Machines vs. Human Labor, and its Effect on the United States Economy

Humans and Automation: Use, Misuse, Disuse, Abuse

by Parasuraman, Raja; Riley, Victor
Human Factors: The Journal of the Human Factors and Ergonomics Society, 06/1997, Volume 39, Issue 2
This paper addresses theoretical, empirical, and analytical studies pertaining to human use, misuse, disuse, and abuse of automation technology. Use refers to...
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This paper addresses theoretical, empirical, and analytical studies pertaining to human use, misuse, disuse, and abuse of automation technology. Use refers to the voluntary activation or disengagement of automation by human operators. Trust, mental workload, and risk can influence automation use, but interactions between factors and large individual differences make prediction of automation use difficult. Misuse refers to over reliance on automation, which can result in failures of monitoring or decision biases. Factors affecting the monitoring of automation include workload, automation reliability and consistency, and the saliency of automation state indicators. Disuse, or the neglect or underutilization of automation, is commonly caused by alarms that activate falsely. This often occurs because the base rate of the condition to be detected is not considered in setting the trade-off between false alarms and omissions. Automation abuse, or the automation of functions by designers and implementation by managers without due regard for the consequences for human performance, tends to define the operator's roles as by-products of the automation. Automation abuse can also promote misuse and disuse of automation by human operators. Understanding the factors associated with each of these aspects of human use of automation can lead to improved system design, effective training methods, and judicious policies and procedures involving automation use.

Computing Inequality: Have Computers Changed the Labor Market?

by David H. Autor; Lawrence F. Katz; Alan B. Krueger
The Quarterly Journal of Economics, 11/1998, Volume 113, Issue 4
This paper examines the effect of skill-biased technological change as measured by computerization on the recent widening of U. S. educational wage...
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The effect of skill-based technological change as measured by computerization on the recent widening of US educational wage differentials is examined. An analysis of aggregate changes in the relative supplies and wages of workers by education from 1940 to 1996 indicates strong and persistent growth in relative demand favoring college graduates. Rapid skill upgrading within detailed industries accounts for most of the growth in the relative demand for college workers, particularly since 1970. Analyses of four data sets indicate that the rate of skill upgrading has been greater in more computer-intensive industries.

3

online

A Changed Economy with Unchanged Universities? A Contribution to the University of the Future

by Cunha, Maria Manuela; Putnik, Goran D

International Journal of Distance Education Technologies (IJDET), 10/2007, Volume 5, Issue 4
.... The advanced information and communication **technologies** together with several applications offer new perspectives, such as the so-called virtual university...
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Individualised open and distance learning at the university continuing education and post-graduate education levels is a central issue of today. The advanced information and communication technologies together with several applications offer new perspectives, such as the so-called virtual university. Simultaneously, to gain market share, several organisational arrangements are emerging in the virtual university field, like consortia arrangements and joint venture initiatives between and among institutions and organisations. The dynamically changing social and economical environment where we live claims for new approaches to virtual and flexible university continuing and post-graduate education, such as the concept of Agile/Virtual University proposed by the authors. However, the implementation of this concept (and of other similar concepts) does not rely just on basic information and communication infrastructure, neither on dispersedly developed applications. Although absolutely necessary as support, the added value comes from the higher-level functions to support individualised learning projects. The implementation of the Agile/Virtual University concept requires a framework and a specific supporting environment, a Market of Teaching Resources, which are discussed in the article.

The Politics of Talk: Coming to Terms with the 'New' Scientific Governance

by Alan Irwin
Social Studies of Science, 04/2006, Volume 36, Issue 2
... about the public) represents an important site for science and **technology** studies analysis. The relationship between 'new' and 'old' approaches to scientific governance is considered...
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Talk of public dialogue and engagement has become fashionable internationally, and particularly within Europe. Building especially upon recent British experience, this paper argues that 'public talk' (that is, talk both by and about the public) represents an important site for science and technology studies analysis. The relationship between 'new' and 'old' approaches to scientific governance is considered. Drawing upon a series of official reports, and also the GM Nation? public debate over genetically modified food, the paper suggests that, rather than witnessing the emergence of a new governance paradigm, the current approach can more accurately be portrayed as an uneasy blend of 'old' and 'new' assumptions. Eschewing a straightforward normative account, the paper explores the social construction of public talk, the relationship between talk and trust, the search for the 'innocent' citizen, and the pursuit of social consensus. Current initiatives should not simply be criticized for their inadequacies, but should also be viewed as symptomatic of the state of science–society relations. In that way, stresses and strains within the politics of public talk assume wider analytical significance than the 'mere talk' epithet would suggest.

Acceptance, Use, and Influence of Political Technologies among Youth Voters in the 2008 US Presidential Election

by James, Tabitha; Khansa, Lara; Cook, Deborah F
International Journal of E-Politics (IJEP), 10/2010, Volume 1, Issue 4
The visibility of network-based **technologies** in the 2008 U.S. **presidential election** is indicative of their importance as tools to inform and motivate a populace...
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The visibility of network-based technologies in the 2008 U.S. presidential election is indicative of their importance as tools to inform and motivate a populace. By explaining what factors impact usage behaviors with respect to these technologies, their use can be better encouraged. In this paper, the authors examine the constructs influencing usage behaviors for political technologies using the unified theory of acceptance and use of technology (UTAUT) model. The authors also explore the impact of the use of political technologies on political interest and activism in organized movements. The model was tested on a large sample of youth voters, and results suggest that performance and effort expectancy, along with social influences, impact the use of political technology. Evidence was also found suggesting that the usage of political technologies positively impacts political interest and political activism. Findings suggest that room for growth exists in devising novel ways to use political technologies to motivate active participation.

The Democratic Divide in the 2008 U.S. Presidential Election

by Nam, Taewoo; Stromer-Galley, Jennifer
Journal of Information Technology & Politics, 04/2012, Volume 9, Issue 2
.... **presidential election** season. The research focuses on the divide patterns of four different types of political Internet use...
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By analyzing Pew Internet and American Life Project's postelection survey, this article examines whether there continues to exist a democratic digital divide in the 2008 U.S. presidential election season. The research focuses on the divide patterns of four different types of political Internet use: information-seeking, communication, mobilization, and use of social networking sites. The research results suggest a higher likelihood for the socioeconomically advantaged to do online political activities. A generational gap is less apparent with regard to communication than information-seeking and mobilization. The sociodemographic pattern of the democratic divide overall resembles that of Internet access divide, but the political divide manifested by education and income is being bridged to some extent among current users of social networking sites. Although younger generations were more likely to use social networking sites for political activities, such use did not significantly raise the probability to cast a ballot in the 2008 presidential election.

Motivations for participating in 'viral politics': A qualitative case study of Twitter users and the 2012 US presidential election

by Penney, Joel
Convergence, 02/2016, Volume 22, Issue 1
.... Drawing upon 25 in-depth interviews with US adults who used Twitter to link to the popular YouTube video Will the Real Mitt Romney Please Stand...
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This study explores the rationales by which citizens both embrace and resist the notion of using peer-to-peer digital platforms to circulate persuasive political messages. Drawing upon 25 in-depth interviews with US adults who used Twitter to link to the popular YouTube video Will the Real Mitt Romney Please Stand Up? I discuss the extent to which they imagine their online activities to be potentially influencing others in certain desired ways and thus constituting an instrumental form of political participation. The resulting analysis focuses on the complex and uneasy relationship between this media-spreading activity and a marketing-like model that positions social media users as microlevel participants in aggregate campaigns to shape public opinion. While some who engage in this activity enthusiastically embrace goals of persuasion, others opt for alternative conceptual frameworks, such as fostering citizenship by informing others and sparking deliberative dialogue, that seemingly avoid the manipulative connotations of political marketing.

Regional economic development in the 21st century

by Grossman, Howard J

Economic Development Review, 03/1998, Volume 16, Issue 1
... Regional **economic development** has grown increasingly important to the **economic** wellbeing of communities across the nation. However, in the next **century**...
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Regional economic development has grown increasingly important to the economic well-being of communities across the nation. However, in the next century regional economic development councils are likely to play an even more significant role in managing local economies. Where economic development was once primarily a matter of local interest, it is now a global undertaking. In fact, it is unlikely that local economies will thrive in the 21st Century unless they can hold their own in a worldwide economy. As a result, many regional development organizations are expanding their boundaries and creating new alliances with public, private and nonprofit development groups.

From policy coherence to 21st century convergence: a whole‐of‐society paradigm of human and economic development

by Dubé, Laurette; Addy, Nii A; Blouin, Chantal; More...
Annals of the New York Academy of Sciences, 12/2014, Volume 1331, Issue 1
...) paradigm for human and **economic development** proposes a **21st century** convergence where, instead of the rest (of the world...
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The 20th century saw accelerated human and economic development, with increased convergence in income, wealth, and living standards around the world. For a large part, owing to the well-entrenched Western-centric linear and siloed industrialization pattern, this positive transformation has also been associated with complex societal challenges at the nexus of agricultural, industrial, and health sectors. Efforts at cross-sectoral policy coherence have been deployed with limited success. To go beyond what has been possible thus far, the whole-of-society (WoS) paradigm for human and economic development proposes a 21st century convergence where, instead of the rest (of the world) converging with the West, sectoral and cross-sectoral efforts converge in their single and collective policy and action on a common target of human and economic development. In this paper, we first review and discuss contributions and limitations of policy coherence approaches. We then elaborate the institutional foundation of the WoS paradigm, taking as an anchor the well-established model of polycentric governance that views individuals, and state, market, and community, forming society as part of the same complex adaptive system. Actors within such systems self-organize into nested hierarchies that operate at multiple scales and move toward 21st century convergence of human and economic development.

The Rolt Memorial Lecture 2008 'Dan Dare's Lair' The Industrial Archaeology of Britain's Post-War Technological Renaissance

by Cocroft, Wayne D
Industrial Archaeology Review, 05/2009, Volume 31, Issue 1
The theme of the 2008 Association for Industrial Archaeology conference seminar was 'Modern military matters'. Modern military sites have much in common with...
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The theme of the 2008 Association for Industrial Archaeology conference seminar was 'Modern military matters'. Modern military sites have much in common with large industrial sites. They are places of employment for many hundreds of people, incorporate complex technologies, and are also creators of new landscapes and communities. This paper explores the places created and used to develop and manufacture

many of the products that were portrayed as representing the rebirth of post-war Britain as a major industrial power. Many of the new industries were based on technologies developed in the Second World War, including radar, jet and rocket engines, and military and civil atomic power. Politically, the World Wars had left a legacy of heavy government involvement in scientific research establishments and the state as the main customer for their products. In the post-war decades, this relationship was strengthened as the development of high-tech weaponry was seen as one means of countering the growing threat from the Soviet Union and her allies.

Technological features of Renaissance pottery from Deruta (Umbria, Italy): An experimental study

by Moroni, Beatrice; Conti, Claudia
Applied Clay Science, 2006, Volume 33, Issue 3
... of human settlement, reached its maximum levels of elegance in the **Renaissance** period (Fiocco and Gherardi, 1988). This was undoubtedly the result of the high...
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This work is focused on the assessment of the basic technological features of the pottery production in Deruta in the Renaissance period. For this purpose, clay samples and two kinds of ceramic products (tiles and wares) dating back to the XVIth century were characterized using different analytical techniques: optical, cathodoluminescence and electron microscopy on thin sections, X-ray fluorescence and X-ray diffraction on the bulk powdered samples. Then two clays best representing the chemical composition of the ceramic products underwent laboratory experimental firing tests at different conditions following the procedure of firing applied in the XVIth century as reported in the ancient historical documents. The firing products underwent textural, chemical and mineralogical characterization by the same analytical techniques in order to be compared with the clays and the shards. Archaeometric investigation of the ceramic bodies led to the identification of two different clay raw materials, both of local provenance, for the tile and the ware production. Archaeometric investigation of the glazes showed some differences between the wares from different workshops. In this respect the typology and the quality of the glaze resulted to be much more effective than the texture and composition of the ceramic body in characterizing the wares from different coeval workshops. Results of the experimental tests evidenced the firing products result from a complex mix of physical and chemical variables strictly correlated to one another. Above all, the heating rate and the amount of calcite in the clay raw material are crucial driving forces of the kinetics of firing. Comparison between the original and the experimental ceramic products indicated ranges of biscuit firing temperature of 850-1050 [degrees]C and of 950-1050 [degrees]C for the tiles and the wares, respectively, and a low heating rate in both cases.

Robust and stable flexible job shop scheduling with random machine breakdowns using a hybrid genetic algorithm

by Al-Hinai, Nasr; ElMekkawy, T.Y

International Journal of Production Economics, 2011, Volume 132, Issue 2

This paper addresses the problem of finding robust and stable solutions for the flexible job shop scheduling problem with random machine **breakdowns**...

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This paper addresses the problem of finding robust and stable solutions for the flexible job shop scheduling problem with random machine breakdowns. A number of bi-objective measures combining the robustness and stability of the predicted schedule are defined and compared while using the same rescheduling method. Consequently, a two-stage Hybrid Genetic Algorithm (HGA) is proposed to generate the predictive schedule. The first stage optimizes the primary objective, minimizing makespan in this work, where all the data is considered to be deterministic with no expected disruptions. The second stage optimizes the bi-objective function and integrates machines assignments and operations sequencing with the expected machine breakdown in the decoding space. An experimental study and Analysis of Variance (ANOVA) is conducted to study the effect of different proposed measures on the performance of the obtained results. Results indicate that different measures have different significant effects on the relative performance of the proposed method. Furthermore, the effectiveness of the current proposed method is compared against three other methods; two are taken from literature and the third is a combination of the former two methods.

The man-machine integration era

by Daniel Bilar

PeerJ PrePrints, 08/2016
Through sensor ubiquity, the **man-machine** integration era is upon us. This integration is taking place in distributed, continuously changing, optimizing/learning, finite precision feedback systems...
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Through sensor ubiquity, the man-machine integration era is upon us. This integration is taking place in distributed, continuously changing, optimizing/learning, finite precision feedback systems. Security challenges of such systems abound, also due to constantly co-evolving threat actors and changing environments. Are we adequately preparing to defend such systems, and more importantly: how do we ensure they are worth defending? This position paper posits we are ill-prepared, due to perverse incentives affecting methodology, results and foundational corpuses. With respect to the first question, we will corroborate this ill-preparedness in the context of a basic requirement – situational awareness – for so-called Moving Target Defenses. We'll argue that the second question hinges on a deceptively straightforward permanence invariant: The ability to robustly encode the infinite value of a human being in finite precision systems. Here too, we are failing to develop needed toolsets and skills. Successfully tackling both questions may determine the future winning model of the man-machine integration era; whether we'll lose the Republic of the People to the People's Republic.

Improving the Driver–Automation Interaction: An Approach Using Automation Uncertainty

by Beller, Johannes; Heesen, Matthias; Vollrath, Mark
Human Factors: The Journal of Human Factors and Ergonomics Society, 12/2013, Volume 55, Issue 6
...–automation interaction. Background: A false system understanding of infallibility may provoke automation misuse and can lead to severe consequences in case of automation **failure**...
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The aim of this study was to evaluate whether communicating automation uncertainty improves the driver-automation interaction. A false system understanding of infallibility may provoke automation misuse and can lead to severe consequences in case of automation failure. The presentation of automation uncertainty may prevent this false system understanding and, as was shown by previous studies, may have numerous benefits. Few studies, however, have clearly shown the potential of communicating uncertainty information in driving. The current study fills this gap. We conducted a driving simulator experiment, varying the presented uncertainty information between participants (no uncertainty information vs. uncertainty information) and the automation reliability (high vs.low) within participants. Participants interacted with a highly automated driving system while engaging in secondary tasks and were required to cooperate with the automation to drive safely. Quantile regressions and multilevel modeling showed that the presentation of uncertainty information increases the time to collision in the case of automation failure. Furthermore, the data indicated improved situation awareness and better knowledge of fallibility for the experimental group. Consequently, the automation with the uncertainty symbol received higher trust ratings and increased acceptance. The presentation of automation uncertaintythrough a symbol improves overall driver-automation cooperation. Most automated systems in driving could benefit from displaying reliability information. This display might improve the acceptance of fallible systems and further enhances driver-automation cooperation.

Secular Stagnation? The Effect of Aging on Economic Growth in the Age of Automation

by Acemoglu, Daron; Restrepo, Pascual
American Economic Review, 05/2017, Volume 107, Issue 5
...174 American **Economic** Review: Papers & Proceedings 2017, 107(5): 174–179
https://doi.org/10.1257/aer.p20171101 The rapid aging of the population...
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Several recent theories emphasize the negative effects of an aging population on economic growth, either because of the lower labor force participation and productivity of older workers or because aging will create an excess of savings over desired investment, leading to secular stagnation. We show that there is no such negative relationship in the data. If anything, countries experiencing more rapid aging have grown more in recent decades. We suggest that this counterintuitive finding might reflect the more rapid adoption of automation technologies in countries undergoing more pronounced demographic changes and provide evidence and theoretical underpinnings for this argument.

AUTOMATION ANXIETY

by Daniel Akst
The Wilson Quarterly, 07/2013, Volume 37, Issue 3
.... In 1966, the Commission on Technology, **Automation**, and **Economic** Progress issued a sensible report rejecting the argument that technology was to blame for a great deal of unemployment, although...
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In Ulysses (1922), it's been said, James Joyce packed all of life into a single Dublin day. So it shouldn't be surprising that he found room in the novel for Leopold Bloom to tackle the problem of technological disruption. More than a century has passed since that now-celebrated day in 1904 when Joyce's creation crisscrossed Dublin, and for most of that time technology and jobs have galloped ahead together. In 1966, the Commission on Technology, Automation, and Economic Progress issued a sensible report rejecting the argument that technology was to blame for a great deal of unemployment, although, with the wisdom of Leopold Bloom, it recognized technological change as a major factor in the displacement and temporary unemployment of particular workers. The robots will surely keep coming, and keep doing more and more of the work people long have done. But one thing they won't be able to do -- at least not anytime soon -- is tell us what people owe each other.

Economic Effects of Renewable Energy Technologies

by Dario Maradin; Ljerka Cerović; Trina Mjeda
Naše gospodarstvo/Our economy, 06/2017, Volume 63, Issue 2
.... The purpose of this research is to analyse both the positive and the negative **economic effects** of investing in various renewable **technologies**, as well as to confirm, by means of the energy-economy model, the benefit of such technologies in boosting the economy.
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Rapid economic development has resulted in the more frequent use of renewable energy technologies. On the other hand, the production and use of renewables fosters the development of new technologies, creating many new opportunities for entrepreneurial-minded individuals and, consequently, the economy in general. Renewable energy technologies have a multiplier effect in spurring the economy and the development of not only the energy sector but also all the supporting activities related to such industry. The purpose of this research is to analyse both the positive and the negative economic effects of investing in various renewable technologies, as well as to confirm, by means of the energy-economy model, the benefit of such technologies in boosting the economy.

Technology spillover effects and economic integration: evidence from integrating EU countries

by Hafner, Kurt A
Applied Economics, 09/2014, Volume 46, Issue 25
The article uses time series for the period 1981-2008 to estimate the impact of foreign **technology** spillover **effects** on Greece, Ireland, Portugal and Spain, representing the integrating European Union (EU) countries...
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The article uses time series for the period 1981-2008 to estimate the impact of foreign technology spillover effects on Greece, Ireland, Portugal and Spain, representing the integrating European Union (EU) countries. I restrict technology diffusion to EU-12 countries and compare the results to unrestricted technology diffusion from a sample of 32 OECD countries. Accounting for nonstationarity and co-integration, the dynamic OLS estimator is used to estimate the impact of foreign R&D stock on labour productivity, taking into account patent-, trade- and FDI-related technology diffusion channels. I find empirical evidence for trade-related foreign technology spillover effects for Greece and Ireland if technology diffusion is unrestricted. Restricting technology diffusion to EU-12 countries, there are significant foreign technology spillover effects from European integration for Portugal (patent related) and Spain (trade and FDI related). Moreover, the domestic R&D stock and education are significant drivers for labour productivity in integrating EU countries. The empirical results are robust for different regression specifications and sources of technology diffusion.

The effect of information technology on economic education

by Savage, Scott J
The Journal of Economic Education, 2009, Volume 40, Issue 4
... of Information **Technology** on **Economic** Education Scott J. Savage Abstract: The author evaluated the **effect** on student performance of using a new information **technology**...
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The author evaluated the effect on student performance of using a new information technology (IT) enhancement that permits students to participate in the recording of lectures that can be downloaded later from the Internet. The author compared two sections of the same Intermediate Microeconomics class and observed the sample students to be representative; the empirical model accounted for any differences in student characteristics between the comparison and test groups. Model results show that students exposed to the IT enhancement performed about 2 percentage points better on their final exam than did the comparison students; however, the difference was not statistically different from zero. The author concluded that the use of IT appears to not have any substantive influence on student performance.

Innovation and technology creation effects on organizational performance

by Huang, Kuo-En; Wu, Jih-Hwa; Lu, Shiau-Yun; More...
Journal of Business Research, 06/2016, Volume 69, Issue 6
...1 Introduction **Organizational** performance and knowledge positively influence a firm's innovation (Jiménez-Jiménez & Sanz-Valle, 2011). Having a greater...
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The purpose of this study is to analyze the relationships among innovation, technology creation, quality management, information management capability and organizational performance. This study contributes to the research on the effect that diversification has on organizational performance under conditions of uncertainty. Firms benefit from either low levels of diversification due to efficiencies in processing innovation knowledge, or from high levels of diversification due to access to broad information management capabilities that facilitate the solving of complex problems and the ability to direct a firm along different trajectories. The use of comparative methods in this research includes multiple regression analysis (MRA) and fuzzy-set qualitative comparative analysis (fsQCA). These analyses demonstrate that an fsQCA can successfully identify conditions that are adequate for successful organizational performance outcomes. The results indicate that an fsQCA outperforms an MRA and successfully models both types of data with causal complexities. The model looks across industries and across various types of firms; at the same time, the differences among industries and firms are also investigated. This study's findings provide useful insights into how firms' members should reinforce their collaborative behaviors and activities to enhance their competitive advantages.

Assessing interfirm collaboration/technology investment tradeoffs: The effects of technological readiness and organizational learning

by Jr, R. Glenn Richey; Autry, Chad W
The International Journal of Logistics Management, 2009, Volume 20, Issue 1
... degrees of **technology** and/or collaboration as the primary vehicle(s) with which to forge a solution...
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Purpose - The current research considers the possibility that when firms are faced with a challenging supply chain task or opportunity for supply chain operational improvement, they choose varying degrees of technology and/or collaboration as the primary vehicle(s) with which to forge a solution. This choice is suggested herein to depend largely on technological readiness, i.e. the extent to which the firm embraces available technological solutions. Furthermore, the learning capability of the firm moderates the inverse relationship between interfirm collaboration and technological readiness, such that firms having strong organizational learning capabilities are less likely to choose a collaboration-intensive solution than those with weak learning capabilities. This paper aims to address these issues. Design/methodology/approach - A sample of retail supply chain managers drawn from the Council of Supply Chain Management Professionals membership database is surveyed related to their firms' levels of interfirm collaboration, organizational learning capabilities, and technological readiness. Two multiple moderated regression variants are used to test the hypotheses. Findings - Results of this research support the hypothesized logic, and implications for practice are presented in light of a revealed inverse relationship between technological readiness and interfirm collaboration that is exacerbated when the firm has a strong learning orientation. Originality/value - This paper is among the first known to examine potential internal/external tradeoffs between collaboration and technology as problem-solving vehicles. Both managers and researchers should find it interesting that collaboration is neither wholly desirable nor necessary (and therefore the associated risks mitigated) in technologically ready and/or high learning capability environments.

The future workplace of young Europeans

by Francis, James; Scheers, Carolien
European View, 12/2013, Volume 12, Issue 2
As the twenty-first century continues to bear witness to technological advancements, so our **workplace** will be **changed** increasingly by **technology** and the digital world...
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As the twenty-first century continues to bear witness to technological advancements, so our workplace will be changed increasingly by technology and the digital world. In this article, we try to explain the view of young Europeans on this inevitable process, the workplace that is changing. After all, the majority of the people who have to work in this new and modern workplace are the young Europeans themselves. We can conclude that young Europeans are aware of and feel part of this digitisation process. However, they still consider human contact to be a vital aspect of the relationships between employees and employers. Moreover, there is a belief that traineeships and internships help young Europeans to better develop their skills and adapt to the new workplace. Due to technological advancements, the workplace is changing in several ways. The differences between work and home can sometimes become blurred, but for many young Europeans it remains very important to be able to distinguish between home and the workplace.

Which Techno-mathematical Literacies Are Essential for Future Engineers?

by Nathalie J. van der Wal; Arthur Bakker; Paul Drijvers
International Journal of Science and Mathematics Education, 01/2017, Volume 15, Issue 1
Due to increased use of **technology**, the **workplace** practices of engineers have **changed**...
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Due to increased use of technology, the workplace practices of engineers have changed. So-called techno-mathematical literacies (TmL) are necessary for engineers of the 21st century. Because it is still unknown which TmL engineers actually use in their professional practices, the purpose of this study was to identify these TmL. Fourteen semi-structured interviews were conducted with engineers with a background in different educational tracks in higher professional education (e.g. civil, chemical, biotechnical and mechanical engineering). As a result of the data analysis, 7 commonly used TmL are identified: data literacy, technical software skills, technical communication skills, sense of error, sense of number, technical creativity and technical drawing skills. Engineers also noted a discrepancy between their education and workplace needs; they characterized mathematics in their education as an island with limited relevance. These findings lead to recommendations for the future of science, technology, engineering and mathematics (STEM) in higher technical professional education that can help students learn STEM for the future.

Why Are There Still So Many Jobs? The History and Future of Workplace Automation

by David H. Autor
The Journal of Economic Perspectives, 07/2015, Volume 29, Issue 3
... **technology** were going to wipe out large numbers of middle class jobs. The best-known early example is the Luddite movement of the early 19thcentury, in which a...
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In this essay, I begin by identifying the reasons that automation has not wiped out a majority of jobs over the decades and centuries. Automation does indeed substitute for labor--as it is typically intended to do. However, automation also complements labor, raises output in ways that leads to higher demand for labor, and interacts with adjustments in labor supply. Journalists and even expert commentators tend to overstate the extent of machine substitution for human labor and ignore the strong complementarities between automation and labor that increase productivity, raise earnings, and augment demand for labor. Changes in technology do alter the types of jobs available and what those jobs pay. In the last few decades, one noticeable change has been a "polarization" of the labor market, in which wage gains went disproportionately to those at the top and at the bottom of the income and skill distribution, not to those in the middle; however, I also argue, this polarization and is unlikely to continue very far into future. The final section of this paper reflects on how recent and future advances in artificial intelligence and robotics should shape our thinking about the likely trajectory of occupational change and employment growth. I argue that the interplay between machine and human comparative advantage allows computers to substitute for workers in performing routine, codifiable tasks while amplifying the comparative advantage of workers in supplying problem-solving skills, adaptability, and creativity.

Social Norms of Work Ethic and Incentives in Organizations

by Forquesato, Pedro
Journal of Economic Behavior and Organization, 08/2016, Volume 128
.... * If effort is complementary: multiple equilibria in work ethic and incentive power. * Firms will choose modern **technologies** in places where work ethic is more disseminated...
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In this paper, I model the relation between the dissemination of social norms of work effort (work ethic) in a given society and the choice of incentives by firms, and I motivate it by presenting evidence from three different datasets that suggests that work ethic is correlated with the intensity of firms' incentives. When the effort choices of different agents in a firm are complementary, having hard-working coworkers makes an agent more productive. Therefore, in equilibrium, she will work harder. Foreseeing that a work ethic is more useful to hard-working agents, parents will be more willing to transmit it in societies in which the probability that their offspring will have coworkers with strong work ethic is higher. I then expand the model to incorporate the firm technology choice, allowing firms to decide between complementary and separable production processes. In societies with wide dissemination of work ethic, firms will want effort to be complementary (as in modern production processes), while the opposite is true when the dissemination of work ethic is narrow. Finally, I investigate the comparative dynamics of the model.