
- Administration of contracts

7.1.2.1. Procurement Process

The procurement process starts with the decision of whether to procure goods or services and finishes with the closure of the contact. In principle, it is a relatively simple and intuitive process but it requires sound commercial and legal skills. Getting it wrong even at this early phase could spell disaster for your project.

<table>
<thead>
<tr>
<th>Stage</th>
<th>Activities Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Procurement Planning</td>
<td>As with any other aspect of PM, the first thing you need to do is plan your approach. The host organization may already have existing policies for procurement and where at all possible the project or program should adhere to these. The best-case scenario is to have organizational standards as well as an environmental management plan that compliment each other.</td>
</tr>
<tr>
<td>Contract Preparation</td>
<td>There are many different approaches to the customer/supplier relationship and you will need to consider what is the best one for each contract on its own individual merits. This will include how you would like the contract to be priced and what form of legal contract you will choose to employ.</td>
</tr>
<tr>
<td>Supplier Selection</td>
<td>Selecting the right supplier is obviously of vital importance to the success of your project or program. Tenders can be assessed qualitatively or quantitatively. Whichever method you choose, the cost must be balanced against value and this should include whole life costing rather than just the initial price. Apointing a supplier will inevitably include contract negotiations for which the project manager needs to have at least a basic understanding of Contract Law but in general should seek assistance by employing legal specialists within this area.</td>
</tr>
</tbody>
</table>
Tender Preparation

The first steps in preparing a tender include ensuring that we have the clearest possible statement of requirements for all the suppliers to bid against whilst having also decided the categories and how best to evaluate the tenders.

Contract Management

Once your supplier is in place, you will need to manage the contract. This can include all the negotiation, leadership and conflict management skills (see B-7.2) that you use to manage an in-house team but will also need the legal awareness to understand the relationship between the different parties.

Contract Close Out

Throughout the project, contracts will eventually come to an end. When they do, these need to be formally closed with the final accounts being paid and any follow on actions agreed and having any maintenance arrangements in place.

7.1.2.2. Plan Procurement Management

In the Plan Procurement Management Phase is the process of documenting project purchases decisions, specifying the approach and identifying potential sellers.

7.1.2.3. Types of Contract

A contract is a voluntary, deliberate, and legally binding agreement between two or more competent parties. Contracts may be written or oral and is both a legal document and a relationship between the parties. The following elements are needed for legal contracts:

- Offer
- Acceptance
- Exchange of consideration
- Competent parties
- Legality purpose

A breach of the contract is a failure to fulfill any part of the contract (unless a legal excuse applies), can be partial or total.

A breach of the contract should carry different types of punishment for the company based on the damages incurred.

Contracts generally fall into three broad categories:

- Fixed Price Contracts
- Cost Reimbursable Contracts
- Time and Material Contracts
7.1.2.3.1. Fixed-Price Contracts

There are three types of fixed-price contracts:

**Firm Fixed Price (FFP)**
- For every RMB the seller can reduce cost below the target, the cost savings are split between the seller and buyer based on a share ratio. There is also a ceiling price.
- Ex. Contract = RMB 88,000. For every four weeks you finish the project early, you will receive RMB 88,000

**Fixed Price Plus Incentive Fee (FPIF)**
- Sometimes a fixed price contract will allow for price increases if the contract is multiple years or the product's prices changes continuously.
- Ex. Year1 - Contract = RMB 88,000
  - Year2 - Contract = RMB 88,000 plus increase in the oil price

**Fixed Price with Economic Price Adjustment**

Also called lump sum or firm fixed price. This category of contract involves a fixed total price for a well-defined product.

EX. Contract = RMB 888,000

A type of contract where the buyer will pay (reimbursement) the seller for the seller's actual costs, plus a fee typically representing seller's profit.

EX. Contract = RMB 1,000 per hour plus materials cost

Sometimes called Unit Price Contracts. This form of contract is priced on per hour or per item basis and has elements of a fixed price contract (in the price per hours) and a cost reimbursable (in the material cost)
7.1.2.3.1.1. FPIF (w2w with suppliers)

Fixed Price plus Incentive Fee (FPIF) represents a win-to-win (w2w) situation for you and your suppliers. It is about sharing the total Profit between your company and your supplier.

In this model, the following variables take place:

<table>
<thead>
<tr>
<th>Variable</th>
<th>Symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Point of Total Assumption</td>
<td>PTA</td>
</tr>
<tr>
<td>Share Ratio</td>
<td>SR</td>
</tr>
<tr>
<td>Target Fee</td>
<td>TF</td>
</tr>
<tr>
<td>Target Cost</td>
<td>TC</td>
</tr>
<tr>
<td>Price Ceiling</td>
<td>PC</td>
</tr>
<tr>
<td>Actual Cost</td>
<td>AC</td>
</tr>
</tbody>
</table>

Here it follows an example of Fixed Price plus Incentive Fee (FPIF).

The previous figure is about a FPIF fixing a supplier share ratio of 70-30, which means that your supplier is going to get an extra 30% from the total profit. That will encourage him to supply you in better conditions (w2w). If we have a target cost of 350RMB, that means that the total profit of 466,67RMB and it’s split up into two: 140RMB to the supplier and 326,67RMB to our company.

The reader can also appreciate that if the target cost is over the point of total assumption (507RMB) there is not w2w situation and all the total profit goes to our company. Furthermore, if the target cost is over the Ceiling Price (600RMB) there is no business.

When Target Cost (TC) is smaller that the Point of Total Assumption (PTA) or, in other words, when there is w2w situation, Target Fee (TF) function is defined by the following equations:
\[ FP_t = TF + SR \left( TC - AC \right) \]
\[ FP_R = AC + FP_t \]
\[ PC = \frac{PC - \left( TF + SR \cdot TC \right)}{1 - SR} \]

7.1.2.3.2. **Cost Reimbursable Contracts**

There are six types of Cost Reimbursable Contracts:

- **Cost-Based (CR)**
  - Cost reimbursable contracts involve payment based on sellers’ actual cost

- **Cost Sharing (CS)**
  - A CS contract involves the buyer and the seller sharing the costs of the project, generally with no provision for profit. CS contracts are sometimes used in research-based projects or development partnerships.

- **Cost Plus Incentive Fee (CPIF)**
  - Seller is reimbursed for allowable costs for performing the contract work and receives a pretermined fee, an incentive bonus, based upon achieving certain performance objective levels set in the contract.
  - EX. Contract = Cost plus a fee of RMB 88,000. For every month the project is completed sooner than agree upon, seller will receive an additional RMB 8,000, if they don’t deliver by December the seller will pay RMB 20,000.

- **Cost Plus Award Fee (CPAF)**
  - The seller is reimbursed for all legitimate costs, but the majority of the fee is earned only based on the satisfaction of certain broad subjective performance criteria defined and incorporated into the contract.

- **Cost Plus Fixed Fee (CPFF)**
  - Seller is reimbursed for allowable costs for performing the contract work and receives a fixed fee payment predetermined in the contract. The fixed fee does not vary with actual costs unless the project scope changes.

- **Cost Plus Percentage of Costs (CPPC)**
  - This is an illegal form of contract for many governments and is very risky for the buyer. With this type of contract, the seller is not motivated to control costs because the seller will get paid on every cost without limit.
  - EX. Contract = Cost plus 15% of costs as fee.
7.1.2.3.2.1. **CPIF (w2w with suppliers)**

Fixed Cost plus Incentive Fee (CPIF) represents a win-to-win (w2w) situation for you and your suppliers. It is about sharing the total Profit between your company and your supplier.

Here it follows an example of Cost Price plus Incentive Fee (CPIF). The variables are the same as in FPIF (B-7.1.4.1.1).

![CPIF Chart](image)

Fig. B-69: CPIF Chart (70-30 Share ratio example)

Actually the difference between FPIF and CPIF is that in CPIF when the target cost is over the point of total assumption, the share ratio turns 100-0 (0% for the supplier). According to the formula:

\[ FP_T = TF + SR \cdot (TC - AC) \rightarrow \text{if } TC > PTA \rightarrow \lim_{SR \to 0} FP_T = TF \]

Because of that, from PTA the supplier is always going to get TF RMB. In the example, if the target cost is over 507RMB, the supplier is going to earn 93 RMB.

7.1.2.3.3. **Time and Material Contracts**

Time and Material Contracts are an Hybrid type of contractual arrangement that contains aspects of both cost-reimbursable and fixed-price type contract; the full value of the agreement and the exact quantity of items to be delivered may not be defined by the buyer at the time of the award.
7.1.2.3.4. Risk on Contracts

The following figure compares graphically the risk level from the contract types explained before.

![Contracts Risk Comparison](image)

Fig. B-70: Contracts Risk Comparison

7.1.2.4. Procurement Management Plan

The procurement management plan describes how a project team will acquire goods and services from outside the performing organization. It describes how the procurement processes will be managed from developing procurement documents through contract closure.

The Procurement Management Plan should indicate [22]:

- The overall procurement strategy
  - Make / buy
  - Competitive tendering
  - Supply chains
  - Relationships
- Key products to be purchased, their source, acceptance criteria and relevant quality assurance requirements.
- Methods used to evaluate, select and control suppliers and sub-contractors.
- Contractual terms and conditions including typical clauses such as: product acceptance and delivery terms, payment terms, compensation terms, ...
- Requirements for and reference to supplier and sub-contractor quality plans where appropriate.
- Types of pricing and methods for reimbursement.
- Methods to be used to satisfy legal and regulatory requirements, which apply to, purchased goods.
7.1.2.5. Procurement Statement of Work (SOW)

For each procurement, the statement of work (SOW), is developed from the project scope baseline and defines only that portion of the project scope that is to be included within the related contract.

7.1.2.6. Procurement Documents

Procurement documents are used to solicit proposals from prospective sellers. Terms such as bid, tender, or quotation are generally used when the seller selection decision will be based on price, while a term such as proposal is generally used when other considerations, such as technical capability or technical approach are paramount.

Request for Information (RFI)
The Request for Information (RFI) is a type of procurement document whereby the buyer requests a potential seller to provide various pieces of information related to a product or service or seller capability.

Invitation for Bid (IFB)
The Invitation for Bid (IFB) generally is equivalent to request for proposal. However, in some application areas, it may have a narrower or more specific meaning.

Request for Proposal (RFP)
The Request for Proposal (RFP) is a type of procurement document used to request proposals from prospective sellers of products or services.

Request for Quotation (RFQ)
The Request for Quotation (RFQ) is a type of procurement document used to request price quotations from prospective sellers of common or standard products or services.

7.1.2.7. Procurement Selection Process

In the Procurement Selection Process we can find the following activities.

| Procurement Strategy and Requirements | Decide an appropriate strategy, such as competitive tendering, partnering, collaboration, etc. Define requirements including quality, time and price parameters. |
| Research market & Identify Potential Suppliers | Identify potential suppliers. Research methods: mail-shots, business directories, industrial libraries, trade journals, networking. |
| Check track record/capability & Shortlist | Investigate suppliers ability to achieve the procurement requirements. Shortlist to reduce tender evaluation effort and costs, using criteria such as price, quality, delivery time scales, support capability, contractual terms and arrangements, and risks. |
Invite Tenders | Request suppliers submit proposals and tenders. Any subsequent technical or contractual questions from suppliers will be answered. The tender evaluation team is likely to decide the final criteria for selection.

Evaluate Tenders | Against the pre-defined criteria. It may be necessary to ask suppliers follow up questions to validate or cover missing information, understand risks, etc.

Select and Negotiate Contract Terms | Selected supplier(s) will be invited to negotiate a contract. A final decision on the supplier will be taken and the contract agreed and signed.

7.1.2.8. Evaluation and Selection Criteria

Selection criteria are often included as a part of the procurement solicitation documents. Such criteria are developed and used to rate or score seller proposals, and can be objective or subjective. Each organization has its own Supplier Selection Criteria (see B-6.1.2). Here there is a short example criteria list.

✓ Understanding of need
✓ Overall or life-cycle cost
✓ Quality
✓ Timescales
✓ Supplier delivery dates
✓ Contractual terms
✓ Incentives and Guarantees
✓ Cost of in service support
✓ Risk management capability
✓ Resource and mobilization capability
✓ Quality management capability
✓ Responsiveness to changes
✓ Sustainability Factor (GPM)

7.1.2.9. Conduct Procurements

In Conduct Procurements phase is when we obtain the seller responses, selecting a seller and awarding a contract.

7.1.2.9.1. Conduct Procurement Techniques

Bidder Conferences
Bidder conferences (sometimes called contractor conferences, vendor conferences, and pre-bid conferences) are meetings between the buyer and all prospective sellers prior to submittal of a bid or proposal. They are used to ensure that all prospective sellers have a clear and common understanding of the procurement requirements, and that no bidders receive preferential treatment.
Advertising
Existing lists of potential sellers often can be expanded by placing advertisements in general circulation publications such as selected newspapers or in specialty trade publications. Some organizations use online resources to communicate solicitations to the vendor community. Some government jurisdictions require public advertising of certain types of procurement items, and most government jurisdictions require public advertising or online posting of pending government contracts.

Procurement Negotiations
Negotiations clarify the structure, requirements and other terms of the purchases so that mutual agreement can be reached prior to signing the contract. Final contract language reflects all agreements reached.

Selected Sellers
The sellers selected are those sellers who have been judged to be in a competitive range based upon the outcome of the proposal or bid evaluation, and who have negotiated a draft contract that will become the actual contract when an award is made.

7.1.2.10. Control Procurements

In Control Procurements phase is when we manage procurement relationships, monitor contract performance and make changes and corrections to contracts as appropriate.

7.1.2.10.1. Control Procurement Techniques

Contract Change Control System
A contract change control system defines the process by which the procurement can be modified. It includes the paperwork, tracking systems, dispute resolution procedures, and approval levels necessary for authorizing changes.

Inspections and Audits
Inspections and audits required by the buyer and supported by the seller, as specified in the procurement contract, can be conducted during execution of the project to verify compliance in the seller’s work processes or deliverables.

Payment System
Payments to the seller are typically processed by the accounts payable system of the buyer after certification of satisfactory work by an authorized person on the project team.
7.1.2.11. Close Procurements

In the close procurement phase is the process of completing every single project procurement.

7.1.2.11.1. Close Procurement Techniques

Procurement Audits
The objective of a procurement audit is to identify successes and failures that warrant recognition in the preparation or administration of other procurement contracts on the project, or on other projects within the performing organization.

Procurement Negotiations
In all procurement relationships the final equitable settlement of all outstanding issues, claims, disputes, by negotiation is a primary goal of the project. Whenever settlement cannot be achieved through direct negotiation, then some form of alternate disputes resolution (ADR) like mediation or arbitration may be explored.

Closed Procurements
In all procurement relationships the final equitable settlement of all outstanding issues, claims, and disputes, by negotiation is a primary goal of the project. Whenever settlement cannot be achieved through direct negotiation, then some form of alternate disputes resolution (ADR) like mediation or arbitration may be explored.
7.1.3. Cost Management

Project Cost Management includes the processes involved in estimating, budgeting, and controlling costs so that the project can be completed within the approved budget.

7.1.3.1. Key concepts

Life-cycle Costing
Cost Management should also consider the effect of project decisions on the cost of using, maintaining, and supporting the product, service, or result. Life cycle costing should improve decision-making and is used to reduce cost and execution time and to improve the quality and performance of the project deliverable.

Opportunity Costs
Opportunity Costs are defined as the benefits that would have been realized from alternative uses of time and money.

Sunk Costs
Sunk costs are those incurred in the past that cannot be retrieved or recovered now.

Direct vs. Indirect Project costs
Direct costs can be directly traced to activities of the project. Indirect costs cannot be directly traced to activities, referred as overhead.

Variable and Fixed Project Costs
Variable project costs vary according to the output of the project. Fix costs do not vary.

Controllable and non-controllable costs
Controllable costs can be influenced by the PM; otherwise non-controllable costs are out of PM control.

7.1.3.2. Plan Cost Management

When Planning costs, we must establish the policies, procedures, and documentation for planning, managing, expending, and controlling project costs. It provides guidance and direction on how the project costs will be managed throughout the project.

7.1.3.2.1. Project Selection Methods

Project selection methods are used to determine which project the organization will select. These methods generally fall into one of two broad categories.

- Benefit measurement methods
- Mathematical models
Now we are going to precede explaining each of them briefly and giving examples to some of them:

**Scoring or Weighted Scoring Models**

In weighted scoring models we must define an evaluation criteria and determine one weight to each criteria. Then fill in the chart with every project information and make the weighted score calculus by:

$$\text{Weighted Score}_i = \sum_{j} \text{Score}_i \text{Eval Criteria}_j \times \text{Weight}_j$$

Here follows an example:

<table>
<thead>
<tr>
<th>Projects</th>
<th>Evaluation Criteria</th>
<th>Weighted Score</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Market Share</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Operations and Maintenance</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Development of new Markets</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Weight = 6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Weight = 4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Weight = 3</td>
<td></td>
</tr>
<tr>
<td>Project A</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>Project B</td>
<td>5</td>
<td>4</td>
</tr>
</tbody>
</table>

Project A: 6.6 + 5.4 + 5.3 = 71

Project B: 5.6 + 4.4 + 2.3 = 52

**Fig. B-71: Scoring Method Example**

In the previous example, we would choose Project A because it has the maximum score of the available.

**Payback Period**

The payback period is the amount of time it takes to recover investment in the project before making any revenue. The financial department gives the yearly revenues data.

$$\text{Payback} = \frac{\text{Total Cost of the Project}}{\text{Yearly Revenues}}$$

Here follows an example:

<table>
<thead>
<tr>
<th></th>
<th>Project A</th>
<th>Project B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Cost</td>
<td>CNY 100,000,000</td>
<td>CNY 75,000,000</td>
</tr>
<tr>
<td>Yearly Revenue</td>
<td>CNY 50,000,000</td>
<td>CNY 15,000,000</td>
</tr>
<tr>
<td>Payback</td>
<td>2 years</td>
<td>5 years</td>
</tr>
</tbody>
</table>

**Fig. B-72: Payback Period Method Example**

In the previous example, we will pick again Project A because it has the shortest Payback Period among the available.
Present Value (PV)

The Present Value calculus shows the difference between the value of the money presently and in a different point in time. We can use this calculus in the Yearly Revenue to get a more accurate Payback Period.

\[
PV_t = \frac{Yearly Revenue_t}{(1 + i)^t} \quad \text{where} \quad t \equiv \text{period} \; ; \; i \equiv \text{financial interest rate}
\]

Net Present Value (NPV)

The net present value is a standard method for financial evaluation of long-term projects. Used for capital budgeting, and widely throughout economics, it measures the excess or shortfall of cash flows, in present value (PV) terms, once financing charges are met. We can use this calculus in the Yearly Revenue to get a more accurate Payback Period.

\[
NPV_t = PV_t - \frac{Inflow_t}{Outflow_t} \quad \text{where} \quad t \equiv \text{period}
\]

Benefit Cost Ratio (BCR)

BCR is a ratio attempting to identify the relationship between the cost and benefits of a proposed project.

\[
BCR = \frac{\text{Present Value of Revenue}}{\text{Present Value of Cost}} \rightarrow \begin{cases} 
BCR > 1 & \text{Benefits greater than costs} \\
BCR < 1 & \text{Costs greater than benefits} \\
BCR = 1 & \text{Benefits and costs are equal}
\end{cases}
\]

When we have done BCR calculus for each project we will pick the one, which has the greater BCR rate. Nevertheless, if the greater is still \( BCR \leq 1 \) we are not going to do any of the projects because we do not work for not gaining benefits (or even loose money).

Return on Investment (ROI)

ROI is a performance measure used to evaluate the efficiency of an investment or to compare the efficiency of a number of different investments.

\[
ROI (\%) = \frac{Net Profit}{Cost of Investment} \times 100
\]

If ROI is negative (Net profit is negative because the project loses money), you should not take the investment, or if you have an alternative with a greater ROI you should take the other alternative.
Here follows an example:

<table>
<thead>
<tr>
<th></th>
<th>Project A</th>
<th>Project B</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total Investment</strong></td>
<td>CNY 100,000,000</td>
<td>CNY 75,000,000</td>
</tr>
<tr>
<td><strong>Net Profit</strong></td>
<td>CNY 25,000,000</td>
<td>CNY 15,000,000</td>
</tr>
<tr>
<td><strong>ROI</strong></td>
<td>25%</td>
<td>20%</td>
</tr>
</tbody>
</table>

*Fig. B-73: Payback Period Method Example*

In this example we could pick both Project A and B because both have a \( \text{ROI} > 0 \). Nevertheless we will pick Project A because it has a greater ROI [ \( \text{ROI}(A) > \text{ROI}(B) \) ].

- **Internal Rate of Return (IRR)**
  
  The IRR is the % rate that makes the present value of cost equal to the present value of benefits. In general, if the IRR is greater than the project’s cost of capital, the project will add value for the company. Therefore, the greater the IRR the better.

  \[
  \frac{i}{\sum_{t=0}^{T} \left( \frac{\text{Yearly Revenue}_t - \text{Investment}_t}{(1+i)^t} \right)} = 0
  \]

- **Mathematical Models**

  Mathematical Models, also called Constraint Optimization Models, are mathematical based programming models that use linear, nonlinear, dynamic, integer, or multi-objective programming algorithms.

7.1.3.3. **Estimate Cost**

In estimating costs phase, we develop an approximation of the monetary resources needed to complete project activities.

For make estimations PMBOK (5th Edition) purposes the following techniques:

**Reserve Analysis**

Reserve analysis is an analytical technique to determine the essential features and relationships of components in the project management plan to establish a reserve for the schedule duration, budget, estimated cost, or funds for a project.

**Activity Cost Estimates**

An activity cost estimate is a quantitative assessment of the probable costs required to complete project work. This includes, but is not limited to, direct labor, materials, equipment, services, facilities, information technology, and special categories such as an inflation allowance or a cost contingency reserve.
Basis of Estimates
The amount and type of additional details supporting the cost estimate vary by application area. Regardless of the level of detail, the supporting documentation should provide a clear and complete understanding of how the cost estimate was derived.

Supporting detail for activity cost estimates may include:
- Documentation of the basis of the estimate (i.e. how it was developed)
- Documentation of all assumptions made
- Documentation of any known constraints
- Indication of the range of possible estimates (e.g. RMB100,000 (±10%) to indicate that the item is expected to cost between a range of values)

7.1.3.4. Determine Budget

Determining Budget means aggregating the estimated costs of individual activities or work packages to establish an authorized cost baseline. Therefore, the expenditure of funds should be reconciled with any funding limits on the commitment of funds for the project.

Cost Performance Baseline
The cost Performance Baseline is an authorized time-phased budget at completion (BAC) used to measure, monitor, and control overall cost performance on the project. It is typically displayed in the form of an S-curve. The cost performance baseline is a component of the project management plan.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Resource</th>
<th>Effort</th>
<th>Rate</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1.1.3</td>
<td>AA4</td>
<td>10 hours</td>
<td>CNY 200</td>
<td>CNY 2,000</td>
</tr>
<tr>
<td>1.1.1.4</td>
<td>AA2</td>
<td>30 hours</td>
<td>CNY 400</td>
<td>CNY 12,000</td>
</tr>
<tr>
<td>1.1.1.4</td>
<td>AA8</td>
<td>25 hours</td>
<td>CNY 150</td>
<td>CNY 3,750</td>
</tr>
<tr>
<td>1.1.1.6</td>
<td>AA11</td>
<td>8 hours</td>
<td>CNY 300</td>
<td>CNY 2,400</td>
</tr>
<tr>
<td>Total Budget</td>
<td></td>
<td></td>
<td></td>
<td>CNY 20,015</td>
</tr>
</tbody>
</table>

Fig. B-74: Budget Example
7.1.3.5. Control Costs

When Controlling costs phase, we need to monitor the status of the project to update the project budget and manage changes to the cost baseline.

7.1.3.5.1. Earned Value Management (EVM)

We use Earned Value Management System (EVMS) that is a commonly used method of performance measurement. It integrates project scope, cost, and schedule measures to help the project management team assess and measure project performance and progress. It is a project management technique that requires the formation of an integrated baseline against which performance can be measured for the duration of the project.

We refer to Earned Value (EV) when assigning a CNY value to a component of scheduled project work.

7.1.3.5.1.1. Procedure

To conduct EVM analysis, the reader must follow this guideline:

1) Collect all necessary performance reports
2) Collect Actual Costs (AC) performance
3) For each task, compute the value earned (EV) based on planned value (PV)
4) Compute a schedule variance (SV) and compute the cost variance (CV)

Planned Value (PV)
The authorized budget assigned to the work to be accomplished for an activity or WBS component.

Actual Cost (AC)
Total costs actually incurred and recorded in accomplishing work performed for an activity or WBS component.

Earned Value (EV)
The value of work expressed in terms of the approved budget assigned to that work for an activity or WBS component.

SV and CV are defined in EVM Formulas section (B-7.1.8.5.1.3).
7.1.3.5.1.2. Methods

PMBOK (5th Edition) proposes the following five Earn Value Management methods:

- **Level of Effort (LOE)**
  Credit given per time percentage (if you reached the 20% of time, you will get the 20% of the credit).

- **Percent Complete**
  Credit given per work percentage (if you achieved the 20% of work, you will get the 20% of credit).

- **0-100%**
  No credit for the start, but 100% upon completion.

- **50-50**
  Half value when started, with the remainder upon completion.

- **Weighted Milestones**
  Credit given upon milestone completion.

7.1.3.5.1.3. EVM Formulas

When performing EVM analysis we should use the following indexes:

<table>
<thead>
<tr>
<th>Index</th>
<th>Formula</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schedule Variance (SV)</td>
<td>$SV = EV - PV$</td>
<td>Negative value means behind schedule</td>
</tr>
<tr>
<td>Schedule Performance Index</td>
<td>$SPI = \frac{EV}{PV}$</td>
<td>Value less than 1.0 means behind schedule</td>
</tr>
<tr>
<td>Cost Variance (CV)</td>
<td>$CV = EV - AC$</td>
<td>Negative value means over budget</td>
</tr>
<tr>
<td>Cost Performance Index (CPI)</td>
<td>$CPI = \frac{EV}{AC}$</td>
<td>Value less than 1.0 means over budget</td>
</tr>
</tbody>
</table>
7.1.3.5.1.4. Forecasting

When forecasting, we have three different indexes.

**Budget at Completion (BAC)**
- The sum of all budgets allocated to a project.
- It is synonymous with the term "Performance Measurement Baseline (PMB)"

**Estimate at Completion (EAC)**
- A value expressed in either CNY and/or hours.
- Represent the projected final costs of work when completed.

**Estimate to Complete (ETC)**
- The value expressed in either CNY or hours developed.
- Represent the cost of the work required to complete a task.

EAC can be estimated using the following formula:

\[
EAC = AC + ETC
\]

EAC can also be calculated by these formulas:

\[
EAC = AC + (BAC - EV) \quad \text{if Variation Eliminated}
\]

\[
EAC = AC + \frac{BAC - EV}{CPI} = \frac{BAC}{CPI} \quad \text{if Same Variation until project finishes}
\]

7.1.3.5.1.5. Advantages and Disadvantages of EVM

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓ Measures the efficiency of work in progress</td>
<td>✓ Because the technique takes a whole view, over-performance in one area may hide under-performance in another.</td>
</tr>
<tr>
<td>✓ Provides auditable and repeatable answers to:</td>
<td>✓ EVM requires considerable data administration effort.</td>
</tr>
<tr>
<td>o Current performance</td>
<td></td>
</tr>
<tr>
<td>o Future out-turn predictions</td>
<td></td>
</tr>
<tr>
<td>o Future performance improvement needs</td>
<td></td>
</tr>
<tr>
<td>✓ Provides reliable information to aid decision-making.</td>
<td></td>
</tr>
<tr>
<td>✓ Facilitates trend analysis.</td>
<td></td>
</tr>
<tr>
<td>✓ Provides data for future estimates of similar work</td>
<td></td>
</tr>
</tbody>
</table>
7.2. Social Skills

Last but not least there are the Social Skills. In this section the reader will be taught some tools and techniques about how to deal with those human resources (B-7.1.1), Stakeholders, etc.

7.2.1. Communication Management

Project Communications Management includes the processes required to ensure timely and appropriate planning, collection, creation, distribution, storage, retrieval, management, control, monitoring, and the ultimate disposition of project information.

Project managers spend most of their time communicating with team members and other project stakeholders (see Stakeholder Management section B-2.4), whether they are internal (at all organizational levels) or external to the organization.

7.2.1.1. Plan Communication Management

Plan Communication Management is the process of developing an appropriate approach and plan for project communications based on stakeholder’s information needs and requirements, and available organizational assets.

7.2.1.1.1. Communication Requirement Analysis

The analysis of the communication requirements determines the information needs of the project stakeholders. These requirements are defined by combining the type and format of information needed with an analysis of the value of that information.

The project manager should also consider the number of potential communication channels or paths as an indicator of the complexity of a project’s communications.

Number of communication channels

\[
\text{Num Com. Channels} = \frac{n (n - 1)}{2} \quad \text{where } n \equiv \text{num. of Stakeholders}
\]

Example 6 Stakeholders:

\[
\text{Channels} = \frac{6 (6 - 1)}{2} = 15
\]
7.2.1.1.2. Communication Models

![Communication Diagram](image)

The **Sender** encodes the message carefully, determines the communication method to use, send it, and confirm that the message is understood.

The **Receiver** should decode the message carefully and confirm that the message is understood.

The communication elements are the following:

<table>
<thead>
<tr>
<th>Element</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Encode</td>
<td>Translate thoughts or ideas into a language that is understood by others</td>
</tr>
<tr>
<td>Transmit message</td>
<td>Information is then sent by the sender using communication channel (medium)</td>
</tr>
<tr>
<td>Decode</td>
<td>Translate the message back into meaningful thoughts or ideas.</td>
</tr>
<tr>
<td>Acknowledge Message</td>
<td>Upon receipt of a message, the receiver may signal (acknowledge) receipt of the message but it does not necessarily mean agreement with or comprehension of the message.</td>
</tr>
<tr>
<td>Feedback / Response</td>
<td>When the received message has been decoded and understood, the receiver encodes thoughts and ideas into a message and then transmits this message to the original sender.</td>
</tr>
<tr>
<td>Noise</td>
<td>Anything that interferes with the transmission and understanding of the message.</td>
</tr>
</tbody>
</table>
7.2.1.1.3. Meetings

The Plan Communications Management process requires discussion and dialogue with the project team to determine the most appropriate way to update and communicate project information, and to respond to requests from various stakeholders for that information. These discussions and dialogue are commonly facilitated through meetings, which may be conducted face-to-face or online and in different locations, such as the project site or the customer’s site.

7.2.1.1.4. Communication Management Plan

It describes how project communications will be planned, structured, monitored, and controlled. The plan should contain, for example:

- Stakeholder communication requirements
- Information to be communicated, including language, format, content, and level of detail
- Reason for the distribution of that information
- Person responsible for communicating the information

7.2.1.1.5. Communication Matrix

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Sponsor</th>
<th>Project Tam</th>
<th>IT Director</th>
<th>Sales Manager</th>
<th>Contractor Manager</th>
</tr>
</thead>
<tbody>
<tr>
<td>What is to be</td>
<td>Project Charter, Milestone Report, Issues</td>
<td>Project Plan, Status Reports</td>
<td>Project Plan, Status Reports</td>
<td>Schedule Updates</td>
<td>RFP, System Requirements, Issues, Risk</td>
</tr>
<tr>
<td>communicated</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How is to be</td>
<td>Meetings and Plan updates</td>
<td>Meetings and Plan updates</td>
<td>E-mails, Meetings</td>
<td>E-mails</td>
<td>E-mails, Calls, Meetings</td>
</tr>
<tr>
<td>communicated</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>When is to be</td>
<td>Monthly</td>
<td>Weekly</td>
<td>Monthly</td>
<td>Monthly</td>
<td>Weekly</td>
</tr>
<tr>
<td>communicated</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Response time</td>
<td>7 days</td>
<td>2 days</td>
<td>5 days</td>
<td>7 days</td>
<td>2 days</td>
</tr>
<tr>
<td>Responsible person</td>
<td>PM</td>
<td>PM</td>
<td>PM</td>
<td>PM</td>
<td>PM</td>
</tr>
</tbody>
</table>

Fig. B-76: Communication Matrix [32]
7.2.1.2. Manage Communications

Manage communication is the process of creating, collecting, distributing, storing, retrieving, and the ultimate disposition of project information in accordance to the communications management plan.

Communication Technology
The methods used to transfer information among project stakeholders may vary significantly. For example, a project team may use techniques from brief conversations to extended meetings, or from simple written documents to extensive materials.

Factors that can affect the project are:

- The urgency of the need for information
- The availability of the technology
- Ease of Use
- The project environment
- Sensitivity and confidentiality of the information

Communication Methods
There are several communication methods that are used to share information among project stakeholders.

These methods are broadly classified as follows:

- Interactive Communication
- Push communication
- Pull communication

Communication Skills
Communications skills are part of general management skills and are used to exchange information:

- Written and oral, listening, and speaking
- Internal (within the project) and external (customer, media, public)
- Formal (reports, briefings) and informal (memos, ad hoc conversations)
- Vertical (up and down the organization) and horizontal (with peers)

<table>
<thead>
<tr>
<th>Formal Written</th>
<th>Must be used for key documents like the project plan, business case, change request forms.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formal Verbal</td>
<td>For example presentations and speeches inside the office or with customers.</td>
</tr>
<tr>
<td>Informal Written</td>
<td>E-mails are considered by PMI as a form of informal written communication.</td>
</tr>
<tr>
<td>Informal Verbal</td>
<td>Informal conversations inside and outside the office.</td>
</tr>
</tbody>
</table>
Performance Reporting
Performance reporting is the act of collecting and distributing performance information, including status reports, progress measurements, and forecasts. Performance reporting involves the periodic collection and analysis of baseline versus actual data to understand and communicate the project progress and performance as well as to forecast the project results.

Project Communication
Project communications may include but are not limited to:

- Performance reports
- Deliverables status
- Schedule progress
- Cost incurred

7.2.1.3. Control Communications
This is the process of monitoring and controlling communications throughout the entire project life cycle to ensure the information needs of the project stakeholders are met.

Information Management Systems
An information management system provides a set of standard tools for the project manager to capture, store, and distribute information to stakeholders about the project’s costs, schedule progress, and performance.

7.2.2. Team Skills
Teamwork is when people work together towards a common goal, but cannot achieve the goal alone and must therefore work in collaboration with others.

Working groups, which are delegated work through a single individual, can support the project team. The groups may not share the same objectives as the team.

The project manager should therefore decide on appropriate teaming arrangements during the planning stage of the project.

Teams tend to develop mutual accountability rather than individual accountability that might be the case in a working group. An effective team is cohesive, aware of the objectives and motivated towards achieving them. Typically, team members are likely to support each other, communicate well, share information, make decisions and work together. When a group develops into a cohesive team they are more likely to outperform other groups. However, some teams can also become too cohesive, which runs the risk therefore of losing focus on their purpose and objectives.
7.2.2.1. Team Development

The group matures and becomes productive. Some groups may get bogged down in earlier stages and never achieve maximum effectiveness.

The group is established. Individuals are anxious about their personal identity, role, the impression they make, the attitudes and backgrounds of others.

The group develops ways of working together, closer relationships are created and camaraderie. The organization, roles and working rules (norms) are established. The framework enables group members to relate to each other and deal with performance issues.

Conflicts emerge between individuals as they sort out their roles, revealing differences. It is characterised by hostility and disruption.

Fig. B-77: Team Development Phases

7.2.3. Negotiation Skills

All projects involve negotiations. The art of negotiation in projects is to balance the needs of the project with the needs of the stakeholders involved in the negotiations. In projects therefore, the aim of negotiations should be to develop a ‘win-win’ solution that is in line with the overall project objectives and needs of the stakeholders.
7.2.3.1. Negotiation Process

- **Preparation**
  - Define your objectives and get to know the other party's objectives
  - Which are the variables?
  - Define an opening offers bearing in mind whether you are going to make concessions

- **Opening**
  - Introduce parties and explain their roles
  - State your objectives and invite the other party to state their objectives
  - Agree a Loose Agenda

- **Bargaining**
  - Present your offer
  - Evaluate other party's response
  - Bargain for specifics
  - Seek agreement

- **Closing**
  - Final Trade Offs
  - Summarize Agreements and Actions
  - Schedule further negotiations

*Fig. B-78: Negotiation Process*

7.2.3.2. Negotiation Power

Having done the Stakeholder Analysis (see B-2.4) that helped the PM to prepare the negotiations, he may also need to understand which type of power does that stakeholders have. Here follows a list with them:

<table>
<thead>
<tr>
<th>Power Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reward Power</td>
<td>Ability to dispense rewards to entice the other party, such as bonuses</td>
</tr>
<tr>
<td>Coercive Power</td>
<td>Threat of taking something away if one party does not accede to the desires of the other</td>
</tr>
<tr>
<td>Legitimate Power</td>
<td>One party has genuine authority over the other</td>
</tr>
<tr>
<td>Informational Power</td>
<td>An advantage gained because one party has access to relevant key information that the other party does not have</td>
</tr>
<tr>
<td>Expert Power</td>
<td>Experience that provides an advantage</td>
</tr>
<tr>
<td>Referent Power</td>
<td>Derived from reputation for fair dealing, development of long term relationships and trust</td>
</tr>
</tbody>
</table>
7.2.4. Manage up

Managing up is a method of career development that is based on consciously working for the mutual benefit of yourself and your boss. It does not mean avoiding work, rebelling, kissing up, or trying to turn the tables on a higher-up, but instead understanding your boss’ position and requirements and making yourself known as a stellar employee by exceeding his expectations and needs.

To sum up, managing the boss is a way to have a win-win situation where everyone, including the organization and project, wins. Because of the previous fact, team members and PM have to worry about those bosses and their needs. Having more than one boss makes work more difficult because they have to consider the needs or preferences of each of them. In any case, whether the reader is a manager at any level should think about managing both up and down.

7.2.4.1. Guidelines for managing up

Once the reader figured out the importance of managing up, in this section has some guidelines’ introduction and definition. [43]

- **Communicate**

  Make sure that the communication is two-way. Good communication skills are the basis for being able to succeed in almost every situation and this can be verbal or written. Some bosses are readers, meaning they prefer to receive the information first in written form, so that they can digest and understand the issue before meeting to discuss it. Others are listeners; prefer to get the information verbally. If you want your ideas to be heard, understood and acted upon, make it easy for your boss by communicating in the manner with which he is most comfortable.

  L.Knowdell, author of “Building a Carreer Development Program: Nine Steps for Effective Implementation” said:
  
  “If we want someone to understand what we have to say, we must learn to speak their language, rather than expect them to learn ours”

  By learning your boss' language you can accomplish what you need, help the boss succeed and make the project and the organization a success.

- **No surprises**

  Don’t surprise the boss. Most readers can cite examples of bringing the boss what they thought were good news, only to find out later that it that it wasn’t so good after all. Let her know what is happening with the project. It may be a quick meeting in her office, a daily, weekly, or monthly e-mail or some other exchange.
**GPM fit into a Chinese Environment**  **Module B: The discipline of PM and Sustainability**

 ✓ **Provide Solutions, not problems**

There are going to be problems with your project. Every project has them. But when you let your boss know about those problems, give him your proposed solution or solutions. That shows him that you have thought the situations through. There are supervisors who seem to want to hear only good news; they don’t want to hear about problems. Those bosses represent a particular challenge. It is up to you to help your boss face problems head on with courage and innovation. For the good of the project and the organization, you must communicate problems and failures with the successes, but do so delicately and appropriately. That’s when providing him proposed solutions to the problems can really pay off.

 ✓ **Be honest and trustworthy**

Dishonesty, covering up problems or failures, and trying to sweep things under the rug will only hurt you and the project in the long run. The truth will come out eventually. Bad news doesn’t get any better with age. A key element in managing your boss is building trust by being trustworthy. Maintain your honesty and dependability so a way of doing this is honoring commitments, project schedules and constraints. The best way is just honest and forthright communication.

 ✓ **Be loyal and committed**

He is your boss and you owe him your loyalty and commitment, and he owes you her support. If you don’t do your part, chances are that she won’t do hers. And that’s bad for you and the project.

 ✓ **Understand your boss’ perspective and agenda**

That way, you can align your priorities with your boss’s priorities. Put yourself in his shoes. While many people think that they have an understanding of their boss’s goals and pressures, they don’t always understand the strengths, weaknesses, aspirations, and work styles of their supervisors, or the pressures and constraints on them. Exploring these will help you identify commonalities you never knew existed and gain a little insight on how to better interact effectively with your boss.

 ✓ **Understand your boss’ preferences and try to conform to them**

If he wants a daily report on what has been accomplished, give it to him. If he wants the big picture and not the details, give it to him that way. If he wants something in a specific format, give it to her. That doesn’t mean that you can’t try to show her a better way, but remember to use tact and diplomacy. If you get crosswise with your boss, even over something minor, you may never be able to undo the damage.

One of the worst mistakes you can make is to assume you know what your boss expects. Many bosses don’t spell out their expectations, and the burden of discovery falls to you. If he doesn’t
give you the information that you need, initiate one or a series of informal discussions on “our” objectives. This can help your boss clarify and communicate his ideas, plans, and needs to you; and it gives you the chance to communicate your own ideas as well. Together, set realistic expectations that you both agree on. They include expectations on schedule, costs, and the final product. The emphasis is on the realistic, do not set expectations too high or you will ruin your credibility when they are not met. Don't intentionally set them low. That won't help you either.

✓ Understand your own management style

Developing an effective working relationship with your boss requires that you understand yourself and your management style. Recognize your own strengths, weaknesses, goals, and personal needs; how you respond to being managed; and how others respond to you. Be aware of the effect that you have on others and their reaction to you, especially those under you. If you don’t, you could be in for a surprise when you meet with the boss, especially at appraisal time.

✓ Depend on your boss’ strengths and use them

Depend on your boss's strengths and use them. You need to determine his strengths. Whether those strengths are communication, seeing the big picture, resource management, new ideas, or something else, go to your boss for his expertise. Get him to use his particular skills for the project. Remember, though, that time is a precious commodity for most managers. Effectively managing your boss requires that you respect his time. Every request made of the boss uses up his time and resources, so make sure your requests are necessary. Use his strengths, but if you can do it yourself, don't waste his time.

✓ Recognize your boss’ weaknesses and compensate for them

He is not going to be good at everything. It is up to you to figure out where he is weak and provide your support in those areas. You might just want to intentionally try doing something to make life easier for your boss. Maybe you can build the slides for her briefings, track the finances, monitor the schedule, or provide the support that she needs in some area. Perhaps your boss will spend that extra time or effort that you saved her to advocate for your project’s needs.

✓ Be aware of your manager’s hot buttons

Being late to meetings or not contributing, sloppy memos or e-mails, swearing, a loud radio, etc. Sounds obvious, but whatever they are, consider them land mines to be avoided. Ignoring them (or not understanding them) can sour your relationship with the boss. And that can mean an unsuccessful project because you didn’t get the support that you needed.
✓ Request feedback and learn to accept it

Request periodic feedback if you aren’t getting it. Don’t wait for the annual appraisal to find out the boss’s opinion of you and your work. If you get bad feedback, discuss your concerns, but do it on a mature level, not emotionally or confrontationally. As in a marriage, the best approach is non-adversarial. Listen to what he says and try to act on it.

✓ Do not go over the boss’ head or behind her back

That is not the way to manage up and can permanently ruin the relationship with the boss. Go to him first. If it is something very serious and he does nothing, you might have to go over her head. In some cases he may be the serious problem and you can’t confront him.

7.2.5. Conflict Management

Conflict exists where there are differences between individuals or groups and must be managed throughout the project life cycle.

Conflict may occur between stakeholders throughout the life cycle. PMs should anticipate potential conflicts and their significance and deal with them before they cause negative impacts on the project.

Often conflict is caused through lack of understanding, lack of facts or because individuals have different interests, beliefs and values. Conflict may either be destructive (having an adverse effect on a project) or constructive (positive benefit).

If conflicts cannot be resolved, they may need to be escalated to higher authorities, or specialist facilitators.

![Fig. B-79: Model of Conflict Progression](image)
This following bulleted point list is about concepts we have to bear in mind when dealing with conflicts:

- Conflict is the emotional, verbal, written or physical expression of differences regarding wants, needs or expectations between two or more individuals.
- Conflict directly impacts behaviour, decision-making and the ability to complete assigned tasks.
- Conflict is inevitable in the workplace; it cannot be eliminated.
- The key to a functional workplace is the ability to minimize the escalation of conflict and ultimately resolve the differences.

### 7.2.5.1. Costs of Conflict

Conflicts have both, qualitative and quantitative effects. Here it follows a brief list of some of that costs:

**Qualitative Costs of Conflict**

- Stress, frustration and anxiety
- Loss of sleep
- Loss of productivity
- Employee turnover
- Employee Absenteeism
- Presenteeism
- Grievances and Litigation
- Strained or broken relationships
- Decrease in customer service quality
- Injury and accidents
- Disability claims
- Sabotage

**Quantitative Costs of Conflict**

- The total value of lost work time due to stress is estimated to be $1.7 billion. *(WarrenShepel online, Health & Wellness Research Database, 2005)*
- The rate of presentee-ism is estimated to be up to three times higher than absentee-ism.
- Conflict accounts for up to 90% of involuntary departures *(Dani, Dan, [online] The Dana Measure of Financial Cost of Organizational Conflict, 2001)*
- 42% of a Manager’s Time is spent addressing conflict in the workplace. *(Watson, C & Hoffman, R, Managers as Negotiators, Leadership Quarterly 7(1), 1996)*
7.2.5.2. Conflict Management Model

In this section we are going to show the Conflict Management Model diagram and explain one by one its elements and useful techniques [44].

Causes and effects Analysis → Root Causes

Stakeholder Analysis (see B-2.4) → Stakeholder needs and power

Fig. B-80: Conflict Analysis Model Diagram

The model is based on the work of Blake and Mouton and provides a framework for understanding and resolving conflict.

<table>
<thead>
<tr>
<th>Causes</th>
<th>The subjects such as timescales, or priorities, changes.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sources</td>
<td>The people involved in the conflict</td>
</tr>
<tr>
<td>Conflict</td>
<td>The nature of the problem or issue, and its intensity.</td>
</tr>
<tr>
<td></td>
<td>Intensity may be defined as the combination of magnitude (say impacts on project objectives) and frequency (how often the conflict occurs).</td>
</tr>
</tbody>
</table>

Two techniques that support conflict management are:

✓ **Cause and Effects Analysis**

   Establishing the root cause will help to determine how often it is likely to occur and will enable conflict intensity to be determined. Root causes often lead to the definition of preventive measures.

✓ **Stakeholder Analysis**

   Understanding the needs and influences of the stakeholders will help to prevent conflict situations arising, or in the event of conflict, it will enable effective management strategies to be used.

Appropriate risk management may also cover preventing conflict.
A number of methods may be used to manage conflict such as formal negotiations, mediation and workshops, depending on the nature of the conflict and stakeholders involved.
7.2.5.3. Conflict through the Life Cycle

Conflict occurs throughout the project. The nature and scale of conflict is directly related to the activities undertaken and the stakeholders involved. Understanding where and who might be involved in the conflict will help the Project Manager in its early identification and resolution.

<table>
<thead>
<tr>
<th>Project Lifecycle</th>
<th>Concept</th>
<th>Definition</th>
<th>Implementation</th>
<th>Handover and Closure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Causes</td>
<td>✅ Ideas</td>
<td>✅ Benefits</td>
<td>✅ Schedules</td>
<td>✅ Acceptance</td>
</tr>
<tr>
<td></td>
<td>✅ Benefits</td>
<td>✅ Requirements</td>
<td>✅ CSC priorities</td>
<td>✅ Snags</td>
</tr>
<tr>
<td></td>
<td>✅ Options</td>
<td>✅ Options</td>
<td>✅ Resources</td>
<td>✅ Demobilization</td>
</tr>
<tr>
<td></td>
<td>✅ Funding</td>
<td>✅ Funding</td>
<td>✅ Changes</td>
<td>✅ Handover Activities</td>
</tr>
<tr>
<td></td>
<td>✅ Success Criteria</td>
<td>✅ Success Criteria</td>
<td>✅ Tech &amp; Performance Issues</td>
<td>✅ Risks</td>
</tr>
<tr>
<td></td>
<td>✅ Risks</td>
<td>✅ Risks</td>
<td>✅ Risks</td>
<td></td>
</tr>
</tbody>
</table>

*Fig. B-81: Conflict in Project Lifecycle Sources and Causes Matrix*

7.2.5.4. Conflict Resolution

The diagram below based on Thomas Kilmann Model [44], shows strategies for managing conflict.

*Fig. B-82: Conflict Resolution Matrix*
### GPM fit into a Chinese Environment

<table>
<thead>
<tr>
<th>Competition</th>
<th>I Win - You Loose</th>
<th>Where one party drives to meet their own interests and disregards the other’s interests</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avoidance</td>
<td>I Loose – You Loose</td>
<td>Withdrawing from conflict; where one party is unable to influence the more dominant party and wishes to avoid conflict.</td>
</tr>
<tr>
<td>Accommodation</td>
<td>I Loose – You Win</td>
<td>The party is prepared to submit or comply with the other's interests.</td>
</tr>
<tr>
<td>Compromise</td>
<td>We win some</td>
<td>Parties trade gains against losses.</td>
</tr>
<tr>
<td>Collaboration</td>
<td>I Win – You Win (w2w)</td>
<td>Typically found in high performing teams, a problem solving style where parties confront issues and seek solutions that meet the interests of both parties.</td>
</tr>
</tbody>
</table>

#### 7.2.6. Leadership

Leadership is the ability to:
- Establish vision and direction
- Influence and align others towards a common purpose
- Empower and inspire people to achieve project success

#### 7.2.6.1. Leadership Focus

John Adair identified three overlapping areas of core responsibility: Task, Team and Individual.

Effective leaders are able to balance their focus in these areas according to the situation. If there is too much focus in one area it will have a detrimental effect on the others. Conversely, each area has a positive influence on the others if properly balanced. For example a well thought out Project Management Plan provides effective guidance to the individual and the team. However, a well though out plan can only be achieved through awareness of the team and individual’s needs [45].
7.2.6.2. Leadership Styles

Depending on which stakeholder you are facing to, may differ the leadership style you perform. Its not the same dealing with your new junior engineer intern than to the CEO and sponsor of your project.

In leadership field we can distinguish the following styles:

<table>
<thead>
<tr>
<th>Leadership Style</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Directing</td>
<td>Dictate other what to do</td>
</tr>
<tr>
<td>Facilitating</td>
<td>Coordinating the inputs of others</td>
</tr>
<tr>
<td>Coaching</td>
<td>Instructing others</td>
</tr>
<tr>
<td>Supporting</td>
<td>Providing assistance along the way</td>
</tr>
<tr>
<td>Delegating</td>
<td>Giving the responsibility and authority to the other person</td>
</tr>
<tr>
<td>Autocratic</td>
<td>Making decisions without anyone else’s input</td>
</tr>
<tr>
<td>Consensus</td>
<td>Problem solving in a group with decision-making based on group agreement.</td>
</tr>
</tbody>
</table>
### 7.2.6.3. Project Manager. Leader or Manager?

*Which makes the best Project Manager?*

<table>
<thead>
<tr>
<th>Manager</th>
<th>Leader</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analytical, structures, controlled, deliberate, orderly</td>
<td>Experimental, visionary, flexible, undeterred, creative</td>
</tr>
<tr>
<td>Uses the power and logic of the rational mind</td>
<td>Used the power of intuition and logic of the heart</td>
</tr>
<tr>
<td>Considers the dangers</td>
<td>Senses opportunity</td>
</tr>
<tr>
<td>Concentrates on short-term results</td>
<td>Focuses on long-term results</td>
</tr>
<tr>
<td>Follows visions</td>
<td>Create visions</td>
</tr>
<tr>
<td>Pursues the tangible</td>
<td>Searches for potential</td>
</tr>
<tr>
<td>Performs duties</td>
<td>Pursues dreams</td>
</tr>
<tr>
<td>Controls</td>
<td>Inspires</td>
</tr>
<tr>
<td>Depends on authority</td>
<td>Depends on influence</td>
</tr>
</tbody>
</table>
Module C

Case of Study: GPM Training Program Project
In this Module C, the reader is going to get some examples of the hard skills developed in module B. As the project took so many activities, in order not to miss the focus, the writer decided just showing a short sample of each skill. The hard skills developed in this module are as follows:

- Objective’s definition using Sponsor Management and PRiSM P5 Methodology.
- Stakeholder Management
- Scope Management
- Time Management
- Some Quality Management Tools
- Risk Management
- Communication Management

### 1. Sponsor’s meeting and Objectives.

The very first thing in every project is the initial meeting with the sponsor. In my particular case he was Jesus Hernandez, Managing Director of Gold Millennium Group (from now on referred as GMG).

In that meeting we were supposed to discuss about the objectives of the project. Eventually we agreed on the following objectives:

1.1. Build-up a 4-day GPM training, as well as all the material required in it (slides, exam preparation, exercises, etc.)
1.2. Build-up a 2-day GPM training, as well as all the material required in it.
1.3. Find locations to administrate GPM-b certification exams and take contact with them.
1.4. Write this thesis and perform a presentation towards Beijing Jiaotong University board.
1.5. Applying PRiSM GPM P5 methodology, I came up with the following sustainable objectives which reduce a 7.33% the Environmental Impact (see Annex C1):
   - 1.5.1. Web based GPM-b practice exams
   - 1.5.2. Plasticized Training Templates
   - 1.5.3. E-Templates after trainings
   - 1.5.4. Ability to work from home
   - 1.5.5. Just printing key documents
   - 1.5.6. Perform Train The Trainer (TTT) Materials
   - 1.5.7. Use of virtual communication tools
   - 1.5.8. Use of local resources
   - 1.5.9. Use of local procurement
   - 1.5.10. Over 50% of the resources are women

To be able to do so, JESUS and Beijing Jiaotong University proceeded giving me the following resources and time:

- A Lead consultant (VIVIAN), a PMP trainer (TINA) and an account manager (SUMMER).
- 50% of my working time.
- Thesis time deadline on the 27th of June.
2. Stakeholder analysis and meeting

Once we have the objectives already defined, we proceed on listing and analyzing the main project stakeholders.

2.1. Stakeholder’s description

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Description</th>
<th>Picture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jesús Hernández 韩树梓</td>
<td>JESUS is the Managing Director of GMG (金色千年咨询有限公司) and the sponsor of this project. He will also be one of the trainers that will use the GPM training that I am performing. He is the only person in the steering committee of this project too.</td>
<td><img src="image1.png" alt="Picture" /></td>
</tr>
<tr>
<td>Javier Hernández 韩威</td>
<td>JAVIER is the CEO of GMG (金色千年咨询有限公司) and is in charge of the company’s legal services. Even though he is not in Project Management department, hardly ever he gives me extra work in some administrative areas.</td>
<td><img src="image2.png" alt="Picture" /></td>
</tr>
<tr>
<td>Pablo 夏保罗</td>
<td>PABLO is the GMG Beijing office director. He focus most of his time in Business Development consulting so, sometimes, he asks me, as an intern, to do some non-related to Project Management work for him.</td>
<td><img src="image3.png" alt="Picture" /></td>
</tr>
<tr>
<td>Vivian 吴昱旻</td>
<td>VIVIAN is a lead project management consultant in GMG Beijing office. As Jesus, she will also be one of the trainers that will use these GPM training materials.</td>
<td><img src="image4.png" alt="Picture" /></td>
</tr>
<tr>
<td>Tina 贾晓菁</td>
<td>TINA is a PMP trainer in Chinese language. She works in GMG Beijing office. When this GPM training program is done, she will be a GPM trainer as well. From time to time, she asks me to help her in some English-Chinese translation issues.</td>
<td><img src="image5.png" alt="Picture" /></td>
</tr>
<tr>
<td>Name</td>
<td>Role</td>
<td>Details</td>
</tr>
<tr>
<td>----------------------</td>
<td>----------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Summer</strong></td>
<td>SUMMER is an Account manager of Project Management training (PMP and GPM) who works in GMG Beijing office. She also prepares all the material to be ready before each training starts and, from time to time, she asks me for some help in that field.</td>
<td></td>
</tr>
<tr>
<td><strong>Oriol Vaquer</strong></td>
<td>ORIOL is the Project Manager. I am writing this Thesis and developing this project thanks to the association of UPC, Beijing Jiaotong University and GMG.</td>
<td></td>
</tr>
<tr>
<td><strong>Irene Ondó</strong></td>
<td>IRENE is a Business Development intern in GMG Beijing office. She asks me for some help from time to time, but not really often.</td>
<td></td>
</tr>
<tr>
<td><strong>Álvaro Torras</strong></td>
<td>ÁLVARO is a Business Development intern in GMG Beijing office. He asks me for help really often in his Spanish to English translation works as well as other minor tasks.</td>
<td></td>
</tr>
<tr>
<td><strong>Beijing Jiaotong University</strong></td>
<td>BEIJING JIAOTONG UNIVERSITY, in particular Professor Tang (唐天巧), is where I am doing this Thesis thanks to its association with Universitat Politècnica de Catalunya (ETSEIB-UPC). This university will be the one that assesses my thesis.</td>
<td></td>
</tr>
<tr>
<td><strong>Joel Carboni</strong></td>
<td>JOEL is the GPM Global President and writer, among others, of PRiSM and GPM P5 Standard for Sustainability in Project Management. Because of that, he is the designer of the theory that I am doing the training project of.</td>
<td></td>
</tr>
<tr>
<td><strong>Shakira</strong></td>
<td>SHAKIRA is an Account Manager Assistant in GMG Shanghai office. After some negotiations with the sponsor, she was added to the PM Resources. Nevertheless, she has other tasks to do, so she usually pulls back in the current project.</td>
<td></td>
</tr>
</tbody>
</table>
### Ashley

ASHLEY is an Account Manager of project management training in GMG Shanghai Office. After some negotiations with the sponsor, she was added to the PM Resources.

### Xavier Horta

XAVIER Horta is a Graphic Designer. He works in a Beijing Retail Design company. I required his services in the building up of the front and back cover of the thesis.

### Beijing Silverpeony Printing Co. Ltd

Beijing SILVERPEONY Printing Co. Ltd, is the company in charge of printing the project materials (off house).

### Them Web Design

THEM Web Design, is the company in charge of the web page design with all the training and practicing materials that the PM consider that should be included (off house).

### Trainees

TRAINEES are the people that the training programs I am designing will be faced towards to.

---

*Fig. C-1: Project Stakeholder’s description*
Remembering the Stakeholder Management diagram (Part B 2.4.1 Figure) we proceed on how to deal with those Stakeholders:

<table>
<thead>
<tr>
<th>Backer</th>
<th>MOTIVATE</th>
<th>ENCOURAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓ TINA</td>
<td>✓ JESUS</td>
<td></td>
</tr>
<tr>
<td>✓ SUMMER</td>
<td>✓ TRAINEES</td>
<td></td>
</tr>
<tr>
<td>✓ JOEL</td>
<td>✓ VIVIAN</td>
<td></td>
</tr>
<tr>
<td>✓ BJTU</td>
<td>✓ ORIOL</td>
<td></td>
</tr>
<tr>
<td>✓ ASHLEY</td>
<td>✓ SILVERPEONY</td>
<td></td>
</tr>
<tr>
<td>✓ XAVIER</td>
<td>✓ THEM</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Blocker</th>
<th>TELL</th>
<th>SELL</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓ ÁLVARO</td>
<td>✓ PABLO</td>
<td></td>
</tr>
<tr>
<td>✓ IRENE</td>
<td>✓ JAVIER</td>
<td></td>
</tr>
<tr>
<td>✓ JAVIER</td>
<td>✓ TRAINEES*</td>
<td></td>
</tr>
<tr>
<td>✓ SHAKIRA</td>
<td>✓ THEM</td>
<td></td>
</tr>
</tbody>
</table>

**Fig. C-2: Project Stakeholder’s matrix I**

We will proceed by building-up the second stakeholder management tool explained in the previous part (2.4.2); called defining the framework for stakeholder analysis.

<table>
<thead>
<tr>
<th>Against the Project</th>
<th>For the Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td><strong>Influence</strong></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>✓ PABLO</td>
</tr>
<tr>
<td>✓ JAVIER</td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>✓ ÁLVARO</td>
</tr>
<tr>
<td>✓ IRENE</td>
<td>✓ TINA</td>
</tr>
<tr>
<td>✓ SHAKIRA</td>
<td>✓ ASHLEY</td>
</tr>
<tr>
<td>✓ XAVIER</td>
<td>✓ XAVIER</td>
</tr>
<tr>
<td>✓ TRAINEES*</td>
<td>✓ TRAINEES*</td>
</tr>
</tbody>
</table>

**Fig. C-3: Project Stakeholder’s matrix II**

* This project consists in building-up some training programs, while I am building them up; TRAINEES are not really for the project. Nevertheless, when the project is over, they will.

To know how to deal with each stakeholder, we need to know what power has each stakeholder and how interested are in the project (Fig. C-3). Afterwards, its also important to bear in mind what does each stakeholder want from the project.
<table>
<thead>
<tr>
<th>Stakeholder (Name and Title)</th>
<th>Power (0 ~ 5)</th>
<th>Interest (-5 ~ 5)</th>
<th>Wants / Needs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Jesus</strong> (韩树梓) Project Sponsor GMG Managing Director</td>
<td>5</td>
<td>5</td>
<td>To have good GPM training materials in order to sell these trainings to GMG clients.</td>
</tr>
<tr>
<td><strong>Javier</strong> (韩威) GMG CEO</td>
<td>5</td>
<td>0</td>
<td>He doesn’t get really involved in this project. From time to time he requires my help in some little administrative tasks.</td>
</tr>
<tr>
<td><strong>Pablo</strong> (夏保罗) GMG Beijing Office Director</td>
<td>4</td>
<td>-3</td>
<td>Wants the delivery of other materials not training related.</td>
</tr>
<tr>
<td><strong>Vivian</strong> (吴昱旻) GMG PM Lead Consultant</td>
<td>3</td>
<td>3</td>
<td>Improved materials to deliver the GPM trainings</td>
</tr>
<tr>
<td><strong>Tina</strong> (贾晓菁) GMG PM Consultant</td>
<td>2</td>
<td>2</td>
<td>Improved materials to deliver the GPM trainings</td>
</tr>
<tr>
<td><strong>Summer</strong> (田红艳) GMG Beijing Office Account Manager</td>
<td>2</td>
<td>2</td>
<td>Increase her PMP and GPM sales rate.</td>
</tr>
<tr>
<td><strong>Oriol</strong> (王傲龙) Project Manager</td>
<td>3</td>
<td>5</td>
<td>Complete the project objectives within the Scope, Time and Cost given by the sponsor. To hand in a good quality thesis in order to get a good score by the assessors (BJTU).</td>
</tr>
<tr>
<td><strong>Irene</strong> (爱琳)</td>
<td>0</td>
<td>-1</td>
<td>To use my working time to help her in Business Development tasks.</td>
</tr>
<tr>
<td><strong>Álvaro</strong> (艾涛) GMG Business Intern</td>
<td>0</td>
<td>-3</td>
<td>To use my working time to help him in Business Development tasks.</td>
</tr>
<tr>
<td><strong>BJTU</strong> (北京交通大学) <strong>Dr. Tang</strong> (唐天巧) Thesis Assessor</td>
<td>5</td>
<td>0</td>
<td>The thesis project to be handed in and presented towards their board before 25th June 2014.</td>
</tr>
<tr>
<td><strong>Joel</strong> President GPM Global</td>
<td>3</td>
<td>5</td>
<td>To spread out GPM around China. Because of that, he supports completely this project.</td>
</tr>
<tr>
<td><strong>Shakira</strong> (沙漱慧) GMG Shanghai Account Manager Assistant</td>
<td>1</td>
<td>-3</td>
<td>Wants to increase sales but she doesn’t want to do the translations.</td>
</tr>
<tr>
<td><strong>Ashley</strong> (马妮) GMG Shanghai Account Manager</td>
<td>2</td>
<td>1</td>
<td>To have good materials and reputation in order to sell more trainings to Shanghai area clients.</td>
</tr>
<tr>
<td><strong>Xavier</strong> Graphic Designer</td>
<td>0</td>
<td>0</td>
<td>Need the front and back cover information as soon as possible</td>
</tr>
<tr>
<td><strong>Silverpeony</strong> Printing Company</td>
<td>1</td>
<td>5</td>
<td>Have the materials as soon as possible.</td>
</tr>
<tr>
<td><strong>Them Web Design</strong> Web Design Company</td>
<td>2</td>
<td>5</td>
<td>Have all the materials as soon as possible.</td>
</tr>
<tr>
<td><strong>Trainees</strong></td>
<td>0</td>
<td>3</td>
<td>Want the best quality training design in order to pass GMP-b exam, as well as learn as much as possible to apply this knowledge in their projects.</td>
</tr>
</tbody>
</table>

*Fig. C-4: Stakeholder’s power, interest and needs analysis*
Stakeholder Analysis Conclusions

After performing the Stakeholder Analysis, we must proceed extracting its conclusions. Those will be taken by looking at the Project Stakeholder’s matrix that show us how to deal with each stakeholder (Fig. C-2) and the Stakeholder’s power, interests and needs analysis (Fig. C-3).

- ORIOL is the project manager. He is really interested in his project indeed.
- PABLO is the most dangerous stakeholder because he has more power than us and he is really against spending my time in this project. Because of that we have to “SELL” him. That means we have to use another stakeholder who has more power than he does to handle him; in this case it is going to be JESUS, who is really interested in this project (actually he is the project sponsor).
- JAVIER and BJTU; even though they have a lot of power, they are not interested in the project so they will not make trouble.
- JESUS and JOEL have a lot of power and are really interested in the project. That means that we have to encourage them in order not to decrease their interest. On top of that, we need JESUS to handle PABLO, so his interest in the project is vital.
- VIVIAN and TINA are interested in the project because they are going to use these materials, but in a passive way. This is because they think of it as in a long-term scope. The PM has to both, motivate and encourage them in order them not to become a blocker in the project.
- As account managers both, ASHLEY and SUMMER are interested in the project because they will send all these materials. Because of that, we must motivate them because, if we need their help, it would be really handy.
- SHAKIRA is a clear blocker to the project because she is going to work in it, but she wants to spend her time doing his ordinary tasks. Because of that, we will use her supervisor, ASHLEY, to manage her. She is not a big problem because of his low power in the project.
- IRENE and specially ÁLVARO require my help really often, which means that they take part of my time and this delays the project. Because of the previous fact they are passive blockers to the project. Nevertheless, as they have really low power, the project manager himself can manage them.
- XAVIER and TRAINEEES are not a problem to the project due to their low power in it.
2.2. **Project Boundaries**

Listing the project Boundaries is really important in order to let your stakeholders know what the Project Manager is going to do and, even more important, what is not going to do.

<table>
<thead>
<tr>
<th>IN the Project</th>
<th>OUT the Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓ Read PMBOK and GMG PMP slides</td>
<td>✓ Translate the materials into Spanish</td>
</tr>
<tr>
<td>✓ Read PRISM</td>
<td>✓ Translate the materials into Italian</td>
</tr>
<tr>
<td>✓ Read ISO 9000, 21500, 14000, 50001 and 26000</td>
<td>✓ Translate the materials into Greek</td>
</tr>
<tr>
<td>✓ Read GPM Headquarters slides.</td>
<td>✓ Read other ISOs</td>
</tr>
<tr>
<td>✓ Remove non interesting slides</td>
<td>✓ Build-up slides for 1-day training</td>
</tr>
<tr>
<td>✓ Create extra slides</td>
<td>✓ Make templates (RACI, Stakeholder analysis, Risk management, etc.)</td>
</tr>
<tr>
<td>✓ Create exams of each chapter of PRISM for trainee preparation.</td>
<td>✓ Create new training exercises</td>
</tr>
<tr>
<td>✓ Build-up slides for the 4-day training.</td>
<td>✓ Train people</td>
</tr>
<tr>
<td>✓ Build-up slides for the 2-day training.</td>
<td>✓ Create videos about related topics of GPM</td>
</tr>
<tr>
<td>✓ Look for videos about related topics of GPM.</td>
<td>✓ Website Development</td>
</tr>
<tr>
<td>✓ Analyze Project Delays data record</td>
<td>✓ Learn how to use extra software</td>
</tr>
<tr>
<td>✓ Identify certification exam centers</td>
<td>✓ Analyze other kind of data record</td>
</tr>
</tbody>
</table>

*Fig. C-4: Initial project boundaries*

Once the Project Boundaries are defined, we should rewrite them for your stakeholders in a document called, Scope statement.
2.3. Scope Statement

The scope statement is a document that needs to be signed by the sponsor in order to start the work.

Assumptions
✓ JESUS must review all the training material after designing it.
✓ Every change done to the original GPM slides must be commented and approved by JOEL.
✓ There are universities interested in becoming training exam centers.
✓ There are enough resources to translate the materials into Chinese.

Constraints (restrictions, etc.)
✓ The Thesis must be over before 25\textsuperscript{th} July 2014
✓ Materials must be aligned with the PRISM so that the participants can pass the exam
✓ Exams and materials must be in Chinese.

Issues (they are not problems, they are like question marks)
✓ Are we going to have an online system for practicing the exams?
✓ Are we going to train some universities to deliver these programs?

Project Boundaries
✓ Fig. C-4

Recommendation: Do not add the "OUT of the Project" to the scope statement before getting signed. After you get the signature is the moment to show it to the steering committee. Then, the Project Manager will be in a better position to negotiate.
2.4. Stakeholder negotiation.

After the Stakeholders have read the Scope Statement, the negotiations with the Project Manager proceeds. As in the Scope Statement is written what the Project Manager is not going to do, some stakeholders may request that some of those may change to the “IN the project” list. Nevertheless, the Project Manager can ask for extra resources (more money, more time, etc.)

In my particular project these were the negotiations in that meeting:

- JESUS wanted me to Build-up slides for 1-day training because the previous day, he received an email from the European Chamber of Commerce in China saying that they wanted this training.
- JESUS also wants a website development to make a high-tech company impression to the trainees.
- JESUS wanted me to build-up two slides showing an example of FPIF and CPIF in the procurement management section.
- SUMMER realized that there were not enough exercises in the original GPM training material, so he wanted me to create new exercises of Crashing in the green time management section.
- TINA wanted me to train her training department in the new concepts of GPM and of the new exercises that SUMMER wanted me to do.
- VIVIAN wanted me to show my WBS and schedules using CLARIZEN software.

Using the previous negotiations, these were the Project Boundaries after the Stakeholder meetings.

<table>
<thead>
<tr>
<th>IN the Project</th>
<th>OUT the Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>Read PMBOK and GMG PMP slides</td>
<td>Translate the materials into Spanish</td>
</tr>
<tr>
<td>Read PRISM</td>
<td>Translate the materials into Italian</td>
</tr>
<tr>
<td>Read ISO 9000, 21500, 14000, 50001 and 26000</td>
<td>Translate the materials into Greek</td>
</tr>
<tr>
<td>Read GPM Headquarters slides.</td>
<td>Read other ISOs</td>
</tr>
<tr>
<td>Remove non interesting slides</td>
<td>Make templates (RACI, Stakeholder analysis, Risk management, etc.)</td>
</tr>
<tr>
<td>Create extra slides</td>
<td>Create videos about related topics of GPM</td>
</tr>
<tr>
<td>Create exams of each chapter of PRISM for trainee preparation.</td>
<td>Analyze other kind of data record</td>
</tr>
<tr>
<td>Build-up slides for the 4-day training.</td>
<td></td>
</tr>
<tr>
<td>Build-up slides for the 2-day training.</td>
<td></td>
</tr>
<tr>
<td>Build-up slides for 1-day training</td>
<td></td>
</tr>
<tr>
<td>Look for videos about related topics of GPM.</td>
<td></td>
</tr>
<tr>
<td>Analyze Project Delays data record</td>
<td></td>
</tr>
<tr>
<td>Identify certification exam centers</td>
<td></td>
</tr>
<tr>
<td>Create new training exercises</td>
<td></td>
</tr>
<tr>
<td>Train people</td>
<td></td>
</tr>
<tr>
<td>Website Development</td>
<td></td>
</tr>
<tr>
<td>Learn how to use extra software</td>
<td></td>
</tr>
</tbody>
</table>

Fig. C-5: Post-negotiation project boundaries
Because of that, they gave me these extra resources:

☑ 100% of my working time. Except for some JAVIER and PABLO local tasks.
☑ Another account manager in Shanghai office (ASHLEY).
☑ An account manager assistant in Shanghai office (SHAKIRA).

**Final Objectives**

To sum up, here are all the final objectives that need to be accomplished at the end of the project:

☑ Build-up a 4-day GPM training, as well as all the material required in it (slides, exam preparation, exercises, etc.)
☑ Build-up a 2-day GPM training, as well as all the material required in it.
☑ Build-up a 1-day GPM training, as well as all the material required in it.
☑ Find locations to administrate GPM-b certification exams and take contact with them.
☑ Write this thesis and perform a presentation towards Beijing Jiaotong University board.
☑ Build-up a Crashing exercise, as well as a training example.
☑ Perform two slides showing an example of FPIF and CPIF in the procurement management section.
☑ An e-platform in order that trainees practice some GPM-b exam questions during and after the training.
☑ Train the Trainers of the new updates.

To accomplish those objectives, the PM must bear in mind to:

☑ Plasticized the Training Templates.
☑ Provide e-Templates to trainees after the training.
☑ The PM has the ability to work from home.
☑ Just printing key documents

### 2.5. Flexibility Matrix

Once the objectives and the steering committee are defined, considering the nature of GMG, I was supposed to build the Flexibility Matrix.

<table>
<thead>
<tr>
<th>Flexibility Matrix</th>
<th>Least Flexible</th>
<th>Flexible</th>
<th>Most Flexible</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Schedule</strong></td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Budget</strong></td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td><strong>Scope Changes</strong></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td><strong>Resources</strong></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>

*Fig. C-6: Flexibility Matrix*

It is really important to define and present the flexibility matrix to the steering committee because, in real life, you have to set up your priorities. The Project Manager will try to make everything as defined (least flexible) but, as experience tells us, problems appear and the project never comes up as planned. Because of the previous fact, the Project Manager will prioritize the Least Flexible constraints over the Most Flexible ones.
3. Scope management

Once we have renegotiated the project boundaries, we proceed on scheduling the project. For doing so, we will use the technique explained in (B-3.1.4) the WBS.

3.1. WBS

In short, the Work Breakdown Structure (WBS) is a technique that allows us to define a schedule for the project. Furthermore, will be followed by the time management section, in which it is mandatory using the WBS.

3.1.1. Project Phases

The very first stage in the building of WBS is identifying and defining the phases of the current project.

Phase 1 Information Gathering
In this phase, it was supposed to gather all the information related with Project Management and Green Project Management areas of knowledge; as well as China’s Green issues information.

Phase 2 Skill Development Phase
In this phase, it was supposed to review and develop all the materials gathered in phase 1; as well as, learn from project management trainings and other sources.

Phase 3 External Supplier Procurement
As one of the objectives was designing a website; in which all training participants will be able practice with extra exam samples of GPM-b certification; in this phase, it was supposed to develop that website.

Phase 4 Training Material Preparation
In this phase, it was supposed to have the slides and practicing exam questions ready in both, English and Chinese.

Phase 5 Pilot Training
In this phase, our team is supposed to perform the training and get an output of it; as well as some improvement recommendations from the trainees.

Phase 6 Final Materials Form
This is the Closing phase (remember we always need to identify a closing phase). At the end of it, I am supposed to have the final materials ready bearing in mind the improvements required in phase 5.
3.1.2. Definition of the main activities

We have to determine the main activities that take place in each one of the previous phases:

1. **Phase 1: Information Gathering**
   1.1. GPM Materials Evaluation Document
   1.2. Reviewed Additional Materials Document

2. **Phase 2: Skill Development**
   2.1. Self directed Learning Document
   2.2. Directed Learning Report

3. **Phase 3: External Supplier Procurement**
   3.1. Website Developed

4. **Phase 4: Training Material Preparation**
   4.1. GPM Materials Ready (Slides)
   4.2. GPM Exam questions Ready
   4.3. Materials Translated into Chinese

5. **Phase 5: Pilot Training**
   5.1. Training Delivered

6. **Phase 6: Final Materials Form**
   6.1. Final Materials

3.1.3. Breaking Down

Once we have the main activities clearly defined, we proceed on breaking them down. Nevertheless PMI recommend bearing in mind these two statements:

- If you have an activity that lasts more than 10 days (2 weeks); it must be broken down.
- If you have an activity that lasts less than 8 hours (1 day); it is pointless breaking more down.

The reader also should bear in mind that every project is different, so its up to the project manager how broken down he wants his project.

Here follows the initial WBS of the project (the activities in capital lettlers are milestones):

**Phase I Information Gathering**
1.1 GPM Materials Evaluation Document
   1.1.0 Get the project Approved to start
   1.1.1 Review PRISM Standard
   1.1.2 Review P5 Standard
   1.1.3 Review GPM website
   1.1.4 Review additional GPM Materials
   1.1.5 Coordinate Review meeting with Joel
   1.1.6 Review Meeting with Joel
   1.1.7 Download additional Materials from Dropbox
   1.1.8 Write Preliminary report on GPM
1.1.9 Receive Report comments  
1.1.10 Write Final Report on GPM  
1.1.11 Write Module A of the Thesis  
   1.1.11.1 China Description  
   1.1.11.2 Environmental Issues and Pollution  
   1.1.11.3 Gather Beijing AQI Data  
   1.1.11.4 Perform Beijing AQI Analysis  
1.1.12 Review Module A  

GET REPORT APPROVED  
1.2 Reviewed Additional Materials Document  
   1.2.1 Review PMI Standards  
   1.2.2 Review PMI Training Materials  
   1.2.3 Review training Materials from PMI  
   1.2.4 Review Exam materials from PMI  

Phase II Skill Development Phase  
2.1 Self directed Learning Document  
   2.1.1 Read Materials Project Management related  
   2.1.2 Consult materials with Senior Trainer  
   2.1.3 Consult Materials with Sponsor  
   2.1.4 Consult Materials with Joel  
   2.1.5 Write Self directed Learning Report  
   2.1.6 Write Module B of the Thesis  
   2.1.7 Review Module B of the Thesis  
2.2 Directed Learning Report  
   2.2.1 Attend Training from PMI Session I  
   2.2.2 Write Report after training with Q&A  
   2.2.3 Attend training from PMI Session II  
   2.2.4 Write Report after training with Q&A  
   2.2.5 Write Module C of the Thesis  
   2.2.6 Review Module C of the Thesis  

Phase III External Supplier Procurement  
3.1 Website Developed  
   3.1.1 Look for website providers  
   3.1.2 Short list website providers  
   3.1.3 Collect Proposals  
   3.1.4 Evaluate proposals  
   3.1.5 Negotiate price  
   3.1.6 Sign contract  
   3.1.7 Test website  
   3.1.8 Request website changes  
   3.1.9 Test Website  
   3.1.10 Perform Front and Back cover from vendor  

GET WEBSITE APPROVED  

Phase IV Training Material Preparation  
4.1 GPM Materials Ready  
   4.1.1 Collect Materials  
   4.1.2 Review Ideas with Sponsor
4.1.3 Review ideas with Senior Trainers
4.1.4 Review Ideas with Joel
4.1.5 Write Draft Materials document
4.1.6 Review Draft materials document by Senior Trainer
4.1.7 Review Draft Materials Document with Sponsor
4.1.8 Review Draft materials Document with Joel
4.1.9 Write second Version of Materials
4.1.10 Review Second materials document by Senior Trainer
4.1.11 Review Second Materials Document with Sponsor
4.1.12 Review Second materials Document with Joel

GET MATERIALS APPROVED

4.2 GPM Exam questions Ready
4.2.1 Collect Materials
4.2.2 Review Ideas with Sponsor
4.2.3 Review ideas with Senior Trainers
4.2.4 Review Ideas with Joel
4.2.5 Write Draft Exam Questions document
4.2.6 Review Draft Exam Questions document by Senior Trainer
4.2.7 Review Draft Exam Questions Document with Sponsor
4.2.8 Review Draft Exam Questions Document with Joel
4.2.9 Write second Version of Exam Questions
4.2.10 Review Second Exam Questions document by Senior Trainer
4.2.11 Review Second Exam Questions Document with Sponsor
4.2.12 Review Second Exam Questions Document with Joel

GET Exam Questions APPROVED

4.3 Materials Translated to CN
4.3.1 Identify right translators
4.3.2 Plan Translator's schedule
4.3.3 Get translator's schedule approved
4.3.4 Follow up translators work
4.3.5 Collect translation and review
4.3.6 Upgrade translation

GET TRANSLATION APPROVED

Phase V Pilot Training
5.1 Training Delivered
5.1.1 Select Trainer
5.1.2 Select training room
5.1.3 Select materials to be printed
5.1.4 Identify printing company
5.1.5 Sign contract with printing company
5.1.6 print materials
5.1.7 deliver materials t training room
5.1.8 training delivery
5.1.9 Identify upgrading points in the training
5.1.10 Write training report
5.1.11 Collect report from participants

CONSOLIDATE REPORT WITH TRAINER

Phase VI Final Materials Form
6.1 Final Materials
   6.1.1 Collect feedback from trainer, and Sponsor
   6.1.2 Join all project sections
   6.1.3 Upgrade Materials
   6.1.4 Do Internal Presentation
   6.1.5 Upgrade Exams
   6.1.6 Upload materials into website
   6.1.7 Test website
   6.1.8 Write Lessons Learned
   6.1.9 Store and transfer program materials to company
   6.1.10 Celebration Party

CLOSE PROJECT

3.2. Defining the Scope

In order to define the scope, we will use the method of answering the seven W’s explained in (3.1.1). We have to do this procedure for each one of the activities in order to define them the more accurate the better. Nevertheless, in the thesis the writer just posted a sample of one of them.

<table>
<thead>
<tr>
<th>Activity 1.1.11.3: Gather Beijing AQI Data</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Why</strong></td>
</tr>
<tr>
<td>The PM needed to have everyday Beijing AQI data in order to perform the Air Quality analysis in (A-2.2.7.1.10.2).</td>
</tr>
<tr>
<td><strong>What</strong></td>
</tr>
<tr>
<td>Everyday AQI data of the observatory of Tuanxugou (漵卯溝) at 1pm from the 5th December 2013 to 4th June 2014.</td>
</tr>
<tr>
<td><strong>How</strong></td>
</tr>
<tr>
<td>Dr. Tang provided the following source:</td>
</tr>
<tr>
<td>Beijingair.sinaapp.com/data/Beijing/all/ [year month day] /CSV</td>
</tr>
<tr>
<td><strong>How much</strong></td>
</tr>
<tr>
<td>Public website. 20min/day * 30days = 200RMB</td>
</tr>
<tr>
<td><strong>Who</strong></td>
</tr>
<tr>
<td>Oriol</td>
</tr>
<tr>
<td><strong>When</strong></td>
</tr>
<tr>
<td>Everyday until 4th of June at 9am.</td>
</tr>
<tr>
<td><strong>Where</strong></td>
</tr>
<tr>
<td>In GMG Beijing office:</td>
</tr>
<tr>
<td>北京市朝阳区高碑店盛世龙源 1110 号 C 棟 4 层</td>
</tr>
<tr>
<td>4th Floor, Bldg. C, NO.1110, Sheng shi long yuan, Gao bei dian, Chaoyang District, Beijing, 100022, P.R. China</td>
</tr>
</tbody>
</table>

*Fig. C-7: 7Ws in the Activity 1.1.11.3*
4. Time Management

Once the WBS and all the activities are defined, we shall proceed on the time management section in which we schedule the project.

First of all we schedule without taking the time constraints into consideration and afterwards we will try to compact the schedule in order to fit those constraints.

The time constraints are:

- Finishing the Thesis and Presentation before Friday 27th June 2014. Time constraint provided by BJTU (presentation of the thesis towards a board of professors).
- Finishing the entire project before Friday 25th July 2014. Time constraint provided by GMG so it is the last day of my internship there.

Compact schedule Techniques:

- Fast Tracking
- Crashing

4.1. Original

In the original scheduling, we proceed on calculating the PERT duration of each of the activities. Those consist on taking the Optimistic (O), Most Likely (ML) and Pessimistic (P) duration of each activity and calculate the PERT duration using the following formula:

\[
PERT = \frac{O + 4ML + P}{6}
\]

The calculus of all those activities, as well as, the resource assignation is shown in Annex C2.

After the PERT calculation, the project manager introduced the data into PM software and obtained an overall and phase-by-phase Gantt diagrams; as well as the critical path diagrams. All those diagrams are in Annex C2. Nevertheless; it is preceded showing the overall diagram of the project.

Fig. C-8: Original WBS Overall Phases Gantt Diagram
In the previous scenario, the project manager checked the two time deadlines:

- The project Presentation would be finished on the 13th August 2014 (still need to be reduced by 35 working days).
- The Closure of the project would be finished on the 25th August 2014 (still need to be reduced by 23 days).

As in the flexibility matrix (see C-2.5) the project manager agreed that the time constraint was the least flexible; he proceeded on compacting the schedule. The first technique to be used is Fast Tracking because there is no need on adding extra resources; so does not increase the project cost to the company.

### 4.2. Fast Tracking

The technique of fast tracking consist on trying to change some activities that were done in series into parallel; therefore, if those are in the critical path, the project get shortened. Therefore, I just made fast tracking in the activities in the critical path.

The changes after the fast tracking are as follows:

- Do “Upgrade Materials” (5.1.2) after “Review Module A” (1.1.12), “Review Module B” (2.1.7), “Review Module C” (2.2.6) and “Get Translation Approved”.
- “Consolidate Review Meeting with Joel” (1.1.5) after “Review PRISIM Standard” (1.1.1).
- SUMMER can arrange “Coordinate Meeting with Joel” (1.1.5) during “Review additional GPM Materials” (1.1.4). Nevertheless, the meeting must be held after (1.1.4).
- The report can be approved independently of the Part A of the thesis; so “Get report Approved” right after “Write final Report on GPM” (1.1.10).
- In order to review PMI Standards (1.1.2), we don’t have to wait until the GPM report is approved. Therefore, (1.1.2) starts just after (1.1.10).

After the previous fast tracking statements, the project manager introduced the new durations into PM software and obtained an overall and phase-by-phase Gantt diagrams; as well as the critical path diagrams. All those diagrams are in Annex C2. Nevertheless; it is preceded showing the overall diagram of the project.

---

![Fig. C-9: WBS after Fast Tracking Overall Phases Gantt Diagram](image-url)
In the previous scenario, the project manager checked, again, the two time deadlines:

- The project Presentation would be finished on the 17th July 2014 (still need to be reduced by 16 working days).
- The Closure of the project would be finished on the 29th July 2014 (still need to be reduced by 4 days).

As in the flexibility matrix (see C-2.5) the project manager agreed that the time constraint was the least flexible; he proceeded on compacting even more the schedule. The second technique to be used is Crashing.

### 4.3. Crashing

The technique of Crashing consists on applying more resources in order to reduce the activity duration and, if applied in the activities in the critical path, reduces project’s duration. Resources equals to money, so we will always do Fast-tracking before Crashing. Moreover, we will just crash until we arrive to the time constraint. If we crash more, we will be applying an unnecessary extra cost to the project.

The changes after the crash are as follows:

- VIVIAN, who is a really experienced lead consultant in this field, helped to write the preliminary report (1.1.8) so we reduced 3 days (from 6 to 3). After this crash, we still have to reduce 11 more days.
- TINA helped in reviewing exam materials from PMI (1.2.4) so we reduced 2 more days (from 6 to 4 days). After this crash we still have to reduce 9 more days.
- As (2.1.5) was the first self-directed learning report, VIVAN helped me and we finished it in just one day. After this crash we still have to reduce 6 days.
- As we planned all the meetings in really advance; we could arrange that VIVIAN, JESUS and JOEL’s meetings to be held the same day. This crash can only be used in those meetings that are short.
  - Review Ideas meetings (4.1.2) (4.1.3) (4.1.4).
  - Review Draft Exam Questions Documents (4.1.6) (4.1.7) (4.1.8).

![Fig. C-10: WBS after Crashing Overall Phases Gantt Diagram](image-url)
GPM fit into a Chinese Environment  

Module C: GPM Training Program Project

The reader should remember that all the Crashing diagrams (overall, phase-to-phase and Critical path) are in Annex C2.

In the previous scenario, the project manager checked, again, the two time deadlines:

- The project Presentation would be finished on the 25th June 2014 (1 working day buffer).
- The Closure of the project would be finished on the 7th July 2014 (14 working days buffer).

As this schedule fits the time, scope and cost constraints (also environmental); the project manager signed it to be the final schedule of the project. Nevertheless, it is important to show the Milestone List to the steering committee.

- The Milestone List sometimes is shown as a time line diagram.
- This is what the steering committee wants to see; they do not really care about every single activity in the project.
- It must be time ordered.

<table>
<thead>
<tr>
<th>Phase</th>
<th>Milestone</th>
<th>Date of Signature</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>Get Report Approved</td>
<td>17th April 2014</td>
</tr>
<tr>
<td>P4.1</td>
<td>Get Materials Approved</td>
<td>30th May 2014</td>
</tr>
<tr>
<td>P4.2</td>
<td>Get Exam Questions Approved</td>
<td>5th June 2014</td>
</tr>
<tr>
<td>P3</td>
<td>Get Website Approved</td>
<td>9th June 2014</td>
</tr>
<tr>
<td>P4.3</td>
<td>Get Translation Approved</td>
<td>18th June 2014</td>
</tr>
<tr>
<td></td>
<td>Hand in and Perform Thesis Presentation in BJTU</td>
<td>27th June 2014</td>
</tr>
<tr>
<td>P5</td>
<td>Consolidate Report with Trainer (After Piloting)</td>
<td>4th July 2014</td>
</tr>
<tr>
<td>P6</td>
<td>Close Project</td>
<td>7th July 2014</td>
</tr>
</tbody>
</table>

Fig. C-11: Project Milestone List with their Date of Signature

The project manager has agreed with the steering committee the previous milestones’ dates of signature. Nevertheless; as he only has one day of buffer; it is really important to identify the critical activities and make sure those are not delayed at any cause.

A critical activity is defined as an activity that if it suffers a delay, the entire project is delayed in the same amount of time. Because of the previous definition, the project manager should make sure to push their resources not to deliver late their activities’ outputs.

The most commonly used technique to determine that activities is the Critical Path Diagram; which only shows the critical activities, as follows.
GPM fit into a Chinese Environment

Module C: GPM Training Program Project

Fig. C-12: Critical Path of the Project (after Crashing)
5. OBS

Next step is building up the Organizational Breakdown Structure (OBS) of the Project Resources (see B-3.1.5). The project OBS is used with the WBS to form the Responsibility Assignment Matrix or RACI (see C-6).

The project OBS identifies key decision making authorities and ownership of work areas. It therefore supports communications, performance monitoring, control and reporting.

In the following figure, the reader can appreciate that the Blue boxes are In-house resources while the red boxes are Off-house resources.

*Fig. C-13: Organizational Breakdown Structure (OBS) of the Project Resources*
6. RACI

RACI matrix is used to define the accountability, role and responsibility of each team member combining WBS and OBS (see B-3.1.6).

In the matrix we have to proceed writing if the activity (i) is X by the stakeholder (j); where X means:

- **Responsible (R)**: the individual or committee that perform the task. There is just one “R” for each of the activities.
- **Accountable (A)**: the individual or committee that supervises “R”. May have power of veto (or not).
- **Consulted (C)**: the individual or committee who is consulted prior to an action.
- **Informed (I)**: the individual or committee who need to be informed after an action has been taken.

This was done for all the activities and milestones in the WBS; nevertheless, as there are too many of them it is preceded showing a sample of it (phase 4):

<table>
<thead>
<tr>
<th>Activity</th>
<th>Jesus</th>
<th>Oriol</th>
<th>Vivian</th>
<th>Tina</th>
<th>Ashley</th>
<th>Shakira</th>
<th>Joel</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1.1 Collect Materials</td>
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<tr>
<td>4.1.2 Review Ideas with Sponsor</td>
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<tr>
<td>4.1.3 Review ideas with Senior Trainers</td>
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<td>4.1.4 Review Ideas with Joel</td>
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<td>4.1.5 Write Draft Materials document</td>
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<td>4.1.6 Review Draft materials document by Senior Trainer</td>
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<td>4.1.7 Review Draft Materials Document with Sponsor</td>
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<td>4.1.8 Review Draft materials Document with Joel</td>
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<td>4.1.9 Write second Version of Materials</td>
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<td>4.1.10 Review Second materials document by Senior Trainer</td>
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<td>4.1.11 Review Second Materials Document with Sponsor</td>
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<td>4.1.12 Review Second materials Document with Joel</td>
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<td>GET MATERIALS APPROVED</td>
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<td>4.2.1 Collect Materials</td>
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<td>4.2.2 Review Ideas with Sponsor</td>
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<td>4.2.3 Review ideas with Senior Trainers</td>
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<td>4.2.4 Review Ideas with Joel</td>
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<td>4.2.5 Write Draft Exam Questions</td>
<td>I</td>
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</tbody>
</table>
To sum up, performing RACI matrix is really convenient to know the role of each of the Stakeholders in the project. Who does the activity, who supervise it, who can be consulted and who should be informed.

7. CBS

Once we have the final WBS ready, we should proceed on the Cost Breakdown Structure. It consists on writing the cost of each activity over the RACI matrix in order to know how many resources do need the different departments and people of the project, so it is convenient to know where the costs are allocated in the WBS (see B-3.1.7).

In this project, JESUS was the financial controller and did not share the cost with the project manager. Most of the resources were internal and it was hard for the PM to compute it.
8. Quality Tools

As it has been explained in B-3.4; there are seven basic quality tools which are a designation given to a fixed set of graphical techniques identified as being most helpful in troubleshooting issues related to quality. If the reader wants more information about their history as well as a wide explanation of them, please go to B-3.4.6.

In this module C, as the PM had a very limited quantity of resources and a really tight schedule, could not take as many data as he wanted in order to perform quality tools and technologies.

Either way, after piloting the training; the PM realized that over 60% of trainees failed the practicing exam so he developed an Ishikawa, Cause-Effect or Fishbone diagram to identify the possible causes in order to correct them (Controlling phase quality tool).

Fig. C-15: Ishikawa diagram “why 60% trainees failed the Practising Exam”
9. Risk Management

As explained in B-4.2.1.1; Risks are presents in all projects and are a threat to its objectives. Because of that the project manager should identify and control them. This is what the risk management analysis is about.

Even though there are risks within the entire project, the most important ones, and those the PM should take more into consideration, are those which:

- Are in the Objectives.
- Are in the activities that delay WBS’ Milestones.
- Are detected as important in Historical Information.

Those Risks must be defined as much specific as possible; then it is more likely to be helped because it is better framed.

The project manager should always bear in mind the fact that the Project Management Office (PMO) has a lot of experience in dealing with those risks so, it would be really convenient to consult them asking how would they solve an specific risk that PM is stacked with.

Before starting with the risk analysis; the project manager should bear in mind in which kind of company he is working with. There are three types of them:

- **Risk Seeker**: those are new companies that want to grow so, as the reader may know, best opportunities are the ones bounded with great risks. Because of the previous fact, these companies penalize the project risks in a linear way.
- **Risk Neutral**: those companies are between risk seeker and risk averse.
- **Risk Averse**: those usually are settled down companies that do not want to take so much risks. Because of this fact, they highly penalize high risks and almost do not penalize low risks in their projects.

In this case, GMG in this project is a Risk Seeker company because GPM is a really new and unknown project management discipline. And it prioritize risks in the following way:

- **RED**: Risks that delay more than 3 days the project.
- **YELLOW**: Risks that delay more than 1 day but less than 3 days the project.
- **GREEN**: Risks that delay less than 1 day the project.

To start with the first stage of risk analysis, the project manager has to identify the project risks as well as their trigger; what means WHEN does that risk happen. Afterwards he has to come up with the probability (P) and the impact on the project (I) if that risk takes place.

Once done that, the PM should proceed calculating the Risk Score (RS):

\[ RS = P \times I \]

Once the risk score is calculated, the project manager should proceed making a priority list, distinguished by priority color code; which is provided by the company depending whether it is risk seeker, neutral or averse.
To perform the risk analysis; the writer decided just showing two of them in order not to miss the point of the module, which is to be a guideline. Nevertheless, in real projects, this list should be analyzing as many risks as possible in order to control them.

<table>
<thead>
<tr>
<th>Risk Identification</th>
<th>Risk Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk</td>
<td>Risk Trigger</td>
</tr>
<tr>
<td>Delay because the sponsor was in business trip</td>
<td>Business Opportunities come</td>
</tr>
<tr>
<td>Delay because after the training too many changes were done to the first version</td>
<td>After each training</td>
</tr>
</tbody>
</table>

*Fig. C-16: Risk Identification and Analysis*

*The risk impact normally is expressed in monetary units, nevertheless in our project the project manager thought it would be better to express it in delay units.*

The second stage of the risk management is the Risk Response Planning; in which the project manager should define the actions to be done towards the risks. Because of that there are two main scenarios:

- The risk has already happened, so the PM must **Accept** that it has already happened:
  - **Contingency plan**; what to do in order to minimize risks effects.
  - **Fall-back Plan**; what to do if contingency plan fails.

- The risk has not happened yet
  - **Avoid**; what to do to avoid the risk happening.
  - **Transfer**; what to do in order to transfer the risk to another business unit.
  - **Mitigate**; what to do in order to reduce the risk effects as much as possible.

The project manager should also attach the associate cost of each of the previous activities.

Then the steering committee (the sponsor JESUS in our project); should decide how many resources give you in order to face those risks. This is the **Contingency Reserve**.

An important decision that must be done before finishing the risk analysis is choosing who is going to control the risk (**Risk Monitor – Owner**).
In this sample we are analyzing the following risks:

- Delay because the sponsor was in business trip (1)
- Delay because after the training too many changes were done in the first version (2)

In the Risk identification analysis we determined that (1) is more important than (2). Because of that we will prioritize (1) in front of (2).

The PM with the help of their team and PMO designed the Risk Response Planning and Monitoring Analysis (Fig. C-17) and showed to the sponsor. The sponsor is who determine which option is going to be used if any. He decided to take measures in both of the risks.

- In risk (1) decided to solve it in a Skype Meeting; whose investment is up to 0RMB and who has to control that it is done properly is the Project Manager
- In risk (2) decided to mitigate it by doing a test training internally first in which both; ORIOL and VIVIAN were involved in one working day so its investment is up to 1500RMB. VIVIAN is the one who is in charge of controlling it.

**Fig. C-17: Risk Response Planning and Monitor Analysis**
10. Communication Plan

Project managers spend most of their time communicating with team members and other project stakeholders. Because of the previous fact, knowing what, how and when to communicate with each of the stakeholders becomes crucial; as well as the response time and who must start the communication.

The communication Management plan (B-7.2.1.1.4) describes how project communications will be planned, structured, monitored and controlled.

A really convenient technique to do so is the Communication Matrix.

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>JESUS</th>
<th>BJTU</th>
<th>Shanghai Team</th>
<th>Silverpeony</th>
<th>Them</th>
<th>Xavi</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>What to be communicated</strong></td>
<td>Every Milestone and programmed meeting (WBS)</td>
<td>Weekly report</td>
<td>When to have everything translated</td>
<td>When to have everything printed</td>
<td>How do we want the webpage</td>
<td>How do I want the cover</td>
</tr>
<tr>
<td><strong>How is to be communicated</strong></td>
<td>E-mail f2f meeting Skype</td>
<td>E-mail f2f meeting</td>
<td>E-mail Skype</td>
<td>E-mail</td>
<td>E-mail Phone call</td>
<td>WeChat</td>
</tr>
<tr>
<td><strong>When to be communicated</strong></td>
<td>2 weeks</td>
<td>Fridays</td>
<td>2 days</td>
<td>Once (20th June)</td>
<td>Once a week</td>
<td>Once (27th March)</td>
</tr>
<tr>
<td><strong>Response time</strong></td>
<td>5 days</td>
<td>2 days</td>
<td>Same day</td>
<td>1 day</td>
<td>3 days</td>
<td>2 days</td>
</tr>
<tr>
<td><strong>Responsible person</strong></td>
<td>PM</td>
<td>PM</td>
<td>PM</td>
<td>PM</td>
<td>PM</td>
<td>PM</td>
</tr>
</tbody>
</table>

*Fig. C-18: Communication Matrix*

Communication Matrix was updated after each phase to adapt the communication needs that the stakeholders had in each phase. This is a sample of one of the phases of the project with some of the key stakeholders.
11. Module C Summary

The aim of the module C is to exemplify most of the project management hard skills explained in module B in a real life example. Even though it is a small project with very limited resources and time; it provides a wide range of possible project management exercises, in which the writer would apply, the previously introduced, PM tools and techniques.

Due to the long amount of activities within the project; regarding some of the tools, the writer decided just to show a sample of them because he thought it was pointless to show the same technique repeated for nearly a hundred activities because, due to its length, the reader may have lost the focus.

As every project; the very first step is the sponsor meeting; in which the objectives of the project will be defined. At the same time, it is highly recommended to perform the Green Project Management P5 analysis in order to both; analyze the sustainability aspect in the project and, provide with new sustainability objectives to make the entire project more “green”.

The main objective, output of this meeting, was building up two GPM trainings; as well as identifying some locations to take the certification exam and to perform this thesis presentation towards a professor board in Beijing Jiaotong University. The sponsor signed all the objectives.

On the other hand, the sustainable objectives were to avoid unnecessary printing, e-communication, use of local procurement and resources, over 50% of the resources to be woman, among others.

Afterwards, the Project Manager decided to perform the stakeholder analysis in order to know who were the project stakeholders, what power they have on the project and how interested they are in it. The writer also wrote what did every stakeholder want from the project.

The stakeholder analysis is a really important tool to detect which are the most threatening stakeholders to the project and, even more important, how to deal with them. You can either give what they want or use another stakeholder to manage them.

Furthermore, the project manager proceeded listing the Project Boundaries; which is a document in which it is written what is IN the project, and what is OUT the project; as well as writing the assumptions, constraints and issues of the same. And show it to the stakeholders.

After showing it to them, begins the stakeholder negotiation. In these meetings some outputs that are OUT the project goes to IN the project and; the project manager should ask for extra resources. After these meetings, the documents get signed by the stakeholders (especially the sponsor).

In that negotiations, it was agreed to provide an extra training (an overall of 3 GPM trainings); as well as, creating new training exercises, train the trainers (TTT), develop a GPM-b practicing exam website and know how to use Clarizen® software. On the other hand I was provided with extra resources; which were: 100% of the PM time and a GMG Shanghai team (Ashley and Shakira).
Another really important tool to be taken into consideration is the Flexibility Matrix. As the reader may know, problems come up with in real life without expectation so, it is important to set the project’s priorities.

In the project, Schedule was the least flexible constraint (because the PM had an unmovable date to present the thesis in BJTU and he also had to leave the company when his visa expired); then budget an resources were more flexible and the most flexible constraint was scope changes.

Once renegotiated the project boundaries, next step is scheduling. To do so, the project manager should proceed performing the Work Breakdown Structure (WBS).

WBS is a technique that allows the project manager to define a schedule. To do so, he has first to define the project phases; the main activities in each of them and breaking down to the basic activities that need to be done. Moreover, in each of the activities it is highly recommended to define its scope by answering the 7Ws.

Once the project manager has the WBS, comes time management phase. Nevertheless, first of all, the PERT durations of each activity should be calculated using an optimistic, pessimistic and most likely duration of it.

With those durations; and using scheduling software, the project manager realized that in those conditions, he will not be able to accomplish the time constraints so he began to compact the schedule. To do so first tried fast tracking and then crashing.

After those techniques, the schedule was programmed to finish the project presentation by the 25th June and the closure of the project by the 7th July. Nonetheless, the project manager listed when each of the milestones would need to be signed by the steering committee and shared that document with them. He also analyzed the critical path of the schedule because; those critical activities must not be delayed at any cause.

After all the scheduling is done, the project manager thought it would be really important to let all the resources know what will their duty be in each of the activities. So he first designed an OBS and; therefore built up the RACI matrix, in which each resource would know whether he is Responsible, Accountable, Consulted or Informed of every singe activity in the project.

On the other hand, when piloting the training, over 60% of the trainees failed the practicing exam. Because of that reason the project manager also designed an Ishikawa diagram in order to find the causes of that.

Once everything is designed, the PM realized that risks are in every single project and activity so he decided to perform a risk analysis of the entire project. After doing so, he knew how to deal with all those issues that could come up with the project.

At the end, all the project was executed and implemented with no outstanding problems so the project manager; and even the steering committee, were really proud of the project team.
This thesis is supposed to be a guideline in project management and tries to answer how to measure sustainability impact and implement projects bearing that in mind.

To do so, it is divided into three clear modules. The fist module tries to get the reader notice about terrible is the environmental situation that China is going through. The second module is a guideline on how to deal with a project from the very beginning to the end; explaining all the tools and techniques to make that possible. Finally, the third module is a real example of the technologies learned in module B.

In this summary, the writer is going to cover one by one; each module and its annexes; ending up with some general comments.

Module A   China and Environment

The module begins with a brief introduction to China, which is the most populated country in the world with up to 1.35 billion citizens. Its capital city is Beijing and exercises jurisdiction in over 22 provinces, five autonomous regions, four direct-controlled municipalities and 2 administrative regions. Also claims Taiwan.

China has 16 out of the 20 most polluted cities in the globe and, because of the previous fact, its citizens demonstrate towards their Government. It answers with some Environmental Policies that, up to the date, have not solved the problem; even though it has been spent a substantial percentage of the Government’s budget.

China has plenty of environmental issues:

- Water resources focused in the south of the country leads to floods in the south and droughts in the north.
- China has some of the largest forested land in the entire world but it is highly threatened by high-populated densities pressure.
- Desertification is expanding 67 Km$^2$ every year.
- China is the world’s most emitter of both; CO$_2$ and CFC gases that accelerate climate change. At the same time, China is one of the most threatened countries by this phenomenon; due to most of its population and cities are located near the coast.
- China’s population is over 1.35 billion (1$^{st}$ in the world) but is growing at a 0.47% rate (159$^{th}$ in the world).
- Chinese Energy Efficiency is in the bottom of the list comparing with western countries.
- Chinese pollution is, perhaps, the worst environmental issue up to the date.
  - Waste is increasing really fast, as well as population's income.
  - River exploitation and deforestation.
  - China is the owner of the most electronic waste in the world (major part of it located in Guiyu, in Guangdong province).
  - Industrial pollution is the major factor that leads into a really poor air quality in its cities.
  - 33% of Chinese children suffer from Lead Poisoning.
GPM fit into a Chinese Environment

- Yellow dust from northern-China, Mongolia and Kazakhstan blows desert sand decreasing air quality. Moreover, this air is blown to other countries such as Korea and Japan.

Because of the previous facts, the writer wanted to perform an Air Quality Analysis (AQI) analysis from Beijing (as he was living in this city while writing the thesis).

He gathered data from the 5th December 2013 to the 4th June 2014; making a half-year analysis.

- 64.84% of the days were considered as not secure.
- 17% of the days were considered as very unhealthy and 11% as hazardous (worst in the legend).
- There were more days considered as hazardous (11%) than Good level (8.24%).
- In February, half of the days were considered very unhealthy and worse.
- In April there were not Good level days at all.

Nevertheless the bad circumstances, Beijing authorities cloud-seeded every time AQI increased over 150 which is when air starts to be unhealthy. Nevertheless; data is data and those are the officials ones provided by the Government. If the reader checked at the US Embassy ones, every single datum would increase by 30 to 50%.

After the analysis, the reader may realize how big is the environmental problem is in China so, while doing projects in China it is convenient to keep an eye in sustainability impact. Because of the previous fact, Green Project Management (GMP), altogether with PMI provides a wide range of tools and techniques to do so; explained in next module.

Module B The discipline of Project Management and Sustainability

The second module is meant to be the guideline of project management discipline tools and techniques bearing in mind the environmental impact of the project.

This summary is going to go on a quick overview through those techniques; in order to make the reader realize on how big amount of them could be found reading the entire module.

It is started by a sustainability chapter in which the writer wanted to outstand that bearing in mind sustainability will lead the company to success in every single aspect; even financial.

Regarding sustainability, some concepts like Corporate Social Responsibility (CSR) and reporting came up. According to GA Institute, more and more companies are reporting their sustainable achievements to GRI, so it is a competitive advantage towards other companies that just do not report.

In these introductory sustainability chapter, the reader may learn about the United Nations Global Compact ten principles, as well as some of the most important ISO standards; such as: ISO26000, ISO9000, ISO14000, ISO50001 and ISO21500.
The last ISO guideline, ISO21500, is the one regarding to project management. Because of the previous fact the writer proceeded structuring the thesis according to this ISO.

In the very first project stage, Initiation Phase, the project manager should define its objective; especially its sustainable objectives using GPM P5 methodology with its tools and techniques; as well as knowing how to perform the Sustainability Management Plan (SMP) bounded to ISO14000.

In this first stage, the reader may also have learnt how to perform a stakeholder analysis in order to know which are the threatening stakeholders to the project and how to deal with them.

The second, and recommended to be the longest stage; is the Planning Phase. In this phase the reader was supposed to learn how to:

- Define the scope of the project
- Build-up the activity diagram of the project; using PBS and WBS techniques
- Learn how the human resources are structured within the company using the OBS
- Perform the Responsibility Assignment Matrix (RACI)
- Predict the cost of each work package and resource using CBS technique
- Achieve quality success using the seven basic quality tools
- Time schedule the activity diagram and how to compact the schedule using several techniques; such as fast tracking and crashing
- Control the schedule

The third stage is the executing and controlling phase; is here when the process is being carried on. If the second stage has planned accurately; then the executing will not take so much time. Nevertheless, in this phase the reader may have learnt how to:

- Perform a risk management analysis
- Issue Management techniques
- Change Control procedure
- Configuration Management
- Information Management

The final project stage is the Closure phase and Reviews in which the reader would have learnt how to close a project with the handover milestone and what reports or reviews should be written in that stage. The project is not over until the Closing phase is completed.

After all the phases were explained; the writer wanted to keep an eye in the Organizational Structure regarding ISO21500. In this chapter, the reader was supposed to appreciate the difference between external environment, organizational environment, project environment, project organization and the project itself.

Afterwards, the project success was covered. The project success is defined by the balance between the scope, time and cost constraints (also environmental impact for GPM). If those constraints are balanced, quality is assured and then, the project achieves success.

As it has been stated before, there are plenty of project management tools and techniques. Nevertheless, in order not miss the focus on the project phases, the writer decided to add an extra chapter regarding resource and social skills.
Just to make a quick overview, in this module B last chapter the reader was supposed to learn:

Regarding Resource Skills:
- Human Resource Management; how to acquire, develop, manage and control a project team
- Procurement Management; types of contract, how to perform them, knowing risk in contracts, as well as other procurement activities
- Cost Management; how to plan, estimate and control costs, as well as determine a budget

Regarding Social Skills:
- Communication Management tools and techniques
- Team skills development
- Some managing up high stakeholders guidelines
- Conflict Management; costs of conflict and resolution
- Leadership focus and styles

Some of the hard skills stated before, will be exemplified in the module C using a real life project.

Module C Case of Study: GPM Training Program Project

The writer was hired in GMG in order to perform the following project: he had to build-up some GPM trainings for GMG and write the present thesis for BJTU. So he thought it would be a good idea showing the tools and techniques learned in Module B or; at least, the hard skills.

The project was started by a sponsor’s meeting in order to define the objectives, which were Building up two trainings; as well as, find locations to do the GPM-b certification test. Nevertheless, the project manager (so be the writer) wanted to perform the GPM P5 analysis and came up with a few, but effective, sustainable objectives that reduced the environmental impact by 7.33% and even more; reduced the return on investment of the project by an extra 35%, datum that the sponsor was really encouraged with.

The second step was defining all the stakeholders as well as their interest and power towards the project and what do they want of it. Then the project manager was able to design some strategies for how to deal with block stakeholders.

Afterwards, the project manager listed the project boundaries, which shows what activities will be in the project and what activities won’t. Then, he was supposed to show this document to the project stakeholders and renegotiate the project boundaries; as well as the project resources.

Real-life projects come with tones of problems, they never execute as planed or, at least, rarely do. Because of that the Flexibility Matrix should be reviewed and signed by the sponsor. In this stage, the project manager establishes the project priorities such as: Schedule, Budget, Scope
Changes and Resources. In the project he was developing in GMG, the highest priority was Schedule (time constraint).

After that; the project manager proceeded on building up the activity diagram using the WBS technique. The project manager was supposed to define the phases and major activities; and from then on, break down until the work packages.

Once the WBS was done and the activities understood; would lead to the scheduling time. For doing so first the activities durations were calculated using PERT technique. Nevertheless, the project overflowed the time constraint and needed to be reduced by 35 working days.

Because of the previous fact, the project needed to be compacted. To do so, the project manager first performed the fast tracking technique reducing 19 working days; and then crashing technique reducing 17 more working days. At the end of these two techniques, the project was designed in time constraint. Nonetheless, the project manager built up the critical path diagram in order to know which activities were critical, in order to keep an special eye in those; because if those got delayed, the whole project would have been delayed by the same amount of time.

The project manager also performed a milestone schedule, which shows the sponsors when they would have to sign the project’s milestones.

On the other hand, the OBS needed to be done in order to build-up, with the WBS, the RACI matrix. This matrix allows the project manager and their human resources to know who is; responsible, accountable, consulted or just informed in every single activity.

While piloting the training, over 60% of the trainees failed the practising exam, so the project manager also performed an Ishikawa diagram (one of the seven basic quality tools) in order to define the cause of the previous fact.

Besides, the project manager also decided to perform a risk management analysis in order to identify the possible risks of the project and try to avoid, or even correct them. This is a very recommendable technique even though most project managers do not develop it.

Finally, the project manager performed the communication matrix, which is a tool that allow him know what, how and when to communicate with each of the stakeholders.

At the end, the project was executed and implemented with no outstanding problems so the project manager; and even the steering committee, were really proud of the project team.
Final Comments

Before writing this thesis; the writer did not know anything but some scheduling and quality techniques learned at Universitat Politècnica de Catalunya (ETSEIB) at subjects taught by Departament d’Organització Industrial such as: Graphs & Decision; Industrial Management; Operations Management; Total Quality Management; Quantitative Methods for Management; among others.

From that point on; he read and studied deeply PMBOK 5th Edition; PRiSM 1st Edition; and ISO Standards covered in module B; among other sources, in order to know about project management discipline and sustainability.

On top of that, he also did some research in Chinese environmental issues, as well as gathered Beijing AQI data from the 5th December 2013 to 4th June 2014; in order to perform the analysis in module A.

This thesis has fully fulfilled the writer’s expectations due to the fact that, as he was learning more and more about project management discipline, he was adding more content and annexes to the project.

The writer would not like handing in the thesis without bearing in mind and acknowledging both; Dr Tang and Mr Herández collaborations in it.

Finally, the reader may appreciate the hard-working output of the project and the writer truly hopes this guideline to be handy or, at least, problem solving in the reader’s project management tasks.
Annex A1
Beijing AQI Data
In this annex, the reader is going to find the Beijing Tuanxugou (鏄屽钩) AQI data gathered from a Chinese Government Official source in order to build Fig. A-14 (A-2.2.7.10.2 section); as well as a clarification of why he took that specific data.

The writer had a lot of trouble finding these data, so Professor Tang from Beijing Jiaotong University, facilitated the website where he took them from. The website is the following:

[19] Beijingair.sinaapp.com/data/Beijing/all/ [year-month-day] /CSV

It is not actually a database; the writer gathered the data one by one by introducing the year, month and day in the previous link. For instance, the very fist datum is from the 5th December 2013, so the writer introduced:

Beijingair.sinaapp.com/data/Beijing/all/20131205/CSV

Afterwards a Microsoft Excel datasheet is downloaded with all AQI data by hour and by observatory in Beijing.

To make the analysis more accurate, the writer decided not to perform means because they hide information. On the other hand, he decided a random observatory: Tuanxugou (鏄屽钩) and a random time: 1pm. So all data is taken from this place and this time.

The writer also picked a random AQI variable: PM$_{10}$ to perform the analysis.

Once explained why he decided to take the location, time and variable; we proceed on showing the gathered data from 5th of December to 4th of June (6 months):
<table>
<thead>
<tr>
<th>Date</th>
<th>AQI PM$_{10}$</th>
<th>Date</th>
<th>AQI PM$_{10}$</th>
<th>Date</th>
<th>AQI PM$_{10}$</th>
<th>Date</th>
<th>AQI PM$_{10}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>05-Dec-13</td>
<td>152</td>
<td>20-Jan-14</td>
<td>101</td>
<td>07-Mar-14</td>
<td>69</td>
<td>22-Apr-14</td>
<td>114</td>
</tr>
<tr>
<td>06-Dec-13</td>
<td>168</td>
<td>21-Jan-14</td>
<td>31</td>
<td>08-Mar-14</td>
<td>124</td>
<td>23-Apr-14</td>
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</tr>
<tr>
<td>07-Dec-13</td>
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<td>167</td>
<td>09-Mar-14</td>
<td>233</td>
<td>24-Apr-14</td>
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</tr>
<tr>
<td>08-Dec-13</td>
<td>418</td>
<td>23-Jan-14</td>
<td>312</td>
<td>10-Mar-14</td>
<td>88</td>
<td>25-Apr-14</td>
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</tr>
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<td>47</td>
<td>24-Jan-14</td>
<td>316</td>
<td>11-Mar-14</td>
<td>265</td>
<td>26-Apr-14</td>
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</tr>
<tr>
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<td>12-Mar-14</td>
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<td>93</td>
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<td>02-Feb-14</td>
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<td>25-Mar-14</td>
<td>220</td>
<td>10-May-14</td>
<td>92</td>
</tr>
<tr>
<td>24-Dec-13</td>
<td>316</td>
<td>08-Feb-14</td>
<td>123</td>
<td>26-Mar-14</td>
<td>231</td>
<td>11-May-14</td>
<td>67</td>
</tr>
<tr>
<td>25-Dec-13</td>
<td>402</td>
<td>09-Feb-14</td>
<td>21</td>
<td>27-Mar-14</td>
<td>331</td>
<td>12-May-14</td>
<td>45</td>
</tr>
<tr>
<td>26-Dec-13</td>
<td>82</td>
<td>10-Feb-14</td>
<td>20</td>
<td>28-Mar-14</td>
<td>182</td>
<td>13-May-14</td>
<td>111</td>
</tr>
<tr>
<td>27-Dec-13</td>
<td>30</td>
<td>11-Feb-14</td>
<td>130</td>
<td>29-Mar-14</td>
<td>150</td>
<td>14-May-14</td>
<td>25</td>
</tr>
<tr>
<td>28-Dec-13</td>
<td>59</td>
<td>12-Feb-14</td>
<td>228</td>
<td>30-Mar-14</td>
<td>73</td>
<td>15-May-14</td>
<td>70</td>
</tr>
<tr>
<td>29-Dec-13</td>
<td>96</td>
<td>13-Feb-14</td>
<td>207</td>
<td>31-Mar-14</td>
<td>171</td>
<td>16-May-14</td>
<td>165</td>
</tr>
<tr>
<td>30-Dec-13</td>
<td>81</td>
<td>14-Feb-14</td>
<td>252</td>
<td>01-Apr-14</td>
<td>219</td>
<td>17-May-14</td>
<td>83</td>
</tr>
<tr>
<td>31-Dec-13</td>
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<td>15-Feb-14</td>
<td>482</td>
<td>02-Apr-14</td>
<td>165</td>
<td>18-May-14</td>
<td>120</td>
</tr>
<tr>
<td>01-Jan-14</td>
<td>100</td>
<td>16-Feb-14</td>
<td>457</td>
<td>03-Apr-14</td>
<td>79</td>
<td>19-May-14</td>
<td>147</td>
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<tr>
<td>02-Jan-14</td>
<td>157</td>
<td>17-Feb-14</td>
<td>228</td>
<td>04-Apr-14</td>
<td>80</td>
<td>20-May-14</td>
<td>198</td>
</tr>
<tr>
<td>03-Jan-14</td>
<td>165</td>
<td>18-Feb-14</td>
<td>99</td>
<td>05-Apr-14</td>
<td>84</td>
<td>21-May-14</td>
<td>100</td>
</tr>
<tr>
<td>04-Jan-14</td>
<td>119</td>
<td>19-Feb-14</td>
<td>114</td>
<td>06-Apr-14</td>
<td>90</td>
<td>22-May-14</td>
<td>231</td>
</tr>
<tr>
<td>05-Jan-14</td>
<td>218</td>
<td>20-Feb-14</td>
<td>161</td>
<td>07-Apr-14</td>
<td>155</td>
<td>23-May-14</td>
<td>109</td>
</tr>
<tr>
<td>06-Jan-14</td>
<td>136</td>
<td>21-Feb-14</td>
<td>361</td>
<td>08-Apr-14</td>
<td>220</td>
<td>24-May-14</td>
<td>96</td>
</tr>
<tr>
<td>07-Jan-14</td>
<td>210</td>
<td>22-Feb-14</td>
<td>354</td>
<td>09-Apr-14</td>
<td>190</td>
<td>25-May-14</td>
<td>129</td>
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<tr>
<td>08-Jan-14</td>
<td>33</td>
<td>23-Feb-14</td>
<td>282</td>
<td>10-Apr-14</td>
<td>230</td>
<td>26-May-14</td>
<td>78</td>
</tr>
<tr>
<td>09-Jan-14</td>
<td>69</td>
<td>24-Feb-14</td>
<td>314</td>
<td>11-Apr-14</td>
<td>120</td>
<td>27-May-14</td>
<td>115</td>
</tr>
<tr>
<td>10-Jan-14</td>
<td>113</td>
<td>25-Feb-14</td>
<td>435</td>
<td>12-Apr-14</td>
<td>137</td>
<td>28-May-14</td>
<td>91</td>
</tr>
<tr>
<td>11-Jan-14</td>
<td>248</td>
<td>26-Feb-14</td>
<td>500</td>
<td>13-Apr-14</td>
<td>167</td>
<td>29-May-14</td>
<td>118</td>
</tr>
<tr>
<td>12-Jan-14</td>
<td>143</td>
<td>27-Feb-14</td>
<td>26</td>
<td>14-Apr-14</td>
<td>258</td>
<td>30-May-14</td>
<td>141</td>
</tr>
<tr>
<td>13-Jan-14</td>
<td>132</td>
<td>28-Feb-14</td>
<td>97</td>
<td>15-Apr-14</td>
<td>164</td>
<td>31-May-14</td>
<td>125</td>
</tr>
<tr>
<td>14-Jan-14</td>
<td>288</td>
<td>01-Mar-14</td>
<td>158</td>
<td>16-Apr-14</td>
<td>81</td>
<td>01-Jun-14</td>
<td>88</td>
</tr>
<tr>
<td>15-Jan-14</td>
<td>228</td>
<td>02-Mar-14</td>
<td>119</td>
<td>17-Apr-14</td>
<td>140</td>
<td>02-Jun-14</td>
<td>57</td>
</tr>
<tr>
<td>16-Jan-14</td>
<td>448</td>
<td>03-Mar-14</td>
<td>247</td>
<td>18-Apr-14</td>
<td>252</td>
<td>03-Jun-14</td>
<td>61</td>
</tr>
<tr>
<td>17-Jan-14</td>
<td>276</td>
<td>04-Mar-14</td>
<td>202</td>
<td>19-Apr-14</td>
<td>86</td>
<td>04-Jun-14</td>
<td>101</td>
</tr>
<tr>
<td>18-Jan-14</td>
<td>234</td>
<td>05-Mar-14</td>
<td>38</td>
<td>20-Apr-14</td>
<td>57</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19-Jan-14</td>
<td>150</td>
<td>06-Mar-14</td>
<td>43</td>
<td>21-Apr-14</td>
<td>67</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Fig. An. A1-1: Beijing PM$_{10}$ from 5th Dec. 2013 to 4th June 2014 Datasheet
Once gathered the data, the writer proceeded on plotting that data:

Afterwards, we counted how many days from 5th of December to 4th of July Beijing was in each of the AQI levels and plot the results:

<table>
<thead>
<tr>
<th></th>
<th>Good</th>
<th>Moderate</th>
<th>Unhealthy for Sensitive Groups</th>
<th>Unhealthy</th>
<th>Very Unhealthy</th>
<th>Hazardous</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Days</td>
<td>15</td>
<td>49</td>
<td>44</td>
<td>22</td>
<td>32</td>
<td>20</td>
<td>182</td>
</tr>
<tr>
<td>%</td>
<td>8,24%</td>
<td>26,92%</td>
<td>24,18%</td>
<td>12,09%</td>
<td>17,58%</td>
<td>10,99%</td>
<td>100</td>
</tr>
</tbody>
</table>

Fig. An. A1-3: Days and percentage of each AQI level of BJ PM$_{10}$ from 5th Dec. 2013 to 4th June 2014 Table
As we had data from several months, we also decided to extract monthly data. Nevertheless, we counted months as follows.

<table>
<thead>
<tr>
<th>Month</th>
<th>Start Date</th>
<th>End Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>December</td>
<td>From 5th December 2013</td>
<td>To 4th January 2014</td>
</tr>
<tr>
<td>January</td>
<td>From 5th January 2014</td>
<td>To 4th February 2014</td>
</tr>
<tr>
<td>February</td>
<td>From 5th February 2014</td>
<td>To 4th March 2014</td>
</tr>
<tr>
<td>March</td>
<td>From 5th March 2014</td>
<td>To 4th April 2014</td>
</tr>
<tr>
<td>April</td>
<td>From 5th April 2014</td>
<td>To 4th May 2014</td>
</tr>
<tr>
<td>May</td>
<td>From 5th May 2014</td>
<td>To 4th June 2014</td>
</tr>
</tbody>
</table>

Next table shows how many days of each AQI level took place by month.

<table>
<thead>
<tr>
<th>Month</th>
<th>Good</th>
<th>Moderate</th>
<th>Unhealthy for Sensitive Groups</th>
<th>Unhealthy</th>
<th>Very Unhealthy</th>
<th>Hazardous</th>
</tr>
</thead>
<tbody>
<tr>
<td>December</td>
<td>3</td>
<td>10</td>
<td>6</td>
<td>4</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>January</td>
<td>4</td>
<td>5</td>
<td>8</td>
<td>2</td>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td>February</td>
<td>3</td>
<td>2</td>
<td>6</td>
<td>3</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>March</td>
<td>3</td>
<td>11</td>
<td>5</td>
<td>4</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>April</td>
<td>0</td>
<td>8</td>
<td>7</td>
<td>6</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>May</td>
<td>2</td>
<td>13</td>
<td>12</td>
<td>3</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

Fig. An. A1-5: Days of each AQI level of BJ PM$_{10}$ from 5th Dec. 2013 to 4th June 2014 by month Chart

Next table shows the percentage of the days of each AQI level by month. Compared by the total month days.

<table>
<thead>
<tr>
<th>Month</th>
<th>Good %</th>
<th>Moderate %</th>
<th>Unhealthy for Sensitive Groups</th>
<th>Unhealthy %</th>
<th>Very Unhealthy %</th>
<th>Hazardous</th>
</tr>
</thead>
<tbody>
<tr>
<td>December</td>
<td>9,68%</td>
<td>32,26%</td>
<td>19,35%</td>
<td>12,90%</td>
<td>9,68%</td>
<td>16,13%</td>
</tr>
<tr>
<td>January</td>
<td>12,90%</td>
<td>16,13%</td>
<td>25,81%</td>
<td>6,45%</td>
<td>29,03%</td>
<td>9,68%</td>
</tr>
<tr>
<td>February</td>
<td>9,68%</td>
<td>6,45%</td>
<td>19,35%</td>
<td>9,68%</td>
<td>22,58%</td>
<td>22,58%</td>
</tr>
<tr>
<td>March</td>
<td>9,68%</td>
<td>35,48%</td>
<td>16,13%</td>
<td>12,90%</td>
<td>19,35%</td>
<td>6,45%</td>
</tr>
<tr>
<td>April</td>
<td>0,00%</td>
<td>25,81%</td>
<td>22,58%</td>
<td>19,35%</td>
<td>19,35%</td>
<td>9,68%</td>
</tr>
<tr>
<td>May</td>
<td>6,45%</td>
<td>41,94%</td>
<td>38,71%</td>
<td>9,68%</td>
<td>3,23%</td>
<td>0,00%</td>
</tr>
</tbody>
</table>

Fig. An. A1-6: Percentage of each AQI level of BJ PM$_{10}$ from 5th Dec. 2013 to 4th June 2014 by month Chart
Finally we plot the information of the previous tables into two plots:

**Fig. An. A1-7:** Days of each AQI level of BJ PM$_{10}$ from 5$^{th}$ Dec. 2013 to 4$^{th}$ June 2014 by month Area plot

**Fig. An. A1-8:** Percentage of days of each AQI level of BJ PM$_{10}$ from 5$^{th}$ Dec. 2013 to 4$^{th}$ June 2014 by month line plot
Annex C1
Module C P5 Analysis
In the Annex C1 the reader is going to find the P5 Analysis performance in order to obtain the sustainable objectives of the project. The very first things to bear in mind are the P5 categories, which are:

**Fig. An. C1-1: P5 categories, subcategories and elements diagram [22]**
At this point, the project manager tried to find out new sustainable objectives bound to the previous categories. Because of this fact, he came up with the following template.

<table>
<thead>
<tr>
<th>Elements</th>
<th>Before</th>
<th>After</th>
<th>Change?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct financial Benefits</td>
<td>As the material is not done, GMG cannot perform the trainings.</td>
<td>The materials allow GMG to perform GPM-b certification trainings so that, comes together with an income of 20000RMB per day of training.</td>
<td>Change</td>
</tr>
<tr>
<td>Net Present Value</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flexibility/ Optionality in the Project</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increased business flexibility</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Local Procurement</td>
<td>The only raw materials are paper and pens. Irrelevant.</td>
<td>The only raw materials are paper and pens. Irrelevant.</td>
<td></td>
</tr>
<tr>
<td>Digital Communication</td>
<td>The company uses mail and Skype to communicate among Beijing, Shanghai, Guangzhou and Hong Kong offices.</td>
<td>The company uses mail and Skype to communicate among Beijing, Shanghai, Guangzhou and Hong Kong offices. Communicate with Joel (US) via Skype and GoToMeeting</td>
<td>Change</td>
</tr>
<tr>
<td>Traveling</td>
<td>Every weekday I go to work from Beijing Jiaotong University to GMG office at Sihui dong.</td>
<td>There are some days that I work from the university using my dorm’s Internet connection.</td>
<td>Change</td>
</tr>
<tr>
<td>Transport</td>
<td>Training materials transport is made by SUMMER using taxi</td>
<td>Training materials transport is made by SUMMER using taxi</td>
<td></td>
</tr>
<tr>
<td>Energy Used</td>
<td>This is an office project that only consumes a very little amount of electrical energy. Irrelevant</td>
<td>This is a office project that only consumes a very little amount of electrical energy. Irrelevant</td>
<td></td>
</tr>
<tr>
<td>Emission / Co2 from Energy Used</td>
<td>Irrelevant (related to Energy Used)</td>
<td>Irrelevant (related to Energy Used)</td>
<td></td>
</tr>
<tr>
<td>Recycling</td>
<td>In the trainings, the participants were given paper exams to practice every chapter of the PRiSM in order to pass GPM-b certification exam</td>
<td>In the trainings, the participants were given access to an Internet based exam’s platform to practice every chapter of the PRiSM in order to pass GPM-b certification exam</td>
<td>Change</td>
</tr>
<tr>
<td>Disposal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reusability</td>
<td>One-use paper templates in the trainings where the participants write on it.</td>
<td>Plasticized paper templates in the trainings where the participants write using post-it.</td>
<td>Change</td>
</tr>
<tr>
<td>Incorporated energy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Waste</td>
<td>Every report I sent to JESUS was printed.</td>
<td>Printing only the final key documents, all reports and activities are shown to JESUS using laptops or tablets, and corrected in there. Thant supposes a reduction of 90% consumption of ink and paper.</td>
<td>Change</td>
</tr>
</tbody>
</table>

*Fig. An. C1-2: P5 Profit and P5 Planet Objectives Template*
Once the project manager had defined the sustainable objectives, he wanted to assess them in order to know how would the environmental impact decrease in the previous conditions.

To do so, he used the P5 GPM-Calculator® template, which is a matrix that compares every objective with the P5 elements. It assesses the objective’s impact to the element from +3 (the worst) to -3 (the best); and the template gives you the environmental impact.

This is our project P5 Analysis GPM-Calculator® template filled in:

**Fig. An. C1-3: P5 People Objectives Template**

<table>
<thead>
<tr>
<th>Elements</th>
<th>Before</th>
<th>After</th>
<th>Change?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employment</td>
<td>Office regular employees</td>
<td>Employed ORIOL as a PM with its appropriate PM training.</td>
<td></td>
</tr>
<tr>
<td>Labor/Management Relations</td>
<td>Local resources did not know about GPM</td>
<td>Use local resources and upgrade their skills with GPM methodology</td>
<td></td>
</tr>
<tr>
<td>Health and Safety</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Training and Education</td>
<td>After every exercise I did, my colleagues were not trained on how to teach it.</td>
<td>All PM training department was trained in every single new activity I came up with; so the PM needed to do TTT materials.</td>
<td></td>
</tr>
<tr>
<td>Organizational Learning</td>
<td></td>
<td>Learned about the Green in Project Management.</td>
<td></td>
</tr>
<tr>
<td>Diversity and Equal Opportunity</td>
<td>Resources to be acquired.</td>
<td>Over 50% of the resources are female</td>
<td></td>
</tr>
<tr>
<td>Hiring Practices based on Skill and Competency</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forced Child Labor</td>
<td>There are no under 18 employees in GMG</td>
<td>Keeps being no under 18 employees in GMG</td>
<td>-</td>
</tr>
<tr>
<td>Forced and Compulsory Labor</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Community Support</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public Policy/Compliance</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Customer Health and Safety</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Products and Services Labeling</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Market Communications and Advertising</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Customer Privacy</td>
<td>Costumers are not involved in this project</td>
<td>Costumers are not involved in this project</td>
<td>-</td>
</tr>
<tr>
<td>Investment and Procurement Practices</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bribery and Corruption</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anti-Competition Behavior</td>
<td>No competitors in-house nor out-house</td>
<td>No competitors in-house nor out-house</td>
<td>-</td>
</tr>
</tbody>
</table>
### Annex C1: Module C5 Analysis

#### Table: P5 GPM Calculator® Assessment

<table>
<thead>
<tr>
<th>People</th>
<th>Planet</th>
<th>Profit</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
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<td>0</td>
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<td>0</td>
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<tr>
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**Fig. An. C1-4:** P5 GPM-Calculator® Assessment
After assessing, the P5 GPM-Calculator® also gives the project manager the sustainable score bounded to the sustainable objectives defined above.

Applying the previous Sustainable Objectives, we reduced the overall environmental impact of the project up to 7.33% (the reader may remember that minus sign means positive impact). That is a great achievement, because the company earned money in the process and, at the same time, is giving a Green enterprise image to its customers and suppliers.

To get deeply into the analysis, the environmental impact was reduced by 17% in P5 Profit statements; 24% in P5 Planet; and 26% in P5 People. This calculus only takes into consideration the elements that our sustainable objectives affect, not the overall environmental impact.

Another interesting plot that the project manager can obtain from the P5 GPM-Calculator® is the executive environmental impact summary, as follows:

The Executive Summary let the project manager and the steering committee realize about the environmental impact reduction of each of the categories and regarding a Product and Process overview.
Even though there are better achievements from a Product than from a Process overview; both are quite satisfactory.

First of all, the writer wanted to remind the sustainable objectives:

- Web based GPM-b practice exams
- Plasticized Training Templates
- E-Templates after trainings
- Ability to work from home
- Just printing key documents
- Perform Train The Trainer (TTT) Materials
- Use of virtual communication tools
- Use of local resources
- Use of local procurement
- Over 50% of the resources are women

With those objectives, these are the Product Sustainable Achievements regarding Environmental Impact:

- Improved a 80% in Labour Practices and Decent Work
- Improved a 50% in Transport
- Improved a 45% in both; Society & Costumers, and Ethical Behaviour
- Improved a 40% in Materials & Procurement
- Improved a 35% in Business Agility
- Improved a 20% in both; Human Rights; and Energy Consumption
- **And even improved a 15% in Return on Investment (ROI)**

With the previous objectives, these are the Process Sustainable Achievements regarding Environmental Impact:

- Reduced an extra 45% in both; Materials & Procurement; and Waste
- Reduced an extra **20% in both; Labour Practices & Decent Work; and return on Investment (ROI)**
- Reduced an extra 15% in both; Business Agility and Economic Stimulation
- Reduced an extra 10% in Transport.

As the reader may notice; just applying some simple sustainable objectives, makes the environmental impact reduce a lot. Because of that is really recommendable using P5 analysis in the Pre-Project Phase of the Project.
Annex C2
Module C Time Management and PERT Durations
In this annex, the writer is going to show how did he manage to come up with the PERT durations used in Module C time management section.

To start with, you have to define the activities once performed the WBS. Once the activities are defined, you have to determine Optimistic (O), Most Likely (ML) and Pessimistic (P) duration and then calculate PERT duration as follows:

\[
PERT = \frac{O + 4ML + P}{6}
\]

In order to introduce it in a project management software, the writer recommend to round up this PERT duration because its more clear and you are getting extra buffer just in case.

In the following table, the writer also added the first stage resources used in each activity.

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<tr>
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### Annex C2: M3 Time Management and PERT Durations

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### GET WEBSITE APPROVED

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### GET MATERIALS APPROVED

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### GET Exam Questions APPROVED

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Once we have defined PERT durations and assigned the resources, the writer used the software “Microsoft Projects 2007” for scheduling.

In the previous software the activities can be added with their durations (PERT) and their respective predecessors.

As it is developed in C-4 section; we cannot accomplish the time constraint in these conditions so we proceeded on developing Fast Tracking technique (C-4.2) followed by Crashing technique (C-4.3).

Because the writer did not want to add all the diagrams in the module C; because was afraid that the reader could miss the focus, he decided to add all of them in annex C2.

In these following pages the reader will find for the Original WBS, WBS after Fast Tracking and WBS after Crashing; the following diagrams:

- **Overall Diagram**: in this diagram the reader will get an overview idea on how long will it take every phase and main activities of the project.
- **Gantt Diagram for every Phase**: shows when starts and finishes every single activity in the phase with the predecessors and successors connections.
- **Critical Path Diagram**: like the previous but only showing the activities in the critical path. If those activities suffer delays, then the entire project will be delayed by the same amount of time.
### Original WBS with PERT durations

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**Fig. An. C2-2: Original WBS Overall Phases Gantt Diagram**

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**Fig. An. C2-3: Original WBS Phase 1 Gantt Diagram**
Fig. An. C2-4: Original WBS Phase 2 Gantt Diagram

Fig. An. C2-5: Original WBS Phase 3 Gantt Diagram
Fig. An. C2-6: Original WBS Phase 4 Gantt Diagram

Fig. An. C2-7: Original WBS Phase 5 and 6 Gantt Diagram
GPM fit into a Chinese Environment

Annex C2: M3 Time Management and PERT Durations

Fig. An. C2-8: Original WBS Critical Path
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**Annex C2: M3 Time Management and PERT Durations**

### WBS after Fast Tracking

**Fig. An. C2-9: WBS after Fast Tracking Overall Phases Gantt Diagram**

**Fig. An. C2-10: WBS after Fast Tracking Phase 1 Gantt Diagram**
GPM fit into a Chinese Environment

Annex C2: M3 Time Management and PERT Durations

Fig. An. C2-11: WBS after Fast Tracking Phase 2 Gantt Diagram

Fig. An. C2-12: WBS after Fast Tracking Phase 3 Gantt Diagram
Fig. An. C2-13: WBS after Fast Tracking Phase 4 Gantt Diagram

Fig. An. C2-14: WBS after Fast Tracking Phase 5 and 6 Gantt Diagram
Fig. An. C2-15: WBS after Fast Tracking Critical Path
### WBS after Crashing

#### Annex C2: M3 Time Management and PERT Durations

#### Fig. An. C2-16: WBS after Crashing Overall Phases Gantt Diagram

#### Fig. An. C2-17: WBS after Crashing Phase 1 Gantt Diagram
### Phase II Skill Development Phase

- **2.1 Self directed Learning Document**
  - 2.1.1 Read Materials Project Management related
  - 2.1.2 Consult Materials with Sponsor
  - 2.1.4 Consult Materials with Joel
  - 2.1.5 Write Self directed Learning Report
  - 2.1.6 Write Module B of the Thesis

- **2.2 Directed Learning Report**
  - 2.2.1 Attend Training from PHL Session I
  - 2.2.2 Write Report after training with Q&A
  - 2.2.4 Write Report after training with Q&A
  - 2.2.5 Write Module C of the Thesis
  - 2.2.6 Review Module C of the Thesis

### Phase III External Supplier Procurement

- **3.1 Website Developed**
  - 3.1.1 Look for website providers
  - 3.1.2 Shortlist website providers
  - 3.1.3 Collect Proposals
  - 3.1.4 Evaluate proposals
  - 3.1.5 Negotiate price
  - 3.1.6 Sign contract
  - 3.1.7 Test website
  - 3.1.8 Request website changes
  - 3.1.9 Test Website
  - 3.1.10 Perform Front and Back cover from vendor

**Fig. An. C2-18: WBS after Crashing Phase 2 Gantt Diagram**

**Fig. An. C2-19: WBS after Crashing Phase 3 Gantt Diagram**
### Annex C2: M3 Time Management and PERT Durations

#### 4.2 GPM Exam Questions Ready
- Collect Materials
- Review Tutorials with Sponsor
- Receive ideas with Senior Trainers
- Receive Ideas with exit
- Final Draft Materials Document
- Final Draft Materials Document with Sponsor
- Final Draft Exam Questions Document
- Final Draft Exam Questions Document with Sponsor
- Final Draft Exam Questions Document with exit
- Receive Exam Questions Document
- Receive Exam Questions Document with Sponsor
- Receive Exam Questions Document with exit
- Receive Exam Questions Document with Sponsor
- Receive Exam Questions Document with exit

#### 4.3 Materials Transferred to On
- Identify output translation
- Make Translation schedule
- Get translator’s schedule approved
- Make output translation work
- Collect translation and review
- Upgrade translation

### Task V Pilot Training

**5.1 Training Delivered**
- Select Trainer
- Select training room
- Select materials to be printed
- Identify printing company
- Sign contract with printing company
- Print materials
- Deliver materials to training room
- Training delivery
- Identify upgrading points in the training
- Write training report
- Collect report from participants
- CONSOLIDATE REPORT WITH TRAINER

**5.1 Final Materials Form**
- Final Materials
- Collect feedback from trainer, and Sponsor
- Join all project sections
- Upgrade Materials
- Do Internal Presentation
- Upgrade Exams
- Upload materials into website
- Write Lessons Learned
- Store and transfer program materials to company
- Celebration Party
- CLOSE PROJECT

---

**Fig. An. C2-20: WBS after Crashing Phase 4 Gantt Diagram**

**Fig. An. C2-21: WBS after Crashing Phase 5 and 6 Gantt Diagram**
Fig. An. C2-22: WBS after Crashing Critical Path
Annex C3
Some of the Project’s Outputs
In this annex, the reader is going to find the following project’s outputs:

- Self Evaluation Exercise
- Crashing Exercise
- Procurement Charts
- GPM-b exams pack

A-C2.1 Self Evaluation Exercise

Due to the new 5th version in PMBOK, the PMP training self-evaluation exercise needed an update in some fields. Because of the previous fact, I was supposed to create the 5th Edition Self Evaluation Wheel.

In this exercise, the trainees are supposed to auto-assess themselves in some fields scoring from 0 to 10. Then, they draw the scores in the paper and compare with their partners.

A-C2.2 Crashing Exercise

During the time management chapter, I showed some exercise samples to Mr Hernández. He liked the crashing exercise I proposed him so he asked me to build up some slides and then an extra exercise of it.

In A-C2.2 the reader will find in this order:

- The Crashing explaining slides and one complete example on the slides.
- Paper-based Crashing Exercise.
- Resolution of the paper-based Crashing Exercise.

A-C2.3 Procurement Charts

Mr Hernández asked me to redo his PMP Procurement Management FPIF and CPIF examples slides. I also added them in the present thesis; FPIF (B-7.1.2.3.1.1) and CPIF (B-7.1.2.3.2.1).

A-C2.4 GPM-b exams pack

It consists on four exams of 25 questions each in order to pass GPM-b exams followed by its answer sheet with an explanation of each of the questions. These materials are going to be used by Gold Millennium Consulting Group in their GPM trainings in order to let their trainees practice. As GMG offers trainings in both English (A-C2.4.1) and Chinese (A-C2.5.1), the reader is going to find the exams in both languages.
Here follows what the trainee is going to be assessed in each exam:

Exam 1
- ✔ Sustainability (B.1 chapter)
- ✔ Pre-Project Phase (B.2 chapter)

Exam 2
- ✔ Planning Phase (B.3 chapter)

Exam 3
- ✔ Executing and Controlling Phase (B.4 chapter)
- ✔ Closure and Reviews Phase (B.5 chapter)
- ✔ Organizational Structure (B.6 chapter)

Exam 4
- ✔ Resource and Social Skills (B.7 chapter)
Project Management Self Evaluation Wheel

Leadership

Team Building

Motivation

Decision Making

Communication

Political Awareness

Influence

Cultural Awareness

Negotiation

Trust Building

Coaching

Conflict
Annex C3.2
Crashing Presentation and Exercise
Crashing Slides

Aim of the Exercise

According to given data, you are asked to build a chart showing the finishing time of your project versus its respective extra cost to Management.

You asked it to your engineer friend and he explained an easy way to do so using a simple heuristic.

HEURISTIC RULES

I. Always reduce activities of the critical path
II. Recalculate critical path(s) after each iteration
III. Always choose the cheapest options according to (I)

Getting started ...

Please, give me the data ...

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<td>F (C, D)</td>
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<td>6</td>
</tr>
<tr>
<td>G (F, E)</td>
<td>4</td>
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<td>3</td>
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Annex C3: Some of the Project's Outputs

... building the diagrams

AOA

B 6 → C 9 → F 10 → G 4

D 14 → E 8

GANTT

Critical Path: A → D → E → G

32 days

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<td>3</td>
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What options do we have to reduce the critical path duration?

✓ Reduce G x1 (2K CHY)
✓ Reduce F x1 (4K CHY)
✓ Reduce C x1 (5K CHY)

Which of the previous options are we going to perform?

Of course, the cheapest
Reduce G x1 (2K CHY)

Iteration 1

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What can we reduce?

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GPM fit into a Chinese Environment

Annex C3: Some of the Project’s Outputs

### Iteration 2

- Reduce F x1 (4K CHY)
- Reduce C x1 (5K CHY)

**What options do we have to reduce the critical path duration?**

**Which of the previous options are we going to perform?**

### Iteration 3

- Reduce Dx1 Cx2 (11K CHY)
- Reduce Dx1 Fx1 (12K CHY)

**What options do we have to reduce the critical path duration?**

**Which of the previous options are we going to perform?**

---

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**Critical Path!!!**
GPM fit into a Chinese Environment

Annex C3: Some of the Project’s Outputs

**Iteration 4**

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Let’s update the table.

**Iteration 5**

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Let’s update the table.

What options do we have to reduce the critical path duration?

NONE !!!!

Even though we can reduce C and F, as they are in parallel with other non-reducible activities. It’s useless !!!

What options do we have to reduce the critical path duration?

Reduce Ex1 (8K CHY)
Let’s have a quick look at the results ...

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Let’s plot the results to Management

BEFORE CRASHING

A B C D E

32 days

AFTER CRASHING

A B C D E G

26 days

What have we learned?

- To build PERT and GANTT diagrams
- To detect the critical path graphically
- How to use your resources when Crashing
- How does the critical path change as we keep crashing
- Can be more than one critical path
Crashing Paper-based Exercise

The company ABC Co. Ltd. has a project on hands, which is composed of 7 activities. Their PERT durations have already been estimated (in days) as are shown in the following table.

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<tr>
<td>Planning Phase</td>
<td>B</td>
<td>-</td>
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<tr>
<td>Executing until first Milestone</td>
<td>C</td>
<td>A</td>
<td>3</td>
</tr>
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<td>Controlling until first Milestone</td>
<td>D</td>
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<td>Executing the rest of the Project</td>
<td>E</td>
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<tr>
<td>Controlling the rest of the Project</td>
<td>F</td>
<td>C</td>
<td>4</td>
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<tr>
<td>Closing Phase and Reviews</td>
<td>G</td>
<td>D E</td>
<td>3</td>
</tr>
</tbody>
</table>

You are a recently hired Project Manager specialized in time management so, first of all, you are asked to draw the AON and GANTT diagrams, as well as detecting the critical path. You can use the quantitative method that you like the most. Which is the total buffer?

Critical Path:

Total Buffer:
Management thinks this project can be reduced in duration terms adding more resources. How long could the project be reduced if they invest 17K CHY? How much money do they have to spend to reduce it the most? How long would it take?

As you are really committed to do so, you have already gathered the following information:

<table>
<thead>
<tr>
<th>Activity</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
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<td>3</td>
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<tr>
<td>Cost of reducing 1 day</td>
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<td>7</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>7</td>
<td>6</td>
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</table>

If management invest 17K CHY, the minimum project duration is of ____ days.

If management wants to reduce it the maximum, at least the project will take ____ weeks and will have an extra cost of ____ K CHY.
Crashing Paper-based Exercise Resolution

The company ABC Co. Ltd. has a project on hands, which is composed of 7 activities. Their PERT durations have already been estimated (in days) as are shown in the following table.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Code</th>
<th>Precedence</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Project Phase</td>
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<tr>
<td>Planning Phase</td>
<td>B</td>
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<tr>
<td>Executing until first Milestone</td>
<td>C</td>
<td>A</td>
<td>3</td>
</tr>
<tr>
<td>Controlling until first Milestone</td>
<td>D</td>
<td>A</td>
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</tr>
<tr>
<td>Executing the rest of the Project</td>
<td>E</td>
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<tr>
<td>Closing Phase and Reviews</td>
<td>G</td>
<td>D E</td>
<td>3</td>
</tr>
</tbody>
</table>

You are a recently hired Project Manager specialized in time management so, first of all, you are asked to draw the AON and GANTT diagrams, as well as detecting the critical path. You can use the quantitative method that you like the most. Which is the total buffer?

**Critical Path:** A – D - G

**Total Buffer:** 2x2 + 2x2 = 8
Management thinks this project can be reduced in duration terms adding more resources. How long could the project be reduced if they invest 17K CHY? How much money do they have to spend to reduce it the most? How long would it take?

As you are really committed to do so, you have already gathered the following information:

<table>
<thead>
<tr>
<th>Activity</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
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<tr>
<td>Cost of reducing 1 day</td>
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<td>2</td>
<td>3</td>
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</table>

If management invest 17K CHY, the minimum project duration is of 8 days.

If management wants to reduce it the maximum, at least the project will take 6 weeks and will have an extra cost of 33 K CHY.
Annex C3.3
Procurement Management FPIF and CPIF Charts
FPIF Chart

To begin with, the writer is going to post the old version of the chart that GMG was using in their PMP training.

As we can see in the chart, the constants are as follows:

<table>
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<th>CONSTANTS</th>
<th>Value in RMB</th>
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<tr>
<td>Target Cost (TC)</td>
<td>¥350</td>
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<tr>
<td>Target Fee (TF)</td>
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<tr>
<td>Share Ratio (SR)</td>
<td>0.30 (70-30)</td>
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<tr>
<td>Price Ceiling (PC)</td>
<td>¥600</td>
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</table>

Afterwards, we precede on calculation the point of total assumption (PTA):

\[
PTA = \frac{PC - (TF + SR \cdot TC)}{1 - SR} = \frac{600 - (140 + 0.3 \cdot 350)}{1 - 0.3} = 507.14 \approx 507
\]

We can see that in the original slide, PTA is slightly less than 500RMB. Furthermore, as the second section (Cost>PTA), then there is not w2w situation and you don’t share your profits with the supplier (factory), so the factory profit (PF) should be null from then on. Moreover, if the cost is even higher than the ceiling price (PC) there is no business.

The supplier profit or factory profit (FP) is calculated by the following formula:

\[
FP_t = TF + SR \cdot (TC - AC_t)
\]
Now, we are going to precede giving values to the Actual Cost (AC) and building the required plot:

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**Annex C3: Some of the Project’s Outputs**

Some of the Project's Outputs
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Fig. An. C3.3-2: FPIF datasheet
Once we have the data, next step is plotting the results:

We can see that in these conditions, our company would have a total profit of 466,67RMB but we share 140RMB (TF) to your supplier because you achieved a good target cost of 350RMB (TC). At the end your supplier would earn 140RMB more and you 326,67RMB.
CPIF Chart

As the writer did in FPIF, he will start by posting the old version of the chart that GMG was using in their PMP training.

Actually the only difference between FPIF is that in CPIF when the target cost is over the point of total assumption (PTA); the share ratio turns 100-0 so FP equals TF. For a more detailed explanation, please see chapter B-7.1.2.3.2.1.

Now, we are going to precede giving values to the Actual Cost (AC) and building the required plot:

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### GPM fit into a Chinese Environment

#### Annex C3: Some of the Project’s Outputs

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<td>¥101</td>
<td>¥580</td>
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</tbody>
</table>
Once we have the data, next step is plotting the results:

As we have said before, the only difference between FPIF is that when the target cost is higher than PTA; the supplier is getting 93RMB instead that none (FPIF).
Annex C3.4.1
GPM-b practice exam pack (English)
Questions and Answers
Exam 1: GPM Sustainability and Pre-Project Questions

1. You are a project manager assigned by your organization to implement a series of guidance documents and standards to help your organization address energy issues. Which ISO of the following choices listed should you apply?
   a. ISO 9001
   b. ISO 5001
   c. None of the above

2. Which of the following ISO standards are considered as guidelines but not as normative standards?
   a. ISO26000 and ISO21500
   b. ISO21500, ISO50001 and ISO9000
   c. ISO215000 and ISO50001

3. You are the PM of the company ABC, due to a change of your company’s policies to environment, you are supposed to explain what CSR is to your boss. Because of that you prepared your presentation structured as the ISO26000 principles of social responsibility. If you want to follow those principles, how is your presentation structured?
   a. Accountability, Sustainability, Transparency, Ethical Behavior and Stakeholder Interests.
   b. Accountability, Transparency, Ethical Behavior, Shareholder Interests and Rule of Law.
   c. Accountability, Transparency, Ethical Behavior, Stakeholder Interests and Rule of Law.

4. Deming Cycle, also referred as PDCA is a concept that we can find in...
   a. ISO14000
   b. ISO9001
   c. Both are correct

5. Juran, one of the quality gurus, developed the PDCA. It stands for...
   a. Juran’s PDCA stands for Plan, Do, Check, and Act
   b. Juran’s PDCA stands for Preview, Do, Corroborate and Actualize.
   c. None of the previous are correct

6. Which of the following statements are correct.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Primary Energy</th>
<th>Final Use</th>
</tr>
</thead>
<tbody>
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<tr>
<td>IV</td>
<td>Biodiesel</td>
<td>Heating</td>
</tr>
</tbody>
</table>

   a. I, II, III
   b. III
   c. II, III
7. Main principles of Internal Audits are.
   a. Ethical conduct, Integrity, Professional care and Corporate Compliance.
   b. Ethical conduct, Fair presentation, Professional care and Independence.
   c. Both are correct

8. ISO21500 is a normative standard for...
   a. Project Management
   b. Energy Management
   c. None of the previous

9. ISO21500 guidance should fit for the following type of organization...
   a. Public and Private organizations
   b. Just Private organizations
   c. Any type of organization

10. ISO21500 Process Groups is structured by the following stages:
    a. Planning, Implementing, Controlling and Closing
    b. Initiating, Planning, Implementing Controlling and Closing
    c. Initiating, Planning, Executing, Monitoring and Closing.

11. Which of the following are the GPM integration into the Initiation Phase?
    a. P5 analysis and develop SMP
    b. TBL
    c. Preparation of a Business Case

12. The Business Case, ...
    a. It’s a part of the Planning Phase.
    b. It’s a document justifying the project done by the PM and doesn’t need the project sponsor signature.
    c. It’s a key document to any project and, regarding to GPM, the environmental impact must be also taken into consideration.

13. The concept of TBL was introduced by John Elkington in 1994 and it is referred to:
    a. P5
    b. Social, Environment and Financial
    c. People, Project and Planet.

14. The 5 P’s of P5 stand for...
    a. Planet, People, Profit, Planning and Process.
    b. Pollution, People, Production, Process and Product.
    c. Product, Profit, People, Planet and Process.

15. According to the P5 integration Matrix...
    a. Show elements on how the TBL is strictly related to the Project.
    b. Helps us to measure our quality production.
    c. None of the above
16. One PM certified as GPM-b is explaining what SMP means to his other PM colleague that has not been trained in GPM yet.
   a. He stated that SMP is only necessary to be attached in all the documents of the initiation phase.
   b. He stated that SMP only identifies project impacts on an Environmental point.
   c. None of the above.

17. To Score the P5 Impact Assessment...
   a. For each statement you have to score from (-4) to (+4).
   b. (+1) means slightly positive while (-3) means really negative.
   c. The project Manager must score at his own criteria.

18. According to Stakeholder Management, how is the best way to deal with a Passive Backer?
   a. Encourage him
   b. Motivate him
   c. Fire him

19. Which are UN Global Compact-Ten principles four sections?
   c. Human Rights, Ethics, Labour and Equality

20. Which of the TBL concepts its not included in UN Global Compact- Ten Principles?
   a. Planet (Environment)
   b. People (Social)
   c. Profit (Financial)

21. Which of the following would represent exactly the GRI indicators?
   a. The same as TBL
   b. The same as P5
   c. The same as UN-Ten Principles

22. Which of the following statements is not correct about sustainability?
   a. Sustainability is about local and global, only focused in the long term.
   b. Sustainability is about ethics.
   c. Sustainability is also about economic interests.

23. As GRI stands, what is the reporting commonly used for?
   a. GRI gives a best sustainability report prize every year
   b. Can be used to compare the performance among different organizations
   c. GRI stands for Global Reporting Institute

24. In this order, which are the fields of the following ISOs? (ISO9000, ISO14000, ISO26000, ISO50001, ISO21500.
   a. Quality, Energy, Environment, CSR, PM
   b. Quality, Energy, CSR, PM, Environment
   c. Quality, Environment, CSR, Energy, PM
25. According to ISO9000, which of the following is not one of its principles?
   a. Leadership
   b. Stakeholders focus
   c. Mutually beneficial supplier
Exam 2: GPM Planning Questions

1. According to the Planning phase, who has the authority role to update the document properties?
   a. Project Manager
   b. Project Sponsor
   c. Project Team

2. As a certified GPM-b, you remember that in the Planning phase, as you cannot define without understanding the scope, the very first thing is defining it. As you attended to a GPM training course, you remember doing an activity for such thing. How was it called?
   a. Answering the 6 W's
   b. Answering the 7 W's
   c. Answering the 8 W's

3. Which of the following would best define the acceptance criteria:
   a. What the costumer states
   b. Only it is necessary to be reviewed constantly and rigorously in the early phases
   c. Must be measurable and unambiguous

4. According to PBS ...
   a. Stands for Policy of Basic Standards
   b. Provides a high level view of the key work (important information for the project stakeholders)
   c. Identifies the items to be used in configuration management

5. Which of the following statements are true according to WBS?
   I. Stands for Work Breakdown Structure
   II. Is derived from PBS
   III. Has product packages at the lowest level of any branch
   IV. Even though cannot be related with OBS, it is mandatory for doing CBS
   V. Provides a framework for communicating throughout the project, including performance reporting and escalation of issues
   a. All are correct
   b. I, II, III
   c. I, II, V

6. According to GMP Planning phase scope management, if PBS and OBS are available; can proceed doing RACI and CBS.
   a. We can only do RACI
   b. We can do both RACI and CBS
   c. We cannot do RACI nor CBS
7. What does RACI stand for?
   a. Responsibility, Acquiring, Critical, Information
   b. Responsible Accuracy on Controlling Initiative
   c. Responsible, Accountable, Consult and Inform

8. Which one of the following can only have one in each row of RACI?
   a. Responsible
   b. Inform
   c. Accountable

9. Which of the following is the basic structure that needs to be done for being able to do
   the others.
   a. RACI
   b. CBS
   c. None of the above

10. Which of the following is correct?
    a. The level of uncertainty grows as the project is being developed
    b. The accuracy and uncertainty level are inverse
    c. The accuracy and uncertainty levels always get crossed in the produce stage

11. According to Resource Management, PRiSM remarks that usually the most valuable
    resource that a PM will ever have is ...
    a. People
    b. Environment
    c. Raw Materials

12. Which of the following is not considered a resource?
    a. Knowledge
    b. Environment
    c. Money

13. Which of the following is a key concept for quality management?
    a. 6σ
    b. Qualitative terms
    c. Relation among Scope, Time, Cost and Sustainability

14. According to success in quality management, requires the participation of all members
    of the team and stakeholders. Nevertheless, the most important of them is ...
    a. Project Manager
    b. Quality Manager
    c. Management

15. According to quality standards, we must focus our effort in achieving quality in ...
    a. Process
    b. Product
    c. Both are correct
16. How many processes cover Quality Environment?
   a. <5
   b. 5
   c. >5

17. Which of the following quality tools helps to identify the cause of a problem in the Planning phase?
   a. Scatter Plot
   b. Cause and Effect diagram, also called Taguchi or Fishbone diagram.
   c. None of the above

18. Why the seven quality tools are referred as "basic"?
   a. They don't solve many quality problems
   b. They are easy to use, even though the user don't have statistic background
   c. Both are correct

19. Kaoru Ishikawa introduced the concept of the 7 basic quality tools relating them as the seven basic weapons of Bankei (samurai). Those are Fishbone diagram, Stratification, Histogram, Pareto chart, Scatter diagram, Flow chart and Run chart. We know that Check Sheet is also a quality tool so, which one of the previous is wrong?
   a. Pareto diagram because it's a histogram (so it is repeated)
   b. Flow chart because it should be in stratification
   c. None of the previous

20. In which phases can we find the seven quality tools?
   a. Planning phase
   b. Execute and Control phases
   c. Both are correct

21. According to Costs of Quality ...
   a. The Quality Guru Crosby said “Quality is free” referring to quality investment. Nowadays we affirm that at long term, it is entirely true.
   b. Prevention (Quality investment) cost is not free
   c. Both are correct
From question 22 to 24 are referred to the following network diagram.

22. Which is the minimum duration of the project if the durations are in days?
   a. 15 days
   b. 16 days
   c. 20 days

23. Which is the critical path of the project?
   a. A-B-E-G
   b. A-B-D-G
   c. There are two critical paths: A-C-E-G and A-C-F-G

24. Which is the total float of the project if the durations are in days?
   a. 4 days
   b. 7 days
   c. 9 days

25. Where would you do crashing first?
   a. In those activities that can be done in parallel
   b. In the cheapest available activity
   c. In the critical path
Exam 3: GPM Executing & Controlling + Closure & Reviews Questions + Organizational Structure

1. According to traditional Risk definitions:
   a. Risk is always negative
   b. All risks are opportunities
   c. None of the above

2. The four levels of risk are usually divided into ...
   a. Strategic, Project, Program and Operations.
   b. Process, Project, Program and Portfolio.
   c. Process, Product, Project and Stakeholders

3. What ISO key concepts must we remember when performing the Risk Document suggested by PRiSM?
   a. ISO21500 Process Groups (Initiating, Planning, Controlling, Executing and Closing)
   b. ISO14011 (EMS)
   c. Both of the above

4. According to the Risk Balance VS Sustainability, which are the two groups that the benefits can be divided to?
   a. Hard and Soft
   b. Tangible and non-tangible
   c. Short term and long term

5. Which one of the following is not part of the Risk Management process?
   a. Execute Risk
   b. Plan Risk
   c. Quantitative Analysis

6. With which word would you associate the risk trigger condition?
   a. What
   b. Why
   c. When

7. Which one of the following techniques examines the project from each of the strengths, weaknesses, opportunities and threats?
   a. Monte Carlo
   b. Delphi
   c. SWOT

8. Ishikawa’s diagram or Fishbone diagram can be associated with which one of the following answers?
   a. Quality Management
   b. Risk Management
   c. Both are correct
9. One of Risk Management techniques is the probability impact matrix. Which kind of technique is it?
   a. Qualitative Technique
   b. Quantitative Technique
   c. Both, Qualitative and Quantitative technique

10. According to PRiSM ...
   a. An Issue is a problem
   b. Issues are threats
   c. Issues can be solved by the Project Manager

11. Which one of the following statements is wrong according to handover milestone?
   a. Users are not a key stakeholder
   b. Allows the project to enter into an operational environment
   c. The ownership of all project deliverables is transferred from the project manager to the sponsor and user

12. Which of the following is not in the Closure?
   a. Lessons learned document
   b. Project account finalization document
   c. Both are in the Closure

13. When closing, we never have to forget performing ...
   a. Quality Review
   b. Risk Review
   c. Procurement Review

14. When are the project reviews done?
   a. During the project
   b. After the project
   c. Both, during and after the project

15. According to Post Project Reviews ...
   a. Are not an Evaluation
   b. The inputs are Project History, the Performance and the Project Documents.
   c. In it we will just find the Lessons Learned

16. In which background is written the Business Case?
   a. Organizational Environment
   b. Project Environment
   c. Project Organization

17. Finish the sentence: Stakeholders are ...
   a. Those ones who can affect the project
   b. Those ones who are affected by the project
   c. Both are correct
18. According to PRiSM, success criteria must be SMART. Which one of the followings is not what SMART stands for?
   a. Representative
   b. Time Bound
   c. Specific

19. According to the success criteria based on the traditional iron constraint:
   a. Quality is not a constraint nor defined from constraints
   b. The traditional way stands that the Environmental Impact is a constraint
   c. None of the above

20. According to Benefits Management, who is the stakeholder responsible for the overall achievement of benefits?
   a. The Project Manager
   b. The Sponsor
   c. The Auditing Team

21. Why do we need to control the changes that occur in a project process?
   a. To communicate changes to the suppliers
   b. To control beneficial impact of uncontrolled changes
   c. None of the above

22. Which one of these are the roles and functions of the Project Manager in Change Control?
   a. Define the change and configuration management process for the project.
   b. Agreeing authorization limit, tolerances and priority categories with the sponsor.
   c. All of the above

23. Which change control activity gets the Change log as an output?
   a. Request
   b. Registration
   c. Assessment

24. Who is the owner of the Configuration Management Plan?
   a. Project Manager
   b. Sponsor
   c. All the stakeholders

25. Which of the following is the purpose of Information Management?
   a. Control the maintenance of the information quality
   b. Ensure information available in an Operational level
   c. Both are correct
Exam 4: GPM Resource and Social Skills

1. What is the Aim of Human Resource Management?
   a. Allocate the Human Resources effectively
   b. How to manage the Human Resources effectively
   c. Both are correct

2. What is the Purpose of monitoring in HR Management?
   a. Establish deviations of the current project and evaluate their impact.
   b. Have a motivation plan for all resources
   c. Find a way to always reduce cost in human resources

3. Which of the following ISOs is the most aligned with GPM Procurement Management?
   a. ISO 9001
   b. ISO 14000
   c. ISO 21500

4. According to Procurement Management contracts ...
   a. If they are Fix Priced, they also are more safe (low risk)
   b. If they are Cost Reimbursable, they also are more safe (high risk)
   c. Sustainability aspect is the most important selection criteria

5. According to PRiSM, which are the typical project costs?
   a. Fix cost and variable cost
   b. Actual cost, expected cost and net cost
   c. Committed cost, accrual, actual cost and forecast out-turn

6. Which of the followings is not a Cost Management benefit?
   a. The S curve
   b. Achieve Budget
   c. Learn Lessons

7. In which phase PM have to perform EVM?
   a. Planning Phase
   b. Controlling Phase
   c. Closing Phase

8. According to the three parameters of EVM ...
   a. They are Pre-Planned, Planned and Actual Cost
   b. Always must be synchronized to the "Time now" date
   c. Both are correct

9. Which of the following is false according to GPM EVM?
   a. EVM technique takes an specific view of each area
   b. EVM requires considerable data administration and effort
   c. EVM provides reliable information to aid with decision making
10. Which of the following is false according to the communication model?
   a. We cannot do anything to remove the noise.
   b. The transmit message is the one that goes from the sender to the receiver.
   c. In order to establish feedback communication, the sender encodes and the receiver only decodes.

11. What is the communication noise?
   a. The misunderstanding of a message due to a non-willing input
   b. Anything that interferes with the transmission and understanding of the message.
   c. The background sound when decoding

12. If you have six stakeholders, how many communication channels do you need at least?
   a. 6
   b. 12
   c. 15

13. What would be the best document to report from the PM to the Project Sponsor?
   a. WBS
   b. Milestone report
   c. Schedule updates

14. How many communication skills does a PM have in order to exchange information?
   a. 2
   b. 4
   c. 6

15. Which is the first Team Development phase?
   a. Pre-planning
   b. Planning
   c. Forming

16. With which of the following concepts would you associate STORMING in team development?
   a. Ideas
   b. Conflict
   c. New business strategies

17. Which is the first stage in the Negotiation Process?
   a. Preparation
   b. Opening
   c. Pre-Planning

18. How would you define Coercive Power?
   a. Threat of taking something away if one party does not accede to the desires of the other
   b. One party has genuine authority over the other
   c. Experience that provides an advantage
19. When does the conflict management take place?
   a. Planning Phase
   b. Executing and Controlling Phase
   c. Throughout the project lifecycle

20. Which of the following should be done in order to resolve a conflict?
   a. Cause and Effects Analysis
   b. Stakeholder Analysis
   c. Both of the previous

21. Which of the followings is a w2w conflict strategy?
   a. Compromising
   b. Collaborate
   c. Accommodate

22. According to the conflict resolution matrix, which one of the followings strategies takes place when both parties loose?
   a. Competing
   b. Compromising
   c. Avoiding

23. How does PRISM define Leadership?
   a. Establish vision and direction
   b. Influence and align others towards a common purpose
   c. Both of the previous

24. Which of the following are the three overlapping areas of leadership core responsibilities identified by John Adair?
   a. Task, Individual and Team
   b. Stakeholders, Scope and Project
   c. Time, Cost and Scope

25. According to Leadership. What makes the best Project Manager?
   a. Analytical, structures, controlled, deliberate, orderly, …
   b. Experimental, visionary, flexible, undeterred, creative, …
   c. Could be both
Exam 1: Answers

1. You are a project manager assigned by your organization to implement a series of guidance documents and standards to help your organization address energy issues. Which ISO of the following choices listed should you apply?
   C. None of the above

Explanation: To energy issues, the ISO we are supposed to follow, a guidance, is ISO 50001.

2. Which of the following ISO standards are considered as guidelines but not as normative standards?
   A. ISO26000 and ISO21500

Explanation: ISO26000 (CSR) and ISO21500 (PM) are the only ones explained in the PRiSM that are considered to be guidelines instead of normative standards (ISO9000, ISO14000 and ISO50001)

3. You are the PM of the company ABC, due to a change of your company’s policies to environment, you are supposed to explain what CSR is to your boss. Because of that you prepared your presentation structured as the ISO26000 principles of social responsibility. If you want to follow those principles, how is your presentation structured?
   C. Accountability, Transparency, Ethical Behavior, Stakeholder Interests and Rule of Law.

4. Deming Cycle, also referred as PDCA is a concept that we can find in...
   C. Both are correct

Explanation: PDCA is in ISO14000 because its one of the main principles of EMS and is in ISO9001 because is part of the continuous improvement.

5. Juran, one of the quality gurus, developed the PDCA. It stands for...
   C. None of the previous are correct

Explanation: PDCA does indeed stand for Plan, Do, Check and Act. Nonetheless, Deming and not Juran stated it.
6. Which of the following statements are correct.

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B III

Explanation: I. Electric is not Primary Energy.
II. Hot Water is not a Final Use.
III. Correct
IV. Biodiesel is not Primary Energy.

7. Main principles of Internal Audits are.
   B Ethical conduct, Fair presentation, Professional care and Independence.

Explanation: ISO9000 refers to Internal Audits and its principles are: ethical conduct, fair presentation, professional care and Independence.

8. ISO21500 is a normative standard for...
   C None of the previous

Explanation: ISO21500 is a guidance (not a normative standard) of Project Management.

9. ISO21500 guidance should fit for the following type of organization...
   C Any type of organization

Explanation: ISO21500 guidance is scoped to any type of organization (Public, Private and Community Organizations).

10. ISO21500 Process Groups is structured by the following stages:
    B Initiating, Planning, Implementing, Controlling and Closing

Explanation: Remember the following chart of ISO21500 Process Groups.
See figure: PRiSM, GPM Global 2013, Version1, page 23
11. Which of the following are the GPM integration into the Initiation Phase?
   A  P5 analysis and develop SMP

Explanation:  TPL is not a new fit but a basis for P5. The business case is not a new fit but GPM recommends that when doing it take environment into consideration. We can go towards the initiation phase diagram:
   See figure: PRiSM, GPM Global 2013, Version1, page 26

12. The Business Case, ...
   C  It's a key document to any project and, regarding to GPM, the environmental impact must be also taken into consideration.

Explanation: The Business case it's a key document to any project done in the Initiation Phase by the project Manager and other stakeholders. When it is finished the project sponsor must sign it. Regarding to GPM, when redacting it, the environmental fact must be taken into consideration.

13. The concept of TBL was introduced by John Elkington in 1994 and it is referred to:
   B  Social, Environment and Financial

Explanation:  Triple Bottom Line (TBL) takes into consideration Social (People), Environment (Planet) and Financial (Profit).

14. The 5 P's of P5 stand for...
   C  Product, Profit, People, Planet and Process.

15. According to the P5 integration Matrix...
   C  None of the above

Explanation:  The P5 integration Matrix relates Project >> Product, Process >> TBL

16. One PM certified as GPM-b is explaining what SMP means to his other PM colleague that has not been trained in GPM yet.
   C  None of the above.

Explanation: The Sustainable Management Plan (SMP) must be attached in all the documents in the whole project (not just the initiation phase) and identifies the project impact on Social, Profit and Environmental point.
17. To Score the P5 Impact Assessment...
   C The project Manager must score at his own criteria.

Explanation: The P5 impact assessment must be scored by the PM at his criteria because there is no scoring guide. (-) means a positive impact while (+) means a negative one. The maximum score in absolute value is 3.

18. According to Stakeholder Management, how is the best way to deal with a Passive Backer?
    B Motivate him

Explanation:
We can appreciate it in the following figure:

19. Which are UN Global Compact-Ten principles four sections?
    B Human Rights, Labour, Environment and Anti-Corruption

20. Which of the TBL concepts its not included in UN Global Compact- Ten Principles?
    C Profit (Financial)

21. Which of the following would represent exactly the GRI Indicators?
    A The same as TBL

Explanation: GRI Indicators are Economic, Social and Environment (same as TBL)

22. Which of the following statements is not correct about sustainability?
    A Sustainability is about local and global, only focused in the long term.

Explanation: This question is asking for the one that is NOT correct. Sustainability is about both, the short and the long term.
23. As GRI stands, what is the reporting commonly used for?
   B  Can be used to compare the performance among different organizations

Explanation: First of all, GRI stands for Global Reporting Initiative and states that reporting can be used to: Benchmarking and assessing sustainability performance with respect to laws, norms, codes, performance standards, and voluntary initiatives; Demonstrating how the organization influences and is influenced by expectations about sustainable development Comparing performance within an organization and between different organizations over time.

24. In this order, which are the fields of the following ISOs? (ISO9000, ISO14000, ISO26000, ISO50001, ISO21500.
   C  Quality, Environment, CSR, Energy, PM

25. According to ISO9000, which of the following is not one of its principles?
   B  All stakeholders focus

Explanation: Stakeholders focus is not one of ISO9000 principles (the principle would be Costumer Focus)
Exam 2: Answers

1. According to the Planning phase, who has the authority role to update the document properties?
   A  Project Manager

Explanation: The Project manager has the authority role, the Project Sponsor is the Owner / Author while the Project team; sponsors and interested parts are the audience.

2. As a certified GPM-b, you remember that in the Planning phase, as you cannot define without understanding the scope, the very first thing is defining it. As you attended to a GPM training course, you remember doing an activity for such thing. How was it called?
   B  Answering the 7 W’s

Explanation: In order to define the scope, the PM has to answer the 7 W’s (Why, What, How, How much, Who, When and Where) as it is necessary to understand the project’s scope before planning.

3. Which of the following would best define the acceptance criteria:
   A  What the costumer says

Explanation: The acceptance criteria must be agreed between the costumer and the project manager

4. According to PBS ...
   C  Identifies the items to be used in configuration management

Explanation: PBS stands for Product Breakdown Structure. It provides a high level view of the key products and it is useful for the project stakeholders who are more likely to be focused on products than the work to be accomplished. It is also used in the identification of the items to be used in configuration management and on change impact assessments.
5. Which of the following statements are true according to WBS?
   VI. Stands for Work Breakdown Structure
   VII. Is derived from PBS
   VIII. Has product packages at the lowest level of any branch
   IX. Even though cannot be related with OBS, it is mandatory for doing CBS
   X. Provides a framework for communicating throughout the project, including performance reporting and escalation of issues

   C  I, II, V

Explanation: WBS is related with OBS when doing the RACI and is has WORK packages at the lowest level

6. According to GMP Planning phase scope management, if we have already done PBS and OBS we can do RACI and CBS.
   C  We cannot do RACI nor CBS

Explanation: In order to do RACI and CBS we need to have the work packages, only available in WBS and not in PBS.

7. What does RACI stand for?
   C  Responsible, Accountable, Consult and Inform

8. Which one of the following can only have one in each row of RACI?
   A  Responsible

9. Which of the following is the basic structure that needs to be done for being able to do the others.
   C  None of the above

Explanation: RACI and CBS are independent. RACI needs WBS and OBS while CBS needs WBS and the company system of allocating costs.

10. Which of the following is correct?
    B  The accuracy and uncertainty level are inverse

Explanation: The explanation of this question can be explained looking at the figure on page 57 of PRiSM (1st Ed). The uncertainty level decreases as the project is being developed and the two levels can cross in any phase (its more likely to be in the produce stage but its not mandatory).
11. According to Resource Management, PRiSM remarks that usually the most valuable resource that a PM will ever have is ...

A  People

Explanation: Quoting PRiSM. “It is important to keep in mind that the most valuable resource that you will ever have is your people, so ensure you lead them and care for them well as they are the most re-usable assets that any Project Manager will ever have”

12. Which of the following is not considered a resource?

B  Environment

Explanation: Environment its not a resource by itself; Natural Resources would be a resource. Knowledge is Non-consumable while Money is a consumable, but both are resources.

13. Which of the following is a key concept for quality management?

C  Relation among scope, time, cost and sustainability

Explanation: Six sigma is an improvement methodology related to quality statistics, but its not a key point for itself. The keypoints for quality are: requirements defined in measurable terms (quantitative), purpose understood and definition of requirements enables de PM to trade-off between scope, time, cost and quality.

14. According to success in quality management, requires the participation of all members of the team and stakeholders. Nevertheless, the most important of them is ...

C  Management

Explanation: A really important thing to be considered is that success requires the participation of all members of the team, but it remains the responsibility of management to provide the resources needed to succeed. Without the management commitment it is not possible to achieve the expected quality.

15. According to quality standards, we must focus our effort in achieving quality in ...

A  Process

Explanation: If process achieves the quality required, as the product is the result of the process, it will also achieve that quality.

16. How many processes cover Quality Environment?

A  <5

Explanation: In PRiSM (figure page 60 and explanation page 61) list that the quality environment is composed by Quality Planning, Quality Assurance, Quality Control and Continuous Improvement. (4 processes <5)
17. Which of the following quality tools helps to identify the cause of a problem in the Planning phase?
   C None of the above

Explanation: The quality tool we are referring to is Cause and effect (also called ISHIKAWA or Fishbone diagram). Scatter plot is used in the controlling phase.

18. Why the seven quality tools are referred as “basic”?
   B They are easy to use, even though the user don't have statistic background

Explanation: Even though there are more sophisticated tools, this seven quality tools are easy to use and can solve most of quality problems.

19. Kaoru Ishikawa introduced the concept of the 7 basic quality tools relating them as the seven basic weapons of Bankei (samurai). Those are Fishbone diagram, Control chart, Histogram, Pareto chart, Scatter diagram, Flow chart and Run chart. We know that Check Sheet is also a quality tool so, which one of the previous is wrong?
   B Flow chart because it should be in stratification

Explanation: The 7 quality tools are Fishbone, Check sheet, Control chart, Histogram, Pareto chart, scatter diagram and stratification (some stratification tools are flow and run chart).

20. In which phases can we find the seven quality tools?
   C Both are correct

Explanation: There some quality tools designed in the Planning Phase (Fishbone, Check sheet (design) and stratification while Check sheet (use), Control chart, histogram and Pareto chart are in the Control phase.

21. According to Costs of Quality ...
   C Both are correct

Explanation: At long term, quality investment cost is less than Failure and appraisal cost so, we can accept Crosby statement. On the other hand, when you invest in quality you have to put some money, so instantly it’s not free.
From question 22 to 24 are referred to the following network diagram.

22. Which is the minimum duration of the project if the durations are in days?
   B 16 days

Explanation: We can see it in the diagram. G is the latest activity and finishes at the 16th day.

23. Which is the critical path of the project?
   A A-B-E-G

Explanation: The critical path is in those activities that have zero float, in the project are A-B-E-G

24. Which is the total float of the project if the durations are in days?
   B 7 days

Explanation: The total Float is calculated like \( TotalFloat = \sum_{i=1}^{N} Float_i \) where \( i=\text{activities} \). In the project \( Total_{\text{Float}}=0+0+3+1+0+3+0= 7 \) days

25. Where would you do crashing first?
   C In the critical path

Explanation: We have to do Crashing first in the critical path activities, then in the cheapest and then in the earliest. On the other hand, Fast Tracking consists in try to do more activities in parallel.
Exam 3: Answers

1. According to traditional Risk definitions:
   C None of the above

   Explanation: Risks can be both negative and positive. When risks are positive, they are also called as opportunities.

2. The four levels of risk are usually divided into ...
   A Strategic, Project, Program and Operations.

   Explanation: To a more detailed explanation please go to page num. 68 and 69 of PRiSM (1st Edition).

3. What ISO key concepts must we remember when performing the Risk Document suggested by PRiSM?
   B ISO14011

   Explanation: PRiSM (1st Edition) page 69-70. According to PRiSM, risk is composed should be faced by these phases: Planning, Identification, Analysis, Responses, Monitoring and Control (different to ISO21500). Moreover, Risk management planning and controlling and monitoring process areas are the convergence point for ISO 14000 and EMS within risk management environment.

4. According to the Risk Balance VS Sustainability, which are the two groups that the benefits can be divided to?
   A Hard and Soft


5. Which one of the following is not part of the Risk Management process?
   A Execute Risk

   Explanation: Risk management process is settled up by the following phases: Plan, Identify, Analyze (Qualitative and/or Quantitative), Respond and Monitor & Control (Feed back to Identify). For more details go to page 72 of the PRiSM (1st Edition).

6. With which word would you associate the risk trigger condition?
   C When

   Explanation: The trigger condition is WHEN the risk action happens.
7. Which one of the following techniques examines the project from each of the strengths, weaknesses, opportunities and threats?

   C   SWOT

Explanation: SWOT stands for Strengths, Weaknesses, Opportunities and Threats.

8. Ishikawa’s diagram or Fishbone diagram can be associated with which one of the following answers?

   C   Both are correct

Explanation: Ishikawa’s diagram is one of the seven basic quality tools in Quality Management and can be one of the Diagramming Techniques to Identify Risks (Risk Management).

9. One of Risk Management techniques is the probability impact matrix. Which kind of technique is it?

   A   Qualitative Technique

Explanation: To a more detailed explanation check page num. 76 of PRiSM (1st Edition).

10. According to PRiSM ...

    B   Issues are threats

Explanation: PRiSM definition of issue: An issue is a threat to the project that cannot be solved by the Project Manager. Issues should be differentiated from problems, which are the day to day concerns that a PM has to deal with case by case.

11. Which one of the following statements is wrong according to handover milestone?

    A   Users are not a key stakeholder

Explanation: The key stakeholders in handover milestones are: PM, Project Sponsor, Project Team, Quality assurance and Users

12. Which of the following is not in the Closure?

    C   Both are in Closure

13. When closing, we never have to forget performing ...

    A   Quality Review

Explanation: According to PRiSM the 5th and mostly forgotten review is Quality review.
14. When are the project reviews done?
   C  Both, during and after the project

Explanation: See figure at PRiSM 1st Edition page 152

15. According to Post Project Reviews ...
   B  The inputs are Project History, the Performance and the Project Documents.

Explanation: Project Reviews are an Evaluation of the project in which can be found the Lessons Learned, Feedback to QMS and Recommendations and Improvements.

16. In which background is written the Business Case?
   B  Project Environment

Explanation: See ISO21500 Organizational Structure in PRiSM page 84

17. Finish the sentence: Stakeholders are ...
   C  Both are correct

Explanation: Stakeholders are people or organizations that is actively involved in the project, or whose interests may be positively or negatively affected by execution or completion of the project. A stakeholder may also exert influence over the project, its deliverables and the project team members.

18. According to PRiSM, success criteria must be SMART. Which one of the followings is not what SMART stands for?
   A  Representative

Explanation: SMART stands for Specific, Measurable, Achievable, Realistic and Time Bound.

19. According to the success criteria based on the traditional iron constraint:
   C  None of the above

Explanation: The traditional Iron triangle’s constraints are Scope, Time and Cost (Quality is the area defined from those). The New way adds the Environmental Impact at the same level as the traditional constraints.
20. According to Benefits Management, who is the stakeholder responsible for the overall achievement of benefits?
   B The Sponsor

Explanation: In the benefit management plan’s Roles and Responsibilities section stands that the sponsor is the responsible overall for achievement of benefits, however other stakeholders will be involved including those working in the business as usual activities.

21. Why do we need to control the changes that occur in a project process?
   C None of the above

Explanation: We need to control the changes that occur in a project process in order to communicate the changes to stakeholders and to control adverse impact of uncontrolled changes, among other reasons.

22. Which one of these are the roles and functions of the Project Manager in Change Control?
   C All of the above

Explanation: A and B are the definition of the Roles and Functions of the Project Manager in Change Control (PRiSM page 123 1st Edition)

23. Which change control activity gets the Change log as an output?
   B Registration

Explanation: See figure in page 124 (PRiSM 1st Edition)

24. Who is the owner of the Configuration Management Plan?
   A Project Manager

Explanation: The Configuration Management Plan is owned by the project manager, and developed as a part of the Project Management Plan to provide guidance on the configuration policy, objectives and processes.

25. Which of the following is the purpose of Information Management?
   A Control the maintenance of the information quality

Explanation: The purposes of information management are to: ensure information is available to support decision making in a timely manner; to control the quality use and maintenance of information throughout the project lifecycle and after it; and to support communication processes.
Exam 4: Answers

1. What is the Aim of Human Resource Management?
   C Both are correct

   Explanation: Human Resources Management focuses on the allocation of resources and how to manage them effectively (PRiSM page 95 1st Edition).

2. What is the Purpose of monitoring in HR Management?
   A Establish deviations of the current project and evaluate their impact.

   Explanation: The purpose of monitoring is to establish deviations and evaluate their impact. Tolerances may be set to enable work to continue with minor deviations. Control and co-ordination involves the planning and implementation of corrective actions to address adverse situations. Alternatively, it may involve re-planning if the original plans appear to be unworkable or unrealistic.

3. Which of the following ISOs is the most aligned with GPM Procurement Management?
   B ISO 14000

   Explanation: The very first stage in GPM Procurement management is EMS (ISO14000). (See fig page 102 PRiSM 1st Edition).

4. According to Procurement Management contracts ...
   A If they are fix prices, they also are more safe

   Explanation: See chart in page 104 PRiSM (1st Edition)

5. According to PRiSM, which are the typical project costs?
   C Committed cost, accrual, actual cost and forecast out-turn

   Explanation: According to PRiSM, the typical project costs are Committed cost, accrual, actual cost and forecast-turn-out (PRiSM page 115).

6. Which of the followings is not a Cost Management benefit?
   A The S curve

   Explanation: The S curve is a cost management tool, but its not a benefit.
7. In which phase PM have to perform EVM?
   **B Controlling Phase**

Explanation: EVM Is a controlling tool, so it is in the Controlling Phase.

8. According to the three parameters of EVM ...
   **B Always must be synchronized to the “Time now” date**

Explanation: The three parameters of EVM are Planned Value, Actual Cost and Earned Value and all of them must be synchronized to the “Time now” date in order to avoid inaccuracies.

9. Which of the following is false according to GPM EVM?
   **A EVM technique takes an specific view of each area**

Explanation: EVM technique takes a whole view, over-performance in one area may hide under-performance in another.

10. Which of the following is false according to the communication model?
    **C In order to establish feedback communication, the sender encodes and the receiver only decodes.**

Explanation: In order to establish feedback communication, even though there would not be interferences because of the noise, the sender and the receiver have to encode and decode once each.

11. What is the communication noise?
    **B Anything that interferes with the transmission and understanding of the message.**

Explanation: The noise is not the misunderstanding, is the non-willing imput.

12. If you have six stakeholders, how many communication channels do you need at least?
    **C 15**

Explanation: NumChan=[n(n-1)]/2=[6(6-1)]/2=15 channels

13. What would be the best document to report from the PM to the Project Sponsor?
    **B Milestone report**

Explanation: The project Sponsor just need to know the milestones that has to approve. The Schedule updates must be communicated to the Sales manager.
14. How many communication skills does a PM have in order to exchange information?
   **B 4**

   **Explanation:** Informal and formal Written; informal and formal Verbal (4).

15. Which is the first Team Development phase?
   **C Forming**

   **Explanation:** The Team Development phases are, in this order, Forming, Storming, Norming and Performing.

16. With which if the following concepts would you associate STORMING in team development?
   **B Conflict**

   **Explanation:** According to Team development phases, Storming is the conflict phase.

17. Which is the first stage in the Negotiation Process?
   **A Preparation**

   **Explanation:** Negotiation Process (Preparation, Opening, Bargaining and Closing).

18. How would you define Coercive Power?
   **A Threat of taking something away if one party does not accede to the desires of the other**

   **Explanation:** (a) Coercive Power. (b) Legitimate Power. (c) Expert Power

19. When does the conflict management take place?
   **C Throughout the project lifecycle**

   **Explanation:** According to PRiSM (page 139) we must deal with conflicts throughout the project lifecycle.

20. Which of the following should be done in order to resolve a conflict?
    **C Both of the previous**

    **Explanation:** See PRiSM 1st Edition, page 140 (fig. 60)

21. Which of the followings is a w2w conflict strategy?
    **B Collaborate**

    **Explanation:** See PRiSM 1st Edition, page 142 (fig. 62).
22. According to the conflict resolution matrix, which one of the followings strategies takes place when both parties loose?

C Avoiding


23. How does PRiSM define Leadership?

C Both of the previous

Explanation: According to PRiSM, Leadership can be defined as:
✔ Establish vision and direction
✔ Influence and align others towards a common purpose
✔ Empower and inspire people to achieve project success

24. Which of the following are the three overlapping areas of leadership core responsibilities identified by John Adair?

A Task, Individual and Team

Explanation: John Adair identified three overlapping areas of core responsibility: Task, Team and Individual.

25. According to Leadership. What makes the best Project Manager?

C Could be both

Explanation: A project manager should be both, a Manager (a) and a Leader (b).
Annex C3.4.2
GPM-b practice exam pack (Chinese)
Questions and Answers
测试一: 绿色项目管理可持续发展与项目启动前管理试题

1. 公司指派你为项目经理去实施一系列的指导性文件和准则，用于帮公司处理能源问题。你应该选用以下哪个 ISO 标准?
   a) ISO9001
   b) ISO5001
   c) 以上都不是

2. 以下哪个 ISO 标准可以看做是指南而不是规范标准?
   a) ISO20600 和 ISO21500
   b) ISO21500, ISO50001 和 ISO9000
   c) ISO215000 和 ISO50001

3. 你是 ABC 公司的项目经理，由于公司对环境方面政策的变化，你需要向老板解释什么是企业社会责任。基于这个原因，你根据 ISO26000 企业社会原则来准备你的演讲大纲。如果你想遵循这些原则，你的演讲大纲会是什么样?
   a) 责任感,可持续性,政策及信息透明度,道德行为和利益相关者权益
   b) 责任感,政策及信息透明度,道德行为,股票所有者权益和法律条文
   c) 责任感,政策及信息透明度,道德行为,利益干系人权益和法律条文

4. 戴明环，也被叫做“策划-实施-检查-改进”（PDCA），我们可以在哪个标准中找到?
   a) ISO14000
   b) ISO9001
   c) 两者都对

5. 质量专家 Juran，开发了 PDCA 的管理理念，它代表了什么?
   a) Juran’s PDCA 代表了“策划-实施-检查-改进”
   b) Juran’s PDCA 代表了“预审-实施-证实-实现”
   c) 以上两点都不正确
6. 以下哪些表述是正确的？

<table>
<thead>
<tr>
<th>表述</th>
<th>初级能源</th>
<th>最终用途</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>电力</td>
<td>光</td>
</tr>
<tr>
<td>II</td>
<td>太阳能</td>
<td>热水</td>
</tr>
<tr>
<td>III</td>
<td>生物质能</td>
<td>供暖</td>
</tr>
<tr>
<td>IV</td>
<td>生化柴油</td>
<td>供暖</td>
</tr>
</tbody>
</table>

a) I, II, III  
b) III  
c) II, III

7. 内部审计的主要原则指的是什么？
   a) 道德行为，公正，专业服务和公司合规。  
   b) 道德行为，公平呈现，专业服务和独立性。  
   c) 两个都正确

8. ISO21500 是与什么相关的规范标准？
   a) 项目管理  
   b) 能源管理  
   c) 两个都不是

9. ISO21500 指南应该与下面哪个组织类型相适应？
   a) 公共组织和私营组织  
   b) 只适合私营组织  
   c) 任何类型的组织

10. ISO21500 过程组是由以下哪些阶段构成？
    a) 计划，实施，控制和收尾  
    b) 启动，计划，实施，控制和收尾  
    c) 启动，计划，执行，监督和收尾

11. 以下哪项是 GPM 与启动阶段的整合结果？
    a) P5 分析和创建 SMP  
    b) TBL  
    c) 准备商业案例
12. 什么是商业案例?
   a) 是计划阶段的一部分
   b) 这是一个证明项目由项目经理完成的文档，不需要项目发起人签字
   c) 对于每个项目来说都是关键性文件，对于 GPM，环境因素必须考虑在内

13. TBL 的概念在 1994 年由 John Elkington 提出，其指代了什么内容?
   a) P5
   b) 社会，环境和经济
   c) 人力，项目和地球

14. P5 代表哪些方面内容?
   a) 地球，人，收益，计划和过程
   b) 污染，人，生产，过程和产品
   c) 产品，收益，人，地球和过程

15. 根据 P5 集成矩阵，以下哪些表述是正确的?
   a) 说明 TBL 是如何与项目紧密联系的各个方面
   b) 帮助我们衡量产品的质量
   c) 两者都不是

16. 一个获得 GPM-b 认证的项目经理正在向没有经过 GPM 培训的其他项目管理的同事解释 SMP 的意义，以下哪个表述是正确的?
   a) 他指出 SMP 只需要被附在项目发起阶段的所有文档中
   b) 他指出 SMP 只识别项目对于某一环境因素的影响
   c) 两个都不是

17. 用 P5 影响评估法评分，以下那个表述是正确的?
   a) 对于每个表述，你必须给一个从(-4) 到(+4)的评分
   b) (+1) 表示轻度满意，而(-3)表示很不满意
   c) 项目经理必须按照他自己的标准评分

18. 根据干系人管理原则，对待被动的支持者的最佳方式是什么?
   a) 鼓励他
   b) 激发他的积极性
   c) 辞退他
19. 联合国全球契约十项原则的四个部分是什么?
   a) 儿童权利，人权，劳动力与反腐败
   b) 人权，劳动力，环境与反腐败
   c) 人权，社会道德，劳动力与平等

20. 哪个 TBL 的概念没有包括在联合国全球契约十项原则内?
   a) 地球（环境）
   b) 人（社会）
   c) 效益（经济）

21. 以下哪项能准确的表述 GRI 指标?
   a) 和 TBL 一样
   b) 和 P5 一样
   c) 和联合国全球契约十项原则一样

22. 以下关于可持续发展的表述，那项是不正确的?
   a) 可持续发展包括本地与全球，只着重于长期发展
   b) 可持续发展是社会道德
   c) 可持续发展同样也是关乎经济利益

23. 根据 GRI, GRI 报告通常用在哪些方面?
   a) GRI 每年颁发一个最佳的可持续发展报告奖
   b) 可以用于比较不同组织间的表性
   c) GRI 代表的是全球报告研究所。

24. 按照这种顺序，以下 ISO 标准属于哪些领域 (ISO9000, ISO14000, ISO26000, ISO50001, ISO21500)
   a) 质量，能源，环境，企业社会责任，项目管理
   b) 质量，能源，企业社会责任，项目管理，环境
   c) 质量，环境，企业社会责任，能源，项目管理

25. 根据 ISO9000，下列哪项不是它的原则?
   a) 领导力
   b) 干系人导向
   c) 互利的供应商
测试二：绿色项目管理计划部分试题

1. 在项目计划阶段，谁有权利去更新文档属性？
   a. 项目经理
   b. 项目发起人
   c. 项目团队

2. 你作为一个被授予 GPM-b 证书的员工，明的知道在项目计划阶段，对范围没有充分的认识就不能定义它，所以最开始要做的就是定义它。当你参加 GPM 培训课程时，你记得做这件事的活动，他叫什么？
   a. 回答 6 W’s
   b. 回答 7 W’s
   c. 回答 8 W’s

3. 下列以下哪项表述能更好的定义验收标准？
   a. 客户所表达的内容
   b. 在项目初始阶段有必要不断地并且严厉地审查
   c. 必须是可以衡量的并且不含糊的

4. 根据 PBS 模型，以下哪项表述是正确的？
   a. PBS 代表基础准则政策
   b. 为关键性工作（对于项目干系人的重要信息）提供了一个高的视野
   c. 鉴别将运用在配置管理中的项目

5. 根据 WBS，以下哪项表述是正确的？
   I. WBS 表示的是工作分解结构
   II. WBS 是来源于 PBS
   III. 在任何分枝下的最低级都有产品包
   IV. 即便与 OBS 相关，而对于做 CBS 是强制的
   V. 在整个项目中提供了交流的框架，包括绩效报表和升级问题
   a. 所有都正确
   b. I, II, III
   c. I, II, V
6. According to the project management plan, if we have done PBS and OBS, we can do RACI and CBS.
   a. We can only do RACI
   b. We can do RACI as well as CBS
   c. We cannot do RACI or CBS

7. What does RACI mean?
   a. Able to take responsibility and accept criticism
   b. Having the ability to control things actively and accurately
   c. Highly responsible in negotiation and notification

8. Which of the following words can appear in every line of RACI?
   a. Responsibility
   b. Notification
   c. Explaination

9. Which of the following is something that can be done by others?
   a. RACI
   b. CBS
   c. None of the above

10. Which of the following statements is correct?
    a. Uncertainty increases with development
    b. Accuracy and uncertainty are opposite
    c. Accuracy and uncertainty often appear in the production phase

11. According to resource management, sustainable development methods indicate that project managers usually have the most valuable resource is
    a. People
    b. Environment
    c. Materials

12. Which of the following is not considered a resource?
    a. Knowledge
    b. Environment
    c. Money
13. 以下哪一个对质量管理来说是关键的概念？
   a. 6σ
   b. 品质条款
   c. 机会、时间、成本之间的关系，以及可持续性

14. 质量管理上的成功，需要所有小组成员和干系人参与。然而，他们中最重要的
    是谁？
    a. 项目经理
    b. 质量经理
    c. 管理者

15. 根据质量标准，我们必须努力实现质量的哪一方面？
    a. 过程
    b. 产品
    c. 以上都是正确的

16. 下面有多少过程涵盖了质量环境？
    a. <5
    b. 5
    c. >5

17. 下面那个质量控制工具可以在计划阶段帮助鉴定问题出现的原因？
    a. 散点图
    b. 因果分析图，也叫做田口图或者鱼骨图
    c. 没有一项是正确的

18. 为什么7个控制质量的工具被归类成基础的？
    a. 他们没有解决很多质量问题
    b. 他们使用方法很简单，即使使用者没有统计背景。
    c. 两者都正确

19. 石川馨结束了7个基本的控制质量工具理论，和Bankei的7个基础武器连提
    并论。他们分别是鱼骨图，控制图标，直方图，排列表，散点图，流程图，趋势
    图。我们知道控制图表同样也是一种控制质量工具，以上哪个是错误的？
    a. 排列表，因为他是直方图（重复）
    b. 流程图，因为应该是分层表
    c. 没有一项是错误的
20. 我们能在那个阶段找到 7 个质量工具？
   a. 计划阶段
   b. 执行和监控阶段
   c. 两个都正确

21. 以下关于质量成本的表述那个是正确的？
   a. 质量大师克罗斯比说“质量是免费的”，就质量的投资进行表述。目前
      我们断言在长期来看，这个是完全正确的。
   b. 预防成本（质量投资）不是免费的
   c. 两者都正确

看图表，回答 22-24 题。

22. 如果用天计算，下面那个是项目的周期？
   a. 15 天
   b. 16 天
   c. 20 天

23. 下面那个是项目的关键路径？
   a. A-B-E-G
   b. A-B-D-G
   c. 有两个关键路径：A-C-E-G 和 A-C-F-G
24. 项目的总浮动的时间是几天?
   a. 4 天
   b. 7 天
   c. 9 天

25. 你在什么地方必须要做赶工?
   a. 在哪些需要同时做很多事的活动中
   b. 在最便宜可得到的活动
   c. 在一些关键路径
测试三
绿色项目管理执行和监控以及收尾和评估部分解析

1. 根据传统的对风险的定义，以下哪种表述是正确的？
   a. 所有风险都是负面的
   b. 所有风险中都存在机遇
   c. 两者都不正确

2. 风险经常被分成以下哪四个层次？
   a. 战略，项目，程序和操作
   b. 过程，项目，程序和公文包
   c. 过程，产品，项目和干系人

3. 当项目整合可持续方法中展示风险材料时，以下那些ISO主要方面是我们必须记住？
   a. ISO21500过程组（启动，计划，控制，执行和收尾）
   b. ISO14011（EMS）
   c. 两者都是

4. 根据风险平衡和可持续发展的比较，收益可以被分为哪两个组？
   a. 硬的和软的
   b. 可触摸的和不可触摸的
   c. 短期的和长期的

5. 下列哪个部分不属于风险管理过程？
   a. 执行风险
   b. 计划风险
   c. 定量分析

6. 下列哪个词你将会关联到风险触发条件？
   a. 做什么
   b. 为什么
   c. 何时

7. 以下那个方法分别从强势，弱势，机会和风险来审视项目？
   a. 蒙特卡洛分析
   b. 特尔斐分析
   c. SWOT分析
8. 石川的图和鱼骨图可以和一拿哪个回答联系在一起?
   a. 质量管理
   b. 风险管理
   c. 两者都对

9. 有一种风险管理方法是概率影响矩阵，具体的是那种管理方法?
   a. 定性技术
   b. 定量技术
   c. 两者都包含，定量和定性

10. 根据项目整合管理方法，以下哪项是正确的?
    a. 事件是问题
    b. 事件是风险
    c. 事件可以项目经理解决

11. 根据移交里程碑，以下表述哪个是不正确的?
    a. 用户不是关键干系人
    b. 允许项目进入一个可操作的环境
    c. 所有项目可交付成果是从项目经理传递到项目发起人和用户的。

12. 以下哪项不是在结束过程中的?
    a. 经验教训文件
    b. 项目账户终结文件
    c. 两者都在结束过程中

13. 当在结束时，我们从来不会忘记展示什么?
    a. 质量评审
    b. 风险评审
    c. 采购评审

14. 项目评审在什么时候结束?
    a. 在项目进行过程中
    b. 在项目之后
    c. 两者都有可能，在项目过程中或者结束之后

15. 根据项目后评价，以下哪项表述是正确的?
    a. 项目后评价不是评估
    b. 输入的是项目历史，项目执行和项目文件
    c. 在这个里面，我们将会发现经验教训
16. 书面的商务案例是在哪个背景中？
   a. 组织环境
   b. 项目环境
   c. 项目组织

17. 完成句子：干系人是...
   a. 可以影响项目的一些人
   b. 是会被项目影响的一些人
   c. 两个都正确

18. 根据项目整合可持续方法，成功的标准必须符合 SMART 原则。下面哪一项不是 SMART 所代表的？
   a. 代表力
   b. 时效性
   c. 明确的

19. 根据成功标准和基于传统的铁约束，以下哪项表述是正确的？
   a. 质量既不是一种约束也不是有约束定义的
   b. 传统的方式代表环境影响也是一种制约
   c. 两者都不正确

20. 根据效益管理，哪个干系人需要负责整体的利益成就？
   a. 项目经理
   b. 项目发起人
   c. 审计团队

21. 为什么你需要控制在项目过程中发生的变化？
   a. 因为要和供应商沟通变化
   b. 因为要控制不可控的变化的效用影响
   c. 两个都不对

22. 以下哪个是项目经理在变化控制方面的职责和权利？
   a. 项目变化的定义和配置控制过程
   b. 和项目发起人一起批准权限，允许偏差和优先类别
   c. 两个都对
23. 那个控制变更行为把变更记录当做是输出?
   a. 请求
   b. 注册
   c. 评估

24. 谁是配置管理计划的所有者?
   a. 项目经理
   b. 项目发起人
   c. 所有干系人

25. 以下哪项是信息管理的目的?
   a. 控制信息质量的稳定性
   b. 保证信息在操作环节可以使用
   c. 两者都正确
测试四：绿色项目管理资源和社会技巧考题

1. 人力资源管理的目的是什么？
   a. 有效地分配人力资源
   b. 如何有效的管理人力资源
   c. 两者都正确

2. 在人力资源管理中，监控的目的是什么？
   a. 建立目前项目的偏差，同时评估他们的影响
   b. 对于所有的资源有激励计划
   c. 找到一个能在人力资源行业中减少成本的方式

3. 下列那个 ISO 标准与绿色项目采购管理更一致？
   a. ISO 9001
   b. ISO 14000
   c. ISO 21500

4. 根据采购管理合同，以下哪项表述是正确的？
   a. 如果是属于固定价格，这个会更加安全（低风险）
   b. 如果是属于费用补偿，这个会更加安全（高风险）
   c. 可持续性方面是最终重要的选择标准

5. 根据项目整合可持续方法，哪项是典型项目成本？
   a. 固定成本和可变成本
   b. 实际成本，预期成本和净成本
   c. 承诺成本，应计项目，实际成本和预计成本

6. 以下哪项不是成本管理收益？
   a. S 曲线
   b. 实际预算
   c. 吸取教训

7. 在项目管理哪个阶段需要展示 EVM？
   a. 计划阶段
   b. 监控阶段
   c. 收尾阶段
8. 根据 EVM 的三个参数，以下哪项是正确的？
   a. 他们是预计划成本，计划成本和实际成本
   b. 必须和当前时间日期同步
   c. 两者都正确

9. 根据绿色项目的 EVM，以下表述那个是错误的？
   a. EVM 技术对于每个领域有精细的看法
   b. EVM 需要相当大的数据管理和努力
   c. EVM 提供可靠的信息用于辅助信息决策

10. 根据沟通模型，以下表述那项是错误的？
    a. 我们没有办法去除噪音
    b. 传递信息是从信息发送者到接受者的过程
    c. 为了建立反馈式沟通，发送者编码，接受者只需解码。

11. 什么是沟通噪音？
    a. 强迫性输入会导致信息的误解
    b. 传播过程中接入和理解信息的各种声音
    c. 在解码过程中的背景声音

12. 如果你有 6 个干系人，你至少需要多少沟通渠道？
    a. 6
    b. 12
    c. 15

13. 要从项目经理到项目发起人报告，以下那个文件最好？
    a. 工作分解包
    b. 里程碑报告
    c. 进度计划更新

14. 项目经理需要多少沟通技巧，用于交换信息？
    a. 2
    b. 4
    c. 6

15. 那个是团队发展第一阶段？
    a. 预计划
    b. 计划
    c. 成立
16. 以下哪个方面有助于你团队发展的调整阶段？
   a. 想法
   b. 冲突
   c. 新工作战略

17. 谈判过程的第一步是什么？
   a. 准备
   b. 开始
   c. 预计划

18. 你要如何定义强制权？
   a. 如果一方不同意另一方的要求，就会有失去一些东西的风险
   b. 一方有对另一方的绝对权力
   c. 提供优势的经验

19. 冲突管理会什么时候发生？
   a. 机会阶段
   b. 执行和监控阶段
   c. 贯穿整个项目周期

20. 为了平定冲突，应该做以下那个分析？
   a. 因果分析
   b. 干系人分析
   c. 两者都正确

21. 下面哪项是 W2W 冲突战略？
   a. 妥协
   b. 合作
   c. 调节

22. 根据冲突解决矩阵，在双方都占下风时，以下哪一个策略发生？
   a. 竞争
   b. 妥协
   c. 回避

23. 项目整合可持续方法是如何定义领导力？
   a. 建立愿景和方向
   b. 通过共同目的影响和引导别人
   c. 两个都正确
24. 以下那三个是 John Adair 定义的领导力核心责任重叠领域？
   a. 任务，个人和团队
   b. 干系人，范围和项目
   c. 时间，成本和范围

25. 根据领导力，什么性格促使成为最好的项目经理？
   a. 分析力，结构性，控制力，深思熟虑，有条理….
   b. 有经验，有远见，灵活性，未受阻碍的，有创新的….
   c. 两者都正确
测试一：答案

1. 公司指派你为项目经理去实施一系列的指导性文件和准则，用于帮组公司处理能源问题。以下哪个 ISO 标准你应该选择应用？
   C. 以上都不是

   解析：对于能源问题，可以当做指导的是 ISO50001。

2. 以下哪个 ISO 标准可以看做是指导方针而不是规范标准？
   A. ISO26000 和 ISO21500

   解析：ISO26000（企业社会责任）和 ISO21500（项目管理）是在整合项目可持续方法中，唯一可以看做是指导方针而不是规范标准的(ISO9000, ISO14000 and ISO50001)

3. 你是 ABC 公司的项目经理，由于公司对环境方面政策的变化，你被任命向老板解释什么是企业社会责任。基于这个原因，你根据 ISO26000 企业社会原则，准备你的演讲的结构。如果你想遵循这些原则，你的演讲的结构会是什么样？
   C. 责任感，政策及信息透明度，道德行为，利益相关者权益和法律条文

4. 戴明循环，也被叫做“策划-实施-检查-改进”（PDCA），我们可以在什么准则中找到？
   C. 两者都对

   解析：PDCA 在 ISO14000 体系中，因为他是 EMS 的主要原则。同时，他也在 ISO9001 体系中，因为是持续改进的一部分。

5. Juran 是一位质量专家，发展了 PDCA 的理念，这代表的是什么？
   C. 以上两点都不正确

   解析：PDCA 着实代表“策划-实施-检查-改进”。但是，是戴明而不是 Juran 开始这些。
6. 以下哪些表述是正确的？

<table>
<thead>
<tr>
<th>陈述</th>
<th>初级能源</th>
<th>最终用途</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>电力</td>
<td>光</td>
</tr>
<tr>
<td>II</td>
<td>太阳能</td>
<td>热水</td>
</tr>
<tr>
<td>III</td>
<td>生物质能</td>
<td>供暖</td>
</tr>
<tr>
<td>IV</td>
<td>生化柴油</td>
<td>供暖</td>
</tr>
</tbody>
</table>

B . III

解析：
I. 电力不是初级能源
II. 热水不是最终用途
III. 正确
IV. 生化柴油不是初级能源

7. 内部审计的主要原则指的是什么？

B 道德行为，公正反映，专业维护和独立性。

解析：ISO9000 涉及内部审计和他的原则是：道德行为，公正反映，专业维护和独立性。

8. ISO21500 是一个规范标准，他指的是什么？

C 两个都不是

解析：ISO21500 在项目管理中是一个指导方针（不是一个规范标准）

9. ISO21500 准则应该与下面哪个组织类型相适应？

C 任何类型的组织

解析：ISO21500 准则使用与任何组织（公营，私营和集体组织）
10. ISO21500 过程组分为以下哪些结构?
   B 启动，计划，实施控制和收尾


11. 下列哪些成分将 GPM 融入到启动阶段?
   A.P5 分析和发展 SMP

   解析：TPL 对于 P5 来说不是一个新的配置，而是一个基础。商业案例不是一个新的配置但是 GPM 建议，当我们做这个，请把环境考虑进去。我们可以看启动阶段的图表：See figure: PRiSM, GPM Global 2013, Version1, page 26

12. 商业案例指的是什么?
   C 对于每个项目来说都是关键性文件，对于 GPM，环境因素必须考虑在内

   解析：商业案例，对于由项目经理和其他干系人完成启动阶段的任何项目来说，都是很重要的文件。当项目结束，赞助商必须签字。在 GPM 的要求中，当撰写这个文件时，必须把环境因素考虑在内。

13. TBL 的理念被 John Elkington 在 1994 年提出的，他涉及了什么内容?
   B 社会，环境和财务

   解析：三重底线（TBL）将社会（人），环境（地球），财务（利益）考虑在内。

14. P5 代表哪些方面内容?
   C 产品，收益，人，地球和过程
15. 根据 P5 集成矩阵，以下哪些表述是正确的?
   C 两者都不是

   解析：P5 集成矩阵与产品、过程、三重底线有关。

16. 一个项目经理被授予了 GPM-b，正在向没有获得 GPM 培训的其他员工解释 SMP 的意义，以下那个表述是正确的?
   C 两个都不是

   解析：可持续管理计划必须附加在各个项目的各个过程中（不只是启动阶段），同时鉴别项目对于社会、收益和环境影响的观点。

17. 对于 P5 影响评估评分，以下那个表述是正确的?
   C 项目经理必须按照自己的标准评分

   解析：P5 影响评估评分必须有项目经理按照自己的标准打分，因为没有一个指导标准。(−)表示一个积极的影响，而(+)代表一个负面的影响。绝对值最高分是 3。

18. 根据干系人管理原则，对待被动的支持者的最佳方式是什么?
   B 激发他的积极性

   解析：我们可以下面的图标看出：

   ![干系人管理图标]

   Backer
   Motivate
   Blocker
   Tell
   Active
19. 哪些是联合国全球契约十项原则的四个部分？
   B 人权，劳动力，环境和反腐败

20. 哪个 TBL 的理念是不包括在联合国全球契约十项原则内？
   C 效益（经济）

21. 以下哪个能准确的代表 GRI 指标？
   A 和 TBL 一样

   解析：GRI 指标是经济，社会和环境（就和 TBL 一样）

22. 以下关于可持续的表述，那个是不正确的？
   A 可持续是关于地方和全球的，只着重在长期

   解析：这个问题问的是不正确的一点。可持续性既是长期的也是短期的。

23. 对于 GRI 标准，报告通常用在哪些方面？
   B 可用于比较不同组织间的表

   解析：首先，GRI 表示的是全球报告倡议组织，同时表明报告可以用作是标
   杆和评估关于法律，规范，准则，表现标准和志愿者倡议的可持续性表现。
   证明组织是如何影响和被一个组织中与不同组织中的对可持续发展的预期比较所影响。

24. 按照这种顺序，这些 ISO 属于哪些领域 (ISO9000, ISO14000,ISO26000,ISO50001,ISO21500)
   C 质量，环境，企业社会责任，能源，项目管理

25. 根据 ISO9000，下列哪个不是在这个原则之内的？
   B 干系人导向

   解析：干系人导向不是 ISO9000 准则中的点（准则应顾客导向）
测试二：答案

1. 在项目计划阶段，谁有权利去更新文档属性？
   A 项目经理

解析：项目经理拥有权威作用，项目发起人是项目所有者，而项目团队，发起人，收益团体是观众。

2. 你作为一个被授予 GPM-b 证书的员工，明白的知道在项目计划阶段，对范围没有充分的认识就不能定义它，所以最开始要做的就是定义它。当你参加 GPM 培训课程时，你记得做这件事的活动，他叫什么？
   B 回答 7 W’s

解析：为了能定义范围这个概念，项目经理必须回答 7 W’s（为什么，是什么，如何，有多少，谁，什么时间和在什么地方）。因为这在计划前理解项目范围是十分必要的。

3. 下列以下哪项表述能更好的定义验收标准？
   A 客户所表达的内容

解析：验收标准必须由客户和项目经理达成共识

4. 根据 PBS 模型，以下哪项表述是正确的？
   C 鉴别将运用在配置管理中的项目

解析：PBS 表示的是产品分解结构。他为关键产品提供了高层次的视野，同时对于更关注与产品而不是工作完成的项目干系人来说是十分有用的。他同样用在鉴别将会运用在配置管理中的项目和改变影响评估中。
5. 根据 WBS，以下哪项表述是正确的？
   VI. WBS 表示的是工作分解结构
   VII. WBS 是来源于 PBS
   VIII. 在任何分支下的最低级都有产品包
   IX. 即便与 OBS 相关，而对于做 CBS 是强制的
   X. 在整个项目中提供了交流的框架，包括绩效报表和升级问题

   C. I, II, V

解析：在做 RACI 时，WBS 是与 OBS 相关的，同时在最低级也有工作包。

6. 根据绿色项目管理的计划阶段的范围管理，如果我们已经做了 PBS 和 OBS，我们可以做 RACI 和 CBS。
   C. 我们既不能做 RACI 也不能在 CBS

解析：为了完成 RACI 和 CBS，我们需要工作包装，仅仅是在 WBS 而不是在 PBS。

7. RACI 表示的是什么意思？
   C. 在磋商和通知方面是高度负责的

8. 下列给出的词中，哪一个是可以仅仅出现在 RACI 的每一行的词？
   A. 责任

9. 以下哪一个是最基本的结构，同时需要别人也可以做
   C. 以上都不是

解析：RACI and CBS 是各自独立的。RACI 需要 WBS 和 OBS，而 CBS 需要 WBS 以及需要分配费用的公司系统。
10. 以下那种说法是正确的？
B 准确性和不确定的水平是相反的

解析：对于这个问题的解释可以参考在项目可持续性方法（第一版）第 57 页。随着项目的发展，其不确定水平降低，并且两个水平可以在任何阶段交叉（它更可能发生在生产阶段，但不是一定的）。

11. 根据资源管理，项目可持续发展方法表明，项目经理通常拥有最有价值的资源是什么？
A 人

解析：引用可持续发展方法“记住你拥有的最有价值的资源是人力是十分重要的，所以说确保你可以领导并且照顾他们，因为他们是任何项目经理可以拿来重复利用的资产。

12. 以下哪一个不被看作是一种资源
B 环境

解析：环境本身不是一种资源，自然环境才是一种资源。知识是不可消费的而金钱是可消费的，但是它们同时都是资源。

13. 以下哪一个对质量管理来说是关键的概念？
C 机会，时间，成本之间的关系，以及可持续性

解析：6σ 是与质量统计相关的一个提升方法论，但是它本身并不是一个关键因素。对于质量最关键的是：在测量条款（定性）中应以的要求，目的明确以及对要求定义，使得项目经理能在机会，时间，成本和质量之间可以权衡。
14. 根据质量管理上的成功，要求所有小组成员和相关人士参与。然而，他们中最重要的是：
C 管理者

解析：一个非常重要的要被考虑到的因素是成功需要小组中所有成员的参与，但是，它要求的是用管理者的责任来提供需要的资源获得成功。没有管理者的承担，是不可能获得好的效果的。

15. 根据质量标准，我们必须努力实现质量的哪一方面
A 过程

解析：过程实现了质量的要求，而产品知识过程最后的结果。所以是过程满足了质量的实现。

16. 下面有多少过程涵盖了质量环境?
A <5

解析：在整合可持续方法列表中（图表在 60 页，解析在 61 页），质量环境是由质量计划，质量保证，质量控制和持续改进组成。（4 个步骤<5）

17. 下面那个质量控制工具可以在计划阶段帮助鉴定问题出现的原因?
C 没有一项是正确的

解析：我们所涉及的质量控制工具是因果关系（也叫做田口图或者鱼骨图）。散点图是用在控制阶段

18. 为什么 7 个控制质量的工具被归类成基础的?
B 他们使用方法很简单，即使使用者没有统计背景。

解析：即使有很多很复杂的工具，这 7 个质量控制工具运用很简单，可以解决很多质量问题。
19. 石川馨结束了7个基本的控制质量工具理论，和Bankei的7个基础武器连提并论。他们分别是鱼骨图，控制图表，直方图，排列表，散点图，流程图，趋势图。我们知道控制图表同样也是一种控制质量工具，以上哪个是错误的？
B 流程图，因为应该是分层表
解析：7个基本的控制质量工具是鱼骨图，控制图表，直方图，排列表，散点图，流程图，分层表（一些分层表工具是流程图和趋势图）。

20. 我们能在哪个阶段找到7个质量工具？
C 两个都正确
解析：一些质量工具在计划阶段设计（鱼骨图，设计查账单和分层表），而有些则在控制阶段（如使用查账单，控制图表，直方图，排列表）。

21. 以下关于质量成本的表述那个是正确的？
C 两者都正确
解析：从长远来看，质量投资成本比失败和评估成本少，所以我们接受克罗斯的说法。在另一方面，当你在质量方面投资，你需要花钱，暂时来看，不是免费的。

看图表，回答22-24题。
22. 如果用天计算，下面那个是项目的周期？
   B 16 天

解析：我们能在图中看出。G是最迟的活动，它在第16天结束。

23. 下面那个是项目的关键路径？
   A A-B-E-G

解析：关键路径0浮动的活动，在项目中是A-B-E-G

24. 项目的总浮动的时间是几天？
   B 7天

解析：总浮动时间的计算公式：，I=活动。在项目中，总浮动=0+0+3+1+0+3+0=7天。

25. 你在什么地方必须要做赶工？
   C 在一些关键路径

解析：我们必须在关键路径的一开始就要做好赶工工作。然后再坐到便宜和尽早完成。在另一方面，快速跟进包括在同时做很多事。
测试三：答案

1. 根据传统对风险的定义，以下哪种表述是正确的？
   C 两者都不正确

   解析：风险可能是负面的也可能是正面的。当风险是正面时，也被称作为机遇。

2. 风险经常被分成以下哪四个层次？
   A 战略，项目，程序和操作

   解析：详情请参见项目整合可持续方法（第一版）68、69页

3. 当项目整合可持续方法中展示风险材料时，以下哪些 ISO 主要方面是我们必须记住？
   B ISO14011 (EMS)

   解析：项目整合可持续方法（第一版）69-70页。根据项目整合可持续方法，风险组合应该包含这些阶段：计划，鉴定，分析，响应回复，监控和控制（与 ISO21500 不同）。再者，风险管理的计划，控制，监管过程领域是 ISO14000 的聚焦点，也是有风险管理环境的 EMS 的聚焦点

4. 根据风险平衡和可持续发展的比较，收益可以被分为哪两个组？
   A 硬的和软的

   解析：项目整合可持续方法（第一版）71页—风险平衡和可持续发展

5. 下列哪个部分不属于风险管理过程？
   A 执行风险

   解析：风险管理过程是以下阶段解决的：计划，鉴定，分析（质量和或者数量），回馈和监控以及控制（反馈来确定）。详细内容请参见项目整合可持续方法（第一版）72页
6. 下列哪个词你将会关联到风险触发条件？
C. 何时
解析：触发条件是当风险行为发生时。

7. 以下那个方法分别从强势，弱势，机会和风险来审视项目？
C SWOT 分析
解析：SWOT 分析表示的是强势，弱势，机会和风险

8. 石川的图和鱼骨图可以和一拿哪个回答联系在一起？
C 两者都对
解析：石川的图是质量管理中七个基础质量工具中的一种，也是用来识别风险（风险管理）的图表绘制技术的一种。

9. 有一种风险管理方法是概率影响矩阵，具体的是那种管理方法？
A 定性技术
解析：详情请参见项目整合可持续方法（第一版）76 页

10. 根据项目整合管理方法，以下哪项是正确的？
B 事件是风险
解析：项目整合可持续方法定义事件：事件是对于项目来说是一个不能解决被项目经理的风险。事件和问题不同，问题是日常的问题，项目经理会一件一件的解决。

11. 根据移交里程碑，以下表述哪个是不正确的？
A 用户不是关键干系人
解析：在移交里程碑中，关键干系人是项目经理，项目发起人，项目团队，质量保证和用户。
12. 以下哪项不是在结束过程中的?
C 两者都在结束过程中

13. 当在结束时，我们从来不会忘记展示什么？
A 质量评审

解析：根据项目整合可持续方法第 5 和主要被遗忘的审查是质量审查。

14. 项目评审在什么时候结束？
A 两者都有可能，在项目过程中或者结束之后

解析：详情请参见项目整合可持续方法（第一版）152 页。

15. 根据项目后评价，以下哪项表述是正确的？
B 输入的是项目历史，项目执行和项目文件

解析：项目审查是能找到经验教训、对于 QMS 的反馈、建议和提升的项目的评估。

16. 书面的商务案例是在哪个背景中？
B 项目环境

解析：请参见在项目整合可持续方法 82 页的 ISO21500 组织结构。

17. 完成句子：干系人是…
C 两个都正确

解析：干系人是积极参与在项目中，或者是哪些会被项目执行或者结果积极或者消极影响的人或者组织。干系人可能会实施影响在项目，可交付成果和项目团队成员中。
18. 根据项目整合可持续方法，成功的标准必须符合 SMART 原则。下面哪一项不是 SMART 所代表的？
A 代表力

解析：SMART 原则表示的是明确的，可衡量的，能达到的，可以实现的和时效性。

19. 根据成功的标准和基于传统的铁约束，以下哪项表述是正确的？
C 两者都不正确

解析：传统的铁约束是范围，时间和成本（质量是从这里定义的）。新方法将环境影响以相同的程度融入到这个传统的约束中。

20. 根据收益管理，哪个干系人需要负责整体的利益成就？
B 项目发起人

解析：在收益管理计划中，权责部分代表发起人是负责整体的利益成就，然而其他干系人将会融入到包括日常活动的其他工作中。

21. 为什么你需要控制在项目过程中发生的变化？
C 两个都不对

解析：我们需要控制项目过程中的变更，为了与项目干系人沟通和控制由其他原因带来的不可控变化的负面影响。

22. 以下哪个是项目经理在变化控制方面的职责和权利？
C 两个都对

解析：A 和 B 是对项目经理在变化控制方面的职责和权利的定义

23. 那个控制变更行为把变更记录当做是输出？
B 注册

解析：详情请参见项目整合可持续方法（第一版）124 页
24. 谁是配置管理计划的所有者？
A 项目经理

解析：配置管理计划的所有者是项目经理，同时也是发展作为项目管理计划的一部分，用来给配置政策，目标和过程提供指导。

25. 以下哪项是信息管理的目的？
A 控制信息质量的稳定性

解析：信息管理的目的是保障信息能及时地运用于决策；在整个项目生命周期中和周期后控制信息质量的稳定性；同时支持整个沟通过程。
测试四：答案

1. 人力资源管理的目的是什么?
   C 两者都正确

解析：人力资源管理着重在资源的分配和如何有效的管理人力资源。

2. 在人力资源管理中，监控的目的是什么?
   A 建立目前项目的偏差，同时评估他们的影响

解析：监控的目的是建立偏差和评估他们的影响。公差可能使工作继续减少偏差。控制和协调包含了用于处理相反的情况的纠正措施的计划和实施。或者，他可能包含预计划，如果原先的计划表现出不工作或者不现实。

3. 下列那个 ISO 标准与绿色项目的采购管理更一致?
   B ISO 14000

解析：绿色项目管理中的采购管理的第一步是 EMS (ISO14000)

4. 根据采购管理合同，以下哪项表述是正确的?
   A 如果是属于固定价格，这个会更加安全（低风险）

解析：请参照项目整合可持续方法（第一版）104 页表格

5. 根据项目整合可持续方法，哪项是典型的项目成本?
   C 承诺成本，应计项目，实际成本和预计成本

解析：更加项目整合可持续方法，典型的项目成本包含了承诺成本，应计项目，实际成本和预计成本。
6. 以下哪项不是成本管理收益？
   A. S 曲线

   解析：S 曲线是成本管理的工具，但不是收益。

7. 在项目管理哪个阶段需要展示 EVM？
   B. 监控阶段

   解析：EVM 是一个监控工具，所以是在监控阶段。

8. 根据 EVM 的三个参数，以下哪项是正确的？
   B. 必须和当前时间日期同步

   解析：EVM 的三个参数是计划价值、实际成本和挣得值，同时所有参数为了避免不精确，必须和当前时间日期同步。

9. 根据绿色项目的 EVM，以下表述哪个是错误的？
   A. EVM 技术对于每个领域有精细的看法

   解析：EVM 技术提供了一个整体的看法，在一个领域高于市场表现可能会导致另一个市场的不好的表现。

10. 根据沟通模型，以下表述那项是错误的？
    C. 为了建立反馈式沟通，发送者编码，接受者只需解码。

    解析：我们建立反馈式沟通，即使因为噪音不会干扰，发送者和接受者必须相互编码和解码。

11. 什么是沟通噪音？
    B. 传播过程中接入和理解信息的各种声音

    解析：噪音不是误解，是强迫伤害输入。
GPM fit into a Chinese Environment 

Annex C3: Some of the Project’s Outputs

12. If you have 6 key stakeholders, how many communication channels do you need at least?
   C 15

   **Analysis:** Communication channels number = \( \frac{n(n-1)}{2} = \frac{6(6-1)}{2} = 15 \) channels.

13. To go from the project manager to the project sponsor, which document is the best?
   B Milestone report

   **Analysis:** The project sponsor only needs to understand the milestone results that have been approved. Progress plan updates must be communicated to the sales manager.

14. How many communication skills does the project manager need to exchange information?
   B 4

   **Analysis:** Formal and informal written communication, formal and informal oral communication.

15. Which is the first stage of team development?
   C Establishment

   **Analysis:** The stages of team development are: establishment phase, adjustment phase, normative phase and demonstration phase.

16. Which aspect is helpful for you to improve team development in the adjustment stage?
   B Conflict

   **Analysis:** According to the team development process, the adjustment stage is the conflict phase.

17. What is the first step of negotiation process?
   A Preparation

   **Analysis:** The negotiation process (preparation, beginning, discussion and conclusion)
18. 你要如何定义强制权？
A 如果一方不同意另一方的要求，就会有失去一些东西的风险

19. 冲突管理什么时候发生？
C 贯穿整个项目周期

解析：根据项目整合可持续方法（第 139 页），我们必须在整个项目周期中处理冲突。

20. 为了平定冲突，应该做以下那个分析？
C 两者都正确

解析：详情参照项目整合可持续方法第一版，140 页（图 60）

21. 下面哪项是 W2W 冲突战略？
B 合作

解析：详情参照项目整合可持续方法第一版，142 页

22. 根据冲突解决矩阵，在双方都占下风时，以下哪一个策略发生？
C 回避

解析：详情参照项目整合可持续方法第一版，142 页

23. 项目整合可持续方法是如何定义领导力？
C 两个都正确

解析：根据项目整合可持续方法，领导力可以定义为：
- 建立愿景和方向
- 通过共同目的影响和引导别人
- 授权和激励员工达到项目成功
24. 以下那三个是 John Adair 定义的领导力核心责任重叠领域?
A 任务，个人和团队

解析：John Adair 定义三个领导力核心责任重叠领域：任务，个人和团队

25. 根据领导力，什么性格促使成为最好的项目经理?
C 两者都正确

解析：项目经理既是经理（a）又是领导（b）.
Reference List
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GPM Fit into a Chinese Environment begins with an introduction of China’s environmental issues scenario to get the reader involved on how important is to bear in mind sustainability.

Because of the previous fact, in these pages the reader is going to find a guideline for project management profession and, especially, in how to be more sustainable when executing a project. Furthermore, it is being aligned with some of the most prestigious ISOs and the United Nations Global Compact; as well as the Project Management Institute and GPM Global standards.

Eventually, it closes with a sample of all those tools and techniques applied in a real life project in a local Chinese company, in which the writer was actually the project manager.

Some of the knowledge, tools and techniques the reader is going to learn about are as follows:

- How a project is structured and what to do in every single phase
- How to measure the environmental impact of a project
- How to report your company’s sustainable achievements
- How to achieve success in a project
- How to plan the cost of a project
- How to deal with project stakeholders and the steering committee
- How to schedule, and reschedule a project
- How to get quality excellence in your project
- How to avoid communication issues
- How to deal with human resources; and even more, how to manage up
- How to perform project risk analysis
- And more …