An Automated Digital Tool for Digital Maturity Enablement in Business Sector

**ABSTRACT**

The fourth industrial revolution delivered a message of rapid to exponential technological evolution, implying that industry must migrate to non-static quantification of digital maturity. Various publications have defined various aspects of digital maturity from hardware, systems, integration, and other paradigms with two key limitations, firstly the quantification is static and secondly one or more aspects are quantified but not all aspects. Add to this the exponential evolution and limited skills in quantifying and implementing a contemporary maturity.

This study adopts technological evolution modelling in conjunctions with systems thinking to develop an AI based evolutionary digital maturity quantification platform. The key aspects of skills limitations, technological identification and sectorial best practice is integrated into the solution design.

This objective is realized by creating an automated digital tool that leverages principles derived from the Software Development Life Cycle (SDLC) with a user interface that is both visually intuitive, structured and sector specific. This visualization method facilitates a dynamic presentation of complex relationships among digital maturity elements, offering users an insightful perspective on interdependencies deriving their paradigms via AI based probabilistic functions. The simplification and back-end correlations imply a major step forward in addressing the challenge of evaluating digital maturity. Through interlinked and structured components, the graphical user interface (GUI) seamlessly navigates users through the intricacies of digital maturity assessment, ensuring clarity and usability in the evaluation process. INTRODUCTION

LITERATURE REVIEW

RESEARCH METHODOLOGY

Build strings.

RESULT AND DISCUSSION

| **Business Function** | **Categories / Measuring Element** |
| --- | --- |
| Exploration and Geology | Market analysis  Data Utilization and Analytics |
| Mining Operations | Power Generation  Generation Technology  Digital Capability  Worker Safety  Quality Control  Scheduling, Logistics  Ventilation Requirements  Mineral Processing  Mine Access  Underground and Surface Infrastructure  Digital Twin Technologies  Data Utilization and Analytics Internet of Things (IoT) Integration,  Advanced Communication and Connectivity  Ease of Use and Adoption  Automation and Robotic |
| Health, Safety, and Environment (HSE) | Environmental and Sustainability Solutions  Worker Safety, Digital Twin Technologies,  Data Utilization and Analytics,  Advanced Communication and Connectivity  Remote Monitoring and Diagnostics |
| Processing and Metallurgy | Mineral Processing,  Digital Twin Technologies |
| Supply Chain and Logistics | Supply Chain Digitization  Logistics  Digital Twin Technologies  Data Utilization and Analytics  Unified data |
| Finance and Accounting | Strategic Vision and Leadership  Digital Capability  Data Utilization and Analytics |
| Human Resources (HR) | Workforce Skills and Training  Human Resources  Worker Enablement  Culture  Advanced Communication and Connectivity  Ease of Use and Adoption |
| Corporate Development and Strategy | Strategic Vision and Leadership  Change Management  Data Utilization and Analytics  Unified data  Advanced Communication and Connectivity |
| Legal and Compliance | Cybersecurity and Data Privacy  Contract Management |
| Community and Stakeholder Relations | Environmental and Sustainability Solutions  Stakeholder Involvement |
| Marketing and sales | Customer satisfaction |

| **Categories** | **S/N** | **Subcategories** |
| --- | --- | --- |
| Data Utilization and Analytics | 1  2  3  4  5 | Data Collection  Data Storage  Data Management  Data Analysis  Use of ML |
| Automation and Robotics | 1  2  3  4  5  6  7  8  9  10  11  12  13  14  15  16 | Automation of the drilling production process  Utilization of advanced production technologies e.g., additive manufacturing  Automation of the blasting production process  Automation of the loading production process  Use of digital device for seismicity measurement for geotechnical analysis  Use of digital device and technology in ascertaining rock properties for geotechnical analysis  Use of technology for the loading and hauling and hoisting fuel cost  Stability risk analysis  Continuous geotechnical monitoring  Automating the type of mining method as per the rock quality  Digital device in slope geometry  Automation of the hauling production process  Debottlenecking  Value Chain Visualization  Pit to Port  Automation of the hoisting production process |
| 4Internet of Things (IoT) Integration | 1  2  3  4  5  6  7  8 | Equipment performance  Environmental conditions  digital communication Utilization with stakeholders  Collect, update, and distribute project documents through digital platform.  Computer-aided calculation, optimization, and simulation  Utilize IoT-solutions, advanced analytics, or artificial intelligence.  Digitally monitor problem issues and solving process  Decision making |
| Digital Twin Technologies | 1  2  3  4  5  6  7  8  9  10  11  12 | Predictive Maintenance  Asset Optimization  Power Plant Simulation  Grid Simulation  Building Energy Management  Demand Response Optimization  Wind and Solar Farm Modeling  Energy Storage Optimization  Fault Detection and Isolation  Emissions Monitoring and Mitigation  Disaster Response Planning  Compliance Modeling |
| Advanced Communication and Connectivity | 1  2  3  4 | Wireless network  Satellite communication  Fiber optics  Sensitive data |
| Cybersecurity and  Data Privacy | 1  2  3  4  5  6  7  8  9 | Infrastructure  Operational systems  Data privacy  Intrusion Detection and Prevention  Data Encryption and Secure Communication  Access Control and Authentication  Incident Response and Recovery  Compliance with Regulatory Requirements  Continuous Monitoring and Auditing |
| Supply Chain Digitization | 1  2  3  4 | Procurement  Logistics  Inventory management.  Real time tracking |
| Workforce Skills and  Training | 1  2  3  4 | Training programs  Knowledge transfer initiatives  Workforce development strategies  Digital literacy and skills |
| Environmental and  Sustainability Solutions | 1  2  3  4  5  6  7  8 | Environmental impact  Energy consumption  Sustainable mining practice  smart energy management  waste reduction.  Rehabilitation  Digital authority involvement in environmental issues  Digital plan, monitoring and tracking of environmental issues |
| Strategic Vision and Leadership | 1  2  3 | Strategic vision  Leadership commitment  Organizational structure |
| Remote Monitoring and Diagnostics | 1  2  3 | Enabling Real-Time Visibility  Alarms  Alerts |
| Power Generation | 1  2  3  4  5  6  7 | Transmission Infrastructure  Distribution Networks  Grid Stability and Reliability  Renewable Integration  Environmental Impact  Generation Capacity  Electricity Generation |
| generation technology | 1  2  3  4  5  6  7  8 | Heat Rate  Forced Outage Rate  Conversion Efficiency  Emissions Intensity  Fuel Cost  Interconnection Capacity  Nuclear Capacity Factor  Electricity Generation |
| Digital Capability | 1  2  3 | IT Infrastructure  Descriptive Analysis  Predictive Analysis |
| Human Resources | 1  2  3  4  5  6 | Training on digital platforms  Monitor skills on digital platforms.  Digitally monitor staff health status  Change Management  Reskilling  Stakeholder Engagement |
| Worker Enablement | 1  2  3  4 | Quick Decision  Making Employee  Enablement  Employee Effectiveness |
| Culture | 1  2  3  4 | Work Transformation  Changing Behavior  Departmental Transformation  People Transformation |
| Customer Experience | 1  2 | Customer Satisfaction  Mine to Customer |
| Unified Data | 1  2  3  4  5  6 | Integrated Operations Centers  Realtime data  Integration  Data-Driven Mine  Eliminating Silos  Single Platform |
| Performance  Management | 1  2  3  4  5 | Value Chain Optimization  Business Intelligence  Business Improvement  Shareholder Returns  Key Performance Indicators |
| Stakeholder Involvement | 1  2  3 | Labor  Unions  Employees |
| Ease of Use and Adoption | 1  2  3 | Practicality of technologies  Project Value Realization  Motivation (No Incentives) |
| Change Management | 1  2  3  4 | Ineffective change management  communication  Change Resistance  Reskilling |
| Worker Safety | 1  2 | Safety message announcement  Monitoring of staff and visitor presence |
| Contract management. | 1  2  3 | Digitally update and follow-up contracts towards clients  Digitally track sub-contractor and supplier  payment management |
| Quality control | 1  2 | Collect and monitor progress reports.  Quality inspections with mobile devices |
| Scheduling | 1  2  3 | Create, assign, and prioritize tasks in real time and distribute to mobile devices.  Plan and simulate site progress in 4D-software.  Maintain a digital construction site disposition plan |
| Logistics | 1  2  3 | Identify, track and locate material and equipment on-site with digital tools.  Digitally monitor procurement orders, receipts, use, and quality issues  Maintain digital bill of quantities |
| Design management | 1  2 | Visualize drawings and 3D models on-site on mobile platforms.  Update digital drawings, models, and technical information with notes and asbuilt records |
| Ventilation requirements | 1  2  3  4  5 | Dust control measures.  control measures.  Stabilization of haul road surfaces  Utilization of fog cannons for visible dust  Dust suppression installation systems |
| Mineral processing | 1  2  3  4  5  6  7  8  9  10  11  12 | Comminution  Ore characterization  Process facilities.  Plant operation and maintenance philosophy.  Expandability and expansion options  Classification  Gravity Separation  Flotation  Magnetic Separation  Leaching  Dewatering  Smelting and Refining |
| Mine access | 1  2  3  4  5  6  7  8 | Blind spot  Intersections  Safety berms and ditches  Equipment selection process  Material handling  haul road cross-sections.  drainage requirements  road construction materials |
| Market analysis | 1  2  3  4  5  6 | Product specification  Demand and supply forecast.  Pricing strategy  Competitors  Revenue forecast  Product shipping storage and distribution |
| Underground and surface infrastructure | 1  2  3  4  5  6  7 | Utilities  Change rooms.  Underground waiting areas  Transport infrastructures.  Temporary infrastructures  Communication  Building and facilities |

CONCLUSION