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DIGITAL GREECE: THE PATH TO GROWTH

MINING & METAL PROCESSING INDUSTRIES DIGITAL STATE

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1 Identifying the perceived digital maturity of the Greek Mining & Metal Processing Industries

As evident by a recent global study ran by Accenture with Mining & Metals Processing CXOs, digital is understood to be a prioritized area for attention, as a means of sustaining and extending their competitiveness. 87 percent of the CXOs report that Mining companies that do not embrace Digital will lose their competitive position and may face extinction and 82 percent of respondents report that investment in Digital in the next three years will significantly or modestly increase in their organization, with no planned cuts.[1] Recognizing the increased significance of digital, our analysis reveals that key industry players actively pursue a digital agenda. In this context, their Greek counterparts which were surveyed by Accenture[2], also recognize digital to be a prioritized area for attention, mainly as a means of sustaining and extending their organization's competitiveness.

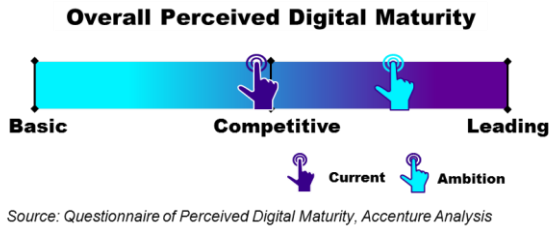


Figure 1: Overall Perceived Digital Maturity – Mining & Metal Processing Industries (Current State – Ambition)

Zooming into the Greek Mining & Metal Processing industries, surveyed executives appear to acknowledge the role of digital and perceive themselves to perform on par with their respective global market and have clear ambitions to increase their digital maturity the future (Figure 1).

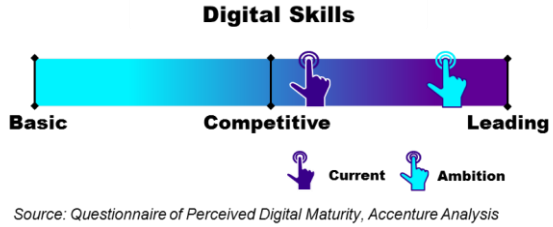


Figure 2: Perceived Digital Skills Maturity – Mining & Metal Processing Industries (Current State – Ambition)

Dissecting the digital maturity score into its levers, it is evident that the sampled Mining and Metal Processing executives perceive themselves to perform on par with market with regards to **their digital skills**. However, as also stated in the relevant workshop, Mining and Metal Processing companies acknowledge the fact that they shall invest to enhance to digitally upskill their workforce and to further increase their digital maturity (Figure 2).

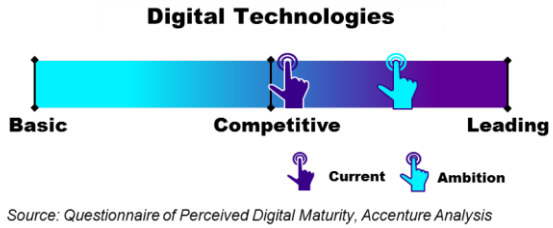


Figure 3: Perceived Digital Technologies Maturity – Mining & Metal Processing Industries (Current State – Ambition)

With regards to **the digital technologies** lever, Mining and Metal Processing representatives ascertain to have already adopted a set of leading practices that will enable them to rotate to digital, with increased sensitivity showed across their Security & Privacy capability area (sub-area within the digital technologies lever) (Figure 3).

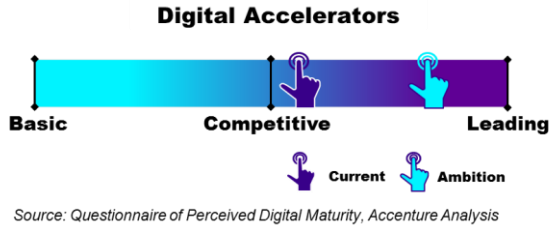


Figure 4: Perceived Digital Accelerators Maturity – Mining & Metal Processing Industries (Current State – Ambition)

Finally, it is evident that the survey participants believe to be performing better than the market-competitive level with regards to **their digital accelerators** lever. This indicates that the survey participants consider themselves to operate within a complex ecosystem, which however may have already adopted digital practices, digital

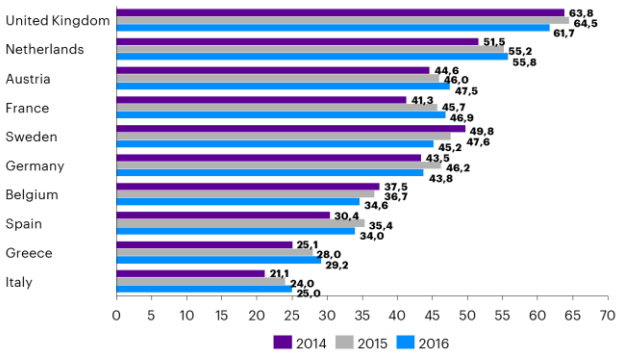
[1] "Accenture Global Digital Mining Survey", Accenture, 2014

[2] The performed analysis and the respective conclusions were based on data recorded through the "*Questionnaire of Perceived Digital Maturity*", launched on December 19, 2016 and remained open until January 30, 2017

processes and a structured framework to some extent to enable the ease of doing business (Figure 4).

1.1 Evaluating the Greek Mining & Metal Processing Industries' digital maturity

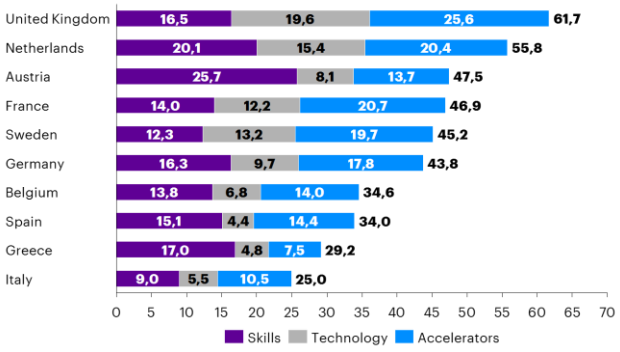
Moving one step further from our initial analysis, we examined secondary data against the executives' opinions, in order to extract an additional layer of insight. To evaluate the Greek industries' digital maturity and identify the primary factors that can drive economic growth in their digital economic output, we have applied the Digital Economic Opportunity Index (DEOI) for the Mining and Metal Processing industries.



Source: Oxford Economics, Accenture analysis

Figure 5:Mining & Metal Processing Industries Digital Economic Opportunity Index from 2014 to 2016

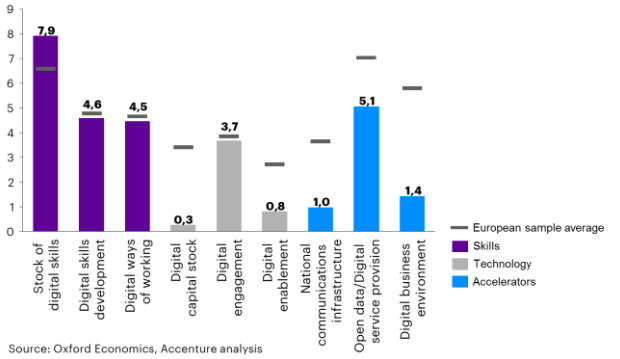
Our analysis for the Greek Mining and Metal Processing industries with regards to their digital maturity suggests that Greek players score at the lower end against nine other European peers over the last three years (2014 to 2016). In more detail, since 2014 the Greek Mining and Metal Processing industries have moderately progressed, increasing their digital maturity by approximately 4 points (Figure 5).



Source: Oxford Economics, Accenture analysis

Figure 6: Mining & Metal Processing Digital Economic Opportunity scores by country

The breakdown into the three levers that make up the DEOI, namely, digital skills, digital technologies and digital accelerators are represented in the following graph. (Figure 6).



Source: Oxford Economics, Accenture analysis

Figure 7: Mining & Metal Processing Industries - Digital Economic Opportunity Index Components

To further understand the key drivers of the Digital Economic Opportunity Index, we deep dive into the nine underlying components to get a more in-depth view of the factors that contribute to the poor performance of the Greek Mining and Metal Processing industries (Figure 7).

With regards to ***digital skills***, the Greek Mining and Metal Processing industries seems to have a relatively high number of ICT specialists and a workforce that exhibits mastery of at least some basic digital skills. In terms of investments in digital training and development both Greek industries perform currently on par with their European sample. In addition, the two industries in focus have already adopted digital practices to enhance workforce's mobility (i.e. remote access to enterprise's IT systems). This brings them closer to the sample's average score across the "digital ways of working" component.

Contrary to the exhibited high performance across the digital skills, the ***digital technologies*** lever appears to have significant room for improvement. Data indicates that the Greek Mining and Metal Processing companies have yet to make significant investments with regards to their ICT hardware and software stock. This contributes to the Greek industries' significant low scoring across the "digital stock" component, which is significantly behind the sample's average maturity. In addition, the Greek Mining and Metal Processing organizations demonstrate a low adoption rate of emerging technologies (i.e. IoT, cloud, analytics), approximately 2 points lower than the sample's average. In acknowledgement of this observation, industry stakeholders have stated during our workshops that these are indeed areas of high priority that can enable their digital transformation. Finally, it appears that the two Greek industries have already adopted to a certain extent digital collaboration practices across their organizations and initiated the digitization of selected processes.

Finally, the Greek Mining and Metal Processing industries appear to lag behind their European sample on all components of their ***digital accelerators*** lever. The underlying components suggest that the Greek industries under performance is influenced by the state of the national communications infrastructure. Additional inhibitors that decelerate enterprises' digital transformation and contribute to the low maturity score in the "Ease of doing business" component. Furthermore, the strict regulations imposed by the Hellenic Data Protection Authority with regards to data openness and interoperability, as well as the lack of digital, lean, user-centric public services provided to businesses are additional decelerators.

1.2 Defining the contribution of digital to the industries' economic output

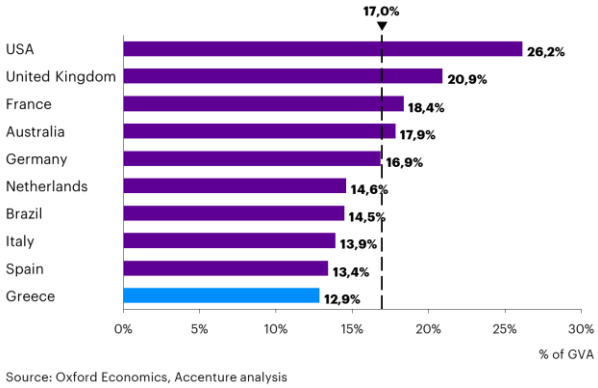


Figure 8: Mining & Metal Processing Industries - Digital Economic Value Index 2016

The Greek Mining and Metal Processing industries' exhibited low digital maturity appears to be further validated by the moderate contribution of digital to the industries' economic value. In more detail, Accenture's analysis indicates that digital inputs currently contribute to 12.9 percent of the industries' Gross Value Added (GVA)[3], equals to €509 million. The data also suggests that the contribution of digital to the Greek industries' GVA is positioned approximately 4 percentage points below the sample's average and situates the Greek Mining and Metal Processing industries at the lower end of the table (Figure 8). At the top of the table, our analysis finds the US Mining

[3] Gross value added (GVA) is a productivity metric that measures the contribution to an economy, producer, sector or region. Gross value added provides a dollar value for the amount of goods and services that have been produced, less the cost of all inputs and raw materials that are directly attributable to that production. The relationship between GVA and GDP is defined as:
GVA + taxes on products - subsidies on products = GDP, or restated as:
GVA = GDP + subsidies - (direct, sales) taxes

and Metal Processing industries with a digital output estimated to comprise 26,2 of the industries' economic output. From a European perspective, Mining and Metal Processing industries from the UK and France are identified to be the frontrunners of the pack at 20,9 percent and 18,4 percent of their digital potential.

2 Rotation to Digital

There is wide-spread evidence that all industries are impacted by digital. In fact, as per Accenture research, "every business is a digital business". However, as each industry is also unique, its digital rotation puts the emphasis on different parts of the value chain, which we refer to as "digital pivot points".

What are the digital pivot points?

Companies organize their business activities against value chains that typically consists of strategy, production, sales and customer services and operations. There is widespread evidence that all industries are impacted by digital. However, as each industry is also quite unique, its respective digital rotation places emphasis on different areas of the value chain. These areas are referred to as digital pivot points.

This below mentioned value chain (see Figure 9) will be used as our framework to identify the digital "pivot point(s)" of the Greek industries.

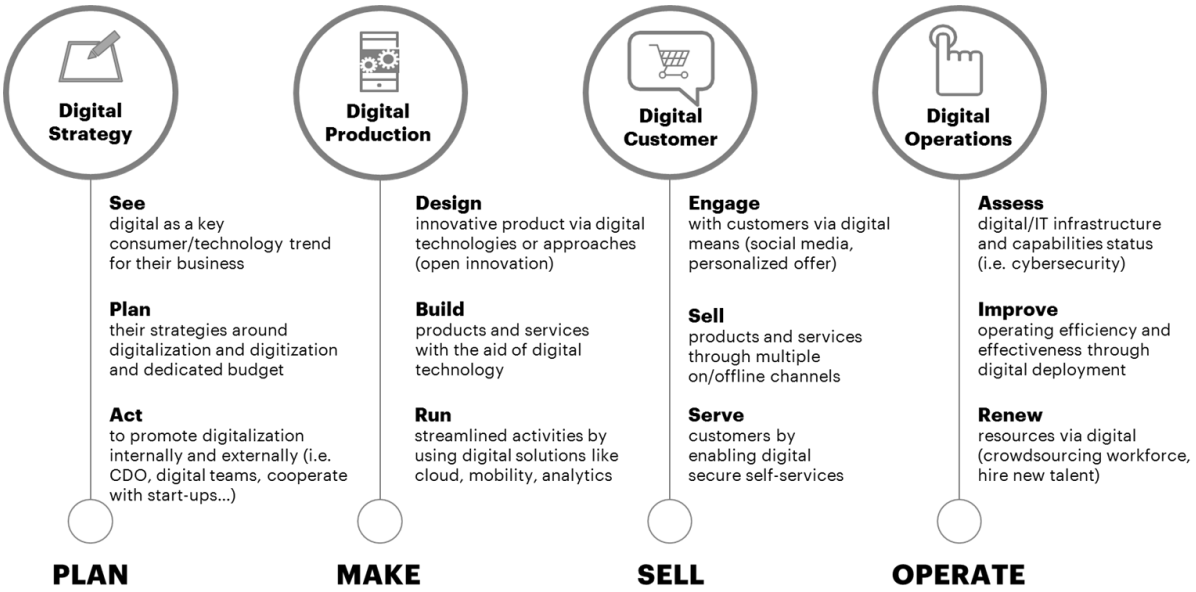


Figure 9: The typical Value Chain

2.1 Industry Clustering

According to our analysis on how digital impacts the Greek industries' value chain, we have placed the Greek Mining and Metal Processing industries within the first group of the Greek industries, the "traditional" (asset heavy) industries (see Figure 10).

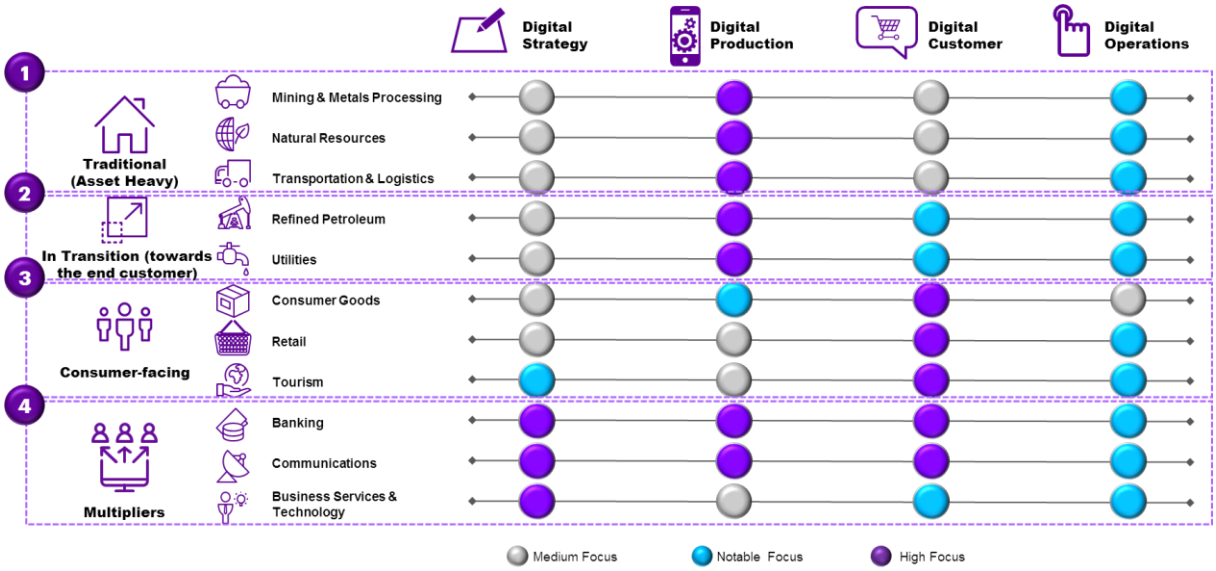


Figure 10: The Clustering of the Greek industries

Enterprises that belong to this group, are typically asset-heavy organizations, require large amounts of capital to establish and operate and their production is dependent on heavy industrial machinery. Their workforce demonstrates a different composition and set of characteristics from that across the other industry groups. Their production and operations are heavily dependent on a large number of field workers. The focus of their digitalization is primarily targeting production and operations. Six digital themes influence the "traditional" (asset heavy) industries as presented in the Figure 11 below. The description of the digital themes is presented in Figure 13.

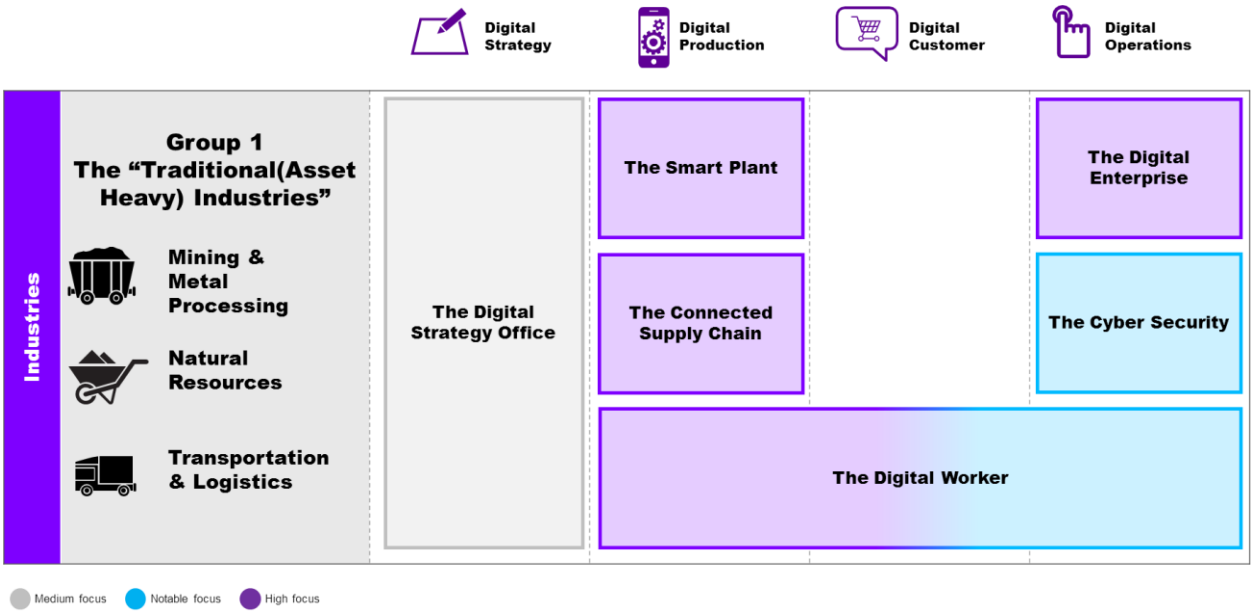


Figure 11: The "Traditional" industries

International best practices suggest that, at the core of their digital rotation, Mining and Metal Processing industries shall become connected, collaborative, contextual and capable for real-time data processing. Figure 12 illustrates elements of the above.

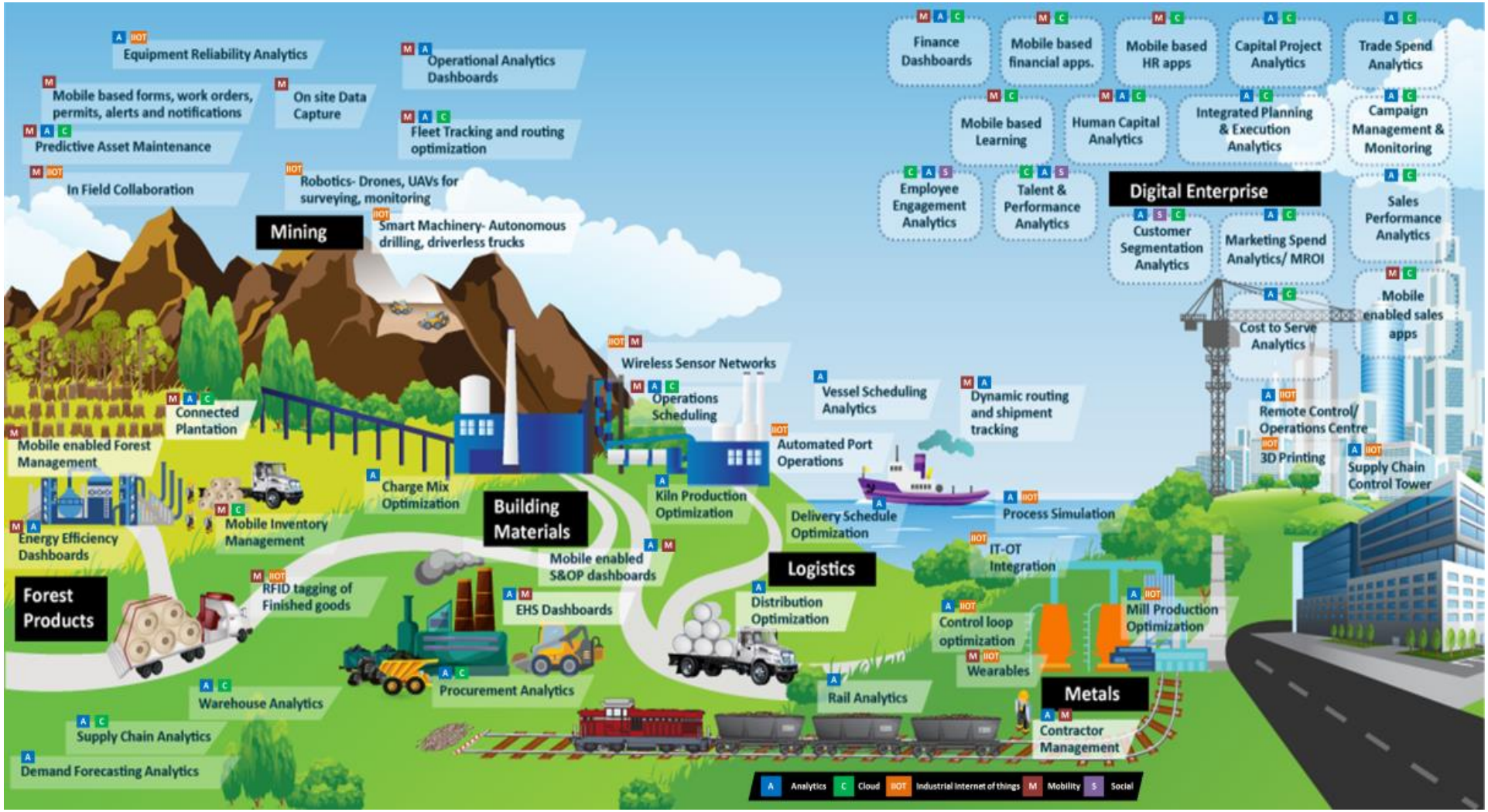


Figure 12: Digital Mining and Metal Processing

Figure 13: Digital Themes

2.2 Digital pivot points

Contextualizing these observations with industries' executives, we have identified the internal operations automation and the value chain integration as the primary areas for digital attention. A conclusion that is supported by our analysis as well. The improvement of their customers' experience is another area of focus; primarily enabled via the deployment of data analytics in the area of digital production. Figure 14 illustrates the emphasis on the different pivot points for the Mining and Metal Processing industries.

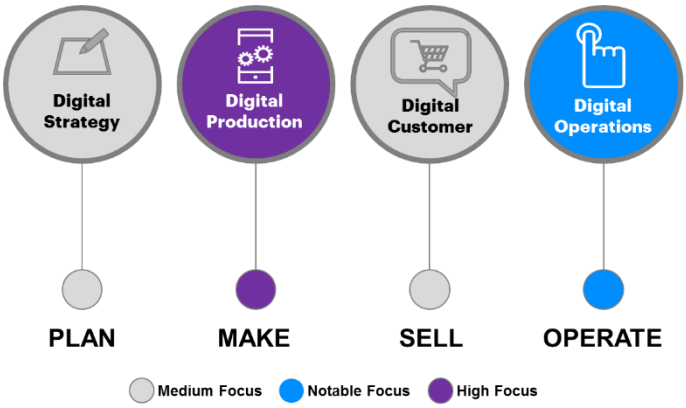


Figure 14: Mining & Metal Processing Industries - Digital Pivot Points

2.3 Initiating the digital transformation

With global best practices as our reference point, we propose a set of initiatives that will accelerate the industries' digital rotation. It is evident that not all initiatives may be applicable for all organizations within these industries; indeed, digital initiatives are recommended to be selected in accordance to the different strategy, business model, size, available budget and most importantly, each company's own digital aspirations and vision. The initiatives that follow are broken down into tactical, which we call "**tactical moves**" and disruptive, which we call "**cut new ground**". In addition, they are linked to the digital themes presented previously that influence the specific group of industries. The classification of the identified initiatives is depicted in Figure 15.

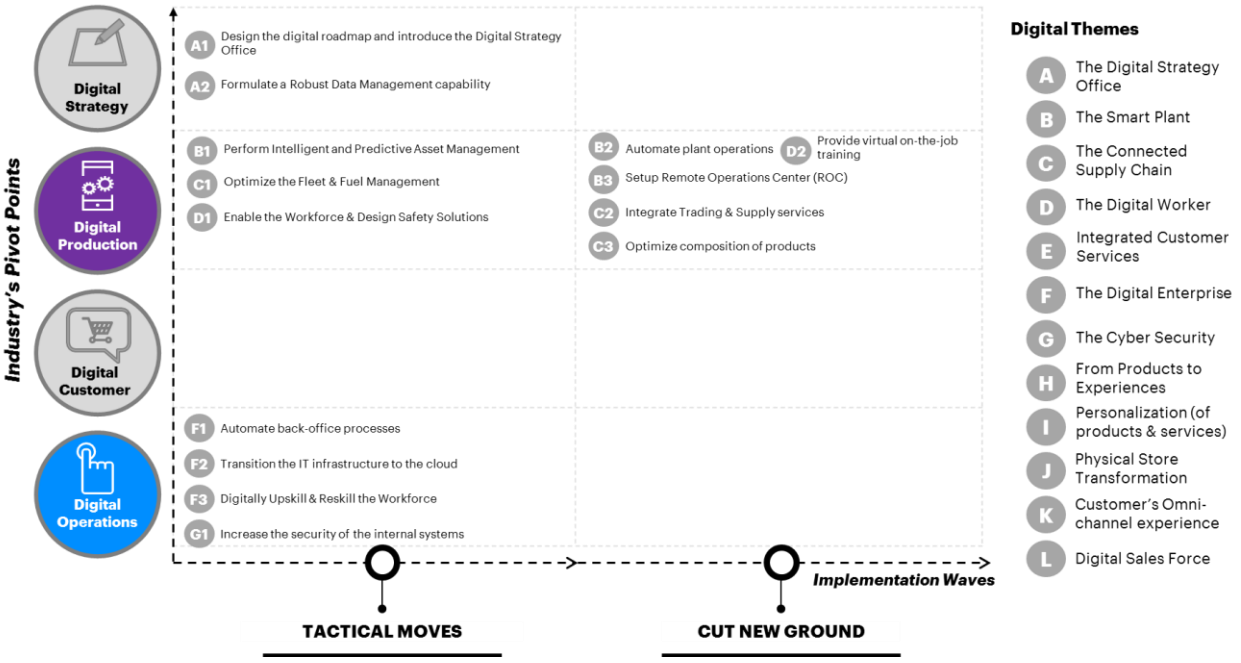


Figure 15: Classification of Suggested Initiatives Across Three Dimensions

A description of the proposed initiatives is presented in the table below:

#	Digital Initiative	Description	Value Chain Area
A1	Design the digital roadmap and introduce the Digital Strategy Office	Design and implement a digital roadmap that will incorporate all digital initiatives to be undertaken by the organization and set up the Digital Strategy Office that will be responsible for the effective operationalization of the digital roadmap	Digital Strategy
A2	Formulate a Robust Data Management capability	Formulate a robust data management capability that will involve a set of initiatives around building an effective data architecture, data quality management, as well as data security	Digital Strategy
B1	Perform Intelligent and Predictive Asset Management	Deploy smart sensors on the organization's assets and introduce mobile applications for the field engineers to collect asset data in the field. The primary objective of the mobile app is to create a comprehensive database of all company assets located at well sites, plants, facilities, and other locations and to get real-time insights into their performance	Digital Production
B2	Automate plant operations	Implement automation techniques (i.e. robotics) to control systems for operating equipment such as compressors, heat exchanges, boilers and furnaces, switching power grids and other applications with minimum human intervention	Digital Production
B3	Setup a Remote Operations Center (ROC)	Setup a Remote Operations Center (ROC) that will integrate the supply chain processes and tools across silos. Continuously monitor the execution of operations activities and provide visibility to performance metrics, perform 'what if' analysis, and dynamically respond to changes. The Remote Operations Center (ROC) brings together capabilities such as Events & KPI Management, Analytics and Execution to enhance outcomes	Digital Production

#	Digital Initiative	Description	Value Chain Area
		such as Operational Excellence and Overall Equipment Effectiveness	
C1	Optimize the Fleet & Fuel Management	Deploy sensors and smart devices on organization's fleet and leverage big data analytics to improve fleet's monitoring and optimize the fleet and fuel management	Digital Production
C2	Integrate Trading & Supply services	Design platforms that will integrate trading with supply chain optimization and execution, will cover production and logistics, spanning across value chain as well as operational assets, will allow to track product lifecycle from the time of deal creation to deal closing and will provide collaborative demand forecasting integrated with sales offices, historical demands, and trading	Digital Production
C3	Optimize composition of products	Leverage big data analytics and integrate end-to-end the supply chain processes to quickly respond to customer requirements and produce products (i.e. alloys) tailor made to the specific customer needs	Digital Production
D1	Enable the Workforce & Design Safety Solutions	Leverage wearable solutions and analytics solutions to capture, analyze, communicate critical manufacturing information to and from workers, and improve operational performance by supporting fact-based decisions in near real-time. Remotely monitor and manage safety across a manufacturing site	Digital Production
D2	Provide virtual on-the-job training	Implement VR/AR technologies to enhance and modernize the on-the-job training	Digital Operations
F1	Automate back-office processes	Digitalize and automate end-to-end internal processes (i.e. finance, sourcing & procurement) powered by artificial intelligence (robotics) and big data analytics	Digital Operations
F2	Transition the IT infrastructure to the cloud	Move the IT infrastructure to the cloud to improve efficiencies, enable the seamless integration of business processes and provide immediate, on-demand access to the latest solutions and approaches and ready-to-deploy environments for creating and delivering the innovative business strategies and products	Digital Operations
F3	Transform the Digital Talent	Define the new digital roles, capabilities and skillset, assess the active workforce and design digital training sessions to digitally upskill and reskill the organizations' personnel according to their personal development needs	Digital Operations
G1	Increase the security of the internal systems	Strengthen internal systems and incorporate increased security measures such as multilayered authentication and internal control processes to strengthen security and comply with increased regulations	Digital Operations

2.4 Global Leading Practices

- **Case Study – Klöckner & Co Digital Transformation through AI**

Klöckner & Co SE, one of the largest producer-independent distributors of steel and metal products worldwide, and arago GmbH ("Arago"), a pioneer in artificial intelligence (AI) and leader in intelligent IT automation, announced an innovation partnership focused on leveraging AI to further drive Klöckner & Co's digital transformation. By amplifying human IT knowledge through continuous learning and built-in self-optimization, Arago's problem-solving AI platform HIRO will automate Klöckner & Co's IT operations and help them to drive their strategic goals enterprise-wide. To create an entirely digitalized supply and service chain from the suppliers to the customers, Klöckner & Co actively develops innovative solutions for selling steel and other metals online. The company plans an open industry platform and targets to handle more than 50 percent of its sales via online transactions by 2019. Klöckner & Co's CEO emphasized their goal to develop an open industry platform, connecting as many market participants as possible. Gisbert Rühl believes that HIRO implementation into the existing IT environment will be a strong lever for continuing the digital transformation of his company.

Source: https://www.arago.co/press-release-aragos-artificial-intelligence-supports-kloeckner-cos-digital-strategy/

- **Case Study – Rio Tinto – Big Data Analytics Excellence Centre**

Rio Tinto began Mining big data at its world-first Analytics Excellence Centre to significantly enhance equipment productivity across its global operations. The Center assesses massive volumes of data captured by the array of sensors attached to Rio Tinto's industrial machinery and fixed equipment and enables experts to predict and prevent engine breakdowns and other downtime events, significantly boosting productivity and safety. Using artificial intelligence and machine learning algorithms, data scientists in the Analytics Excellence Centre in Pune, India work to identify a range of problems before they occur. This analysis enables scheduling predictive maintenance capabilities which will reduce maintenance costs and production losses from unplanned breakdowns.
Rio Tinto group executive technology and innovation Greg Lilleyman said "The Analytics Excellence Centre will allow us to extract maximum value from the data we are capturing around the performance of our equipment, making our operations more predictable, efficient and safer.

Source: http://www.riotinto.com/media/media-releases-237_14527.aspx

2.5 Maximizing the Mining and Metal Processing industries' economic output (GVA)

Our econometric analysis suggests that by 2021 the initiation of the digital rotation for the Mining and Metal Processing industries is expected to result to a moderate increase in the economic output by 1,57 percentage points equal to approximately €67,7 million[4]. The projected GVA uplift is a product of macroeconomic analysis assuming a 10% increase on the industry's digital maturity (Figure 16).

Source: Oxford Economics, Accenture analysis

Figure 16: Mining and Metal Processing GVA Uplift as % of the 2021 GVA Baseline, (Million Euros, %)

[4] 2021 Gross Value Added is calculated from Eurostat data using Oxford Economics projected growth rates. The spill-over effect to the economic performance of other industries is not included in this figure.