

IT/OT convergence as basis for digitisation in the fast-changing industrial environment



Introduction

In recent years, we saw a majority of industrial companies migrate to more complex ecosystems to achieve their digital ambitions. These ecosystems with often tighter vertical integration can drive efficiencies and real value, but they require a different approach on how IT and OT are supported and managed. To anticipate this, industrial companies will need to change the way they interact with, react to and provide services for their customers to achieve the desired value from the next wave of digitisation.

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1

Challenges

Over the last years, digital transformation has been at the top of the agenda in industrial companies worldwide. In addition, the current COVID-19 crisis has given these companies no choice but to accelerate their digital transformation. As the application landscape within industrial companies is digitally transforming, a window of opportunity opens to re-engineer the way service providers are being organised. However, efforts to innovate and digitise are often slowed down or impossible to execute because of the lack of a cross-IT and OT supporting structure and lack of vision on IT and OT collaboration.

Information Technology (IT)

IT concerns all aspects of managing and processing information



Operational Technology (OT)

OT refers to the hardware and software used to control industrial processes

The lack of a combined IT and OT vision, can result in a dispersed organisation, where it becomes hard or even impossible to fully achieve smart manufacturing. Costs will be hard to manage and the added-value will be difficult to realise. From a business perspective it is crucial to ensure that the system doesn't become too rigid, and that local plant adoption remains one of the main priorities. If all new technologies are being forced in a framework to manage large transactional systems, it becomes impossible to even move ahead with a proof-of-concept. However it remains important that local initiatives also comply with certain needs from a global context.



Tomorrow's production environment becomes more complex, while the technology market provides a helping hand. **44%** of the companies reported challenges with transparency on performance, and **37%** indicated a lack of process control in production

The Future of Manufacturing Operations Management (2021, PwC)



As a result, these technologies can often be perceived as complex and difficult to maintain. The table below provides an

overview of the main challenges when IT and OT are not aligned:

 Segregated teams and execution power	Different organisational groups both within and outside of industrial companies cover the full spectrum of activities without achieving the optimal way of collaboration, often resulting in segregated strategies.
 Security risks	Security risks within industrial companies increase rapidly as OT devices become more interlinked with widespread IT networks.
 High degree of tacit knowledge	A high degree of tacit knowledge among staff creates many single points of knowledge, which might result in migration related issues of legacy systems and services, when certain staff leave the company.
 Vertical integrated technologies	Applications become more interconnected as a result of the application ecosystem that is rapidly growing, having an impact on both critical and non-critical business processes.
 Ambitious digital vision of the business	The interactions between IT and OT create growing requests and expectations from clients in terms of digitisation, both internal and external.
 IT/OT data integration	Operational data is often not fully integrated with IT related data, creating a challenge for decision-makers to analyse data in real time, leading to misinformation and untimely decisions.

To ensure a successful transformation towards one digital industrial organisation, it is important to look broader than just the technological perspective. In practice, IT/OT convergence can relate to the redesign of local and global processes,

optimising the view on plant performance and maintenance, reshaping your application landscape or even improving the collaboration, governance and efficiency of teams.

2

Benefits

There is no doubt that IT/OT convergence has many benefits. Industrial companies that have an aligned IT/OT strategy and roadmap reported the benefits outlined below. Of course, these benefits are dependent on the specific company set-up and day-to-day activities.

Allow real-time decision-making and reporting

IT/OT convergence allows your industrial company to create applications that efficiently combine information from the whole value chain. Capturing and making data more available, coherent and user-friendly results in a better view on the day-to-day reporting and operations, such as productivity, quality or safety. Achieving better reporting, and creating applications that use a range of data sources, are essential elements for developing vertical integrated tools. This can enable site performance management, performance maintenance and planning.

Scaling the value from local initiatives

IT/OT convergence can leverage local shadow IT/OT applications that often result from hands-on experience and capabilities from local employees. A better IT/OT convergence can help your company to achieve better innovation by “enforcing” these local initiatives, and thereby maximising the bottom-up initiatives.

Targeting one or two sites as “lighthouse” sites can deliver value by being an exemplar for other sites. These lighthouse sites can be used to showcase and demonstrate early successes. This can help to speed up the digital transformation of your local shadow IT applications, resulting in a better adoption of new digital tools and the creation of success stories.

Embracing local initiatives will encourage employees to come up with innovations faster and in line with the IT/OT model defined at corporate level. And in turn, sharing of best practices between production sites then results in an acceleration of innovation.

Create more value by combining new technologies

As a part of IT/OT convergence, legacy systems can be combined with new technologies to help your company reach its full digitisation potential. New technologies can help provide real-time insights and clarity into costs and operational performance, maintenance and reliability, allowing you to make smarter and faster business decisions, and optimise the current way of working.

Providing transparency on your application landscape

With the ever-increasing number of applications, maintaining a clear overview has never been more difficult. Applications can be intertwined, resulting in the fact that changes in one application often have an unintended impact on many other applications. One of the crucial steps in achieving IT/OT convergence is allowing your company to have a clear view on the total application landscape, thus lowering and minimising the risk of malfunctioning applications and security issues.



3

Key success factors

Depending on the nature of your company and the day-to-day activities, there are many key success factors to enable a smooth IT/OT convergence. From our past experiences we can already provide an overview of some general key success factors that we always take into account in our transformation projects.



Embrace the platform way of working in a secure environment

Enabling scalable and value-adding digital solutions throughout your whole industrial organisation is a challenging task. Different factors such as increasing complexity, fast-changing technologies, legacy

applications, local ownership, poor availability of data, security and differences between manufacturing sites create bottlenecks to achieve an “Everything-as-a-service (XaaS)” platform.

Generally OT infrastructure situations are not always aligned with the rapidly rising demands on cybersecurity, connectivity and information exchange. In most companies OT is often considered as a separate world, with its own technologies and skillset. A lack of cross collaboration between IT and OT can result in a low adoption rate of new infrastructure technologies within the OT infrastructure.

OT should always strive to achieve the best of both worlds by relying on their legacy technologies while also keeping an eye on new technologies to safeguard cybersecurity. Given that the business continuity of OT legacy technologies is crucial, there is often a cautious attitude toward the implementation of new technologies.



80% of manufacturing data created in the last two years has not been used to its full potential, due to data silos between different sites, plants, and even between work cells.

Neal Meldrum, Business Strategy Leader for manufacturing, Microsoft

In order to fully grasp the opportunities of digital solutions, a shift is needed in the way companies organise their technology landscape. Whereas the current technology landscape is often fragmented, companies need to transform their fragmented landscape into a platform-oriented landscape. By doing so, companies can leverage their platforms to enable use cases that have the same data needs, knowledge needs, value generation and support and demand needs.

- **Data needs:** These platforms will enhance the exchange of information. Resulting in better reporting, ranging from manufacturing to energy and environment and production.
- **Knowledge needs:** Clear expertise will be clustered and can be used in the continuous improvement cycle of different manufacturing plants.
- **Value generation:** New applications with the same goal can effortlessly work together, resulting in a better structured application landscape.
- **Support and demand needs:** Cluster applications that need to be supported and changed on requests of the same audience.

Below we provide one example of a platform-oriented solution, in this case a central IIoT manufacturing platform. This platform ensures that no changes are made in local critical applications and the ownership of sites, as local ownership is

a key element to continuously optimise your manufacturing capabilities. This central manufacturing platform also consists of many applications (also called use cases), ranging from operation to reliability and product optimisation.

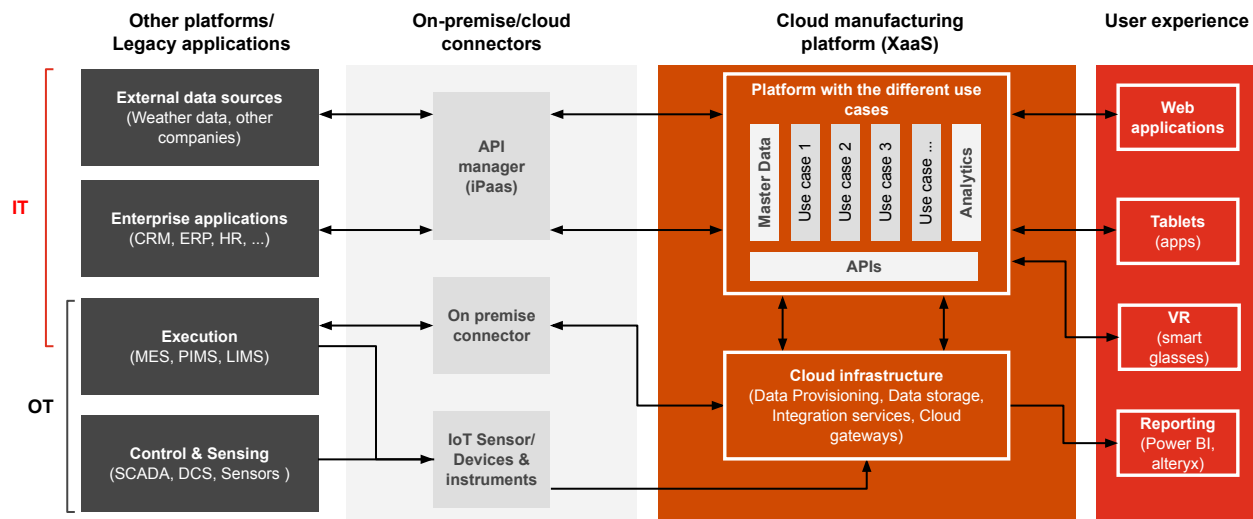


Figure 1. High-level reference architecture IIoT manufacturing platform taking into account ISA 95 levels

In this example, the central manufacturing platform has the purpose to create a better digital ecosystem, establish more standardisation and to deliver high-performance services such as machine learning, application development frameworks and cloud services. A complementary technology with a IIoT platform is a MES (Manufacturing Execution System). Together these technologies will break data silos and integrate best-of-breed technologies even better, to create transparency across functions and plants. These synergies are described in PwC's The Future of Manufacturing Operations Management (2021)¹.

The establishment of this ecosystem is based on the creation of a future-proof infrastructure and a well-aligned data environment, both local and global. In addition, companies must grasp modular new-gen architecture that can be orchestrated to build cloud-based applications (e.g. AWS⁵, GCP⁶, Azure).

“

IIoT Platforms will be a key enabler to move from connected to predictive to cognitive.

Neal Meldrum, Business Strategy Leader for manufacturing, Microsoft

Transitioning to a platform-oriented landscape must help propagating data across enterprise systems and making it accessible when needed. An important prerequisite is that all data must be available from a single master source, and must be provided within a single view for the enterprise and partners.

¹ <https://www.pwc.be/en/news-publications/2021/the-future-of-manufacturing-operations-management.html>

Set up a data centre of excellence for optimum value

Building analytics capabilities are of key importance for optimising your production performance, reliability and reporting. Setting up a data centre of excellence will therefore help to build and anchor these analytics capabilities.

This data centre of excellence will be the organisation that educates, trains and brings more innovative ways of working to the business, manufacturing sites and functional groups. In addition, it will deliver data science resources in line with the data science needs described by delivery teams.

However, due to the unique nature of every industrial company, there is no one size fits all. It is important to ask yourself two questions:

- How do we want to structure data science resources, while keeping in mind important local site knowledge?
- How can we achieve better innovation from the acquired data science knowledge?

The data centre of excellence will drive more data science innovation within use cases by sharing best practices and new methods of analysing and automating. It will play a major role in the transition from ideation to Minimum Viable Data Product.

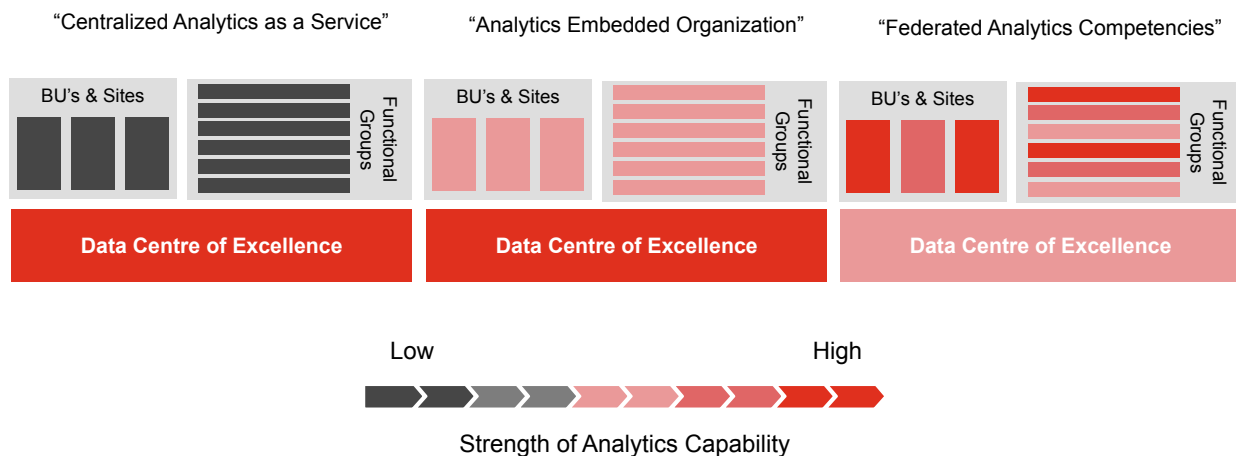


Figure 2. Examples on how to structure your data centre of excellence in your organisation



Last but not least, your data science organisation will need to create the right knowledge base to work with the different types of data such as structured static data, process sensor data, telemetry data, image and videos, unstructured data, and so on. Based upon the chosen operating model, it's highly important to provide training to data scientists so they can provide support to the business units and functional groups in the best way possible.

Build your delivery teams around a specific use case

In a platform-oriented landscape, vertical integrated applications will not be able to be fully allocated to IT or OT but instead will be owned by the team responsible for the use case. We can make a distinction between global product groups and core site product groups. Based on the site strategy, a fit needs to be made with the global IT strategy.

All services and use cases need to be aligned with a target vision of a digital platform, keeping in mind the needs of the end-users. This also includes considering the user experience when designing the front-end of applications. Typically these tasks are embedded in the role of the product owner.

In order to achieve this, a flexible organisational structure needs to be implemented, safeguarding an optimal use of resources at all times. Many industrial companies currently operate based on delivery teams, whereas IT service providers within those companies are traditionally split into subgroups (e.g. IT and OT).

Teams should be built around critical use cases in order to support vertically integrated digital solutions. By doing so, many different services are merged to innovate and take ownership of the application.

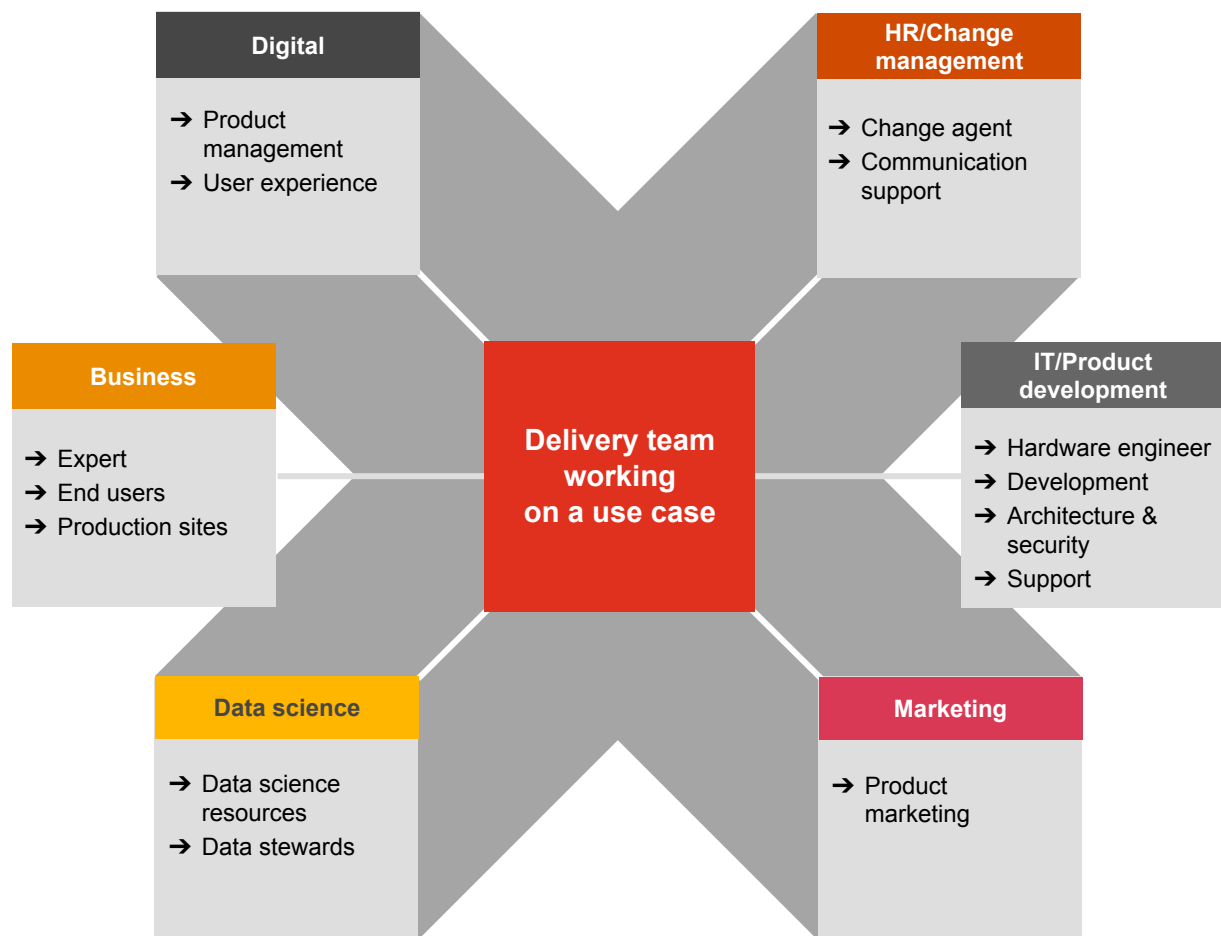


Figure 3. Delivery team as way of achieving good ownership and knowledge-sharing

When establishing use-case centred delivery teams, chances are high that many of the resources will not reside in the same geographical location. These teams bring expertise together from different inhouse expert pools such as data science, product development, energy and environment, change management and engineering.

The current COVID-19 crisis has left companies no choice but to embrace platforms such as Zoom, Slack, Office 365 and the G suite to enhance digital communication, file sharing and the overall new way of working. Levels of remote working have skyrocketed whereas 90% of firms globally request people to work from home, in comparison to only 5% before the COVID-19 crisis. Investing in these platforms can be the first step in creating use-case centred delivery teams across different services in your company.

Give ownership to the business while maintaining an overview on your application landscape

To ensure a successful transformation towards a more digital organisation, it is not sufficient to only address the technical developments. Companies need to transform their organisation, culture and processes.

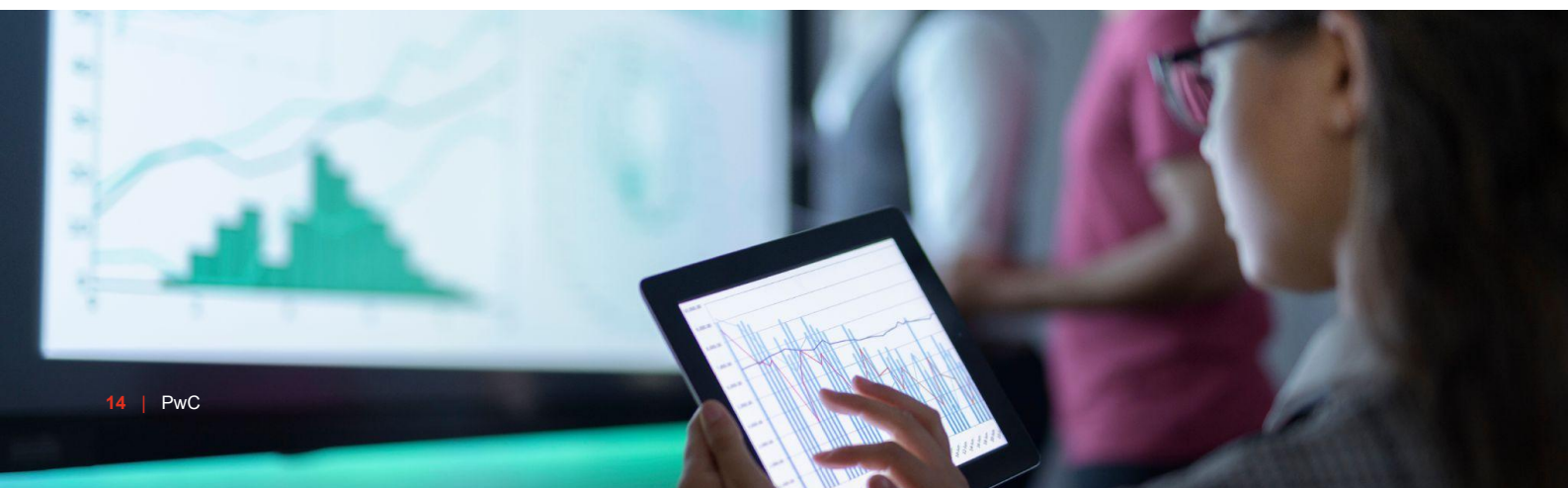
In the current way of working, end users within an industrial context often don't know where to go when they have a request, need support or have other questions about new IT/OT digital solutions. To counter this problem, it is important to keep some guiding principles in mind when designing processes related to IT/OT convergence. In order to give ownership to the business without losing grip on your landscape, partnerships between the business and IT/OT need to be established.

In these partnerships the business represents the end user, while IT/OT stimulates innovation and standardisation within the application landscape and processes.

First of all there is a need for a local entry point with the required knowledge of highly critical OT applications. Whenever a certain problem or question isn't related to a critical local process, a delivery team could take ownership of that problem. However, a deeper analysis will need to be done in order to distribute these requests, support needs and other questions. Ideally, industrial companies can act proactively on critical problems before they are flagged by the end user.

In addition, if not already put into place, industrial companies need to set up an architecture board to maintain a clear view on the application landscape. Keeping this clear overview has never been more difficult since applications within companies increase significantly and changes in one application potentially impact many others. Setting up an architecture board will help mitigate this risk and assist in the following ways:

- assess initiatives from a long-term architectural strategy and fit with site and global strategy;
- decide whether initiatives requires further analysis, or whether solution design is sufficiently developed;
- assess whether there is potential impact on other applications, and;
- design and maintain the Enterprise Architecture model.



Closing

This paper is intended to provide insights for industrial companies into the challenges and benefits of IT/OT conversion, and to list some key success factors to achieve this and evolve towards an overall better digital organisation. The listed key success factors are generic, accumulated from our expertise and implementation in this domain. However, this is not to say that these are the only key success factors for a successful IT/OT convergence. Depending on the context and nature of the business, additional key success factors may be important.

We sincerely believe that IT/OT convergence can play a big role for industrial companies, which enables them to translate their digital ambitions into tangible benefits, ranging from strategy through execution. We hope that this paper helps you to think critically about the role IT/OT convergence could play in fully digitising your company and the impact it can have on your day-to-day business.

Our expert team at PwC can help you identify business value creation by choosing and implementing specific use cases in your company by relying on a firmly established IT/OT converged organisation, and proposing the necessary change management.



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As a Partner at PwC Belgium, Xavier has been defining and driving technology and digital transformations. Helping clients to realise their ambitions and solving important problems.



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```

mirror_mod = modifier_ob.mirror_mod
#set mirror object to mirror_mod
mirror_mod.mirror_object = mirror_ob

if operation == "MIRROR_X":
    mirror_mod.use_x = True
    mirror_mod.use_y = False
    mirror_mod.use_z = False
elif operation == "MIRROR_Y":
    mirror_mod.use_x = False
    mirror_mod.use_y = True
    mirror_mod.use_z = False
elif operation == "MIRROR_Z":
    mirror_mod.use_x = False
    mirror_mod.use_y = False
    mirror_mod.use_z = True

```

```

#selection at the end -add
mirror_ob.select= 1
modifier_ob.select=1
context.scene.objects.active = mirror_ob
print("Selected" + str(modifier_ob.name))
mirror_ob.select = 0
one = bpy.context.selected_objects[0]
data.objects[one.name].select = 1

print("please select exactly one object")

```

--- OPERATOR CLASSES ---

```

class Mirror_OT(bpy.types.Operator):
    """Mirror X mirror to the selected object.mirror_mirror_x"""
    bl_idname = "mirror_mirror_x"
    bl_label = "Mirror X"

```

```

def execute(self, context):
    if context.active_object is not None:

```