UG PROJECTS Dr Somasundaram Kumanan

No.	Project Title	Year
1	Experimental setup for the measurement of Tool Tip Temperature	May 1990
2	Appreciations of Computer Applications in Sheet Metal Industry	May 1993
3	Computer aided design of progressive die for sheet metal blanking	April1994
4	Selection of materials for gear using expert system	April 1995
5	Knowledge based project management	April 1995
6	Expert system for overall quality planning	April 1996
7	Development of Expert system for hole making process	April 1996
8	Finite element analysis in manufacturing engineering	May 1997
9	Selection of EDM parameters using VP-expert system	May 1997
10	Sales Forecasting using ANN	May 2003
11	Time Cost Trade off using Multi objective GA	May 2003
12	Virtual NC	May 2003
13	Modeling and Simulation of Robotic Cell	May 2003
14	PM in manufacturing	May 2003
15	Process optimization using ANN and GA	May 2004
16	Finite Element Analysis of Welding in ANSYS	May 2004
17	Finite Element Analysis in Machining	May 2004
18	Aggregate Process Planning for Fabrication	May 2005
19	Product Development Scheduling	May 2005
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22	Intelligent Decision Making on surface finish	May 2006
23	Development of an intelligent CAD system	May 2007
24	Fuzzy logic based energy saving technique	May 2007
25	Fuzzy logic for decision making product design	May 2007
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27	Performance evaluation of a supply chain using simulation	May 2008
28	Heuristic for hierarchal facility location design	May 2008
29	Energy optimization in CNC turning process	May 2009
30	Modeling and simulation of a robotic work cell	May 2009
31	Case study in manufacturing system simulation	May 2009
32	Product and process optimization using FEA	May 2009
33	Computer Aided Analysis of an all terrain vechicle using FEA	May 2010
34	Software selection using AHP and Fuzzy AHP	May 2011
35	Decision making in product development multi-criteria analysis	May 2011
36	Knowledge based design of supercritical boiler	May 2012
37	Supply chain performance measurement analysis	May 2012
38	Supply chain optimization of pharmaceutical industry	May 2013
39	Supply chain management in healthcare industry	May 2013
40	A knowledge based system for assigning service technicians	May 2015
41	Energy management strategy for parallel hybrid vehicle Fuzzy logic	May 2015
42	Development of predictive models for Wire EDM Process	May 2016
43	Scope of vendor managed inventory in BHEL	May 2016
44	Prediction of performance in abrasive water jet machining	May 2016
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46	Design of a compressed air energy storage system	May 2017
47	Vendor managed inventory- a case study	May 2017
48	Fault diagnosis using neural networks	May 2017

49	An automated visual inspection system using a robot	May 2017
50	Design and development of solar photovoltaic refrigerator	Dec 2017
51	Optimization of Micro Turning Process	May 2018
52	New Product Success by Integration of QFD and FMEA	May 2018
53	Optimization of Process parameters for Microdrilling	May 2018
54	Development of Vendor Managed Inventory System	May 2018
55	Evaluation of Sustainable Manufacturing A Case Study	May 2019
56	Process Evaluation using Value Stream Mapping	May 2019
57	Life Cycle Assessment A Measure of Industry 4.0 Attainment	May 2019
58	An analytical study of barriers in dairy Supply chain using AHP	May2020
59	Prediction of weld bead width using artificial neural networks	May2020
60	Manufacturing process improvement by using Value Stream Mapping	May 2020
61	Intelligent process model for bead geometry prediction in WAAM	May 2021
62	Sustainable measures in industrial application	May 2021
63	Ranking indicators for sustainability indicators	May 2022
64	Preparedness for Industry 4.0	May 2022
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67	Enhancing green total factor productivity through manufacturing output	May 2024
68	Performance metrics for a smart manufacturing system	May 2024
69	A measure of sustainability for an industry	May 2025
70	Evaluation of readiness for digital manufacturing	May 2025
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1. Experimental setup for the measurement of tool tip temperature Cutting tool tip temperature is one of the important factors deciding tool life and correspondingly production cost. Cutting parameters must be so chosen and so maintained that the tool tip temperature does not exceed the tolerable limits. To understand the influence of cutting parameters on tool tip temperature the estimation of the latter is vital. Towards this purpose a study was carried out on an experimental setup for determining tool tip temperature. There are various methods available for the measurement of this temperature. The viability and feasibility of each method was studied, discussed and the method namely Tool work Thermocouple was chosen. An experimentation program was drawn up after the setup was suitably designed and fabricated. Testing program followed the fabrication. The experimentation program was executed and the results tabulated. The inferences were presented. [GO TO LIST]

2. Appreciations of Computer Applications in Sheet Metal Industry This project specially concerns the appreciation of computer applications in sheet metal industry. It comprises three major areas in sheet metal industry. Chapter 1. gives brief detail of the sheet metal working, computer in decision making and about programming languages. Chapter 2. deals with decision model under certainty, like break-even point analysis, inventory management. Chapter 3. deals with the decision model under uncertainty, like critical path analysis and PERT.Chapter 4. brings out the economic of strip-layout and calculation of stock utility Chapter 5. deals with the progressive die design. [GO TO LIST]

3. Computer aided design of progressive die for sheet metal bending Tool design is one of the important tasks in the manufacturing of sheet metal components. Even today, tool design for sheet metalworking remains more an art than a science. This is

due to the complexities involved in the toll design procedure, where several mutually interacting factors must be considered. The state of the art is that major part of the diedesign is done imperially by experienced designers with little or no computer aids. Hence, the development of CAD system for the Die Design would be significant step forward in improving the process efficiency. An attempt has been made to link the sheet nesting and die design modules together to form a useful system for design of progressive dies. [GO TO LIST]

4. Selection of materials for gear using expert system The aim of the project is to develop a expert system which carries out the task of selecting material for gear. The selection of materials for gears is a very important design decision. Material selection influences the cost of the product, its function, manufacturing equipment and processes. Hence, a proper material selection can strike a balance between the gear performance and its cost.The functional rating is graded as: Excellent; Good, and Average and cost is graded as High, Medium, Low. The least value obtained from the metal, when comparing the functional rating cost from the grade table with other metal, which ensures a high functional rating as well as low cost. The expert system for this purpose is built using the A.I. language PROLOG.The package consists of the components of the expert system, which are:Knowledge base: The knowledge base is where the domain specific knowledge acquired from the energy is stored. Inference engine; Expert systems do inferential computing and not algorithmic computing .The inference engine carries out the search through the knowledge base either to prove hypothesis or to arrive at a conclusion. User interface: This component is an interface module for a user to interact with the expert system. This program has been developed in Turbo prolog and the objective of improving functional rating and minimizing cost of the component is achieved

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5. Knowledge based project management Project delay is a major headache .In an age where companies are trying to reduce the product development time in order to enter the market as early as possible, problem with project management and technical support are causing critical delays, most often project management is performed manually , by people with aid from computerized critical methods and PERT techniques. CPM and PERT techniques are concerned with finding a path, through activity network, which contain no slack, which is known as critical path. A delay in an activity on the critical path results in the entire project delay. Therefore, it is desirable to find the critical path in order to know which activities are most important to keep on time. In this age of rapid and radical changes involving risks and uncertainties and shorter response time, replacement of manual project of manual project management with computer based system is but natural. Keeping the above said in mind we made a sincere endeavor in developing a knowledge based system for project management. It was sought to develop a system to provide the next best alternatives in case of bottlenecks in any of the activities of a project, during project implementation, thus avoiding project delay

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6. Expert system for overall quality planning Quality planning is the activity of establishing quality goals and developing the products and process required to meet these goals. Keeping this definition in view the expert system QUAPLEX (name of our expert system) was carefully designed and consolidated according to the steps presented by expert Mr . J, Juran, which were as, follows. 1)Define the project 2)Identify the customers 3)Discover customer needs 4) Develop product 5)Develop

process 6)Develop controls/ transfer to operation 7) Designed for user friendliness, the program was developed in turbo prolog incorporating the following features.1 Product analysis 2 Process variable selection3 Inspection policy4 Selection of inspection instrument5 Defects analysis6 Vendor performance evaluation.7 Documentation of plan. The inputs are given in an interactive mode and the program advices the user in case he goes out of the input range.The program also helps the user to carefully plan and execute the inputs at every stage. Useful recommendations are provided after every module and these recommendations are drafted in the documentation of plan, which forms the final plan for entire process. The expert system can easily be substituted as a general expert system model which can be easily manipulated for serving any other manufacturing process other wise. The QUAPLEX gives optimum rendering for quality management keeping in view the modern trends in quality management

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7. Development of Expert system and knowledge base for hole making processes: The aim of this project is to develop an expert system, which tells about the different hole making process is very important especially seeing today's competitive environment. The program has been split into two parts . one is the master program and other one the data base file. The master program is compatible with the database file. The program will ask a set of questions and on answering them depending upon the requirements of the user, the best process available will flash on the screen along with the requisite details and speciation. The data base file contains all the data available and it can easily updated without mush problem. The expert system for this purpose is built using the A.I. language PROLOG.The package consists of components of the expert system are: **knowledge base:** the knowledge base is where the domain specific knowledge acquired from the energy is stored. **Inference engine:** expert systems do inferential computing and not algorithmic computing. The inference engine carries out the search through the knowledge base either to prove hypothesis or to arrive at a conclusion using the thump rule. **User inference:** this component is an interface module a user to interact with the expert system

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8.Finite element analysis in manufacturing engineering: The critical points in the generation of finite element mesh for static analysis of gear tooth and shrink fit problem are discussed. Besides the analysis of a stress distribution in the gear tooth and ring gear cylinder assembly are also discussed. The load carrying capacity of a gear can be determined reliably by practial experiment. It is time consuming and rather tedious. The advent of finite element methods facilitate to find stress distribution conditions in the teeth. On account of running on tooth form either FEM, stress condition in the teeth, local concentration effect etc . are applied are enabled to analysis. This report gives only the static analysis of the load carrying capacity.

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9.Selection of EDM parameters using VP-expert system: The electrode discharge machining is a non-traditional machining process that has developed recently in the last decade. The tool and the workpiece are charged with the opposite voltages and appropriate voltage is applied, so that the workpiece makes the way for thee next. The

gap t o be maintained between the tool and the workpiece is an important factor that needs to be just appropriate for efficient results.Previously the selections of these parameters were done normally using old data. As it was very tedious process involving labor and time.Here we have used the vp-expert system to get the optimum values of current gap. This is done with the help of simple consultation with the used in which the ranges of data are specified so that the user can easily interact with the software and get the values required.An already existing knowledge base with the data selected from industry is used by us. The current and gap are thus computed. The simplicity of the software is the main feature. It can be used by amateur user and machine can be started simultaneously. Further advancement can be made to make this software to deal with any material.

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10.Sales Forecasting using ANN: Sales forecasting is an important process for the industries to survive in the market amidst competition. The near future sales forecast supplies an economic foundation for operations planning, scheduling, production, programming, inventories and logistics of physical distribution and projecting cash generation and operating profits. Long run sales forecast supply the framework for corporate investment planning, modernization, and research promotion and executive development. Neural network simulations appear to be a recent development. In this project, a Neural Network model SPNN for effective Sales Prediction is established. This SPNN model has been established by means of training process using feed forward back propagation algorithm. The model efficiency is verified by Moving Range chart and found to be efficient. It also proves that the network does not memorize but generalizes the input – output relationship.Trend Prediction Neural Network (TPNN) model is also established for sales trend recognition. During training, the network is trained to associate outputs with input patterns. When the network is used, it identifies the input pattern and tries to output the associated output pattern. The power of neural networks comes to life when a pattern that has no output associated with it, is given as an input. In this case, the network gives the output that corresponds to a taught input pattern that is least different from the given pattern. We believe these SPNN and TPNN models will provide a more sophisticated technology for sales predictions in an organization.

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11. Time Cost Trade off using Multi objective GA : it is one of the most important aspects of manufacturing projects planning and control. There are trade-offs between time and cost to complete the activities of a project; in general, the less expensive the resources used, the longer it takes to complete an activity. using CPM , the overall project cast can be reduced by using less expensive resources for non –critical activities without impacting the project duration. existing methods for time-cost trade- off analysis focus on using heuristics or mathematical programming . these methods however are not efficient enough to solve large scale CPM networks .Analogues to natural selection and genetics in reproduction ,genetic algorithm have been successfully adopted to solve many science and engineering problems and have proven to be an efficient means for searching optimum solution in a large problem domain. This project presents 1) an algorithm based on the GAs for construction time cost trade-off optimization 2) a computer program that can execute the algorithm efficiently

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12. Virtual NC: Virtual Manufacturing is the use of a desktop virtual reality system for the computer- aided design of components and processes for manufacturing. It offers unrivalled scope for creating and viewing three dimensional engineering models.3D visualization and simulation techniques provide powerful tools for the verification of the design of manufacturing systems. It allows the designer to examine the system design in detail. This includes movements of material handlers, relative positions of machine tools, setups of an individual machine tools and machining complex processes in a manufacturing environment. The work done in this project involves modelling of NC machine tool as VNC for OFF-LINE programming .The NC machine features were modelled and simulated to generate NC programs .The tool used is VERTICAL NUMERIC CONTROL (VNC). A 3-D CAD MODEL was created and simulation was carried out to collect data regarding speed, feed rate, acceleration, axes position, cycle time, reference positions. Finally analysis was carried out using the data collected during simulation to study graphically the behaviour of various parameters like speed, feed rate, acceleration, axes position, cycle time, reference positions.

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13. Modeling and Simulation of Robotic Cell: A Robot is defined as a Programmable, multifunction manipulator designed to move materials, parts, tools, or special devices through variable programmed motions for the performance of a variety of tasks. Robots today are used in a wide variety of application such as material handling, welding, painting, assembly etc. A robotic work cell includes the robot(s), conveyors, pallets, machine tools, fixtures and other devices that enable the robot(s) to carry out the work cell required functions. As compared to previous methods of work cell design, work cells are today designed using highly sophisticated software which enable the designer to prepare layout and simulate the work cell virtually to satisfaction in 3-D. The steps generally followed in solving the problems explained in subsequent chapters are delineated as follows :3-D Modeling of robot work cell components. 3-D Assembly of robot work cell components, Defining robot inematics. Simulation of robot work cell, Verification of the model. In this project we attempt to solve typical problems of interest using UltraGRIP to highlight and appreciate its features. Chapter 2 explains about the theoretical information on robot and work cell. Chapter 3 gives brief information on the Modeling and Simulation software “UltraGRIP” used here. Subsequently chapter 4 and chapter 5 involve the problem solutions taken for study.

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14. Project Management in Manufacturing: Although manufacturing has not been a traditional area for the conventional practice of project management techniques, recent literature has shown an increasing rate of embrace of project management techniques in manufacturing settings. The techniques have traditional been limited to construction-type now being applied to manufacturing with increasing frequency. This work has been done to determine the critical path and project duration in CPM and PERT problems in manufacturing project scheduling using visual basic. The work formulates finding the critical path in text mode as well as graphics mode. The coding has been done so that it will take input for both deterministic as well as probabilistic model. For CPM model it will find the critical path and project duration and for PERTit will also find the normal deviate so that probability of the project completing with in due time can calculated. The implication of this work is that critical path and project duration for manufacturing projects such as aerospace industry can be calculated by selecting the correct model. The results indicate the performance of the coding is accurate in text mode as well as graphic mode.

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15. Process Optimization using ANN: Flexibility and intelligence are indispensable factors in automation and manufacturing. For such demands, intelligent information systems are required, especially considering the technological data type. The process setting parameters have to be determined in the best suitable way. An in-process based surface recognition system to predict the surface roughness of machined parts in the end milling process was developed in this research to assure product quality and increase production rate by predicting the surface finish parameters in real time. In this system, an accelerometer and a proximity sensor are employed as in-process surface recognition sensors during cutting to collect the vibration and rotation data, respectively. Using spindle speed, feed rate and depth of cut as three input neurons, an artificial neural networks (ANN) model based on back propagation was developed to predict the output neuron-surface roughness *R*a values. The experimental results show that the proposed ANN surface recognition model has a high accuracy rate (96–99%) for predicting surface roughness under a variety of combinations of cutting conditions. This system is also economical, efficient, and able to be implemented to achieve the goal of in-process surface recognition by retrieving the weightings (which were generated from training and testing by the artificial neural networks) predicting the surface roughness *R*a values while the part is being machined, and giving feedback to the operators.

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16.FEA in Welding using ANSYS : This dissertation makes an effort to understand the influence of residual stresses on the fatigue failure of butt, lap, and T, joints. Finite element analysis is performed using ANSYS and fatigue life is predicted in the analytical way. The model is made using ANSYS . Thermal and Structural analysis is made on the model and the residual stresses is predicted with the required loads and constraints in the finite element method. The residual stresses thus obtained are taken as the input for the fatigue life and it is solved analytically to find the fatigue life.

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17. FEA in machining using PROE and ANSYS: The increased use of machining in manufacturing systems to produce high quality products has created a significant challenge in studying various factors affecting machining operation and to optimize the machining parameters. Although, a number of extensive researches have been conducted to study the machining process, still it is not unexploded. This project uses Finite Element Analysis with the help of PRO-E software for modeling and ANSYS for finite element analysis. Various methods for study of machining are discussed in detail. The project also list salient features of PRO-E and ANSYS. A single point cutting tool, a drill bit and drilling work piece is modeled in PRO-E Wild Fire and analyzed in ANSYS.

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18 **Aggregate Process Planning for Fabrication**: aggregate process planning is a methodology for evaluating alternative design and processing options at the early stages. In order to capture necessary design information for aggregate process planning of a complex fabrication, a feature-based, an aggregate product model has been developed. Aggregate product model has been developed. Aggregate process planning makes use of generated aggregate product model and expores alternative processing and fabrication options to find the optimum production method. The next step is the implementation of aggregate process planning methods and their use in evaluation of alternative design options in terms of production time and cost. This includes selection of optimum process and route for minimum product cost or lead time . to cope up with concurrent engineering task Aggregate process planning system will be a suitable tool. Various elements of costs are considered and the factors influence cost are taken care in cost calculations

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19 Product development scheduling using dsm, heuristic and a genetic algorithm: May 2005 Product development process (PD) is an important and complex business process of transforming new ideas into marketable new products, process or services. It constitutes a major contribution to the business excellence. Managing PD is best done through Project Management (PM) approach. The current project scheduling tools are limited to address sequencing and uncertainties. This project work, addresses the uses of managing PD projects through Design Structure Matrix (DSM) and heuristic. The product development projects are delayed either due to delay in particular task or due to the iterations i.e. repetition of group of tasks. Initially, a DSM is generated using Problem Solving Matrix (PSM) based on the information such as, number of tasks, duration of each task and dependency relationship among the tasks. The obtained DSM is then partitioned to give the different group of tasks that iterate due to the dependency relationship among them. Based on this information, the duration of the project is determined by the proposed heuristic through Critical Path Methods and the tasks that are involved in the project scheduled. Then, depending up on the type of delay i.e., task delay or iteration, the project is rescheduled, so that it is finished within the stipulated duration. A Genetic Algorithm (GA) is also proposed for optimization of Schedule under resource constraints. The proposed Methods are validated through a numerical example.

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20 **Intelligent Decision Making for EDM process:2006** a compact selection of Electrical Discharge Machining parameters based on expert rules, which were obtained from experimental results and extracted from the knowledge of skilled operators, is presented. Expert rules are evaluated by the fuzzy set theory. the developed fuzzy model uses fuzzy expert rules, triangular membership function for fuzzification and centroid area method for defuzzification process the system was developed on a pc using MATLAB fuzzy logic toolbox. Inevitably, there are many machining parameters that should be considered in EDM process. Selection of these parameters is still an ill defined problem and generally relies on heuristics, which are not easy to model, and based on the experience of specialist. In this project discharge current, pulse duration is the inputs while the outputs are electrode wear, surface roughness and erosion rate. The remaining parameters are considered at constant rate during machining. the system is compact and homemade tool that can be easily used by an average operator and provides the EDM parameters which lead to less electrode wear, better surface quality and more erosion rate .according to the selected operation . A neural network approach for optimization of cutting parameter is proposed. it describes the multi- objective technique of optimization of cutting conditions by means of the neural network taking into consideration the technological, economic and organizational limitations. The approach is suitable for fast determination of optimum cutting parameters during machining

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21 **Intelligent Energy Management in Compressors:2006** The demand for energy is growing and the energy management has become vital from the smallest concern to the largest multinational . this methods and techniques adopted to improve energy utilization will vary depending on circumstances, but the basic principles of reducing energy cost relative to productivity will be same. Energy management requires huge manual work, time and support of knowledge experts. Moreover energy experts are scarce and costly to hire application of a self decision making energy management device will be faster , cost effective and efficient. This project proposes the use of neural network an expert system to perform energy management in an air compressor. The neural network is trained for optimum output a compressor

should give for standard conditions. Hence when an aberration happens it calculates the deviation of the aberration. Hence the compressor parameters are controlled to optimum level. The energy conserved for a specific period of time is simulated using simulink. this expert system is developed and validated using MATLAB neural. Network and Fuzzy logic toolboxes. Neural network and fuzzy logic were interlinked with well defined user interface using Simulink.

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22 **Intelligent Decision Making on surface finish:2006** machining performance is evaluated by major measures such as cutting speed, feed & depth of cut and the machining quality by the level of surface finish. This paper presents a study of surface roughness while machining cast iron using ceramic tool. A series of cutting tests have been done under various conditions of speed, feed, and depth of cut, corresponding surface finish values have been measured. It then proposes the use of neural network to perform the prediction of surface finish values for a range of machining parameters
. A Neural network is created and trained using a set of known parameters values and then checked this trained network is used for prediction of unknown output values. This system is also economical , efficient and able to be implemented to achieve the goal of inproces surface recognition by determining the weighting, predicting the surface roughness Ra values while the part is being machined, and giving feed back to the operators when necessary corrective action has to be taken.

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23 **Development of an intelligent CAD system: 2007** Intelligent CAD is a tool to verify the designer's ideas in terms of feasibility cost and performance in the concept design stage itself so as to save time and cost. The purpose of the project is to develop an intelligent design system in UNIGRAPHICS using GRIP Language. That is the system must help the designer to choose the product details such as materials used, feature size, processes, Machining parameters, Outsourcing requirements and equipment details. It should correct errors made by the designer. For this purpose we propose to build a knowledge base containing the limitations of the process rules for making decisions and constraints and other details. Referring to this knowledge base the expert system should make decisions about the design. Thus an optimal design will be obtained without costly and time consuming redesign steps.

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24 Fuzzy logic based energy saving technique for a split air conditioning system 2007 New Product development is a typically vague and not well – defined process, and thus, is ideally suited for fuzzy and intelligent modeling. To illustrate the use of these intelligent systems, a general product development model is taken and formulated and investigated by the use of fuzzy if then rules and neural network learning.Although the model is a simplified version, it can be generated easily to model a more complicated system. The basic idea is that modeling by first using fuzzy approximate linguistic if – then rule representation and then fine tuning or improving the accuracy by neural network learning.No matter which evaluation technique is used, a long period of time is always necessary to observe the results of such a strategic level decision.Design is a multi – solution problem. Thus, with a common basis of analysis to make comparisons of product design alternatives is an important work to assure effectively the quality and cost of the designed product.Though many evaluation methods, such as the matrix method, point evaluating method, semantic difference method, 5 point or 10 point scale scoring method, were proposed in the design methodology, every method has its own application situation or object. For a design problem with high fuzziness and uncertainty, the membership function of the fuzzy set can be used to quantify the mental perception of the customer or of the designer The

main objective of this project is to use fuzzy logic based approach in solving problems related to product development, with the help of matlab software and to improve the accuracy of decision making in new product development under uncertainty.

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25 Fuzzy logic for decision making in product design: 2007 New Product development is a typically vague and not well – defined process, and thus, is ideally suited for fuzzy and intelligent modeling. To illustrate the use of these intelligent systems, a general product development model is taken and formulated and investigated by the use of fuzzy if then rules and neural network learning. Although the model is a simplified version, it can be generated easily to model a more complicated system. The basic idea is that modeling by first using fuzzy approximate linguistic if – then rule representation and then fine tuning or improving the accuracy by neural network learning. No matter which evaluation technique is used, a long period of time is always necessary to observe the results of such a strategic level decision. Design is a multi – solution problem. Thus, with a common basis of analysis to make comparisons of product design alternatives is an important work to assure effectively the quality and cost of the designed product. Though many evaluation methods, such as the matrix method, point evaluating method, semantic difference method, 5 point or 10 point scale scoring method, were proposed in the design methodology, every method has its own application situation or object. For a design problem with high fuzziness and uncertainty, the membership function of the fuzzy set can be used to quantify the mental perception of the customer or of the designer. The main objective of this project is to use fuzzy logic based approach in solving problems related to product development, with the help of mat lab software and to improve the accuracy of decision making in new product development under uncertainty.

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26 Performance evaluation of a supply chain: 2008 The supply chain is an important element in logistics development for all industries. It can improve efficiency and effectiveness of not only product transfer, but also information sharingBetween the complex hierarchies of all the tiers. This project presents the formulization of quantitative performance measurements for easy representation and understanding. This project presents the method to performance evaluate a Capacitated Arc Routing Problem. This is an NP-Hard class of problem. CARP finds applications in supply of raw materials to plants, postal services, etc. We quantitatively performance evaluate the different supply chains generated by different existing heuristics and Meta-heuristics. The heuristics discussed are the Extended Path Scanning (EPS), Extended Augment Merge (EAM), and Extended Ulusoy's Heuristic (EUH).And the Meta-heuristics used are Genetic Algorithm and Simulated Annealing. The supplychains are performance evaluated for cost.

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27 Performance analysis of supply chain using simulation: 2008 A supply chain management consists of all parties involved, directly or indirectly, to fulfill a customer request. In supply chain management, it is necessary to obtain the best possible solution to their logistics problems. Various techniques are used to determine the solution in Supply Chain that consists of distributors, retailers, and customers. Among the techniques supporting a multi-decisional context, as a supply chain (SC) simulation, can undoubtedly play an important role, above all for its main property to provide what-if analysis and to evaluate quantitatively benefits and issues deriving from operating in a co-operative environment rather than playing a pure transaction role with the upstream/downstream tiers. In this project, various supply chain models are built

Exhibiting various network flows and these models are simulated with the help of WITNESS. The models are categorized into 3 types, namely Inter organizational supply chain, Network supply chain and Regional clustered supply chain. These models are simulated under the given conditions and the performance analysis is done on the basis of average order lead time, resource utilization and cost.

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28 Heuristic for hierarchal facility location design: May 2008 In this report it is proposed a heuristic for solution of a discrete hierarchical facility location problem. The main features of the model are cost minimization objective, dual level of demand and nested hierarchy of facility. The heuristic is a combination of algorithms to compute shortest path, a greedy heuristic and some intelligent constraints on maximum capacity, demand satisfaction, demand precedence and on dual allocation are used to reduce the process time without losing optimality. A program with graphical user interference is created to solve a two level hierarchical facilities location problem. There program provides for user defined capacity, setup cast and transport cost values .The utility of the model in providing minimal cost solution is illustrated through several tests performed with varying parameters.

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29 Energy optimization in CNC turning process: CNC turning is one of the most prominent machining operation in a manufacturing industry .Optimization of energy consumed in any operation is an area of prime concern in this era. Cutting Speed, Depth of Cut, Feed and Nose radius are found to be the primary parameters in a turning operation and optimization of same is performed. An L-27 orthogonal array is planned to conduct the experiment on a CNC turning machine. A regression model is developed from the L-27 orthogonal array using Response Surface Methodology .Genetic Algorithm (GA) has been used as an optimal solution finder on the regression equation developed.

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30 Modeling and simulation of using robotic work cell: 2009. Robotic workcell simulation is a modeling based problem solving approach developed for the design, analysis and offline programming of robotic workcells. Current industrial practices show that commercial robotic simulation software packages are able to provide designers with an interactive and virtual environment in which credible solutions for robotic workcells design can be obtained. However, conducting robotic workcell simulation studies via robotic simulation packages require designers to carry out complex processes of modeling, programming and analysis which often results in technical challenges and difficulties. In this project, a methodology for developing robotic workcell simulation models via DENEB UGRIP technology is introduced. The development of the method is based on successful applications of DENEB's UGRIP robotic simulation software in designing real robotic workcells.Robotic workcells are important elements in automated manufacturing systems for delivering required manufacturing materials and operations with industrial robots and associated peripheral devices. Rapid design and deployment of a robotic workcell requires a successful application of concepts, tools and methods for fast product design, manufacturing process planning, and plant floor/cell control support. An important technology for achieving this goal is robotic workcell simulation.

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31 Case study in manufacturing system simulation: 2009 The project deals with the performance evaluation of various manufacturing processes with respect to the following parameters a) Throughput analysis b) Time-in-system analysis

c) Bottleneck analysis The goal of the second phase of the study was to analyze the impact of the proposed changes on the overall performance of the manufacturing system. The performance measures selected to evaluate the impact of these changes were the following: Throughput; work-in-process (queue sizes) The Three manufacturing models have been analyzed with the help of simquick. Now a days, in this fierce competition the industries are trying to use many cost cutting measures for gaining the profit and their survival. Before implementing any new manufacturing process in the system its feasibility should be checked with respect to certain parameters i.e. the new process which we are implementing is meeting the standards or not, whether it is cost effective in the present scenario. The equipments necessary for implementing new process is meeting the cost standards which are well within the reach of the manufacturing system.

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32 Product and process optimization using FEA : 2009 Optimization of product and processes are important for efficient manufacturing. The traditional methods limits the design as it uses the rules of thumb and many design methods does not have simple and closed form solutions. The finite element method has been used for many years to solve complex problems. In this project the optimization of product and process by finite element analysis is detailed with illustrative designs. A product that performs as intended and meets all the specified requirements and is least costly to produce is optimum product. The products under study are Double wish bone suspension system, a truck chassis and a Butt weld process by utilizing a commercial finite element packaged ANSYS. Many parts in the suspension system and the chassis are joined by welding. Thus the process requires special analysis as the joints need to be strong for sustaining the loads. In this study thermo elasto plastic analysis is conducted to analyze the thermo mechanical behavior and to evaluate the residual stresses in butt-welded joints. The simulations were carried out using a two-step process; non-linear heat transfer that produces the dynamic temperature distribution throughout the weld seam and the plates, and the elasto-plastic analysis, which yields residual stresses.

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33 **Computer Aided Analysis of an all terrain vechicle using FEA** 2010 The objective of this project is to design and develop an All Terrain Vehicle for a specification using finite element analysis. The vehicle is for a racing event and its performance is tested in various events like hill climbing, braking test event, acceleration test event, and maneuverability test event and endurance race. The vehicular deformations for different conditions like bumping, collision are to be estimated. The critical components of ATV are the roll cage, suspension, steering and transmission systems. The roll cage being the backbone of the ATV; it must support all the car's subassemblies as well as protect the driver. Design is finalized after several iterations. FEA analysis is performed using ANSYS V 10.0 interface. The Finite Element Analysis process require a sound wireframe design on which the appropriate type of elements could be assigned and used for further structural analysis by the application of meshing and loading techniques available in ANSYS software. The Roll Cage is simulated for various cases of Vehicular Deformation like Front Impact Collision, Side impact Collision and One Wheel Impact Collision. Analysis is to be done for the above mentioned conditions to verify that the frame would not undergo excessive stress at any one location for common forces that it would experience during competition. Similar kind of analysis is to be carried out on the A- Arm of the suspension system to determine the stresses developed for the given boundary conditions.

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34 Software selection using AHP and Fuzzy AHP

The project proposes a structured model for evaluating best anti-virus software selection using the analytical hierarchy process (AHP) and fuzzy AHP. . A high quality anti-virus software system is a system which meets the standards of software quality. Software quality assurance plays an essential role in the development of such software systems. Measurement of the software quality includes various factors such as functionality, reliability, usability, efficiency etc. It should take full responsibility of computer system security against all kinds of malwares. This project aims to demonstrate how the model can help in solving software selection decisions in practice. A usability evaluation of the AHP-based model with three antivirus companies is discussed. The model is developed using evidence from an empirical study. The project aims to demonstrate how the model can help in solving such decisions in practice. A usability evaluation of the AHP-based model for prominent anti-virus software is discussed. It also examines the structure of the decision hierarchy, whether it can represent software quality selection decisions in reality and whether it covers all key factors affecting anti-virus software quality selection choices. The effectiveness of the AHP model is studied and the results validated using fuzzy AHP. Through these techniques and concepts, we develop a new decision support system that can resolve MCDM on software selection problem and achieve a consistent attitude toward decision-making. *Keywords:* Analytical hierarchy process (AHP), Fuzzy AHP, software quality, multi criterion decision making, pair wise comparison

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35 Decision making in product development using multi-criteria analysis

The Effective product development rests on a product's design ability to create a positive product experience. This involves complex transformation of product information from customers to engineers to production to sales and back to customers. This work presents the model that gives us a trend of the influence of various parameters, over a time period, that lead to the development of a better product. The multicriteria analysis of product development in a multi-dimensional space is being used. The model shows in which direction the product will be developed on the basis of existing information. In the set multi-dimensional space, in which each observation parameter has a designated polar dimensional in terms of dependence on time, development on the basis of selected products is simulated. The case studies of heating systems, sanitary fittings and washing machines showing influence of various parameters over a period of time are presented. Keywords: multi-criteria decision analysis, product development, multi dimensional space, heating systems.

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36 Knowledge based design of supercritical boiler. Every product developing industry is aiming for to reduce its time to market and thereby a way to reduce time and cost. One approach to do so is to avoid recurrence in process. Knowledge based design allows the designer to automate the routine work, which gives designer more time for creative work, which is fuel of innovation. Knowledge based systems(KBSs) are intelligent computer programs which simulate human decision making capability through the use of separate reasoning engine and set of design rules stored in knowledge base. Since design and based on skill and experience of designers and the company guidelines, the knowledge of the system is classified as facts, procedures and heuristics. KBSs include techniques such as rule based, model based, and case- based reasoning. The present investigation has been focused on knowledge based system, supercritical boilers and development of knowledge based design for supercritical boiler using database management software. The modeling and programming of knowledge based design and user interface was done in VB.NET v10.

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37 Supply chain performance measurement analyses. Supply chain management (SCM) has been a major component of competitive strategy to enhance organizational productivity and profitability. In recent years, organizational performance measurement and metrics have received much attention. The role of these measures and metrics in the success of an organization cannot be overstated because they affect strategic, tactical and operational planning and control. The process of choosing appropriate supply chain performance measures is difficult due to the complexity of these systems. Moreover, an effective supply chain performance measurement system must align with companies own supply chain process. This project presents an overview and evaluation of the performance measures, including balance score card, SCOR and a QFD model used in companies to build their supply chain performance measurements and also provides a frame work for the selection of performance measurement systems. In conclusion, this project suggests a road map consisting of eight steps for companies to follow in the design and implementation phases of establishing a supply chain measurement system

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38 Supply chain optimization of pharmaceutical industry. The shortening of patent life periods, generic competition and public health policies, among other factors, have changed the operating context of the pharmaceutical industry. In this work, we address a dynamic allocation/planning problem that optimizes the supply chain planning of a pharmaceutical company, from production stages at primary and secondary sites to product distribution markets. The model explores different production distribution costs in order to maximize the company's net profit value (NPV). This thesis is intended to highlight the methodology of integrated planning for co-coordinating the supply chain in order to improve a system's overall performance. Mixed Integer Linear Programming formulations are utilized to optimize the system. This algorithm enables the solution of large instances of the problem in reasonable time with good quality

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39 Supply chain management in healthcare industry. The supply chain process is essential link for all programs and services offered by hospital, and hence any improvement in managing supply chain can positively impact bottom line profitability of any hospital's operation. The first topic of future research concerns the adoption of new technology to hospital, especially if the new technology significantly affects the rest of supply chain. The second proposed topic concerns the use of better demand forecast to improve service while reducing inventory. This includes the analysis of sourcing and services, inventory and distribution management and purchasing systems and technology. Because of scheduled surgeries and other known events, a large portion of future demand can be determined exactly. Therefore, inventory management technique that takes advantage of derived demand should be investigated for application within the healthcare value chain.

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40 A knowledge based system for assigning service technicians. Field service management most commonly refers to companies who need to manage installations, service or repairs of systems or equipment at customer sites. FSM comprises of forecasting, planning and optimization, execution, control and continuous improvement. This project focuses on planning and optimization face of the field services value chain. In real world, resource planners are finding difficulty in allocating right resource to the right scope due to lack of visibility of their availability, skills and location for a given period. Due to multi criteria involved in decision making under a dynamic and uncertain field service environment. There is a need to

develop a system to recourse planners to identify the right resource in short span. Minimal has been done in this area through exploiting the heuristics, traditional techniques as well as knowledge based analysis. Through this project we have developed a program that could assign optimal technicians to service faults considering multiple factors using knowledge based system. This can be used as an effective tool for addressing service faults of automobile companies.

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41 Energy management strategy for parallel hybrid vehicle using Fuzzy logic. In this project, a fuzzy logic controller is developed for hybrid vehicles with parallel configuration. Using the driver command, the state of charge (SOC), and the motor/generator speed, fuzzy logic controller rules have been developed, to determine the split between electric motor and internal combustion engine. The underlying theme of the fuzzy rules is to optimize the operational efficiency of all components, considered as one system. Simulation results have been used to assess the performance of the controller. A forward-looking hybrid vehicle model was used for implementation and simulation of the controller. Potential fuel economy improvement has been shown by using fuzzy logic, relative to other controllers, which maximize only the efficiency of the engine. Hybrid electric vehicle (HEV) improvements in fuel economy and emissions strongly depend on the energy management strategy. It is shown that it is possible to obtain the optimal control policy using the instantaneous minimization of a well-defined cost function dependent only on the system variables at the current time.

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42 **Development of predictive models for Wire electrical discharge Machining Process**

Autonomous factories rely on effective and efficient decision making tools. The decision making is increasingly difficult due to rapid changes in design due to variety of products and processes. There is a need to develop generalized models which can dynamically predict a wide variety of process parameters to assist the intelligent manufacturing system. The intelligent tools such as Neural network, fuzzy logic and evolutionary algorithms are being attempted in the decision making process to increase flexibility, accuracy and productivity. Wire electrical discharge machining (EDM) is a non-traditional machining process that uses electricity to cut any conductive material precisely and accurately with a thin, electrically charged copper or brass wire as an electrode. During the wire EDM process, the wire carries one side of an electrical charge and the workpiece carries the other side of the charge. When the wire gets close to the part, the attraction of electrical charges creates a controlled spark, melting and vaporizing microscopic particles of material. The spark also removes a miniscule chunk of the wire, so after the wire travels through the work piece one time, the machine discards the used wire and automatically advances new wire. The process takes place quickly—hundreds of thousands of sparks per second—but the wire never touches the workpiece. The spark erosion occurs along the entire length of the wire adjacent to the workpiece, so the result is a part with an excellent surface finish and no burrs regardless of how large or small the cut.Wire EDM machines use a dielectric solution of deionized water to continuously cool and flush the machining area while EDM is taking place. Predictive model comprising of Multiple Regression and Artificial Neural Networks are proposed for the prediction of Material removal Rate, Kerfwidth, Wire Wear Rate and surface roughness in Wire- Electrical Discharge Machining Process. Training of the model was performed with data from WEDM experiments on Nickel-based superalloy. The proposed models use Pulse On, Pulse Off, Current and Voltage as input parameters. Regression Analysis was carried out in order to find relationship between individual parameters and result are reported. The normal residual plot for the individual regression models were validated and models were found to be fit. .

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43 Scope of vendor managed inventory in Bharat Heavy Electricals Limited
In the traditional method, the customer manages his own inventory and places replenishment orders that are made to order by the manufacturer. An efficient integration of the supply chain is very important for the companies to be competitive. One of the supply chain initiatives is Vendor Managed Inventory (VMI), in which supplier is responsible for keeping the inventories at adequate levels of the customer, generating benefits for both the customer and the supplier. VMI is expensive for the manufacturer as the inventory costs are transferred from the customer to the manufacturer. Being responsible for the inventory management, the manufacturer can coordinate the production and inventory control decisions. Commodities are automatically pushed to the custodian as the supplier checks the custodian's stock status and responds, according to pre-established maximum and minimum stocking limits. In Bharat Heavy Electricals Limited, there are many sections where VMI system can be applied and get better results than the existing system. Our aim is to implement the VMI system to various sections of BHEL and checking for technical advantages, economic advantages and competitiveness.

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44 Prediction of performance in abrasive water jet machining Abrasive Water Jet Machining (AWJM) is a non-traditional machining process in which material removal takes place by high pressure flow of water and abrasive materials through small nozzle. Abrasive Water Jet Machining (AWJM) is used when precision is of prime importance. The cutting operation in AWJM is challenging and improvement of more than one machining performance measures which are Metal removal rate(MRR), Kerf width(KW), Surface roughness(Ra) are expected. The present work is aimed at predicting the performance of an AWJM process by considering the simultaneous effect of various input parameters. Feed forward back propagation neural network models were developed and used for predicting the parameters using MATLAB software. Regression analysis is done to develop the best fitness function for the given data using MINITAB 14 software. The process parameters are optimized using artificial neural networking by using MATLAB software. Confirmation experiments were conducted to validate the results given by ANN. The different strategies that are adopted for the prediction of machining quality machining theory approach, experimental investigation design of experiments and intelligent techniques. The multiple regression analysis is done to develop multiple regression equations. These equations are used to generate additional data for training the neural networks along with the experimental data. The experiments are designed and conducted as orthogonal array as per the principles of Taguchi's design of experiments. The intelligent tools applied in the modelling of machining processes are Back propagation neural networks. These function replacing hybrids are compared for their performance in terms of number of epochs required for training the network and results are presented. The scope for the future research is identified.

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45. **An energy audit in industrial system**
Energy auditing is a core component of any energy management system; unless energy use can be measured it is difficult to control and, without baseline performance metrics, a site's performance improvement cannot be measured over time. Whilst auditing a site that has a limited number of energy meters is a difficult proposition, there are ways of gathering sufficient information to allow a practical engineer to make an educated assessment of the breakdown of energy usage across a complex manufacturing plant and identify suitable energy saving opportunities.
The four Appendices cover specific issues around key universal energy technologies: Lighting, Compressed air, Steam systems and fired heaters (Ovens), Refrigeration and air conditioning. Included in the appendices are checklists that may be referenced during the course of an energy audit that cover key energy using aspects of

equipment. Energy is one of the major inputs for the economic development of any country. In the case of the developing countries, such as our India, the energy sector assumes a critical importance in view of the ever-increasing energy needs requiring huge investments to meet them. Hence for reducing cost and increasing efficiency, use of *energy conservation, management and audit* is required.

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46. **Design of a compressed air energy storage system for storing renewable energy**

As India is expanding in Industrial sector we require methods to tap in energy from renewable sources and to store this energy for future use. This project is aimed in finding a greener way of storing energy through mechanical means. Most energy storage systems require the useful energy to be converted from its initial state into another form, which is more suitable for storage. When ready to use, it's then converted back into a useful form. With each conversion there are losses associated which affect efficiency, for this reason efficiencies of 100% are not achievable. Compressed Air Energy Storage (CAES) is not an unproven technology and on a large scale there are two existing CAES plant in the world. The first plant ever built was in Huntorf Germany, which was commissioned in 1978 and capable of producing 321 MW for two hours. The second was in McIntosh Alabama USA, which was commissioned in 1991 and capable of producing 190MW for 26 hours. CAES technology would dramatically lighten the loads on networks, help people who cannot connect to a power grid and serves as an advantage to those people living in developing countries. It is said that the most common solution for small to medium storage is batteries, although very good at storing energy they are very hard to recycle and are very dangerous if not used correctly. Yet the benefits of compressed air over electric storage are the longer lifetime of pressure vessels and materials are entirely benign as well as life time costs are potentially lower.The approach is to design a mechanical energy storage system based on compressed energy storage method by utilization of solar energy. The design approach is to utilize Photovoltaic(PV) units in the initial energy production and use of it in working a compressor to compress air and store in a tank and then use a turbine to expand the air and use it to run an ac generator for the production of energy whenever needed. The design is based on the A-CAES technology where there is an additional Thermal Energy Storage(TES) system used unlike the one in adiabatic condition. Using Ideal gas law and thermodynamic equations in adiabatic condition we can use it to find the size of the components. The sizing of the components is based on ideal conditions. The sizing is found out using the assumed values and further improvements are discussed

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47. **Vendor managed inventory- a case study**

This report briefly reviews some recent work aimed at inventory management and its problems in today´s competitive world. The study is focused especially on BHEL. The goal is to outline the major difficulties influencing the performance of BHEL in connection with the complexity of their inventory management. Industries are facing difficulties of Large Inventory Capital Management and Stock outs. The Major part includes describing the building of Quantity Based Dispatch Model of Vendor Managed Inventory and implementing it under Stochastic conditions that should positively influence the inventory management and gain some savings in terms of Inventory Cost Holdings. Vendor-managed inventory is a family of business models in which the buyer of a product provides certain information to a supplier (vendor) of that product and the supplier takes full responsibility for maintaining an agreed inventory of the material, usually at the buyer's consumption location (usually a store). Modelling of Current inventory model and Vendor Managed Inventory model is carried out in Arena Simulation Software And Value of Total Inventory Cost and Inventory

level is optimized using optimization Opt Quest Tool. Finally, Summary and Contribution of Research is highlighted.

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48. **Fault diagnosis using neural networks** In earlier days maintenance function is not considered as integral part of production process. However in today's global competitive market there is intense pressure from manufacturing industries to continuously reduce and eliminate costly unscheduled downtime and unexpected breakdowns. Importance of maintenance function is increased as it helps to keep machine throughout the production which in turns help to improve the quality of product. E-maintenance is the process of execution of maintenance and/or exchange off maintenance related information in an electronic way. This project thesis outlines the basic concept of e-Maintenance, different tools of e-Maintenance and how Artificial neural networks (ANN) are used to achieve e-Maintenance by diagnosing fault conditions of a machine. The data has been collected and they are used to train in the artificial neural networks so as to identify the faulty conditions of the pneumatic valve. It is also important to find the factors which are responsible for faulty operations of the equipment. Now this trained artificial neural networks will be used for fault diagnosis of equipment and the factors for faulty operation.

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49. **An automated visual inspection system using a robot**

Every industry must meet the required quality standards; hence quality plays a major role in manufacturing of a successful product. Inspection is the tool used to ensure the quality of produced parts. Most common/general form of inspection is the Visual inspection, and human visual inspection has lots of disadvantages like being error prone, etc. Hence Vision systems are being developed to conduct automated visual inspection. To be acceptable in industry, vision systems must be inexpensive, within the speed of the production-line flow, and very accurate. While visual inspection is high in potential, at present the design and implementation of automatic visual inspection systems is labour-intensive. In addition, most of the visual inspection systems are developed in isolation with no systematic approach. Increasing flexibility to allow the inspection of parts whose positions are less constrained is desirable. This work aims to show a systematic automated visual inspection concept that separates the detection of primitives from the model-based analysis process. This separation is obtained by defining a general analysis graph for inspection, containing detail relations that represent detection algorithms. Together with an object-specific description, deemed in a so called description language, the analysis graph is instantiated. Existing pattern recognition software is re-used in the detection stage and therefore the use of any detection algorithm is possible without changing the analysis. The concept can be seen as a "recipe" for solving industrial applications, stating which kind of decision has to be made at which stage.

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50. **DESIGN AND DEVELOPMENT OF SOLAR PHOTOVOLTAIC REFRIGERATOR**

A reliable and energy efficient approach to providing refrigeration needs (both grid connected and off-grid areas) is a major challenge in most developing countries due to low energy access and unreliable power supply. Research and development of appropriate and sustainable stand-alone refrigeration technologies are therefore relevant and essential. In the current study, the methodology of connecting a refrigerator to solar s has been explored. A130 L stand-alone solar powered refrigerator has been developed. The design replaces includes a battery to back up the system when the power input becomes low. Thus providing refrigeration throughout a day. In this study, the refrigerator is powered by an installed 100 Watt peak (Wp) solar PV panel, 20 A charge controller and a 100 AH battery bank.. The performance (in terms of evaporator temperature profile and energy consumption) of the refrigerator has been evaluated. The experimental results revealed that the 130 Litres refrigerator performed optimally as expected during the peak sun hours (9 am to 4pm approx.) and battery comes into play at night time and an inverter helped in controlling the fluctuations in power and thus making it a robust system. Finally, an economic assessment conducted on the

overall power requirement revealed that the solar powered refrigeration system reduces the power consumption dramatically. Keywords: Compressor, Stand-Alone Solar PV, Refrigeration, Energy Savings.

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51 Optimisation of Micro Turning Process Micro machining is the most basic technology for the production of miniature parts and components. Miniaturization of industrial products had been the trend of technological development. Extraordinary properties of materials like high strength, High hardness, Corrosion resistance etc., demands development of machine processes. Micro turning is one of the best processes for making pins. Micro turned pins are used in automotive parts, aerospace industries and in circuit boards. Turning is one of the most basic operations used for machining. This project is focused on the establishment by optimization of micro-turning parameters by using Taguchi, ANOVA, Regression analyses and performing neural networks on the observations. Turning operations are common in the automotive and aerospace industries where large metal workpieces are reduced to a fraction of their original weight when creating complex thin structures

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52 New Product Success by Integration of QFD and FMEA Product life cycle management as the integrated, information driven approach to all aspects of a product's life, from concept to design, manufacturing, maintenance and removal from the market, has become a strategic priority in many company's boardrooms. The importance of new product development within product life cycle management has been highlighted virtually in all businesses. In business and engineering, new product development covers the complete process of bringing a new product to market. It requires understanding of customer needs and wants, the competitive environment, and the nature of the market. Cost, time and quality are the main variables that drive customer needs. Focusing on these three variables, new product development techniques have been used to develop products that satisfy customer needs.This project explores the design and planning phase of the new product development. In market, companies find difficulty in determining the exact technical requirements according to the customer needs. Hence a quality function deployment model is developed to determine the main technical requirements as per customer needs, and also considering the technical features of the competitors products. Failure mode effects analysis is developed to understand the causes and effects of failure of the product. This model uses risk priority number values to analyze the prime failure modes. An integration of quality function deployment and failure modes effects analysis decision model is developed. This model first analyses the technical descriptors and evaluation criteria. The analyzed technical descriptors are compared with the competitor's technical descriptors to determine the critical technical descriptors. Further, the failure modes corresponding to these technical descriptors are analyzed based on risk priority number values. The failure modes having low risk priority number values are said to have low probability of failure and the corresponding technical descriptor is best suited for product development.

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53 Optimization of Process parameters for Microdrilling In the present growing world of technology, micro-machining process has demanding operation in various sectors like aerospace, oil, defense, automobile, biomedical science. The micro-drilling is the part of solid tool based micro-machining operation. Generally micro-drilling is used to fabricate micro-holes in micro-products, various factors has to be considered and these factors are known as process control parameters. In this study, the cutting speed and feed rate will be taken as process parameters and thrust force and machining Removal Rate has been measured. The project is aimed at the design of experimental analysis and neural network analysis of the system for micro-drilling processes and responses(Thrust force, MRR). The interpretation of data for L27, 3 parameters and 2 responses, is done considering the different plots obtained

using the software. Generally micro- drilling is used to perform micro holes and the factors which facilitates the performance are considered. In this work, optimization of process parameters like Drill diameter, Feed rate, Spindle speed are considered to obtain a lower thrust force and high MRR. DOE has been performed to select the levels of input parameters and further ANOVA modeling is performed to compare the Mean values obtained for process factors with respect to different responses using the F- distribution. Neural network analysis is done to forecast the output values from the input parameters given using Function fitting and Curve model.

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54 Development of Vendor Managed Inventory System This report briefly reviews some recent work aimed at inventory management and its problems in today's competitive world. Inventory management is the management of inventory and stock. As an element of supply chain management, inventory management includes aspects such as controlling and overseeing ordering inventory, storage of inventory, and controlling the amount of product for sale. The study is focussed especially on Large and medium-sized industries with production processes. The goal is to outline the major difficulties influencing the performance of these manufacturing companies in connection with the complexity of their inventory management. Industries are facing difficulties of Large Inventory Capital Management and Stock outs. The major part includes describing the building of Quantity Based Dispatch Model of Vendor Managed Inventory and implementing it under Stochastic conditions that should positively influence the inventory management and gain some savings in terms of Inventory Cost Holdings. Vendor Managed Inventory is a family of business models in which the buyer of product provides certain information to a supplier (vendor) of that product and the supplier takes full responsibility for maintaining an agreed inventory of the material, usually at the buyer's consumption location (usually a store). A third-party logistics provider can also be involved to make sure that the buyer has the required level of inventory by adjusting the demand and supply gaps. As a symbiotic relationship, VMI makes it less likely that a business will unintentionally become out of stock of a good and reduces inventory in the supply chain. Furthermore, vendor (supplier) representatives in a store benefit the vendor by ensuring the product is properly displayed and store staff are familiar with the features of the product line, all these while helping to clean and organize their product lines for the store. VMI can also decrease the magnitude of the bullwhip effect. Modelling of Vendor Managed Inventory model is carried out in Arena Simulation Software and Value of total Inventory Cost and Inventory level is optimized using optimization tool. Finally, Summary and Contribution of Research is highlighted.

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55. **Evaluation of Sustainable Manufacturing A Case Study** Sustainable Manufacturing and operations have become a crucial issue in the present scenario for manufacturing firms. The emphasis on adopting eco-friendly practices, implementing sustainability measures, and protecting the environment has continued to grow, gaining traction across diverse industries, sectors, and settings including the manufacturing world. While industries were trying to reduce material and energy consumptions to bring down the cost and attain economic stability, presently manufacturing firms are keenly interested to become sustainable in all aspects. Goal oriented approach should be developed to ensure the sustainability of the industry. This work presents the major sustainability criteria and the factors that drive these criteria. The various methods and standards to evaluate the sustainability of the industry were analysed. This will provide intricate understanding to measure the sustainability of an industry in order to suggest measures to improve sustainability. A case study on "Section manufacturing" Industry is done. The existing processes were studied in a detailed manner considering the major criteria for sustainability, and scope for sustainability improvements were identified. The predominant process in this case is Submerged Arc Welding; any improvement in this process will have a positive impact on all the primary aspects of sustainability. Measures

to improve the sustainability of this case study were suggested. This work will help as a reference material for industrialists to evaluate their status of sustainability and to improve the sustainability index.

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56.Process Evaluation using Value Stream Mapping Value Stream Mapping (VSM) is a World Class Manufacturing tool that can be used to minimise waste in manufacturing. Companies are experiencing intense competitive pressure due to globalisation hence they cannot afford to operate with waste in their processes. And further this lean manufacturing technique that originated from the Toyota Production System is used to analyse and design the flow of material and information required to bring a product or service to a consumer in an efficient manner. The main objective of this thesis is to analyse the process of a furniture industry using value stream mapping and to improve the efficiency of the process.Various lean tools such as overall equipment effectiveness, fishbone chart, process flow diagrams and man machine chart are used to identify and quantify non value added activities and analyse the present state of the industry. And further lean manufacturing principles are suggested for the removal of the waste, production levelling is used to balance the takt times of all operations and further eliminate bottlenecks from the present state map. As a result, the improved value stream maps were proposed to the industry, the improved state of map can improve the efficiency of the process.Researchers and practitioners can review these concepts aiming to test its general applicability for improvement in different batch production systems with high product mix variety.

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57.**Life Cycle Assessment A Measure of Industry 4.0 Attainment** Life cycle assessment (LCA) is a well-established methodology for assessing the environmental impacts of products and services. An LCA entails examining the product from the extraction of raw materials for the manufacturing process, through the production and use of the item, to its final disposal, and thus encompassing the entire product system. In this study, LCA has been performed on a component and analysed its global environmental impacts. However, the conventional LCA method, which is extremely time consuming and often limited by uncertainty in the inventory data, has duration gap in assessing the environmental impacts. The present assessment method is not able to record the raw materials & energy consumption and emissions to surroundings in real time. The manufacturers across all the sectors who are actively looking to move to Industry 4.0 can no longer rely on the conventional LCA framework. Over the last few years, the fourth industrial revolution has attracted more and more attentions all around the world. Smart manufacturing in an Industry 4.0 setting requires developing unique infrastructures for sensing, wired and wireless communications, cyber-space computations and information tracking. While an exponential growth in smart infrastructures may impose drastic burdens on the environment, the conventional Life Cycle Assessment (LCA) techniques are incapable of quantifying such impacts. This study has measured the attainment level of Industry 4.0 technologies in the perspective of existing LCA. Therefore, it is found that there are gaps between advances in the manufacturing domain and the environmental assessment field. It is identified that the key technologies and components of Industry 4.0 can fill the gaps measured facilitating advanced impact assessment, and decision-making mechanisms that match the needs of future manufacturing strategy. This study has proposed a future LCA model that possess the capabilities of tracking the data real-time utilizing the Internet of Things (IoT) with fully decentralized and self-configured architectures.

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58 **An analytical study of barriers in dairy Supply chain using AHP** Dairy industry is an important global industry with considerable contributions to a country's economy, the supply chain covers every stage of the food system starting from the milk production at

farmer's level to final consumption. It also plays an important role in the socio-economic status of rural India, especially in women empowerment. For achieving success in the dairy supply chain, it is needed to focus on factors that can cause hindrances to the supply chain system. Barriers can be of various kinds, from lack of manpower to lack of customers. The study explores such barriers to the dairy supply chain. After extensive study through literature review a total of 20 barriers have been identified. The necessary data required for ranking was collected through a survey by experts from the dairy industry in India on the difficulties faced to keep the dairy supply chain intact. and had been carried forward for AHP(Analytical Hierarchy Process) analysis and have been ranked accordingly based on criticality and severity.

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59 **Prediction of weld bead width using artificial neural networks** Welding is the most widely used metal joining process. Creating a model which is able to predict the quality of weld bead is the first important step towards automating welding. Semiautomatic and fully automatic systems increase output by eliminating the human factor from the welding process. Automated welding systems offer four main advantages: improved weld quality, increased output, decreased scrap and decreased variable labour costs. Weld quality consists of two factors: weld integrity and repeatability. Automated welding systems ensure weld integrity through electronic weld process controllers. Combining mechanized torch and part motions with electronic recall of welding parameters results in a higher quality weld than can be accomplished manually. This offers instantaneous quality control. In this project, we try to predict a feature that determines the quality of weld-bead i.e. weld bead width. We use Artificial Neural Networks for our rendering. Semiautomatic and fully automatic systems increase output by eliminating the human factor from the welding process

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60 **Manufacturing process improvement by using Value Stream Mapping** VSM is a lean strategy used for identification and implementation of lean practices more effectively in manufacturing plant to improve efficiency of product flow. Companies are experiencing intense competitive pressure and demand to improve efficiency due to globalisation. This lean manufacturing techniques that originated from Toyota production systems is used for analysing and designing the flow of material and information required to bring a product or service to a consumer. The main objective of this thesis is to analyse a metal manufacturing factory based on data using value stream mapping. Various lean tools such as overall equipment effectiveness, fishbone chart, process flow diagrams and man machine are used to identify and quantify nonvalue added activities and analyse the present state of the industry. further some defects are also identified in the process flow and measures are suggested to curb them to make process more efficient. Future state map is drawn with some suggestions to reduce processing time in factory. The value stream mapping process is utilized to analyse the work and target waste, the removal of which has projected future improvement toward a better state. As a result, the improved value stream maps can be guidelines for future studies.

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61 **Intelligent process model for bead geometry prediction in WAAM**

Wire and arc additive manufacturing (WAAM) is a predominant technique for metal based additive manufacturing process. In this process, generation of layers by depositing beads puts high emphasis on single bead geometry. This Work focuses controlling the bead geometry by suitable selection of welding process parameters. For this artificial neural network (ANN) is modeled to predict the bead parameters based on given process parameters and then the reverse model is designed to select the weld parameters based on user specified bead geometry. The results show that the variable welding parameters are significant, and the ANN model assures the possibility of predicting welding process parameters for desired bead geometry in WAAM application.

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62 **Sustainable measures in industrial application** The growing advances in the manufacturing sector are forcing us to rethink and redesign existing production systems to address the challenges posed by globalization and environmental concerns. Increased customer awareness has changed producers' focus on sustainability. In the current business climate, financial benefits were no longer a significant concern. As a result, many innovative techniques are being introduced into production systems, such as slower, greener, faster, and more sustainable production processes. However, many production strategies are always limited to one or two items. There are no reliable guidelines available to ensure the successful implementation of sustainable production. Humanity faces global challenges related to the economic and social environment, e.g., The world's population is looking for a way of life for developed countries, resources, and the global ecosystem is under increasing pressure, a significant challenge for humanity, which is the effect of global warming on the environment. It was forecasted that in the late 21st century, global warming would have risen from 1.2 to 5.5 degrees Centigrade compared with actual prices, the reasons for human consumption of mineral oil, deforestation, and certain farming practices. Nowadays, the use of force worldwide is almost seven times as high as during the 19s. It was felt that developed and developing countries must face these challenges together to preserve the resources and environment of the planet for future generations at the global political level—steps to implement global strategies and regional governance and promotion programs. The principle of sustainability as a statement of development machinery goes where attention is given. Sustainability comes from the forest, where only as much wood will be found as can be achieved through reforestation. In the contemporary business environment, financial benefits no longer were the primary concern. As a result, many innovative strategies were brought into manufacturing systems, such as lean, green, agile, and sustainable manufacturing practices. In this study, 25 measures were obtained by reviewing research papers and articles; these measures were analyzed by checking the reports and shortlisted 20 steps. The shortlisted measure was analyzed using the DEMATEL method. DEMATEL is a multicriteria decision-making tool that identifies the relationship between measures based on the data obtained by experts. DEMATEL's way of making decisions in many ways. After identifying the steps, hypothetical data was collected, and a direct relationship matrix was created, which then was normalized to equal scales. The matrix is then converted into a total relationship matrix from a simple effect diagram developed, which indicates the most and least influencing measures. The results obtained in this study show that the most influencing efforts were Focusing on 6R concepts. This study satisfies its research objective by providing a fruitful approach to research that contributes to the effectiveness of sustainable production.

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63 Ranking indicators for sustainability indicators The purpose of the present study is to identify the vital indicators of environmental sustainability (EN) that are utilized in the manufacturing sector. Identifying vital indicators of environmental sustainability in manufacturing becomes important due to the large uneven number of indicators for sustainability assessment. The research work identifies and proposes a list of vital indicators of Environmental, Social & Economic Sustainability through exhaustive review of the literature using MCDM (Multi-criterion Decision Making technique of decision-making TOPSIS'. Further, these indicators were prioritized and ranked with the help of the Best-Worst method, which is a new MCDM technique. This technique is implemented to rank and arrange the ENs following their criticality by assigning them a weight. This work will be helpful in the successful implementation and/or evaluation of sustainability assessment, particularly in manufacturing industries in India.

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64 Preparedness for Industry 4.0 This Project concentrates on developing a framework to measure the readiness of an Industry towards Industry 4.0. With the help of the

information available in the literature, 7 dimensions with 5 Intervention points in each dimension are constructed which is the starting stage of the development of this framework. A Questionnaire is made with questions pointing to the intervention points. A total of 35 questions were made, and responses from companies were collected. The Intervention Points within each dimension is ranked using Multiple criteria decision making and performance factor is found for each Intervention point. This Performance factor is multiplied with the responses of each question to arrive at the final value, and percentage value is calculated which is the final output of the framework. This project helps companies to understand how prepared/ready they are towards Industry 4.0. It helps them to learn about new technologies that they could possibly implement in their Industry, while responding to the questionnaire.

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65 An Enhanced E Maintenance Framework This research project aims to integrate the new technologies which are recently invented and helpful to the e-maintenance in the industry. In this study we will try understanding the importance of e-maintenance and how integrating new technologies to e-maintenance will help the overall efficiency of maintenance in the industry. In this project we are going to use a hybrid approach for the e-maintenance framework. The advantage of the hybrid approach is it is not as simple as Newtonian or very complex where maintenance is time and resource consuming. In most of the frameworks which have been on the e-maintenance have not focused much on the technologies like Predictive analysis, AR and VR technologies. This report will mainly focus on the how to implement advanced technologies in an e-maintenance framework. To understand its important, we have gathered the information from previous research and data. Results obtained by various companies after using predictive analysis have been added. Our research findings should be of interest for those who want to implement or enhance their maintenance with new technologies. This paper concludes by discussing the importance of the hybrid approach enhanced with the new technologies.

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66 Comparative analysis on Assesment models for industry 4.0 Maturity level

This research project compares the maturity assessment level of the CCMS 2.0 model and the Line-Warwick model, two prominent frameworks for assessing organizations Industry 4.0 maturity levels. The stall is motivated by the increasing need for small and medium-sized enterprises (SMEs) to embrace Industry 4.0 technologies and their difficulties in choosing the most suitable maturity assessment framework. To conduct the comparison, we evaluated the subcategories of software, such as product design and development, smart material planning, smart procedure, smart maintenance, and smart logistics, and hardware, such as machine readiness, machine communication, and IT security. We rated catch subcategory based on its strength or weakness and assessed the maturity level of each model. In addition to the comparison, we conducted a SWOT analysis to identify both models' strengths, weaknesses, opportunities, and threats. The analysis provided valuable insights into each model's potential advantages and disadvantages and helped us understand the factors that could influence the choice of the proper framework. Our research findings will help SMEs choose the most appropriate Industry 4.0 maturity assessment framework for their needs. This is particularly important as SMEs often need more resources and expertise to select the proper framework

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67 Enhancing green total factor productivity through manufacturing output servitization

This study focuses on the urgent need for sustainable practices in manufacturing industries amidst the backdrop of increasing environmental pollution and dwindling resources due to traditional manufacturing methods. By analysing data from various manufacturing companies, ranging in power, scale, and position, the study delves into the impact of manufacturing servitization on green total factor productivity (GTFP), which measures the overall effectiveness of production while considering environmental consequences. The findings suggest a notable correlation between manufacturing servitization and GTFP. Specifically, companies that adhere to the Global Reporting Initiative framework for environmental, social, and governance reporting tend to experience a more substantial positive influence on GTFP due to their adoption of manufacturing servitization. This highlights the pressing issue of environmental pollution and resource depletion resulting from traditional manufacturing practices. The study utilizes data from a range of manufacturing companies, acknowledging their diversity in terms of size, influence, and operational scope. The focus of the study is on manufacturing servitization, which refers to the integration of services into traditional manufacturing processes. This strategy aims to enhance customer value, operational efficiency, and sustainability.GTFP serves as a metric for evaluating the overall efficiency of production while considering its environmental impact. It provides a holistic view of a company's performance, considering both economic and environmental dimensions. The study's findings suggest a significant relationship between manufacturing servitization and GTFP. This implies that adopting servitization practices can potentially improve both economic performance and environmental sustainability. Overall, the study sets a strong foundation for understanding the intersection of manufacturing servitization, environmental sustainability, and productivity enhancement. The implications of the study extend beyond individual companies to the broader manufacturing industry, emphasizing the imperative of adopting eco-friendly practices for long-term viability and success.

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68. **Performance metrics for a smart manufacturing system**

The emergence of smart manufacturing systems is characterized by the integration of new technologies that facilitate rapid and extensive information flow throughout the manufacturing process and its control mechanisms. These systems offer unprecedented levels of awareness, agility, productivity, and resilience by leveraging real-time manufacturing data. However, effectively collecting and analysing this vast amount of data to inform decision-making is a complex and dynamic endeavour. Ensuring that smart manufacturing systems operate as intended requires robust performance assurance measures. These measures encompass activities across system design, operation, performance assessment, evaluation, analysis, decision-making, and control, necessitating potential adjustments to traditional approaches. This paper evaluates current methods and tools utilized to establish and uphold system performance standards, highlighting trends in data and information system integration, performance measurement, analysis, and improvement crucial for the reliable performance of smart manufacturing systems.

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69 **A measure of sustainability for an industry**

This thesis focuses on evaluating sustainability development initiatives in the Fast-Moving Consumer Goods (FMCG) and automobile industries in alignment with the United Nations Sustainable Development Goals (SDGs). The study analyses data from five major companies in each sector, assessed across ten selected sustainability criteria. These criteria are carefully chosen to reflect the key environmental, social, and governance (ESG) aspects relevant to the SDGs. A Multi-Criteria Decision-Making (MCDM) approach is employed using the Decision Making Trial and Evaluation

Laboratory (DEMATEL) method to identify the most influential criteria and understand the causal relationships among them. To support this analysis, a cause-and-effect diagram is developed to visually interpret the interdependencies between sustainability factors across the two industries. The integrated approach helps in identifying the leading companies in terms of sustainable practices and provides strategic insights into improving industrial sustainability. The findings of this thesis contribute to a deeper understanding of corporate sustainability performance and offer a comparative framework that can guide future policy, industry benchmarking, and academic research in sustainable development.

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70 **Evaluation of readiness for digital manufacturing**

This thesis explores the concept of digital manufacturing and evaluates the readiness of organizations to transition towards it in the era of Industry 4.0. As technologies like IoT, AI, big data, and cyber-physical systems reshape manufacturing, companies must adopt digitally integrated processes to remain competitive. However, this shift requires more than technological upgrades calls for strategic planning, skilled workforce, cultural adaptability, and supportive infrastructure. The study assesses key readiness dimensions such as technological infrastructure, workforce capabilities, leadership commitment, and organizational culture. A hybrid methodology, comprising literature review, surveys, and case studies has been used to capture both quantitative and qualitative insights. Findings reveal that while many firms have initiated digital adoption, significant gaps remain in strategic alignment and skills development. The thesis concludes with targeted recommendations to help organizations close these gaps and better prepare for a successful digital transformation. The results aim to guide businesses and researchers in fostering a more future-ready manufacturing ecosystem.

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71 Optimizing service absorption ratio: an automated MSI tracking framework for heavy construction In heavy construction, the Service Absorption Ratio (SAR) is critical for financial resilience. At PPS Motors, manual MSI tracking caused revenue leakage and warranty risks, creating blind spots in service capture.

To resolve these inefficiencies, this project replaces manual oversight with a synchronized engine monitoring equipment via two concurrent streams: HMR-based thresholds and calendar-based intervals.

MSI Engine: Acts as the technical backbone, establishing automated guardrails (e.g., 50-hour compliance windows) to ensure strict adherence to Tata Hitachi OEM standards. By integrating Excel VBA and Python, the system reduced manual data entry errors by 95%. Color-coded urgency indicators minimize cognitive load for staff, while "Service Done After" metrics provide data-driven insights into appointment conversion. This transition to a predictive model maximizes revenue, ensures warranty compliance, and transforms PPS Motors into a precision-driven service organization.

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72 **Configuration-driven data orchestration and integration hub framework**

The methodology adopted in this work follows a six-month phased approach encompassing platform onboarding and baseline understanding, orchestrator deep-dive analysis, metadata model exploration and configuration standards development, incremental load framework study, observability and operational readiness assessment, and final documentation consolidation. Configuration standards and a pre-run validation checklist were developed to ensure consistent job onboarding and reduce runtime failures caused by metadata mismatches, connection errors, or missing configuration fields.

Results and observations demonstrate that the configuration-driven approach reduces new source onboarding time by approximately 60-70% compared to traditional custom-coded pipelines. The metadata-driven execution model enables scalable job management without requiring changes to the core orchestration logic. Incremental loads achieve up to 80% reduction in data processing volume for frequently updated sources. The priority-based

execution model provides flexible dependency handling while maintaining deterministic behaviour across complex multi-step jobs.
The thesis concludes with an analysis of current limitations including watermark reliability for edge cases such as late-arriving data, the need for enhanced cross-engine logging consistency, and recommendations for future enhancements in areas of real-time streaming integration, machine learning–based anomaly detection in pipeline execution, and automated configuration validation using rule engines.

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73 **Adoption of ai approaches on E-maintenance**
Traction motors power conveyor belts, robotic welding arms, and automated guided vehicles (AGVs) on automotive assembly lines. Their unexpected failure can immediately halt production, causing losses of up to $2.3 million per hour in the automotive sector. Conventional maintenance methods such as periodic servicing, single-sensor threshold alarms, and expert rule systems often fail because they monitor variables independently and cannot capture complex multi-sensor failure interactions.
This project presents a comparative study of ten e-maintenance approaches for traction motor fault detection using the AI4I 2020 Predictive Maintenance Dataset from the UCI Repository. The dataset contains 10,000 records with five sensor variables: air temperature, process temperature, rotational speed, torque, and tool wear, along with a binary failure label. With only 3.39% failure cases, the dataset reflects the severe class imbalance common in industrial fault detection.

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