

# TEACHING TECHNOLOGY FORESIGHT TO BUSINESS AND MANAGEMENT STUDENTS

**P. McGowan**

*University of Portsmouth (UNITED KINGDOM)*

## Abstract

Predicting the future is an important, yet highly difficult management task. Disruptive technologies create new ways of working, shopping, and consuming, offering both risk and opportunity. Leading experts struggle to make accurate predictions about which technology will become ubiquitous, and which will face obscurity. However, 82% of jobs require digital skills, and while the current skillset is known, future requirements are unknown. Therefore, developing the ability of students to understand and capitalise on technology change is a problematic, but worthwhile endeavour.

Technology foresight, sometimes called road-mapping is the process of looking at current trends and identifying how a new technology might impact a country, industry, market, or firm, should the future application and posited benefits be realised. This is problematic because – contrary to other forms of forecasting in which ex post forecasts can be compared to events – the dynamic nature of technology means that comparison is extremely difficult.

This paper reports on the design and delivery of a module called Trends in Technology, to third year undergraduate Marketing students at a UK University. Hitherto, there would appear not to be an academic model to support teaching technology foresight. Therefore, through synthesis of literature of technology foresight and pedagogy with regard to design thinking, a process was developed that could be taught. Design thinking was selected because it is particularly useful when a solution cannot be judged in absolute terms and where user or customer perceptions of the same solution may differ based on a wide range of heuristics, which may be unknown to the designer.

Students reported that a design thinking approach to technology application enabled them to relate to it and how it may impact their everyday lives. This fostered engagement. Furthermore, the potential career impact was recognised, with, for example, assessment artefacts being used as evidence to support job applications and interviews. Contributions include presentation of a process for teaching technology foresight and a theoretical model that explains how technology foresight can be applied to marketing theory to create both firm and consumer value.

Keywords: Technology Foresight, Design Thinking, Employability, Marketing value, Industry Advisory Board

## 1 INTRODUCTION

Predicting the future is an important, yet highly difficult management task [1]. Disruptive technologies create new ways of working, shopping, and consuming, offering both risk and opportunity [2]. Leading experts struggle to make accurate predictions about which technology will become ubiquitous, and which will face obscurity [1, 3, 4]. However, 82% of jobs require digital skills [5], and while the current skillset is known, future requirements are unknown [5]. Therefore, developing the ability of students to understand and capitalize on technology change is a problematic, but worthwhile endeavour.

This paper reports on the design and delivery of a module called Trends in Technology, to third year (L6) undergraduate Marketing students at a UK University. During planning four problems were identified. First, the teaching team were not technology experts. Therefore, consideration was needed to how non-technical tutors could support students while they identify and understand technology trends.

Second, unless technology is your passion, crystal ball gazing might also appear to be dull and abstract. Indeed, in order to foster engagement, each student must see the relevance of their work to their life and career [6, 7]. To overcome this, leading firms were invited to join an informal industry advisory board, which included representatives from Gartner, Google, Microsoft, Softbank Robotics, and others. Board members suggested content and delivered guest lectures [8], which brought the technology to life for the students. For example, one speaker brought in humanoid social robots for students to interact with. Another provided low-cost 3D glasses so students could 'virtually visit' tourist attractions. Course alumni

who work in the technology sector were also invited to deliver online sessions, in which they explained what their job entailed and how they found/secured their role.

Third, cognisant that all students do not have equal digital access, interest, experience, or capability [9], and at the recommendation of the industry board, simple browser based access to the Gartner Research Portal was arranged [10]. This resolved potential issues around digital poverty.

Finally, as far as could be ascertained, hitherto there was no academic model or process to support teaching technology foresight. Therefore, through synthesis of literature of technology foresight and pedagogy with regard to design thinking [11], which is a process of exploration and iteration [13] a process, presented herein, was developed that could be taught.

## 2 METHODOLOGY

Technology foresight, sometimes called road-mapping [2] is the process of looking at current trends and identifying how a new technology might impact a country, industry, market, or firm, should the future application and posited benefits be realised [2, 3]. This is problematic because – contrary to other forms of forecasting in which ex post forecasts can be compared to events – the dynamic nature of technology means that comparison is extremely difficult [3].

Literature suggests the use of a range of technology forecasting methods. Scanning is the process in which extant knowledge is reviewed, and a range of possible near-future scenarios are generated. This approach is seen as arbitrary and therefore unreliable [1]. Analytical methods have also been attempted. However, the lack of repetitive events (i.e. patterns) has led to mixed results, and therefore there has been a decline in the use of quantitative methods [3]. Alternatively, domain experts can be called upon to provide forecasts. Yet, problem definition and human bias has again led to unreliable forecasts [4]. In summary, none of the academic theories posited to date appear appropriate for teaching technology forecasting.

Furthermore, the fact that technology changes at pace [12] suggested teaching a process, rather than any particular technology, would best serve the students in their future careers. Bonaccorsi, Aprea [4] details such a process, comprising gathering strategic intelligence from credible sources, sense-making, in which options and timeframes are considered, selecting priorities, and implementation [4]. However, while this suggests what needs to be done, it does not explain how to do it.

Design thinking is a cognitive process of exploration and iteration that can be applied to problem solving [13]. It is particularly useful when a solution cannot be judged in absolute terms and where user or customer perceptions of the same solution may differ based on a wide range of heuristics, which may be unknown to the designer [13]. The first step is discovery in which the challenge/problem/opportunity is defined, and this is followed by a process of research to identify what is known and unknown. The second step is that what has been discovered is interpreted with meaning and insight sought. The third step is to ideate, which means to use creative techniques to generate new ideas. This is followed by experimentation, in which ideas and assumptions are evaluated. Finally, consideration should be directed to how the future may evolve [11, 14].

Therefore, by synthesising the technology forecasting process [4] and design thinking, plus input from members of the Industry Advisory Board, the process as shown in Table 1 was developed.

*Table 1: Application of design thinking to teach technology forecasting*

<b>Technology forecasting process [4]</b>	<b>Design thinking [11]</b>	<b>Implementation process</b>
Strategic intelligence	Discover: Understand the opportunity/problem	Research trends in technology using Garner's portal, and reports from Accenture, Deloitte, and IDC.
Sense-making	Interpret: Search for meaning and insight	Consider how new technology might impact markets, firms, and customers. Review the research and what leading industry players

		are claiming. Look for early adopters and consider their claims.
Select priorities	Ideate: Generate ideas	Consider how to apply technology trends within your chosen firm. How can it be used to deliver value to the firm and customers, in an ethical and sustainable way, over a five-year period? Generate multiple ideas.
	Experiment: Test your ideas. Be prepared to iterate.	Apply a wide range of marketing theories to evaluate your ideas/assumptions. Select the most effective idea.
Implementation	Evolve: Consider what to do next.	Develop a five-year roadmap that shows each phase of the new technology and how it will contribute to overall value creation.

### 3 FINDINGS AND DISCUSSION

A blended and connected module design was adopted [15]. Weekly recorded online lectures were provided that introduced a technology trend. Gartner research and YouTube videos showing how said technology might be applied within a marketing context were also curated. Students were asked to read strategic technology trends reports from leading consulting firms including Accenture, Deloitte, Gartner, and IDC. Additionally, Gartner Campus Access was provided to students as this offers in-depth technology research that could be used to underpin their ideas. Furthermore, students attended a weekly in-person seminar in which they are asked to discuss their views about the trend of the week and how it might be applied to a firm.

Students were assessed using two artifacts. First, they delivered a presentation of their technology driven marketing innovation idea, ostensibly to the CEO of their chosen firm (who was represented by the tutors). Tutors provided summative and feed-forward advice to the students, which they could then apply in a final written report. To ensure rigour, students were required to underpin their ideas with both marketing theory and technology trends research (using the Gartner research portal and strategic trends reports as aforementioned).

Examples of technology driven marketing innovations presented by students included a virtual changing room, in which shoppers look in a digital 'smart mirror' to see a representation of how they might look when wearing a garment. When purchased, the garment would be digitally printed, in-store, to a design that fitted the customer perfectly. Another marketing innovation suggested was for a travel firm that would rent holiday clothes, ordered by the customer through an app and delivered by a local supplier to their hotel room upon arrival. This had the advantages of requiring less hold luggage, thus reducing aircraft weight, saving fuel, reducing carbon emissions, reducing ticket prices and more sustainable use of so called 'fast fashion' garments.

Given the need for digital skills [5], and the importance of technology forecasting [1, 2], it is clear that the module supported development of important employability skills including research, communication, and creativity [17]. Using design thinking supported the development of creative problem-solving skills [18, 19]. Students reported that learning how to apply technology to their everyday lives was both interesting, fun [16] and most importantly, they recognised its potential career impact [6, 7], with, for example, assessment artefacts offering evidence of their ability. Some students have subsequently used their assessment artefacts to support job applications and interviews.

This paper therefore offers two theoretical contributions. First, by applying conceptual deduction [20] and by synthesising literature pertaining to technology foresight [2-4] and design thinking [11] a model has been developed that explains the development of customer and firm value through technology forecasting when combined with marketing theory. As shown in Figure 1, both are necessary, yet

presence alone appears insufficient. It is, however, application of a design thinking process that creates sustainable value.

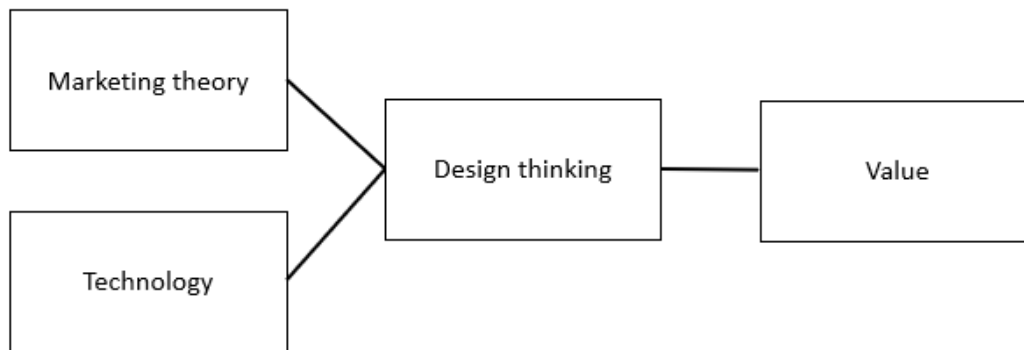


Figure 1: Creation of value through design thinking

Second, hitherto, there has been some debate in literature about the usefulness of teaching design thinking in Higher Education [11, 18, 22]. Yet, this paper reports that integration of theory into the ideation, experimentation, and evolution stages of design thinking appears to deliver a replicable process that can be taught to students so that they can learn how to apply it to future situations.

#### 4 CONCLUSIONS

Through synthesis of literature, this paper presented a new process for teaching technology foresight. It contributes to theory through consideration of how combining marketing theory and future technology may be developed into organisational and customer value, through a design thinking process. This paper does, however, have its limitations. First, it is based upon one module that has been taught in one UK Higher Education institution, for only three years and with relatively small cohorts of 150 students per year. Second, the process presented has not yet been underpinned by empirical testing. This leads to a number of questions for further research. While in this instance, design thinking was taught, it could be argued that other problem-solving techniques might be appropriate/as effective. Therefore, work to determine the efficacy of different problem-solving techniques in teaching technology foresight would be useful.

Job-seekers require digital skills [5] and students appear recognise the usefulness of the process as taught. Yet, how such teaching translates into future graduate career prospects is unknown. Furthermore, as technology pervades everyday life and is constantly evolving [10], work to identify the scope of usefulness of technology foresight would be of interest. Questions might include: Do firms recognise the value of technology foresight? If they do, in which roles is it particularly important? Does possessing technology foresight increase the likelihood of securing a graduate role, and if so, are such roles paid at a premium?

Gartner is well known as the leading independent technology research firm [10]. Indeed, over two-thirds of universities in the UK have access to their research and it is the stalwart forecasting tool of many chief information officers around the globe [10]. However, while its research undergoes a rigorous internal process, it is not peer-reviewed in the way that we would expect of an academic journal article. This raises the question of its usefulness as an academic source. As aforementioned, determining the reliability of technology foresight prediction is complex and to date no reliable method has been developed [4]. Therefore, further research to establish a reliable way to evaluate prior predictions would be useful, as this would allow scholars to further develop and assess the efficacy of new methods of prediction

#### REFERENCES

1. Honda, H., et al., *The difference in foresight using the scanning method between experts and non-experts*. Technological Forecasting and Social Change, 2017. **119**: p. 18-26.
2. Miles, I., et al., *Technology foresight in transition*. Technological Forecasting and Social Change, 2017. **119**: p. 211-218.

3. Apreda, R., et al., *Expert forecast and realized outcomes in technology foresight*. Technological Forecasting and Social Change, 2019. **141**: p. 277-288.
4. Bonaccorsi, A., R. Apreda, and G. Fantoni, *Expert biases in technology foresight. Why they are a problem and how to mitigate them*. Technological Forecasting and Social Change, 2020. **151**: p. 119855.
5. Nania, J., et al., *No longer optional: Employer demand for digital skills*. Burning Glass Technologies. <https://www.burning-glass.com/wpcontent>, 2019.
6. Muddiman, A. and A. Bainbridge Frymier, *What is Relevant? Student Perceptions of Relevance Strategies in College Classrooms*. Communication Studies, 2009. **60**(2): p. 130-146.
7. Albrecht, J.R. and S.A. Karabenick, *Relevance for Learning and Motivation in Education*. The Journal of Experimental Education, 2018. **86**(1): p. 1-10.
8. Taylor, E. and A.P. Calitz. *The Use of Industry Advisory Boards at Higher Education Institutions in Southern Africa*. in *ICT Education*. 2020. Cham: Springer International Publishing.
9. Pentaris, P., S. Hanna, and G. North, *Digital poverty in social work education during COVID-19*. Advances in Social Work, 2020. **20**(3): p. x-xii.
10. Gartner, I. *About us*. 2021 [cited 2021 22/05/2021]; Available from: <https://www.gartner.com/en/about>.
11. Foster, M.K., *Design Thinking: A Creative Approach to Problem Solving*. Management Teaching Review, 2019: p. 2379298119871468.
12. Williams, R.S., *What's Next? [The end of Moore's law]*. Computing in Science & Engineering, 2017. **19**(2): p. 7-13.
13. Glen, R., C. Suci, and C. Baughn, *The Need for Design Thinking in Business Schools*. Academy of Management Learning & Education, 2014. **13**(4): p. 653-667.
14. Armstrong, C.E., *Teaching Innovation Through Empathy: Design Thinking in the Undergraduate Business Classroom*. Management Teaching Review, 2016. **1**(3): p. 164-169.
15. Armellini, A., V. Teixeira Antunes, and R. Howe, *Student Perspectives on Learning Experiences in a Higher Education Active Blended Learning Context*. TechTrends, 2021.
16. Nick, Z. and L. Linda, *Improving student engagement: Ten proposals for action*. Active Learning in Higher Education, 2010. **11**(3): p. 167-177.
17. Ramberg, U., G. Edgren, and M. Wahlgren, *Capturing progression of formal knowledge and employability skills by monitoring case discussions in class*. Teaching in Higher Education, 2021. **26**(2): p. 246-264.
18. Wrigley, C. and K. Straker, *Design Thinking pedagogy: the Educational Design Ladder*. Innovations in Education and Teaching International, 2017. **54**(4): p. 374-385.
19. Ejsing-Duun, S. and H.M. Skovbjerg, *Design as a Mode of Inquiry in Design Pedagogy and Design Thinking*. International Journal of Art & Design Education, 2019. **38**(2): p. 445-460.
20. Meredith, J., *Theory building through conceptual methods*. International Journal of Operations & Production Management, 1993. **13**(5): p. 3-11.
21. DeSimone, J.A., *Exemplary Exercises for Entrepreneurship Education*. Management Teaching Review, 2016. **1**(3): p. 170-175.
22. Spivack, A.J., *Recasting the Door: An Applied Design Thinking Skill Building Exercise*. Management Teaching Review, 2019. **5**(3): p. 218-230.

# Teaching technology foresight to business and management students

McGowan, Phill

2022-03-08

---

McGowan P. (2022) Teaching technology foresight to business and management students. In: INTED2022: 16th International Technology, Education and Development Conference, 7-8 March 2022, Virtual Event, pp. 2350-2354

<https://doi.org/10.21125/inted.2022.0689>

*Downloaded from CERES Research Repository, Cranfield University*