Obsolescence and life cycle management for automation systems

Recommended practice
Acknowledgements

IOGP Instrumentation and Automation Standards Subcommittee (IASSC) Obsolescence Management Task Force

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Obsolescence and life cycle management for automation systems

Recommended practice
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Foreword

With the ever-increasing demand to extend the life of operating assets, the risk of obsolescence has become more prevalent. It now presents significant concern to the industry, for both new and brownfield projects (maintenance and automation system evolution).

Automation systems are expected to perform their function through the field life. A typical automation system life cycle is around 25 years, while large oil and gas field are expected to last significantly longer (more than 50 years).

The impact of obsolescence is felt when equipment fails and the replacement for the failed component is no longer available, can no longer be satisfactorily supported or can no longer be sourced from approved sources. Significant and expensive downtime might take hold whilst the search for new approved sources or alternative solutions continues.

A robust obsolescence management strategy can address and mitigate the risks associated with the obsolescence of equipment.

An IOGP Task Force Obsolescence Management (OMTF) was created to address the significant obsolescence issues of automation systems being experienced by oil and gas producers in a consistent manner.

The objective of the IOGP OMTF is to make available a recommended practice (RP) that could be freely used by any/all oil and gas producers and automation systems suppliers in the industry, as required. The intention is that a common practice used by all would minimize the different types of methods employed within the major suppliers to manage obsolescence of automation systems.

This recommended practice is intended to cover the complete automation systems both on greenfield development (new deliveries) and brownfield development (previously delivered equipment) both onshore and offshore.

The purpose of this recommended practice is to define the proactive Obsolescence Management Process as it applies to automation systems for oil and gas producers and to specify the minimum requirements for automation systems suppliers to manage the risks of obsolescence through activities associated with:

- preventing
- predicting
- resolving.

The combination of these tasks should help reduce the risks, costs and impact to the business when components, tooling, suppliers, process and knowledge become obsolete, through the continued management of the equipment life cycle status.
The report is structured in two parts:

1) Sections 1 to 3 explain the life cycle overall approach to meet requirements.

2) Section 4 articulates a recommended process for each element of an Obsolescence Management Plan that is required to be developed and delivered by the automation systems suppliers in order to fulfil the oil and gas producer requirements.

This report is supported by (published separately):

- Form 551A, Automation System Equipment Component Detail
- Form 551B, Automation System Equipment Status Overview.
1. Scope

This recommended practice (RP) gives guidance in life cycle planning and obsolescence management to maintain integrity, high availability and low life cycle cost automation systems.

An automation system, in this context, is the collective term for equipment and legacy equipment types that perform safety, control, and/or monitoring functions on oil and gas installations. The automation system includes the ICSS (Integrated Control and Safety Systems), SCADA systems, Package Unit Control systems (including PLCs and HMIs).

The main focus will be more on complex computer-based system which is costly and challenging (engineering and downtime) to upgrade, migrate or replace.

Field equipment such as transmitters and sensors, are not included.

This recommended practice:

- defines a life cycle terminology
- introduces a proactive life cycle management process
- provides guidance to ensure best return on investments in technology (optimize life cycle cost)
- provides guidance to projects to select solutions and products that should be tolerant of rapid technological development and component moving into after sale and obsolete phase
- defines a policy on how to interact with suppliers to prolong system and product lifetimes
- increases awareness of challenges with and definition of compatibility between versions and generation
- identifies the expected useful lifetime of an automation system.
2. Terms and definitions

For the purpose of this recommended practice, the following terms and definitions apply.

2.1 **Active sales phase**
Phase in life cycle that starts when development phase is finalized. Actively sold and continuously developed and supported. Typical preferred technology for greenfield and large plant extensions.

2.2 **After-sales support phase**
Phase in life cycle that starts when active sales ends. Product is only available as spare parts or repair of components. No further development of product. Technical support from vendor is still available. Critical software updated (e.g. patch, antivirus) is supported.

2.3 **Alternative**
An item whose performance may be different from that specified for one or more reasons (e.g. quality or reliability level, tolerance, parametric, temperature range).

2.4 **Asset**
This term in the offshore oil and gas industry is used to define the installation of equipment in unique geographically located position of a field.

2.5 **Automation system**
The collective term for equipment and legacy equipment types that perform safety, control, and/or monitoring functions on oil and gas installations. The automation system includes the ICSS (process and safety systems), SCADA systems, Package Unit Control systems (including PLCs and HMIs).

2.6 **Brownfield**
An area of commercial or industrial site that is currently being used as an industrial site, but has been earmarked for further development or expansion.

2.7 **Change**
Decision to manage obsolescence via physical change.

2.8 **Component**
Autonomous element of a system, which fulfils a defined sub-function.

[IEC 62890: Ed.1.0]
2.9 **Development phase**
Phase in life cycle before product is released. Normally this phase starts when the predecessor still is in Active-sales.

2.10 **End of life (EOL):**
Discontinuance of production by the original manufacturer.
*NOTE: EOL should not be confused with 'time to wear out' or 'end of use'.*
[IEC 62402:2007]

2.11 **Equivalent**
An item which is functionally, parametrically and technically interchangeable (form, fit and function).

2.12 **Greenfield**
An area of undeveloped site earmarked for commercial development or industrial projects.

2.13 **Hardware**
Physical components of a system including its associated data and documentation.
[IEC 62402:2007]

2.14 **Infrastructure**
Facilities, plant and people who design, manufacture, operate and support the product.
[IEC 62402:2007]

2.15 **Last Time Buy**
Life-Cycle-Management strategy in which instances of an abandoned product type are purchased and stored.
[IEC 62890: Ed. 1.0]

2.16 **Legacy product (equipment)**
Product whose development is complete.
[IEC 62402:2007]

2.17 **Legacy system**
System whose development is complete.
[IEC 62402:2007]
2.18 Life cycle
The period from initial facility design and construction through to decommissioning and site remediation.

2.19 Life cycle costs
Cumulative cost of a product over its life cycle.
[IEC 60300-3-3:2005, subclause 3.3]

2.20 Material
Systems, products, stores, supplies, spares and related documentation, manuals, computer software and firmware.
[IEC 62402:2007]

2.21 Migrate
Replace component (e.g. I/O cards) with a functionally similar component from current supplier.

2.22 Obsolescence
Transition from availability from the original manufacturer to unavailability.
[IEC 62402:2007]

2.23 Obsolescence management
Coordinated activities to direct and control an organization with regard to obsolescence.
[IEC 62402:2007]

2.24 Obsolescence management plan
Description of the strategies for the identification and mitigation of the effects of obsolescence through all stages of the life of a product.
[IEC 62402:2007]

2.25 Obsolescent
Subject to an announced future end of; service provision, support of software or production by the original equipment manufacturer.

2.26 Obsolete
No longer available from the original manufacturer to the original specification. Support and spare parts on best effort, vendor cannot guarantee available spare parts, ability to repair or any technical support of the product.
2.27 **Original equipment manufacturer (OEM)**
Manufacturer of an assembly or a product.

*NOTE 1: OEM is a common term used to identify a position in the supply chain.*

*NOTE 2: The assembly or product might be regarded as a component by a customer.*

[IEC 62402:2007]

2.28 **Proactive strategy**
Development and implementation of an Obsolescence Management Plan in advance.

[IEC 62402:2007]

2.29 **Process control system or process automation system (PCS/PAS)**
Group of technologies or system that is used to automatically control industrial process. PAS often uses the automation network to interconnect controllers, sensors, operator's human machine interface and final control elements (e.g. actuators).

2.30 **Product**
Result of a process. It is a completed item of manufacture that has been released to the market.

[IEC 62402:2007, definition 3.1.22 modified]

*NOTE With respect to the automation system, there are three generic product categories, as follows:*

1. software (e.g. computer program)
2. hardware (e.g. mechanical component, electrical component or assembly)
3. firmware.

2.31 **Project**
The undertaking to implement/install a unique solution for a particular purpose. It may consist of one or more products from a supplier or suppliers. Generally, a project consists of one, or a combination of, design, manufacture, installation and support (it has definitive start and end date).

2.32 **Reactive strategy**
Reaction to develop and implement solution to problems of obsolescence as and when they occur.

[IEC 62402:2007]

2.33 **Replace**
Remove current system entirely (or partially) and fit new system. Continuity with current supplier is not necessarily implied.
2.34 **Safety instrumented system (SIS)**
Instrumented system used to implement one or more safety instrumented functions.
[IEC 61511-1:2004]

2.35 **Software**
Programs, procedures, rules, data and documentation associated with programmable aspects of systems hardware and infrastructure.
[IEC 62402:2007]

2.36 **Supplier**
The company designated on the purchase order form as being the contracted supplier of materials or services.

2.37 **Support**
Total resources required to operate and maintain systems or products throughout their operating phase, including all aspects of software, hardware and complete design knowledge.

2.38 **System**
Defined and structured set of components which fulfill a function (system function) through interactions or interrelationships with each other.

*Note 1 to entry: Systems could have a hierarchical structure, i.e. they could consist of underlying systems (which are then considered components of the system).*

*Note 2 to entry: From a sales perspective, a system denotes a set of product types belonging to a specific portfolio line.*
[IEC 62890:Ed.1.0]

2.39 **Update (maintain)**
Improve existing software to a newer revision designed for error correction and/or minor functional improvements.

*Note 1 to entry: an update is called a patch management which can include bug fix for general errors and hotfix for critical or urgent error corrections.*
[IEC 62890:Ed.1.0, definition modified]

2.40 **Upgrade**
Improve existing software and firmware to a newer version with enhanced functionality.

*Note 1 to entry: The term upgrade can apply to firmware and software.*
[IEC 62890:Ed.1.0, definition modified]
### Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
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<tbody>
<tr>
<td>BoM</td>
<td>Bill of Material</td>
</tr>
<tr>
<td>CAPEX</td>
<td>Capital expenditure</td>
</tr>
<tr>
<td>Company</td>
<td>Oil and Gas Producer</td>
</tr>
<tr>
<td>COTS</td>
<td>Commercial off-the-shelf</td>
</tr>
<tr>
<td>DCS</td>
<td>Distributed control system</td>
</tr>
<tr>
<td>EOL</td>
<td>End of Life</td>
</tr>
<tr>
<td>ESD</td>
<td>Emergency Shut down</td>
</tr>
<tr>
<td>FGS</td>
<td>Fire &amp; Gas System.</td>
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<tr>
<td>HMI</td>
<td>Human–machine interface</td>
</tr>
<tr>
<td>HW</td>
<td>Hardware</td>
</tr>
<tr>
<td>IASSC</td>
<td>IOGP Instrumentation and Automaton Standards subcommittee</td>
</tr>
<tr>
<td>ICSS</td>
<td>Integrated Control and Safety System</td>
</tr>
<tr>
<td>IEC</td>
<td>International Electrotechnical Commission</td>
</tr>
<tr>
<td>I/O</td>
<td>Input/Output</td>
</tr>
<tr>
<td>OEM</td>
<td>Original Equipment Manufacturer</td>
</tr>
<tr>
<td>OM</td>
<td>Obsolescence Management</td>
</tr>
<tr>
<td>OMP</td>
<td>Obsolescence Management Plan</td>
</tr>
<tr>
<td>OPEX</td>
<td>Operating expenditure</td>
</tr>
<tr>
<td>PAS</td>
<td>Process automation system</td>
</tr>
<tr>
<td>PCS</td>
<td>Process Control System</td>
</tr>
<tr>
<td>PLC</td>
<td>Programmable logic controller</td>
</tr>
<tr>
<td>PSS</td>
<td>Process Safety System</td>
</tr>
<tr>
<td>RMB</td>
<td>Risk Mitigation Buy.</td>
</tr>
<tr>
<td>SIS</td>
<td>Safety instrumented system.</td>
</tr>
<tr>
<td>SW</td>
<td>Software</td>
</tr>
<tr>
<td>UCP</td>
<td>Unit Control Panel</td>
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3. Life cycle management

3.1 Automation system evolution

In terms of life cycle management within automation system, experience shows that to distinguish between different terms like upgrade, migrate and replace is difficult. To clarify the definition, this RP uses the generic terminology **automation system evolution**.

Automation system evolution should in this context be understood as **update (maintain)**, **upgrade**, **migrate** or **replace**.

*Figure 1: Automation system evolution*

<table>
<thead>
<tr>
<th>Update (maintain)</th>
<th>Upgrade</th>
<th>Migrate</th>
<th>Replace</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improve existing software to a newer revision designed for error correction and/or minor functional improvements. It is called patch management.</td>
<td>Improve existing software and firmware to a newer version with enhanced functionality.</td>
<td>Replace component (e.g. I/O cards) with a functionally similar component from current supplier.</td>
<td>Remove current system entirely (or partially) and fit new system. Continuity with current supplier is not necessarily implied.</td>
</tr>
</tbody>
</table>

3.2 Life cycle model

All commercial products normally have some sort of life cycle defining if the product is in active sales or not.

Automation system vendors typically have a life cycle indication for components or system divided into several phases, based on principles defined in IEC 62402, *Obsolescence management – Application guide*.

Different automation system suppliers use slightly different terms, definitions of the life cycle phases and notification to inform about phase change. (For example, notifying a phase change into After-sales support is often done in the form of a
product discontinuance notice (PDN), end of life (EOL) notification or last time buy (LTB) notification.)

To overcome these variations, this recommended practice defines a generic life cycle model.

Figure 2 illustrates a typical automation life cycle of a product type (or system). It clearly identifies the different phases, including relevant milestones.

The colour coding defines the different life cycle phases. The same colours should also be used in life cycle reporting scheme described in 4.3 (Product life cycle diagrams).

<table>
<thead>
<tr>
<th>Development</th>
<th>Active sales</th>
<th>After-sales support</th>
<th>Obsolete</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compatibility profile shall be described. Compatibility assessment against replacing product should be defined.</td>
<td>Actively sold and continuously developed and supported. Typical preferred technology for Greenfield and large plant extensions.</td>
<td>No further development of product. Technical support from vendor is still available. Critical SW updated (e.g. patch, antivirus, etc) is supported. Purchase of spare parts and product for minor plant extensions is available until LTB. After this only spare parts or repair of components.</td>
<td>Support and spare parts on best effort, vendor can not guarantee available spare parts, ability to repair or any technical support of the product.</td>
</tr>
</tbody>
</table>

**Figure 2:** Typical automation system life cycle model
Figure 2 illustrates the life cycle as a line (with defined start and stop point). In real life, a life cycle is an evolution where, normally, a new product type (successor) should be available as a new version before the current product enters the After-sales support phase.

The compatibility between these versions should be described by vendor – see 3.4.2 (Compatibility).

Guiding through life cycle model

To increase the probability of succeeding in the strategic goal of lower the total life cycle cost, some general considerations should be defined for the different phases in the generic life cycle model.

**Development**

The end of the Development phase can be an ideal time for user to start an evaluation of this technology. Typical elements to evaluate/influence might be:

- life cycle management integrated into design
- compatibility with predecessor
- ensure technology fulfills required need.

**Active sales**

Greenfield project or major automation system evolution should select technology from the Active sales phase.

Choosing technology from beginning of this phase helps secure a longer time period of use before becoming obsolete. The risk is, of course, a higher failure rate due to introduction of new faults, known as the beginning of bath tub curve effect.

If the technology has been in the Active sales phase for a long time, it might be an indication for upcoming change to After-sales support phase.

Vendors should inform customers before reaching the next phase (After-sales support). This is a signal for each asset to prepare for next phase, buy required spare parts and start planning for next step.
After-sales support

When entering the After-sales support phase, assets need to focus on long-term planning. Avoid choosing technology from this phase for new large projects but, in some cases, minor plant extensions can be done cost efficiently with technology from this phase. Dialogue with supplier regarding users’ needs for lifetime extension and/or compatible solutions should be established. The probability for succession with acceptable solutions is fairly high in this phase.

At the beginning of this phase, the end-user should normally get an information or warning referred to as Last Time Buy (LTB) from supplier. For end users that have not established a strategy, this can be the last time to plan for and buy spare parts. Vendors do normally inform customers before reaching the next phase (Obsolete).

Obsolete

It is possible to continue using technology that is obsolete but the risk with doing this should be identified, considering issues like available spare parts, competence and reliability.

Agreement with suppliers for extended support should be arranged to mitigate the risk level.

3.3 Life cycle expectations

It is important to have a common understanding between end user and system producer regarding the different life cycle phases, milestones and notification of transition between phases as indicated in Figure 2.

The time of transition from one phase to another should be made known to end users, and notified before the phase transition takes place as follows:

- **Milestone a** – announcement of end of active sales *minimum 1 year* before reaching milestone 3
- **Milestone b** – announcement of Last Time Buy *minimum 1 year* before reaching milestone 4
- **Milestone c** – announcement of end of service *minimum 1 year* before reaching milestone 5
- The duration of the After-sales support phase is expected to be *minimum 10 years* [separate rules for COTS IT (commercial off-the-shelf) equipment/SW].
For an automation system, experience shows that different components have different expectations to duration of a life cycle.

Automation system life cycle expectation should be understood as the time from milestone 2 (product is available) until milestone 4 (Last Time Buy) defined in Figure 2.

The application in the controller is expected to last for the lifetime of the facility, although software may have to be translated at some stage to run on a new platform or operating system.

Automation system supplier is in charge of the obsolescence management plan of all the equipment of its solution.

The minimum expectations to ICSS life cycle are indicated in Figures 3 and 4.

The following life cycle expectations are specified without any evolution:

**ICSS HW – Life cycle expectations**

- HMI Clients / Servers
- ICSS HMI Network layer
- ICSS Controller Network layer
- Controllers
- I/O cards and termination panels

*Figure 3: Technical hardware (HW) life cycle expectations*

**ICSS SW – Life cycle expectations**

- HMI System Software and Firmware
- HMI Application
- Controller Application

*Figure 4: Software (SW) life cycle expectations*
To fulfill the 20-year life cycle expectation for the HMI application (Human–Machine Interface), it is expected that the functionality (operator pictures, symbols, faceplates, scripts, etc.) is maintained unchanged even if PCs should be upgraded. Refer to 3.4.2 (Compatibility) for details regarding compatibility expectations.

One of the challenges with the use of COTS (commercial off-the-shelf) is to control the life cycle of third party software (e.g. operating systems from Microsoft) that have a shorter life cycle (illustrated in Figure 6) than the expected life cycle of automation system. Upgrade of software often requires hardware replacement (PC, server) with potentially porting of automation system application software (HMI, control blocks, alarms).

Figure 5 is included as an example. Updated information is available at Microsoft’s official home page (https://support.microsoft.com/en-us/gp/lifecycle).

![Figure 5: Typical life cycle information from Microsoft](image)

3.4 Typical factors to evaluate within life cycle

The basis for every automation system is to have a good initial design. The initial design of the automation system should be in such a way that any changes during the life cycle of the system does not impact or degrade the overall performance of the system and with no impact to the industrial process connected to it. The design of the system should support the exchange, automation system evolution and/or addition of individual components as well as larger system parts.
The maintenance on system and application software is preferably done online without any stop in system functioning. If online maintenance is not possible, the impact to the system and its connected process should be minimized. A solid design guarantees a system capable of incorporating changes and additions in the future.

During the long expected life cycle of an automation system, the system might be affected by many different factors. These are for example technological, political, environmental and human factors. A very important factor which is often overlooked is the business factor.

Other important factors to be evaluated during the life cycle are:

- system limitations within automation system innovation potential
- new regulations
- availability knowledge.

### 3.4.1 System limitations within automation system

Over the lifetime of the system, the connected process can change. This might be changes initiated by several parameters such as:

- increasing production output
- quality needs to be improved
- production cost has to be decreased
- changes in operations.

This causes the need for the automation system to grow with the new demands of the process. New additional automation system parts should connect seamlessly with the already operational system. At the same time, the current system should have enough spare capacity to embed all the new functions with respect to, for example:

- system limitations for the existing system
- number of tags
- number of graphics
- number of controllers
- number of I/O
- the load of the controllers
- network capacity/load/speed
- number of operator stations
- number of operator graphics
- number of engineering work stations
- number of servers
• power supply load
• partial upgrade, migrate or replacement
• mix of old and new generations of automation system.

Such system limitations should be known and be a part of the evaluation for choosing proper obsolescence management strategy.

3.4.2 Compatibility

Evolution of product and systems happens. To reduce the consequences with respect to life cycle management of installed base, suppliers should take the compatibility challenges into consideration. IEC 62890, clause 6, describes the compatibility model that should be used by suppliers to perform a compatibility assessment.

An automation system generation is defined as a system based on constant interfaces in the automation system topology (i.e. network, interface between controller and I/O, interface between controller and HMI (human–machine interface, applications, application environment/tools).

Newer releases (hardware and software) within an automation system generation should be compatible with older releases. In the transition between generations, it is required that the new solution supports the old interfaces.

Figure 6 is a graphical representation of the typical interfaces within the automation system, marked with red oval shapes.

![Figure 6: Compatibility between interfaces](image)

Compatible / Persistent interfaces:
1. HMI ➔ Controller Application
2. Controller App ➔ Controller HW/SW
3. Controller App/HW ➔ I/O
4. Controller App ➔ Controller App
It is expected that, in the process of extending the useful life of a system by replacing component with shorter expected lifetime, all necessary tools for maintaining and operate remaining components should be available, e.g. by automation system evolution of HMI, necessary engineering and analyses tool for remaining I/O and controller should be available.

To define compatibility and to document this, a compatibility assessment should be performed and be documented before the older version becomes obsolete.

How to add new functionality to an old automation system without upgrading the whole plant or system?

• partial upgrade, migrate or replacement, e.g. HMI
• mix of old and new controllers
• mix of old and new I/O
• mix of old and new network equipment
• mix of old and new power supplies
• mix of old and new interfaces to third party systems
• parallel operation of new and old HMI
• conversion tools for logic
• conversion tools for graphic
• mix of old and new configuration tools.

3.4.3 Innovation potential

New functionalities may be added to the hardware/software but it is the asset owner responsibilities to upgrade migrate or replace its automation system component/system/equipment/device.

The new system parts with the new functionality should be checked to seamlessly connect and interact with the existing automation system. A comparison between former and new functionality should be executed to check if the new functionality fulfils the demand of the control tasks required by the process as well as the operators.

3.4.4 New standards

A new technical requirement introduced by changes in standards does normally not become retrospective for older facilities unless other directives should prevail if:

• legal or regulatory expectations have been altered
• an existing system does not conform to performance standard ensuring adequate risk reduction, e.g. process risk changed, new equipment installed.
3.4.5 Availability knowledge

An important factor in the life cycle management of the system is the availability of the necessary spare parts. This is well described in this report. But even so important is the required knowledge of the system both for the end user but also at the supplier side. For a system installed for years, there is an impact of the availability of the engineers capable of maintaining it or having the knowledge how to make software modifications. The availability of knowledge and systems competencies should be planned in the life cycle management.

Probably the lack of knowledge of obsolete system might be an increasing problem in the future due to increased complexity in system architecture and dependencies against third party software.

3.4.6 Other factors to evaluate

To handle automation system life cycle strategy and obsolete technology, trying to determine when what and how to perform an automation system evolution is not an easy straightforward issue. Each plant and project needs to make its own decision based on an individual business case with experience from similar cases in the company.

In the process of determine a life cycle strategy, trying to make a decision and a consistent business case, it is recommended to define the drivers for initiating an upgrade, migration or replacement project.

Some of the key point in this process can be:

- **retaining activities** – The automation system may no longer be considered prudent due to technical evolution.
  - **competency** – how to maintain competency on old automation system generation (supplier/user)?
    - Does there exist sufficient competence within asset?
    - Is supplier able to support?
    - Can supplier keep and develop in-house capabilities of his replacement of own personnel?
      - At what price?
      - To what extent (locally, globally)?
  - **reliability** – old and unreliable equipment might increase the demands on safety functions.
  - **monitoring of performance** – older systems may have limited monitoring facilities and reporting to supervisory systems is not always expedient.
  - **robustness** – does aging or out of support make the system vulnerable to failure?
3.5 Obsolescence and life cycle contractual/execution strategy

This recommended practice for Obsolescence Management Plan elements applies to both greenfield and brownfield.

This obsolescence strategy has the following objectives:

1) provides oil and gas producer with a roadmap on how to manage their exposure to obsolescence
2) focuses on identifying safety, production and cyber-security consequences as a result of obsolescence
3) takes account of operational resource constraints such as people and operating expenditure budget
4) obsolescence evaluation
5) split between proactive and reactive strategies is dependent on the result of the obsolescence evaluation, expected end of life of the facility and the oil and gas producer’s risk strategy
6) Maintain dialogue with vendors regarding life cycle status to get an early as possible indication of end of support date, giving the end user time to:
   a) challenge suppliers official end of support date to get a global extension for all end users
   b) identify possible individual extended service agreement
   c) clarify supplier’s solution to move forward from obsolete to active technology, clearly defining the compatibility between these technologies

Figure 7 in IEC 62402:2007 describes proactive vs. reactive strategy.
Derive strategy

Apply a proactive strategy?

No

Reactive strategy
(do nothing until the need arises)

Yes

Proactive strategy

- Design considerations
- Technology transparency
- Obsolescence monitoring
- Upgrade at defined intervals
- Lifetime buy

- Part search
- Cannibalization
- Design revision
- Product obsolescence

Figure 7: Proactive vs. reactive. From IEC 62402:2007

Different situations and different equipment might require different strategies. Before choosing a strategy, all aspects related to obsolescence management should be evaluated. Depending on a facility’s situation and remaining production life, this strategy can change.

For this recommended practice, the definition can be interpreted with the following main points:
- guiding through life cycle model
- proactive strategy
- reactive strategy
- strategy for greenfield case
- strategy for brownfield case

3.5.1 Proactive obsolescence strategy

The adoption of a proactive strategy can reduce the full impact of obsolescence. A successful proactive strategy determines obsolescence status well in advance and makes action plans for maximizing the service life of installed systems while ensuring reliability.

Some of the strategies may include the following.
- Extend the duration of equipment supplier’s Active and/or After-sales support phase to postpone obsolete phase.
- Long term service agreements for major critical equipment. An early settlement should increase the chances of a positive outcome, and such agreement should already be established when equipment still is moving into After-sales support phase.
Secure sufficient spare part whilst they are widely available (before Last Time Buy). Proper handling for long time storage should be taken care of. A prerequisite for succeeding is a proper overview of installed base, and ability to handle proper system competence.

Maintain relevant competence/human skills.

Plan for automation system evolution at defined intervals based on result from risk evaluation.

Accepted risk level might be an influential factor during the life cycle management.

Ensure safety consequences are documented in the safety case and clear response plans are generated and communicated.

Choose equipment/system where obsolescence management is included into a robust design already from the development phase. An example of this might be a modular system based on open standards and with fully compatible interfaces from current to next version.

3.5.2 Reactive obsolescence strategy

When the impact, cost, and probability of failure indicate less risk, then a reactive strategy may be employed, i.e. do nothing until any need arises.

Do nothing before a component or product fails. If the equipment is in late After-sales support phase or in obsolete phase, the probability of fast recovery decreases.

Repair or replace components based on used or third party supply.

Replace complete system when it becomes obsolete and fails.

For the components or product replacement:

1) Verify that back-ups are available
2) Procedure for restoring the control and safety systems are defined and communicated to all stakeholders.

Robust procedures for escalation upon detection of a threat are widely available and easily accessible.

Design revision (equivalent, alternative, emulation, redesign, replacement). Need for proper re-qualification before use should be evaluated.

The obsolescence strategy has to be defined for both new projects [greenfield] and existing installations [brownfield].
3.5.3 Maintain human competence

Obsolescence of the human competence is mainly due to the lack of sustainable training program, lack of expertise development, lack of documentation availability and personnel replacement. A human competence study should include the necessary training development, staff certification as well as the necessary staff training simulator.

- Vendor support information
  - Availability and location (Contact name, address, phone, email...)
  - Experienced correspondent for each equipment.

- Vendor skills management
  - Training management
  - Staff certification management
  - Training simulator/hot spare rack/reference system availability

3.5.4 Recovery from obsolescence

Considering the design life of the facilities, it is a possibility that a supplier may cease its activities during this period. To protect asset owner against such an event, the supplier should provide contractual provisions to allow the asset owner to recovery from obsolescence.

This can be done in several ways. Two examples are:

1) an agreement between asset owner and supplier to continue providing support

2) be based on the “ESCROW” principle. An “ESCROW” principle is an arrangement made under Contractual provisions between Company and Supplier, whereby an independent trusted third party receives the documents for the recovering from obsolescence transfer product with all license, documentation, drawings to another contractor that will take over the supplier responsibility.

For the last alternative, the Contractor should pay a particular attention that the necessary documentation, drawings, etc. are available at a supplier chosen location to allow the Asset Owner having access to the Vendor information for repairing, partial redesigning or full designing the system. The Supplier should provide information to permit the Asset Owner to recover from obsolescence based on “ESCROW” principle for any hardware, software, drawings, documentation etc. part of its scope of supply. Supplier should address in a Recovery from Obsolescence Study the following topics:
• Product Search (within existing stock/stock availability including that held for other clients/industries, other sites world-wide)
• Repair (It may be possible to repair certain components for this all detail conceptual drawing should be available)
• Equivalent (this refers to replacing the obsolete component, or possibly module, with something that is functionally, parametrically and technically interchangeable i.e. matching in form, fit and function)
• Alternative (this refers to replacement of a component or module with something that does not fully comply with the form, fit and function)
• Partial Redesign (this involves partial redesigning part of the equipment, at as high a level in the design hierarchy – component, module, etc. – as is necessary to replicate the form, fit and function at that level)
• Full Redesign or Replacement (this involves partial redesigning of equipment).

3.5.5 Greenfields case

When selecting a supplier, the capability to manage obsolescence to the end customer’s requirement should be reflected as part of the selection process. The contractual Strategy and Vendor evaluation has to be based on CAPEX/OPEX.

• During project phase or Front End Engineering Design phase (FEED).
  – Specify, select and use equipment’s which minimize and secure migrations with minimum operating constraints.
  – Establish an Obsolescence Management Plan including hardware and software inventory, lifetime, support and an automation system evolution strategy.
  – Include equipment lifetime, automation system evolution and maintenance costs and knowledge transfer criteria during the evaluation of vendor’s offers (CAPEX+OPEX). This should be the implementation of the Total Cost of Ownership (TCO) approach.
  – Minimum the use of IT equipment and standardize IT equipment.

• During the operating phase:
  – Consider automation system evolution works as maintenance tasks with minimum impact on operation activities.
  – Identify and mobilize resources to perform those activities.
  – Continuous monitoring of spare parts and end dates of support and assistance.
  – Schedule for automation system evolution, either upgrade, migrate or replace.
3.5.6 Existing plants (brownfield)

The preferred strategy for an existing plant (brownfield) depends on several factors like economical consideration (cost and return of investment) and risk evaluation (include definition of opportunities). This should be assessed before selecting a suitable strategy. Note that the needs might change during time and therefore an evaluation should be done on regular basis.

Before evaluation of a suitable life cycle strategy, key information should be collected:

- manage hardware and software equipment inventory
- identification and monitoring of spare parts availability, spare parts stocks, end dates of support/assistance and training

Different strategies with different characteristics to assess:

- **Last-Time Buy** – purchase last buy spare parts
- **Substitution** – identify alternative sourcing of compatible parts
- **Automation system evolution** – Schedule for upgrade, migration or replacement (partly or complete).
4. Obsolescence and Life Cycle Management Plan

4.1 Plan requirements

Forethought and careful planning can minimize the impact and cost of automation system due to technology change or components no longer available (obsolete).

Obsolescence Management Plan and coordination:

- Automation system supplier should provide Obsolescence Management Plan for delivered equipment, known dates of After-sales and Obsolete phase should be shown in the plan.
- Each plant should have a documented automation system technology strategy – showing to which preferred components the automation system is standardized for further expansion.
- Each plant should have a long term overview plan for the automation system life cycle showing when changes to the technology strategy are expected, if any [decisions should be taken due to plant needs, obsolete issues, etc.]

4.2 Plan elements

The Obsolescence Management Plan elements consist of the minimal elements that should be considered in an Obsolescence Management Plan document, describing the strategies for identification and mitigation of the effects of obsolescence, through all stages of the life of the product. The plan elements should be documented and maintained throughout the plant’s life cycle.

The Obsolescence Management Plan (OMP) content should include as a minimum the following elements:

- product life cycle diagrams
- risk assessment
- obsolescence mapping and monitoring
- obsolescence management reporting
- organization roles and responsibility for OM.

For each of these elements, describe a robust process of an Obsolescence Management Plan that are required on a Topsides and onshore Control Production System.

Using this method, if the core design of the processes is maintained, or improved upon, then the result is fully proactive obsolescence management.
4.3 Product life cycle diagrams

For new projects, the following product life cycle diagrams should be required from suppliers.

For existing facilities (brownfield), this diagram should be updated on a regular basis to present an overview of the obsolescence status of the main system elements.

A sample Automation System Equipment Status Overview template has been included with this report as Form 551B, shown in Figure 8. It shows the automation system element names with their life cycle statues (Active/After-sales/Obsolete) from the current year and covering the other years over the lifetime of the asset.

**Figure 8:** Example of Automation System Equipment Status Overview (Form 551B)

- **Current Status.** The box is filled in the colour that indicates the current life cycle status/level of support as indicated at the bottom of the overview page. This can be taken from the accompanying Equipment Detailed Inventory Sheet.

- **Status in 1 year.** The box is filled in with the colour that indicates the life cycle status/level of support in 1 years’ time, as indicated at the bottom of the overview page.

- **Status in 3 years.** The box is filled in with the colour that indicates the life cycle status/level of support in 3 years’ time, as indicated at the bottom of the overview page. This enables the proactive management of equipment that is approaching the end of the life cycle and support.
• **Status in 5 years.** The box is filled in with the colour that indicates the life cycle status / level of support in 5 years’ time, as indicated at the bottom of the overview page. This to enable the proactive management of equipment that is approaching the end of the life cycle and support.

• **Facility Forecast life cycle.** The boxes are filled in with the colour that indicates the life cycle status/level of support for the equipment over the life of the asset (starting with current year) so that major expenditure and/or production outages can be planned.

### 4.4 Obsolescence evaluation

To manage the complete life cycle strategy, obsolescence evaluation is a topic that should be given more and more attention as the life cycle moves through After-sales phase towards obsolete phase. See 3.2 (Life cycle model).

As a part of a development of an Obsolescence Management Plan, it is important for the asset to have a complete overview of the equipment status of all automation system.

The following steps should be followed to develop the obsolescence status overview (OSO):

**Step A: Create the automation systems equipment component inventory.**

As-built/As-running documentation is an essential element of the obsolescence management. For each Obsolescence plan, a list of documents should be identified in order to be provided in `as built` status.

To develop a good Obsolescence Management Plan, the first step is to create an inventory of the automation system equipment components details. This inventory provides details of the obsolescence status of the automation system elements. Most automation system vendors have tools built into their system that makes it possible for the automation element inventory to be generated automatically. This is the recommended approach for generating the inventory of the automation system elements. It is also expected that the systems equipment inventory also covers third party system.

A sample Automation System Equipment Component Detail template has been included with this report as Form 551A, shown in Figure 9.
Background
The ICSS Logic Solver - ESD xxxx is located on the XXXX platform. The panel is located in the field at the edge of Train 1 within the XXX Utilities area. The panel comprises of a single full height bay with front access. The panel was supplied by XXXXX to ICSS supplier XXXXX and has been in operation since c. 1992.

Equipment Inventory

<table>
<thead>
<tr>
<th>Description</th>
<th>Manufacturer</th>
<th>Part Number / Model</th>
<th>Version Info (Patch, FW, etc.)</th>
<th>Qty</th>
<th>Status</th>
<th>Last Buy</th>
<th>Date Obsolete</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCS Controller (family x)</td>
<td>XXXXXX</td>
<td>AM4400</td>
<td>x.x.y</td>
<td>1</td>
<td>Obsolete</td>
<td>Equivalent Product Series 5000 Field Electronics</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CPU type x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CP type y</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I/O card type x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SIS Controller (family z)</td>
<td>XXXXXX</td>
<td>Unknown</td>
<td>Unknown</td>
<td>1</td>
<td>Obsolete</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CPU Type y</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CP type x</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>I/O card type x</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HMI (family z)</td>
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<td></td>
<td></td>
<td>3</td>
<td>Obsolete</td>
<td></td>
<td></td>
</tr>
<tr>
<td>System SW</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Server HW</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating system</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Figure 9: Automation System Equipment Component Detail (Form 551A)**

Greenfield projects should provide this information to operation that can be used for evaluating obsolescence status.

For brownfield projects, particularly where there are no tools for automatic generation of automation system equipment component register, the generation of such an inventory is not a simple activity. It requires a good understanding and working knowledge of the equipment under review as well as an appreciation of the potential timeframes involved for conducting the review and populating this inventory.

A good starting point for brownfield installations might be to first get an overview on system level. However, a fully populated inventory (down to the component level) makes it easier to determine the overall obsolescence status for the equipment.

**Step B: Determine the equipment life cycle status**

Life cycle status is populated using the inventory list from Step A. For assets that have support contract with the equipment supplier, the life cycle status could also be completed by collaborating with the OEM (original equipment manufacturer). This should save the time required to complete Step A.
A sample Automation System Equipment Status Overview template has been included with this report as Form 551B. Most automation systems also have integrated tools that can also attach the lifecycle status information to the specific element on the component inventory created from Step A.

The purpose of the Equipment Status Overview template is to indicate the status of the major equipment (and software) on the facility from both an obsolescence and support perspective. The status should be reviewed and refreshed on a regular basis, ideally every two years.

Another part of the obsolescence evaluation is to determine the risk.

The outcome from this risk assessment should be used as the basis for defining the course of action and allows the correct priorities to be addressed.

This is an example process only for the required OMP element. The level process flow diagram is shown in Figure 10.

Figure 10: Obsolescence Risk Assessment Process

The activities required for the core Steps 3 to 5 are outlined in Figure 12.
Step 1: System life cycle Plan Assessment

The first step should be to assess the existing life cycle plan and verify according to the current situation of the asset and then consider the time for which the system has to be sustained. It is necessary to take into account the planning for mid-life upgrades and also which subsystems are likely to be upgraded, migrated or replaced at this stage. This allows identifying the period for which each component in the bill of materials (BoM) is required.

Step 2: Resources Planning

This step in the process is intended to secure and allocate the resources to manage the obsolescence evaluation:

- People (e.g. obsolescence managers)
- Tools (e.g. obsolescence monitoring tools)
- Budget for obsolescence management.

At this stage, it is necessary to align the resources with the life cycle strategy selected to meet the contractual terms for obsolescence management. Obsolescence risk assessment should enable to decide the key components for which these resources should be used to minimize the impact of obsolescence in the system’s performance and sustainment costs.

Step 3: Extract and Filter Bill of Materials

The first activity should be to break down the system or equipment into manageable portions. The level of detail to go down to should be the lowest practical level, which is at the discretion of the Obsolescence Manager. Most obsolescence issues are being experienced at the component level. Therefore, it is suggested that the full bill of materials (BoM) should be extracted from the system to the component level and should also include the spares.

The Automation System Equipment Status Overview template (Form 551B) could be used to begin to extract the equipment from systems.

From the BoM, the obvious low risk/low criticality components should be filtered out. This allows reducing efforts that can be misspent if trying to undertake an exhaustive risk assessment for every component in the BoM. The criteria for system elements (e.g. controllers and I/O cards) to be filtered out should be defined individually for each asset based on local site knowledge.
Step 4: Risk Analysis for each Component

All products can be expected at some time to become obsolete, but with a different degree of consequence.

This can be assessed as two different scenarios:

- **Method 1**: Considering the level of components available (on stock or for purchase), matched with the failure rate of this component (failure rates based on experience or predicted failure rate).
- **Method 2**: Considering available competence of the resource person responsible for the component/system (internally or externally), matched with the failure complexity or degree of competence needed to retain functionality.

![Obsolescence risk as function of availability vs consumption](image)

![Obsolescence risk as function of competence vs complexity](image)

**Figure 11: Obsolescence risk**

The result of risk analysis (High, Medium or Low) should be documented into the Automation System Equipment Status Overview template (Form 551B), clearly indicating both obsolescence risk component and competence.
Step 5: Components Prioritization and Mitigation Decisions

It is not realistic to expect that all issues can be addressed immediately. Both budget and offshore operational limitations are significant factors to be considered when formulating and scheduling any corrective work. It is therefore essential that the exact scope of the automation system evolution activity is fully understood. This again emphasizes the importance of using the correct resource to create the inventory to avoid progressing a complete equipment replacement when in fact a single component replacement may be all that is required.

To be able to choose a proper obsolescence strategy (solution) and the consequences, the components exposure to the plant should be determined based on the risk analyses (Figure 11). If a component is only used a few places this should probably have different consequences and solutions compared to if it is used “all over” the plant.

1) Identify component obsolescence risk (Figure 11): High/Medium/Low

2) Determine exposure in system (plant):
   a) used in critical system
      i. used in few instances, but considered as critical (operational or safety critical)
      ii. used in multiple instances
   b) Used in non-critical system
      i. used in few instances
      ii. used in multiple instances

3) Determine consequence of failure:
   a) safety/environment
   b) production
   c) reputation

4) Identify solutions (obsolescence strategy, 3.5):
   a) do nothing (accept risk)
   b) secure spare parts/competence
   c) substitution
   d) re-design
   e) choose automation system evolution, upgrade, migrate or replace [partly or whole].
There is not a preferred solution on how to resolve an obsolescence issue. Based on the four steps above, each situation should require an adapted strategy based on assets evaluation of the cost, remaining risk, and feasibility.

**Step 6: Life cycle reporting Update**

Once the decisions about the level of proactiveness have been made and mitigation strategies have been decided for all the components (where applicable), they should be recorded and implemented.

Automation system equipment status overview has to be kept up to date. See 4.3 (Product life cycle diagrams).

**Step 7: Review**

Periodically, the assessment should be reviewed and updated if necessary. It is suggested to review it every six months for projects at the manufacturing stage (manufacturing phase is not completed yet) and on a bi-annual basis for project at the support stage (manufacturing phase is already completed).

---

**4.5 Obsolescence monitoring**

Once the obsolescence mapping process and risk assessment have been completed for an asset, the obsolescence status and the impact of the mitigation action plan should be continuously evaluated.

Obsolescence monitoring entails tracking the processes and components used in the equipment design in order to ascertain the current and predicted availability of components. The tracking can be done through either automatic processes (using an Obsolescence Management Tool) or manually by engaging the manufacturer/supplier. This process of continuous monitoring should allow timely notification of changes to obsolescence status.

For assets where proactive Obsolescence Management strategy is employed, it is expedient that one form of obsolescence monitoring activity is implemented. The obsolescence monitoring tool can range from reference to OEM (original equipment manufacturer) technology roadmaps to component monitoring tools. The critical element is the availability of high quality components information so that obsolescence analysis and mitigation is based on a sound foundation.

Although it is possible to manually manage this information for products and equipment, the process can take a long time to implement and update and this could lead to a situation where the status of components availability changes before the analysis is complete.
There are three types of obsolescence monitoring:

- Type 1: Component Tool Monitoring
- Type 2: Manual Component Monitoring
- Type 3: Supplier/Manufacturer Monitoring.

**Type 1: Component tool monitoring**

The component tool monitoring is the preferred method for obsolescence monitoring. Most automation system suppliers now provide analytical tool solutions that take components data and manage the Components Lists/Bills of Material to produce reports in different formats. Such tools can be a part of the automation system enabling to execute queries that produce system obsolescence report. Automation system suppliers/vendors are expected to provide such tool or service as one of the deliverables for new projects.

The component monitoring tool can be used to extract the manufacturer’s part number and other relevant details that can be used to highlight the obsolescence status of the piece of equipment.

The listings can be imported through a number of methods but the most common is through an Excel spreadsheet with a template constructed in the Obsolescence Management tool to accept the components list data that the user wants to import. The import is normally handled by an automated process and is a fairly quick process subject to the size of the components list.

Figure 12 shows an example of system-generated reports from a component monitoring tool.

![Figure 12: Obsolescence Status report](image)
Report format and product indenture levels are to be agreed between the oil and gas producer and the supplier.

Obsolescence Management tools allow the import of flat components lists or tree structured/indentured Bills of Material from either a direct interface, Excel spreadsheet, de-limited file, etc. The components are then loaded against the components content information with the generation of a report as can be seen in the example above. Reporting can be defined to suit the user’s requirement and changes in status communicated by an ‘Obsolescence Management Obsolescence Management Alert’ notification process.

Most systems only manage electronic/electro-mechanical and fasteners and fixings. However, there are some with the capability to handle all types of components including COTS assemblies and customer drawn items.

The key component data available from a tool includes:

- manufacturer’s part number and revision (where applicable)
- description
- life cycle maturity of the component
- alternatives
  - upgrade
  - downgrade
- local part numbers (design and manufacturer organization)
- parametric information of the component
- specifications (international and local)
- chemical properties
- stock information
- shelf life
- cost
- counterfeiting notifications.

Type 2: Manual Component Monitoring

For those components not managed by a Component Monitoring Tool, the obsolescence status can be established by web mining and direct manufacture contact either by a third party or by the Supplier Obsolescence Team. This information can be recorded in a Component Monitoring Tool for report generation purposes and possible future management.
Type 3: Supplier/Manufacturer Monitoring

Management of the supplier and/or manufacturers is achieved through the implementation of an Approved Manufacturer List (AML) or Approved Vendor List (AVL) that monitors the status of those manufacturers of components the product choses to include in the design. This should include a history of manufacturer of a component and this trail is a key aspect of managing the component.

With regards to obsolescence monitoring, the OMP should give:
- detail of level that monitoring should be conducted (component, etc.)
- detail of who should be doing the monitoring
- detail of how the monitoring should be conducted (tool, process, etc.)
- detail of how the results should be communicated (means and frequency).

4.6 Obsolescence management reporting – recommended prioritization

Refer to Automation System Equipment Status Overview (Form 551B).

Table 1: Obsolescence status colours

<table>
<thead>
<tr>
<th>Colour</th>
<th>Obsolescence Status</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Current / Active product fully supported</td>
</tr>
<tr>
<td></td>
<td>After-sale support available – mature product still in production, not actively sold</td>
</tr>
<tr>
<td></td>
<td>Obsolete but individual support agreement with supplier</td>
</tr>
<tr>
<td></td>
<td>Obsolete and no supplier support</td>
</tr>
<tr>
<td></td>
<td>Status Unknown at this date</td>
</tr>
</tbody>
</table>
4.7 Organization roles and responsibility for OM

The objective is to define the organization’s roles and resource necessary to meet the life cycle management plan.

General

The policy and strategy for achieving the full functionality of automation systems in the life cycle should be identified together with the means for evaluating its achievement and should be communicated within the organization.

An Obsolescence management system should be in place so as to ensure that, where the automation systems are used, they have the ability to control and maintain the process safety during the life cycle of the asset.

Organization and resources

Persons, departments, organizations or other units which are responsible for carrying out and reviewing any of the life cycle phases should be identified and be informed of the responsibilities assigned to them.

Persons, departments or organizations involved in life cycle activities should be competent to carry out the activities for which they are accountable.

As a minimum, the following items should be addressed when considering the competence of persons, departments, organizations or other units involved in life cycle activities:

a) engineering knowledge, training and experience appropriate to the process application
b) engineering knowledge, training and experience appropriate to the applicable technology used (e.g. electrical, electronic or programmable electronic, automation system)
c) adequate management and leadership skills appropriate to their role in the life cycle activities
d) understanding of the potential consequence of an obsolete product
e) understanding of the potential consequence of having to change any part of the automation system
f) the novelty and complexity of the application and the technology.
The skills and knowledge required to implement all of the activities of the life cycle should be identified. Resources should be assessed against each skill for competency and also the number of people per skill required.

When differences are identified, development plans should be established to enable the required competency levels to be achieved in a timely manner. When shortages of skills arise, suitably qualified and experienced personnel may be recruited or contracted.
References

The following documents, in whole or in part, are referenced in this document and are recommended for its application.


IEC 62890:Ed.1.0 CDV, *Life-cycle management for systems and products used in industrial-process measurement, control and automation*. 
With the ever-increasing demand to extend the life of operating assets, the risk of obsolescence has become more prevalent. It now presents significant concern to the industry, for both new and brownfield projects (maintenance and automation system evolution).

An IOGP Task Force Obsolescence Management (OMTF) was created to address the significant obsolescence issues of automation systems being experienced by oil and gas producers in a consistent manner.

This recommended practice is intended to cover the complete automation systems both on greenfield development (new deliveries) and brownfield development (previously delivered equipment) both onshore and offshore.