

IoT and Other Emerging Technologies for Managing Operations

Credits	3.0
Faculty Name	Manaw Modi, 9437032211, manaw.modi@gmail.com LinkedIn: https://in.linkedin.com/in/manaw-modi-71a294
Program	MBA
Academic Year and Term	2020-2021

1. Course Objective:

Operations management is concerned with the production of goods and the delivery of services to meet ever evolving customer demand. A major challenge always facing business is how to deliver high quality products/services to customer in a timely and cost-effective manner. Technology is one significant enabler of this. These novel technologies and methods demand a corresponding shift in operations. Such game-changing innovations create strategic advantage for fast moving organizations. Therefore, a sound understanding of shift in operations management because of the emerging technologies is important for all managers. This course is aimed at connecting a few new technologies and how those are impacting operations management.

To explore the business implications of three/four latest disruptive ideas reshaping management principles, and significantly influencing business operations:

- a. Internet of Things (IoT)
 - i. Business interaction and new type of data using IoT
 - ii. IoT concepts and technologies
 - iii. Strategic creative thinking and co-creation techniques with IoT
- b. Machine Learning (Artificial Intelligence)
 - i. Basic components of machine learning models
 - ii. Model fitting, model selection and model evaluation
 - iii. Data science, data mining, and data visualization
- c. Business Analytics and Operations
 - i. Disruption or Not
 - ii. Basic Business Analytics in Industries like Healthcare and Retail
 - iii. Analytics Tools and Technologies
- d. Robotics and Operations
 - i. Operations strategy with sensor-based advanced robotic automation
 - ii. Innovative technologies like 3D Printing
 - iii. Game-changing supply-chain methods like delivery using drones
 - iv. Self-Assembly and the ultimate automation; its role in 'nanotechnology'
 - v. 'Nanotechnology', 'Molecular Engineering' and 'Futuristic Manufacturing'
- e. Deployment challenges for such innovative technologies

Prerequisite(s)

1. A technology background is preferable but not necessary.

2. Learning Outcome: On successful completion of this course, students will be able to:

1. Demonstrate basic understanding of elements of IoT
2. Understand the basic architecture of IoT implementation
3. Analyze an IoT solution with operations perspective including costs and business value.
4. Understand the idea behind Business Analytics and success stories, and some failures.
5. Demonstrate basic understanding of elements of Machine Learning
6. Be able to differentiate between Supervised and Un-Supervised Learning
7. Understand how Machine Learning impacts Operations Strategy
8. Demonstrate basic understanding of Robotics from managerial perspective
9. Analyze Robotics implementation with Operations perspectives including costs and quality
10. Be able to integrate the seemingly disparate concepts and technologies
11. Communicate the fundamentals, operational advantages, and deployment challenges

3. Text Book(s):

- a. IoT Fundamentals: Networking Technologies, Protocols and Use Cases for the Internet of Things
Author(s): Hanes David, and Salgueiro Gonzalo et. al.
Publisher: Pearson Education
ISBN-10: 9386873745
ISBN-13: 978-9386873743
- b. A Course in Machine Learning, Hal Daumé III
http://ciml.info/dl/v0_99/ciml-v0_99-all.pdf
<http://freecomputerbooks.com/A-Course-in-Machine-Learning.html>

References:

- a. Pattern Recognition and Machine Learning, Christopher Bishop
<http://users.isr.ist.utl.pt/~wurmd/Livros/school/>
- b. An Introduction to Statistical Learning: with Applications in R, Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani
<http://freecomputerbooks.com/An-Introduction-to-Statistical-Learning.html>
<http://www-bcf.usc.edu/~gareth/ISL/ISLR%20Sixth%20Printing.pdf>
- c. Machine Learning: A Probabilistic Perspective, Kevin P. Murphy
https://chicagoboothml.github.io/MachineLearning_Fall2015
- d. Reading Material/Models/Cases will be shared online or in the class

4. Tentative Session Plan:

SESSION	CONTENT
MODULE A – INTERNET OF THINGS (IoT)	
1	Introduction/Course Outline Why this course is needed; Disruptive Ideas & Current Scenario
2	IoT – Architecture, Protocols, Comparison; High-Level Technical Ideas
3	IoT – Impact on Operations Strategy IoT End-Result – Business Analytics for Operations: Case I
4	IoT – Student Presentations: Case II
MODULE B – BUSINESS ANALYTICS	
5	Business Analytics – The Current Scenario
6	Business Analytics – The Trends and Where We Are Headed
7	Business Analytics – Student Presentations: Case III
8	Business Analytics – Student Presentations: Case IV
MODULE C – MACHINE LEARNING (ML) (ARTIFICIAL INTELLIGENCE (AI))	
9	Idea of ML and AI - impact on Operations Strategy: investment and costs
10	ML Real-World Scenarios
11	Applying ML to Business Management (on-hands exercise) - Supervised learning: Case V
12	Applying ML to Business Management (on-hands exercise) - Unsupervised learning: Case VI
13	ML and Business Management – Student Presentations: Case VII
14	ML and Business Management – Student Presentations: Case VIII
MODULE D – ADVANCED AUTOMATION IN OPERATIONS USING ROBOTICS	
15	Types of Robots - how robots are classified; degrees of freedom, intelligence, size - industries impacted: (https://www.robots.com/applications) - suitable operations for robot types: (https://www.robots.com/robots) - investment, operating costs and maintenance issues
16	Impact on Operations Strategy: Case IX - cost reduction (https://www.robotics.org/content-detail.cfm/Industrial-Robotics-Industry-Insights/Calculating-Your-ROI-for-Robotic-Automation-Cost-vs-Cash-Flow/content_id/5285) - http://www04.abb.com/global/seitp/seitp202.nsf/0/5286c3ec6a838e50482572eb00028dfe/\$file/Robotics+seminar+-+Economic+Justification.pdf - quality impact - human resource (HR) issues
17	Integration of IoT, BA, ML, and Robotics
18	Student Presentations: Case X
19	Student Presentations: Case XI
20	Wrap Up – What Have We Learnt, Where Business Transformation is Headed

Depending upon the class size, a group may be allowed just one presentation over the entire course. A presentation is not “just a bunch of slides” by any means – all groups will work on tasks given, but just one group will present their findings for a task.

5. Evaluation:

1. Class Participation and Attendance	: 10 %
2. Assignments/Exercises – Total 2 (Group)	: 25 %
3. Presentation and Consultatig Type Report – (Group)	: 25%
4. Final exam	: 40 %
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TOTAL	: 100 %

6. Academic Integrity:

Utmost care is taken as to maintain class decorum, follow the exact evaluation norms, conduct fair examinations, fair and transparent evaluation of examination papers to maintain the highest academic integrity.

Any breach of integrity sensed by the instructor may result in a Fail grade for the class – the decision will be final in such cases. Institute's laid down policies will be followed regarding academic integrity.

7. Remarks

1. Given the nature of the contents, the course methodology will be very hands-on that will keep theory sessions to a minimum and will base most of the learning activities on projects, and practical work, following the "learning by doing" principle.
2. Students will be working in lab environment to 'create' simple solutions. Application of creative thinking techniques is must.
3. Underlying basic topics like Big Data and Business Analytics/Intelligence are part of the offering and need not be mentioned separately.
4. This course, by its very nature, will always be looking out for new, relevant, and 'hotter' disruptive ideas and technologies to replace any existing ones.
5. CLASS PARTICIPATION: Heaviest possible interaction through hands-on modeling will be the learning method in this class. Pedagogically, this course will rely very heavily on experiential learning built around the following elements: class discussion of models, thought sharing, and video supplements. For the course to be useful to you, it is essential that, besides reading assigned chapters/articles from the book and the conceptual articles, you come to each class well prepared to discuss your analysis of the assigned material. I would strongly encourage active class participation.
 - a. My experience has been that students generally tend to under - (rather than over) estimate the worth of what they have to say. Thus, if you are ever in doubt, I would encourage you to participate rather than to keep quiet.
 - b. Note that probing questions are as useful a form of class participation as presentations of logical analyses.
 - c. Finally, needless to add, the quantity of your class participation would count positively only if the substantive quality of your comments and/or questions adds value to the class discussions.

6. ATTENDANCE POLICY: A very significant portion of your learning is likely to take place in the classroom as you participate in and listen to conceptual discussion and model/case analyses. Therefore, it is essential that, barring a job-related or personal crisis, each student attend every class. In case of any such exigencies, you must let me know either ex-ante or ex-post. Also, please note that if you miss more than two classes – for any reason – you run the risk of getting an “incomplete” grade in the course.
7. SPECIAL NEEDS: Any student with special needs should bring this to the attention of the instructor as soon as possible, but not later than the second week of class
8. Finish all your personal needs before coming to class. Leaving the class room when the session is in progress for personal needs is strictly prohibited unless there is a medical emergency. You must take permission in such situations before leaving the class room.
9. Be in class on time, no latecomers will be entertained after the roll call is over. It is student’s responsibility to appear in all tests, labs, presentations, and classes. Request for *make-up test/lab/presentation/quiz will not be entertained at all*.
10. Cell phones should remain switched off during the entire duration of the class and should be kept inside your bag and not on the table. Its use during the session is strictly prohibited. Any student found using the phone during the session will be asked to step out of the class.
11. No request will be entertained to change the class project, once finalized by the group.