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A Comparison of European, US and Asian Manufacturing Plants on the Use of Socially Responsible Practices

BRIAN P. NIEHOFF,[*] CHENLUNG YANG,[**] LITZANG HSU[***] AND CHWEN SHEU[****]

ABSTRACT

Manufacturers around the globe are implementing socially responsible practices in their plants to comply with government policies, to create more value or for socially conscious reasons. Research has examined some aspects of the implementation of socially responsible practices, but little is known about the general level of implementation of such practices. Also, only a few studies have examined the degree to which such practices contribute to bottom-line manufacturing performance, or whether such practices differ in various regions around the world. The present study used a database of manufacturing plants to explore whether the practices of pollution prevention, waste reduction, recycling of materials and employee health and safety were related to indicators of manufacturing performance and competitiveness. Results showed that the use of socially responsible manufacturing practices was related to indicators surrounding the speed of delivery. Implications of the results for future research are discussed.

Key Words: social responsibility; manufacturing; green manufacturing

INTRODUCTION

The practice of socially responsible manufacturing and supply chain management has grown considerably (O'Brien, 2002; Kovacs, 2008) as governing bodies and industries have begun to establish environmental and socially responsible standards. In response to initiatives such as the United Nations Global Compact's commitment to environmental

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protection (Brown, 2008) and the European Union's (EU) leadership in establishing such responsible environmental protection policies for businesses (del Brio and Junquera, 2003; Grote et al., 2007; Kovacs, 2008), along with public calls for social and environmental responsibility, global manufacturers have initiated a variety of socially responsible practices. Whether using environmental standards in the selection of outsourcing or supply partners, adherence to employee health and safety standards internally, ethical behaviour in developing countries, or requiring environmental protection in upstream and downstream partnerships, manufacturers have begun to recognise the importance of social responsibility inherent in their activities (del Brio and Junquera, 2003; Trowbridge, 2001). In addition, industry standards are emerging from many fronts, such as ISO 14001 and the Institute for Supply Management's (ISM) Principles for Social Responsibilities. Within manufacturing, socially responsible practices include a variety of activities such as waste reduction, recycling, reuse, remanufacturing, conservation in water usage and employee safety precautions.

Whether the drivers of more socially responsible practices in the supply chain are government edicts, changes in industry standards or bottom-line performance is debatable. There have been a number of studies supporting the cost savings associated with green purchasing (Carter, 2005), pollution control (Klassen and Whybark, 1999) and other socially responsible practices (King and Lenox, 2001; Mitra and Webster, 2008; Shrivastava, 1995; Yang and Sheu, 2007). As noted by the ISM, the payback from socially responsible behaviour can be financial or ensuring that companies avoid difficult and embarrassing scrutiny, but the soft paybacks of integrity, honesty and reputation are the real foundation and rationale for such practices (Novak, 2004). Nonetheless, there is growing evidence of positive relationships with cost efficiency, quality, speed and supply chain performance (Brown, 2008; Carter, 2005; Vachon and Mao, 2008). Many of the studies have been performed on limited samples in specific industries or in smaller case studies. There is a call for more research on a broad level that examines the relationship between socially responsible practices in supply chain management and firm performance.

In addition, there might be variation in the emphasis such socially responsible practices receive in different regions around the world (Zhu et al., 2007). As noted above, the EU has moved forward on legislation and policies that set environmentally conscious standards for manufacturers and supply chain managers. For example, in 2005, a European Commission directive established that manufacturers of energy-using products would be required to examine the integration of eco-design into their standard designs (Grote et al., 2007). This directive has affected the social responsibility of the manufacturers of a wide variety of products including heating systems, computers, televisions, lighting and batteries. In the United States (US), the Environmental Protection Agency (EPA) has very stringent standards for the disposal for hazardous waste and the Occupational Safety and Health Administration (OSHA) standards have long existed for regulating employee health and safety, but legislation concerning other socially responsible practices has yet to be enacted. In Asia, variations by country exist, as Japan has much stronger policies toward environmental management compared to China, for example. Many companies in the US and

Asia have voluntarily adopted socially responsible practices, as the business case for social responsibility gains strength.

There is a need for broader research efforts examining the impact of socially responsible practices in supply chain management on firm performance covering multiple practices, multiple measures of performance and multiple regions around the globe. There is also a need for an agenda for future research in this area. The purpose of the present paper is to initiate research along these paths. First, we present an initial exploration of socially responsible practices in manufacturing facilities using an existing dataset drawn from a number of regions around the globe. The study focused on the practices of waste reduction, recycling, pollution prevention and workplace health and safety activities. The data were gathered as part of a larger effort by the Global Manufacturing Research Group (GMRG), and included samples from Europe, the US, Asia and Australia. In this study, we addressed the following questions:

1. What is the current reported use of socially responsible manufacturing practices in the EU, US and Asia?
2. Do the socially responsible practices correlate with indicators of manufacturing performance and competitiveness?
3. Does the level or use of such socially responsible practices vary by global region (EU, US and Asia)?

In addition, within the discussion of the results, we provide strategies and guidelines for future research in the area of socially responsible manufacturing and supply chain management practices.

LITERATURE REVIEW

Corporate Social Responsibility (CSR) is defined by the Commission of the European Communities (2001: 7) as

> …the voluntary integration, by companies, of social and environmental concerns in their commercial operations and in their relationships with interested parties.

One of the keys in the definition is that the integration of such concerns is voluntary, going beyond mere compliance with any regulations or legal rulings (Kovacs, 2008). Commercial business operations, while meeting the needs of shareholders through profits, exhibit CSR in order to address the concerns of a variety of stakeholders – the local community, government, employees, society at large or even the environment. Research on CSR in manufacturing and supply chain management has been conducted under a variety of terms, including green supply chain management, environmental management, sustainability management and others. Given the specific nature of the activities included in the present study, the term 'socially responsible manufacturing practices' was determined to be the most descriptive.

It is important to note the focus here is on practice, not philosophy or motive. In exploring these socially responsible practices, the present study assessed the perceived

level of use of socially responsible practices themselves, not the social responsibility of the companies involved or their motives for engaging in the practices. It is understood that companies engage in these practices for many motives – to elicit a better reputation with the public or because of the need to comply with government policy – but the present study is not concerned with motives. At this initial phase of the research, the interest was only in the practices that the manufacturers have in place. Also, it is recognised that the global green movement is a powerful force, and that the ultimate measure will be whether companies can reduce the size of their carbon footprints in the global environment. The present study was limited by the items used in the GMRG survey, which simply focused on the perceived use of various socially responsible practices. Given the lack of data on this topic, the present study was able to explore some basic questions for over 1,000 manufacturers around the globe to understand a baseline level of activity.

Socially Responsible Manufacturing Practices and Manufacturing Performance

There are a number of categorisations that have been offered by researchers and practitioners as to the activities included in socially responsible manufacturing practices. The ISM has developed principles of social responsibility for its industry across seven areas. These areas include supporting communities, proactively promoting diversity, environmental responsibility, adhering to ethical standards or conduct, use of sound and transparent financial practices, protection of human rights and dignity, and safety in the work environment as well as in products and practices (Novak, 2004). In their confirmatory analysis of their survey measure for socially responsible supply chain management practices implementation, Zhu et al. (2008) reported five factors: internal environmental management, cooperation with customers, green purchasing, ecological design of products and investment recovery. Kovacs (2008) and others divide socially responsible practices into activities targeting upstream partners (i.e. purchasing from suppliers who are environmentally and socially conscious, ethical and responsive to human rights concerns) and those downstream (i.e. responsibility for the environmental impact of operations, including resource usage, employee health and safety, product safety, waste management, recycling and environmentally conscious packaging). For the purposes of the present study, socially responsible manufacturing practices are defined using four activities targeting downstream stakeholders: pollution prevention, recycling of materials, waste reduction, and employee health and safety.

Pollution Prevention

In the production process, pollutants can be released through the air, water or land. In the US, statutes such as the Clean Air Act (1970), the Clean Water Act (1977), the Resource Conservation and Recovery Act (1976) and the Pollution Prevention Act (1990) and many others were created to control pollution, with the EPA as the agency responsible for monitoring and enforcement. The specific goal of the Pollution Prevention Act was to reduce or eliminate pollution, and to improve technology, manufacturing and products that will

reduce levels of pollution. In Europe, pollution control in member states is governed by hundreds of legal acts or directives that impose obligations which are sufficiently flexible to allow for differing legal and government systems. Asian efforts in pollution control vary by country, for example, Japan enacted initial pollution control laws in the 1960s and has furthered its legislation into the 1990s, while China is just beginning to enact such laws.

A few studies have been conducted examining the relationship between pollution prevention and manufacturing performance. Klassen and Whybark (1999) found that self-reported implementation of pollution prevention technologies was significantly and positively related to manufacturing performance with regard to cost, speed and flexibility. In the process of a manufacturer seeking ways to prevent (rather than control) pollution, engineers are driven to rethink and redesign the process or product, similar to the efforts in quality management practices. In fact, Rothenberg et al. (2001) found that the implementation of lean manufacturing practices was significantly associated with the reduction in air emissions of volatile organic compounds.

Recycling of Materials

A variety of recycling programmes have been developed in manufacturing settings, including recycling of waste materials, recycling outdated or old products, reusing parts and remanufacturing a defective product rather than disposing of it. Recycling generally requires the disassembly of the waste or product, separating parts into component materials, and then reprocessing the materials (Pun, 2006). Remanufacturing generally involves the replacement of old, worn out or obsolete parts of the product, while maintaining part of the original product. The internal cost of recycling or remanufacturing will usually be determined before a programme is initiated (Li et al., 2009). Manufacturers may also contract out to a third-party provider who would perform all of the necessary steps to prepare the recycled product for reuse (Meade and Sarkis, 2002). Thus, by design, a recycling programme should be cost efficient. Since recycling programmes are voluntary at this time, not subject to any legislation, then cost efficiency should be a driver of their implementation.

Waste Reduction

Waste from manufacturing production could take many different forms, including leftover product parts and packaging materials, unused or by-product chemicals and liquids that are part of the production process, or fluids and other materials used in cleaning or maintenance. Theoretically, then, reducing waste would involve activities intending to reduce any of these forms of waste. In practice, waste reduction can influence manufacturing performance in a fashion similar to that of pollution prevention (Piluso and Huang, 2008). In order to determine how to effectively reduce waste, engineers and designers re-evaluate production processes, inputs, fabrication technologies and methods for handling defective parts and by-products. As processes and products are redesigned or reengineered, waste reduction activities should improve production efficiencies.

Employee Health and Safety

Trowbridge (2001) presents a case study of the implementation of socially responsible practices at Advanced Micro Designs (AMD). Their driving policy was geared to provide a safe workplace for employees, protect the natural environment, enhance employee morale, assure compliance with applicable laws and regulations worldwide, and prevent damage to property. The metrics developed by AMD to assess and report on their annual performance in these areas showed a number of positive outcomes emerged in the manufacturing environment. Trowbridge (2001) noted that employee health and safety concerns also include the assurance that upstream suppliers and downstream partners act accordingly as well. Does the manufacturer support or partner with operations in which employees are exposed to a high risk of injuries or other health-related problems? While the cost of altering product and process designs to assure one's own employees' health and safety is challenging enough to compute, it is far more difficult to determine the costs for one's partners.

There is clearly a benefit to an operation if employees remain healthy and satisfied with their workplace (Wright et al., 2007), not to mention the decrease in lost time, replacement, slowdowns or stoppages, and related costs when employees are injured at work. In the US, the federal agency of OSHA oversees all issues concerning worker health and safety to assure safe practices. The EU, Japan and other countries have similar agencies and legislation. Thus, there is a compliance aspect to socially responsible manufacturing, yet the interest in voluntarily taking the attitude toward safety upstream and downstream would be viewed as a step beyond compliance.

In all, these socially responsible manufacturing practices – pollution prevention, recycling of materials, waste reduction and employee health and safety – should increase the effectiveness and efficiency of the manufacturing operation in various ways. Thus, it is predicted:

Hypothesis 1: Socially responsible manufacturing practices of pollution prevention, recycling, waste reduction, and employee health and safety will be significantly related to manufacturing performance; that is, as manufacturers report more socially responsible practices, they will also report more positive performance indicators.

International Differences in Socially Responsible Manufacturing Practices

Regions and countries differ in their relative emphasis on socially responsible manufacturing practices. As noted above, the EU has not only established considerable legislation, directives and policies surrounding pollution control and employee health and safety, but has also targeted producers of energy-using products to consider eco-design frameworks for waste reduction and recycling. In the US, while pollution control and employee health and safety regulations have set compliance levels for those practices, no broad policies exist at this time for waste reduction or recycling. Those practices are strictly voluntary. Japan and other Asian countries such as Taiwan, Hong Kong, South Korea and Singapore have enacted legislation similar to the US for pollution control and employee health and safety, leaving waste reduction and recycling to more voluntary arrangements. As for

China, environmental business practices have just begun, thus one would expect their use of socially responsible manufacturing practices to either be lagging other Western economies or possibly be up to date, given the likelihood of more cutting-edge technology and equipment. Given these differences, the following hypothesis can be stated:

Hypothesis 2: There will be significant differences in socially responsible manufacturing practices among the EU, the US and Asian countries (Taiwan, China and South Korea).

RESEARCH METHODS

The data were gathered by the Global Manufacturing Research Group (GMRG), a multinational community of researchers studying the improvement of manufacturing practices worldwide (see http://www.gmrg.org). The GMRG consists of leading international academic researchers from over twenty countries who developed the GMRG database survey instrument for use around the world. This survey facilitates a global comparison of the effectiveness of manufacturing practices (Whybark, 1997; Whybark et al., 2009). Since 1985, the GMRG has completed three rounds of the worldwide survey and is currently completing the fourth round, from which the present study obtained data. The questionnaires were translated and back-translated for all countries by several academics; in some cases the same language was modified to reflect country/regional differences. The database GMRG 4.0 has 1,072 samples from 17 countries (Table 1). The average number of responses per country was 63. The average firm size in our sample was 363 employees. Companies in Asia had a larger workforce than their counterparts surveyed from other regions of the world. There was no significant difference regarding the age of manufacturing equipment across countries. The GMRG survey is completed by the plant manager or a member of the plant manager's immediate staff.

Table 1: Sample Demographics

Region	Total Number of Responses (Plants)	Average Number of Plant Employees	Average Age of Manufacturing Equipment
1. Asia (China, Korea, Taiwan)	217	889	9.7 years
2. EU (Austria, Germany, Italy, Sweden, Finland)	297	350	11.2 years
3. Non-EU European (Hungary, Macedonia, Albania, Poland)	164	351	12.5 years
4. US	84	373	11.4 years
5. Others (Fiji, Mexico, Nigeria, Ghana)	310	245	12.5 years
Total	*1072*		

The measurement of socially responsible manufacturing practices consisted of four items from the GMRG survey. Each item was a response to the question, 'In the last two years, to what extent has the plant invested resources (money, time and/or people) in programmes in the following areas?' The four items were labelled pollution prevention, recycling of materials, waste reduction and workplace health and safety. The survey used a 7-point Likert scale ranging from 1 ('not at all') to 7 ('to a great extent'). Scores from the four items were summed and divided by four to obtain a single score for the variable of socially responsible manufacturing practices (SRMP).

To measure manufacturing performance, a latent construct of manufacturing competitiveness was derived by combining scores for five competitiveness goals. These indicators were:

1. Cost – manufacturing cost, product cost and raw material cost
2. Quality – product features, product performance and product quality
3. Delivery – order fulfilment speed, delivery speed and delivery as promised
4. Product variety – delivery flexibility, flexibility to change output volume and flexibility to change product mix
5. New product development (NPD) – manufacturing throughput time and new product design time

Within each goal, plant managers were asked to compare the performance of their plant relative to their competitors. Table 2 includes all of the measurement items, and Table 3 presents the correlations matrix for all scales. Since none of the correlations are above 0.8, multi-colliniarity was not considered to be an issue in this study (Hatcher, 1994).

Table 2: Confirmatory Factor Analysis of Competitiveness Performance and SRMP

Competitiveness Performance	Factor Loading
(1) Cost (Construct reliability = 0.848)	
CG02 – manufacturing costs	0.86
CG03 – product costs	0.88
CG04 – raw material costs	0.67
(2) Quality (Construct reliability = 0.864)	
CG05 – product features	0.82
CG06 – product performance	0.87
CG07 – product quality	0.78
(3) Delivery (Construct reliability = 0.901)	
CG08 – order fulfilment speed	0.87

(*Continued*)

Table 2: (*Continued*)

Competitiveness Performance	Factor Loading
CG09 – delivery speed	0.93
CG10 – delivery as promised	0.80
(4) Flexibility (Construct reliability = 0.809)	
CG11 – delivery flexibility	0.76
CG12 – flexibility to change output volume	0.79
CG13 – flexibility to change product mix	0.75
(5) NPD (Construct reliability = 0.660)	
CG14 – manufacturing throughput time	0.77
CG15 – new product design time	0.63
Socially Responsible Practices (Construct reliability = 0.893)	**Factor Loading**
IP32 – pollution prevention	0.67
IP33 – recycling of materials	0.80
IP34 – waste reduction	0.84
IP35 – health and safety	0.71

Table 3: Correlation Matrix of Competitiveness Performance Indicators and SRMP

	(1) Cost	(2) Quality	(3) Delivery	(4) Flexibility	(5) NPD	(6) SRMP
(1) Cost	1.000					
(2) Quality	0.402*	1.000				
(3) Delivery	0.412**	0.446**	1.000			
(4) Flexibility	0.384**	0.435*	0.625**	1.000		
(5) NPD	0.494**	0.452**	0.587**	0.585**	1.000	
(6) SRMP	0.180*	0.212**	0.233**	0.158**	0.273*	1.000

Note: * = $p < 0.05$; ** = $p < 0.01$

Measurement of Study Constructs

In this study, we used the multiple items to represent two latent constructs: socially responsible manufacturing practices (SRMP) and manufacturing competitiveness. For each latent construct, reliability and validity were assessed based on a three-step procedure with confirmatory factor analysis (CFA), shown in Table 2. Each latent construct was tested for internal consistency using Cronbach's alpha and construct reliability. The alpha

coefficients were between 0.80 and 0.92, which are above the benchmark of 0.70 suggested by Nunnally (1978), and construct reliabilities were between 0.68 and 0.86, which are above the benchmark of 0.60 suggested by Bagozzi and Yi (1988). Overall, the results suggested a high internal consistency of measurement indicators and, hence, reliability of each construct was ensured.

Next, convergent validity and discriminant validity were assessed. Convergent validity is supported if the standardised factor loadings of observed items on latent constructs were above 0.50 (Bagozzi and Yi, 1988). The standardised factor loadings range from 0.55 to 0.95 and were statistically significant at $p < 0.05$. Therefore, convergent validity of the measurement indicators was supported. Discriminant validity is tested by comparing the correlation coefficients between latent constructs with the variance-extracted percentages for each construct (Fornell and Larcker, 1981). The variance inflation factors (VIF) of two latent constructs were below the recommended value of 10, implying the lack of multicollinearity, thus the discriminant validity of the constructs was supported.

To ensure content validity, appropriate measurement items were selected and evaluated by subject matter experts (Kerlinger and Lee, 2000). In this study, measurement items were extracted from the previous literature. Suggestions from operations management researchers and practitioners during the questionnaire design and pilot testing further corroborated the content validity of the constructs.

RESULTS

The sample size for the study was $n = 1{,}072$ companies reporting data. The mean score for SRMP was 4.21 (standard deviation = 1.47), thus just above the midpoint on the 7-point scale. Prior to testing the hypotheses, the control variable of organisation size was examined regarding its relationship to the socially responsible practices. It was found that SRMP was significantly correlated with both the number of production workers ($r = 0.13$, $p < 0.05$) and the total number of engineers ($r = 0.13$, $p < 0.05$). Among all regions, the Asian samples have the largest number of employees, production workers and engineers (Table 1). The literature indicated that larger manufacturers were more likely to be implementing socially responsible practices compared to smaller plants (Klassen and Whybark, 1999). In our analysis, the number of employees is treated as a control variable.

With regard to the relationship of SRMP to the rated performance indicators across the five competitiveness areas, five regression analyses were conducted. Table 4 presents the results of the analyses. We found that both quality and delivery were significantly related to SRMP. This finding suggests that socially responsible manufacturing practices were significantly and positively associated with the quality ($p < 0.05$) and delivery ($p < 0.05$) aspects of performance. Additional regression analyses showed no other significant relationships for SRMP and manufacturing performance on cost, flexibility and new product development. Thus the first hypothesis was only partially supported.

Table 4: OLS Regression Analyses of Socially Responsible Manufacturing Practices (SRMP) on Indicators of Competitiveness Performance

	Competitiveness Performance (Dependent Variables)				
	Cost	**Quality**	**Delivery**	**Flexibility**	**NPD**
Intercept	3.09**	4.48**	4.03**	4.62**	2.85+
• Control variables					
• Firm size	0.00**	0.00	0.00	0.00+	0.00+
Industry	0.01	0.07	0.01	0.01	0.04
Independent variable					
• SRMP (Beta)	0.08+	0.09*	0.08*	0.01	0.01
F-value for equation	*3.619*	*3.698*	*12.625*	*3.069*	*3.148*
R^2 for full equation	*0.033***	*0.036***	*0.115***	*0.030**	*0.028*
ΔR^2 for SRMP	*0.020***	*0.028***	*0.071***	*0.018+*	*0.012+*

Note: + = $p < 0.1$; * = $p < 0.05$; ** = $p < 0.01$

With regard to the predictions of SRMP by country, the data were divided into five geographic groupings: (1) Asia (China, South Korea and Taiwan), (2) EU (Austria, Germany, Italy, Sweden and Finland), (3) European but non-EU (Hungary, Macedonia, Albania and Poland (These data were collected prior to Hungary and Poland entering the EU, thus these two countries were treated as non-EU countries for the purposes of comparison.)), (4) US and (5) other countries (Fiji, Mexico, Nigeria and Ghana). Table 5 compares the means for SRMP across these five regions. The results show that the Asian region reported the highest levels of socially responsible practices (mean = 4.64), followed by the US (mean = 4.19) and the EU (4.13). The lowest reported levels of socially responsible practices were in the non-EU European countries (mean = 3.76), while the other countries reported a higher level (mean = 4.11). Statistical analysis showed the Asian region had significantly higher reporting of SRMP than the samples from the other four regions ($F = 14.54$, $p < 0.01$).

Table 5: Social Responsible Practices – Regional Differences

	Average for Total Sample	**Group 1 (G1) Asia**	**Group 2 (G2) EU**	**Group 3 (G3) Non-EU**	**Group 4 (G4) US**	**Group 5 (G5) Others**
Social Responsible Practices	4.21	4.62	4.13	3.76	4.19	4.11

Note: ANOVA comparison of means: $F = 14.54$, $p < 0.01$
Post-hoc test: G1 > G2, G1 > G2, G1 > G3, G1 > G4, G1 > G5 ($p < 0.01$)

DISCUSSION

There have been more voices calling for companies to implement socially responsible practices in manufacturing settings. Socially responsible practices, including recycling of materials, waste reduction, pollution prevention and employee health and safety measures, reflect a growing emphasis among manufacturers on the importance of environmental concerns. The motivation for implementing such practices could be that companies are becoming more socially responsible, or they are seeking a more socially responsible image, or they are simply complying with government policies. The question is whether these practices are accompanied by any financial or productivity advantages. Some research suggests that socially responsible practices complement quality management implementations, as both are seeking to reduce inefficient use of resources (Klassen and Whybark, 1999; Rothenberg et al., 2001). In essence, however, little is known about the actual degree of widespread implementation of these practices in manufacturers around the world. In addition, there are presumptions surrounding the use of such practices in various countries which have not yet been tested for accuracy. The present study was an initial attempt to report some data on these issues.

The findings of the present study answer some questions and raise others with regard to the implementation of socially responsible manufacturing practices both generally and regionally around the world. First, it is clear that, while the reported use of socially responsible practices is not high, it is also not low. The means found for the measures of SRMP suggest that many manufacturers have begun to utilise these practices to at least a moderate extent, if one considers the median point on our scale to be a moderate level of implementation. Also, the data suggest that if one of the four practices – pollution prevention, recycling of materials, waste reduction and employee health and safety concerns – is implemented, the other practices are also likely to be in place. The confirmatory factor analysis found all four practices loaded onto one factor, and the measure of internal validity showed strong correlations among the four practices. When companies decide to be more socially responsible, the efforts are likely multifaceted across the different types of programmes.

Evidently, as suggested by the regression analysis (Table 4), socially responsible practices are complementary to quality management practices, based on the relationships between the practices and quality as a measure of firm performance. This supports literature that draws parallels between the implementation of quality management processes and the implementation of socially responsible practices (Brown, 2008; Klassen and Whybark, 1999; Kovacs, 2008; Rothenberg et al., 2001). Similar processes are used to enact these programmes. All are aimed at being more conscious of improvement in qualitative aspects of the work environment. The improvement of quality involves developing group-based teams to reduce the amount of waste and inefficiencies in the production system, which overlay some of the targets of social responsibility practices. In programmes aimed at reducing waste or increasing recycling and pollution prevention, the firm is seeking ways to decrease the amount of discarded product or by-product. As inefficiencies in purchasing, production or shipping are corrected, not only will production and the supply chain improve in quality, but less waste will be emitted into the environment.

The use of socially responsible practices was also significantly correlated with the indicators of delivery speed and performance (Table 4). Therefore, firms that reported more use of socially responsible practices were also likely to report higher levels of speed in order fulfilment and delivery, as well as more delivery as promised. Many of the strategies for enhancing social responsibility also involve adjustments in the supply chain (Novak, 2004) as firms seek ways to decrease pollution, improve employee working conditions and reduce waste through recycling. For example, if a company is redesigning delivery routes to use less fuel, then delivery speed would naturally increase. Reducing the use of paper orders by digitising information into a computer network would not only reduce waste but also improve the accuracy of delivery orders.

The findings based on the country comparisons were a bit surprising, as the data showed the levels of socially responsible practices reported in the Asian region to be higher than those in the US or EU. Given the recent directives of EU policies toward socially responsible manufacturing practices, it was expected that such practices would be reported at significantly higher levels in the EU compared to other regions. It is possible that the finding reflects the relative newness of plants, equipment and processes in Asia compared to the EU. This phenomenon is true especially considering the majority of samples from Asia were computer manufacturers who have more advanced facilities which include cutting-edge pollution controls and up-to-date processes for waste management (Yang et al., 2010). On the other hand, although it was not included in the samples, Japan has had strong environmental policies in place for decades and firms in other Asian countries have had to make adjustments to their own environmental policies and practices in order to remain a supplier for Japanese firms. Another possible explanation to a higher SRMP score in the Asian region *may* have something to do with the way the survey question was asked. Interviewees were asked if they had invested more in these areas '*in the last two years*'. It is conceivable that the Asians are actually behind the EU and the US, for example, but they may be catching up and investing in these areas more in recent years. More research is necessary to properly understand the nature of this finding. It may be the case that combining all Asian countries together might mask between-country differences. Perhaps including Chinese firms with South Korean and Taiwanese firms ignores possible variance between countries. This is an avenue for further research.

Limitations of the Study

There are a number of limitations to the present study. First, the data were collected using a survey, and all measures represented perceived aspects of the manufacturers, their performance and their implementation of socially responsible practices. Given that all of the information collected depended on the knowledge of the plant manager or the administrative staff, as well as their motivation to provide accurate information, it could be argued that the data might not correlate highly with objective measures of the socially responsible practices or manufacturing performance. In addition, it is possible that the plant managers were motivated to enhance the perception of their own plants' practices. The GMRG survey has been used in many studies over the years, and is generally accepted

as a valid set of data, yet it is possible that there was bias in the answers. A second limitation was that each of the four socially responsible practices – pollution prevention, waste reduction, recycling of materials and employee health and safety – was assessed with only one item. These practices involve a variety of behaviours, processes and programmes, and it is not expected that a one-item measure would fully capture the constructs of interest. It is not possible to tell from the responses of the plant managers the full extent of the range of practices included in the responses to the items. On the other hand, the plant manager would be the focal person in the firm who would be able to indicate the degree of emphasis placed on various potential goals and objectives. Finally, the representation of countries was incomplete. The EU region consisted of only a sub-sample of countries in Europe, and only a sample of companies within those countries. The GMRG survey is limited by its membership and their capacity to gather survey information within their home or other countries. Not all countries are represented in the GMRG, and one hesitates to draw too rigid a conclusion with a somewhat limited sample of countries. Thus, the findings should only be considered as a preliminary estimate, with future research seeking even broader representation among participating countries.

The strength of this study was its focus on manufacturing performance measures, despite the perceptual nature of such measures. That is, the measures gathered would be of interest to manufacturers. On the other hand, however, it is possible that the ultimate impact of socially responsible practices may be reputational. Companies become known among competitors and communities as those who 'do the right thing' in a socially conscious sense. This avenue of thought suggests that socially responsible practices might not pay in a financial or productivity sense, but that they will enhance the reputation of the manufacturer in the eyes of the community or society. Previous literature has noted this as a prime effect, and yet the present study did not assess reputation. Future research might want to include a measure of reputation as an outcome, as that clearly is an important aspect of the motivation for implementing socially responsible practices.

CONCLUSIONS

The implementation of socially responsible manufacturing practices is not simply a socially conscious choice made by the firm, as other factors generally weigh into the decision. The existence of government policy is one mechanism that drives companies to 'go green', as does a potential financial gain. If it can be shown that socially responsible practices also enhance manufacturing or supply chain performance, through cost savings, quality improvement, innovation in design or speed of delivery, eyes can be opened to the need to convert to more responsible practices. The present study found that the level of usage of socially responsible practices is not high in the manufacturing industry, and that such practices are associated with perceived manufacturing performance on quality as well as delivery. More research is needed to determine the generalisability of these findings by including more data, broader representation, stronger measures and the use of methods that are more capable of assessing causal properties among the variables. While some may

presume that socially responsible practices are inherently better than the alternatives, manufacturers will require more data before they delve in too deeply.

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Why Do New Ventures Internationalise? A Review of the Literature of Factors that Influence New Venture Internationalisation

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ABSTRACT

This paper presents a review of the literature on internationalisation of new ventures, with particular focus on the factors explaining why new ventures internationalise at inception. The paper draws together findings from the most-cited publications most closely associated with factors explaining new venture internationalisation across various industry sectors. The paper draws on theoretical push and pull constructs to organise and classify the most recurrent findings across extant studies driving the early and rapid internationalisation of new firms. What emerges as central to understanding these firms is the role of the entrepreneur, who can act as a pivotal force in the decision-making process and who also represents an intermediating factor between push and pull forces in a new firm's decision to internationalise.

Key Words: international new ventures; international entrepreneurship; literature review

INTRODUCTION

The international landscape, once regarded as off-limits for new firms, is now becoming not only an option for some firms, but also a strategic route for survival (McDougall et al., 1994). The rapidly changing global business environment, global economic integration and advances in technology and communications have created unprecedented opportunities for small firms looking to extend their sales activities beyond the domestic market. This has been reflected not only in the large number of small- to medium-sized enterprises (SMEs) that have availed of international expansion in recent times but also in the number of firms – more commonly referred to as international new ventures (INVs) – that have

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internationalised and have engaged in international business from their inception (Autio et al., 2000; Oviatt and McDougall, 2005). Many recent studies (Aspelund et al., 2007; Mudambi and Zahra, 2007) have used Oviatt and McDougall's (1994: 49) definition, describing INVs as 'firms that seek internationalisation and derive at least 25% of their total sales from foreign markets in the first few years of operation'. Knight and Cavusgil (1996: 11) conceptualise INVs as being 'small, technology-oriented companies that operate in international markets from the earliest days of their establishment'. It has been well documented in the empirical research that an increasing number of firms can be classified as INVs according to the above definitions. The most common denominator of all these various definitions in the literature is that the firm acquires significant export involvement early in its life cycle. An increasing number of firms can be classified as INVs, and although many researchers have given such firms many titles,[1] in essence they refer to the same thing. The name INV has been adopted in this review.

There exist three published and comprehensive literature reviews on INVs; these are by Keupp and Gassmann (2009), Aspelund et al. (2007) and Rialp et al. (2005). Building on these works, this inquiry is more specific in its review. The focus of this research is to identify and review the factors influencing the firms' decision to internationalise at or near inception. Although noting the value of Oviatt and McDougall's (2005) paper, this review does not seek to measure the factors that regulate the speed of entrepreneurial internationalisation and country scope. Instead, it aims to synthesise findings from key published studies on INVs, specifically pertaining to factors influencing a new firm's decision to internationalise. Secondly, this review draws on constructs of push, pull and mediating forces of the entrepreneurial mindset (Etemad, 2004) to organise and underpin the key findings on extant INVs. The paper concludes by identifying some avenues for further research.

SYNTHESIS OF LITERATURE

An interesting and relevant research question is 'Why do some new firms choose to go international within a few years of starting up rather than to purely focus their efforts on home markets?' Many researchers have conducted studies within this field and have found several factors driving new firms to internationalise. Table 1 presents findings from key studies on INVs operating across both high and low technology sectors.

From a review of key published studies in the INV literature (Table 1), some initial observations can be made. Firstly, there exists much consensus and overlap of factors in the literature that warrant a framework categorisation. Secondly, most of the studies reveal that a key factor leading to early firm internationalisation is industry related. In particular, the dynamic nature of high-technology industries characterised by technological and short product life cycles coupled with high research and development (R&D) costs lead to early and rapid internationalisation (Johnson, 2004). Thus, it may be no coincidence that the INV firm has been studied in predominately high-technology and knowledge-intensive sectors, whereas a limited number of studies exist in traditional sectors: the crafts industry (McAuley, 1999; Fillis, 2001), the seafood sector (Evers, 2010; Knight et al., 2001), the wine

Table 1: Previous Key Studies Identifying Factors of Early Firm Internationalisation

Author/ Year	Objective of Study	Factors Influencing Early Firm Internationalisation
Bell (1995)	To analyse the relevance of the stages theory in the initial export decision and internationalisation process of small firms belonging to high-technology and service-intensive sectors	Client followership abroad triggered internationalisation
Oviatt and McDougall (1995)	Six key driving forces to determine whether the business being considered should be a global or a domestic start-up	1. A global vision exists from inception 2. Managers are internationally experienced 3. Global entrepreneurs have strong international business networks
Coviello and Munro (1995)	To examine the entrepreneurial high-technology ventures' approach to international market development, focusing on their use of network relationships to pursue foreign market opportunities and conduct international marketing activities; empirical, exploratory research; case-study approach	1. Limited domestic demand 2. Network partners 3. International nature of industry led to short product life

(*Continued*)

Table 1: (*Continued*)

Author/ Year	Objective of Study	Factors Influencing Early Firm Internationalisation
Knight and Cavusgil (1996)	1. To review traditional internationalisation theory and criticisms thereof 2. To describe the recent emergence and characteristics of INV firms 3. To propose factors that may have given rise to their emergence 4. To suggest implications that INVs may hold for management at smaller companies 5. To offer possible approaches for conducting research on these firms	1. New market conditions – the increasing role of niche markets 2. Recent advances in process technologies 3. Recent advances in communications technology 4. Inherent advantages of SMEs (flexibility, adaptability, etc.) 5. The means of internationalisation much more accessible to all firms 6. Global networks Six factors supported by: Bell and McNaughton (2000); Madsen and Servais (1997); Madsen et al. (2000); Knight et al. (2001)
Bloodgood et al. (1996)	To examine the antecedents (strategic and structural characteristics) and outcomes (subsequent performance in terms of sales growth and profitability) of the extent of internationalisation of new, highly potential ventures based in the US and still relatively young at the time of the initial public offering (IPO). Empirical and quantitative research	1. Early internationalisation is directly related to the use of product differentiation as a source of competitive advantage and the international work experience of the board of directors 2. Early internationalisation is finally contingent upon the industry and resource conditions faced by the firm at founding and soon thereafter

(*Continued*)

Table 1: (*Continued*)

Author/ Year	Objective of Study	Factors Influencing Early Firm Internationalisation
Roberts and Senturia (1996)	Development of an integrated model of globalisation that combines a cluster of other influences with elements of two traditional models of global expansion: 1. Vernon's specific product cycle model 2. The more generic internationalisation process models	1. Nature of the industry 2. Unique aspects of one emerging high-tech industry 3. External environmental forces also affect globalisation of high-tech products and firms
Madsen and Servais (1997)	Driving forces and theoretical approaches of the phenomenon of INVs Theoretical links to the U-Model, the (international) network approach, and the evolutionary approach.	1. New market conditions 2. Limited demand for niche product at home 3. Technology 4. Founder's experience and capabilities
Reuber and Fischer (1997)	To explore the role of top management teams (TMTs) in SME internationalisation	Top management team experience led to early firm internationalisation
Oviatt and McDougall (1999)	Aim to develop a framework for developing a dynamic theory explaining accelerated international entrepreneurship (involving breadth and modes of internationalisation, and the role of emerging businesses)	1. Technology innovation 2. Foreign growth opportunities 3. Political economy 4. Industry conditions 5. Firm size/strategy 6. TMT
Burgel and Murray (2000)	To examine the choice of entry modes of INVs using theoretical frameworks of transaction cost theory and organisational capability perspectives; INVs in high-tech sector in UK	1. High-quality innovative products in the form of high-tech offerings 2. Product customisation

(*Continued*)

Table 1: (*Continued*)

Author/ Year	Objective of Study	Factors Influencing Early Firm Internationalisation
Madsen et al. (2000)	Brief description of the main driving forces behind the recent rise of INVs based upon other authors' contributions	Supports findings by Knight and Cavusgil (1996)
Servais and Rasmussen (2000)	Review of external driving forces as preconditions for the rise of typical Danish INVs which mostly operate in non-high-tech industries	1. New markets 2. Technology production 3. Entrepreneur's international mindset 4. Possession of networks, both on the local and global markets, is important for the majority of these firms
Autio et al. (2000)	A knowledge- and learning-based framework is developed to examine the effects of the age of a firm at first international sales, its knowledge intensity and the limitability of its core technology on its subsequent international growth	1. Knowledge-intensive product 2. International work experience of entrepreneur
Bell and McNaugton (2000)	To expound the challenge that the growing emergence of INV (knowledge-/service-intensive or knowledge-based) firms represent to public policy in support of SME internationalisation. Thus, new policy directions and recommendations in support of these firms are provided and widely justified	Supports six factors of Knight and Cavusgil (1996) 1. Production technologies – due to a significant breakthrough in process or technology 2. Offer high-value-added products

(*Continued*)

Table 1: (*Continued*)

Author/ Year	Objective of Study	Factors Influencing Early Firm Internationalisation
Wickramasekera and Bamberry (2001)	To ascertain if the phenomenon of INVs exists within the Australian SMEs wine industry, the factors associated with being an INV, and the challenges this poses to traditional theory	1. Management experience in the industry 2. International market knowledge 3. Overseas contacts (networks), coupled with management commitment
Rasmussen et al. (2001)	To see how the founder of an INV has reduced the equivocality in relation to others, especially international actors, through two major activities in the founding process: sense making though enactment and networking Empirical, case-oriented qualitative study with data from Danish and Australian born global firms	1. Industry conditions/degree of internationalisation of industry 2. Immediate internationalisation was necessary 3.The existence of a network at the founding of the INV was not as important as expected.
Moen (2002)	To develop further understanding of the INV phenomenon by studying the differences existing between INVs and those exporting firms not classified as born globals in terms of competitive advantages, export strategy, global orientation and environmental situation	1.The decision maker's global orientation 2. Market conditions
Johnson (2004)	Examines factors influencing new ventures to internationalise; uses a comparative study of US and UK high-tech firms	1. Rapid technological product developments 2. Short life cycles in the industry
Evers (2010)	To explore factors influencing internationalisation of three case firms of export start-ups operating in the Irish seafood industry	1. Market conditions 2. Creation of new industry 3. Niche market 4. Prior industry experience (only local) 5.Trade shows 6. Social networks identifying foreign market opportunities

industry (Wickramasekera and Bamberry, 2001) and the manufacturing sector (Zucchella, 2002).

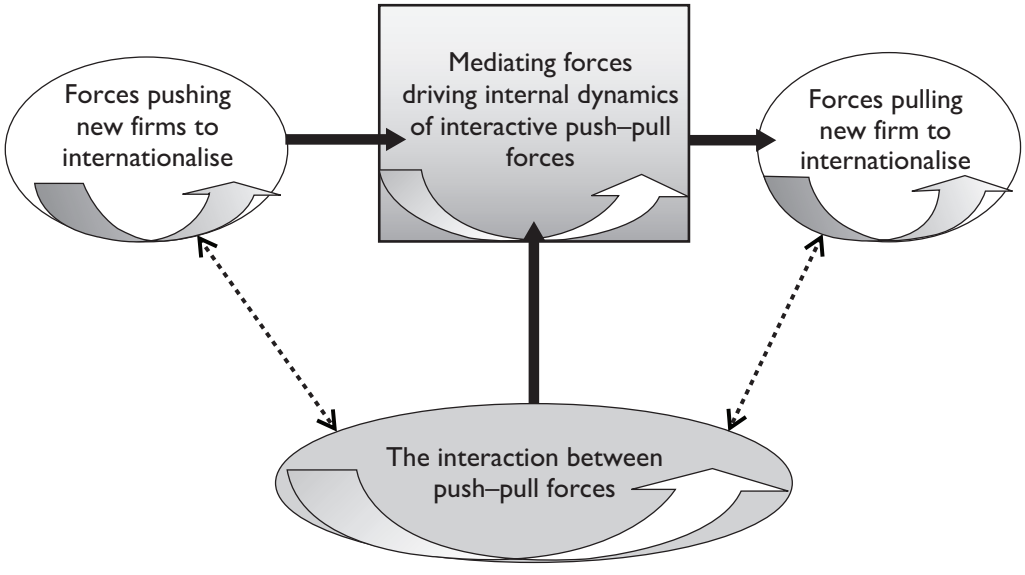
Thirdly, a dominant view in the literature is that INVs are typically led and managed by internationally experienced founders and/or top management teams (TMTs) with a wealth of international contacts (McDougall et al., 2003). In addition to an innovative high-tech offering, a key impetus for early firm internationalisation has mainly centred on the entrepreneur's or TMT's experience, contacts and prior foreign market knowledge. However, the literature on INV firms has been quite vague and some of the factors have only been superficially explored as to why new firms internationalise (Rialp et al., 2005). For instance, little distinction has been made between the founder's international experience, industry experience and the personal ties acquired prior to start-up. International ties of the founder have been commonly associated with the founder's industry and management experience and have been found to be predominantly of a business nature, e.g. clients, suppliers and economic-based partners (Larimo, 2001; Madsen and Servais, 1997; Moen, 2002; Pulkkininen and Larimo, 2002; Wickramasekera and Bamberry, 2001). More recently, social ties have only begun to receive attention as important in driving early internationalisation of the firm (see Ellis and Pecotich, 2001; Evers and O'Gorman, 2011; Kiss and Danis, 2009; Zhou et al., 2007). Social ties, often referred to as informal business relationships, are defined as relationships that consist mainly of social exchanges where no economic exchange exists (e.g. family friends, community groups and informal acquaintances) (see Evers and O'Gorman, 2011).

PUSH, PULL AND INTERMEDIATING FORCES

Similar to the approach to extant INV reviews (Keupp and Gassmann, 2009; Rialp et al., 2005), this review does not adopt a theoretical framework per se. However, drawing on Etemad's SME internationalisation framework (2004), this review integrates three constructs – push, pull and mediating forces – as a framework tool to organise and classify the key findings from the INV literature and to illustrate the dynamics of new venture internationalisation. Figure 1 depicts a simplified framework of the constructs. Pull factors that influence a new firm's decision to internationalise can include both internal and external incentives which pull the firm to engage in international business; for example, international market opportunities for wealth creation. Pull factors provide rich incentives for the entrepreneur to seek out foreign customers as part of their overall business strategy (Etemad, 2004). Push factors are a set of forces (or drivers) that are mainly internal to the firm and exert pressure on the firm (from the inside) to internationalise. The push factors tend to be entrepreneurial in nature and follow the Schumpterian quest for 'creating' opportunities, especially when the firm has 'innovative combinations' (e.g. innovative products, new to the economy) and the wherewithal to realise them (Etemad, 2004).

Consistent with Kirznerian views of entrepreneurs and entrepreneurial firms, INVs can display a response to large international 'opportunities' (Kirzner, 1973), such as unfulfilled market demand abroad. For example, the manifestation of push and pull factors may accelerate new venture internationalisation processes, especially when domestic market

Figure 1: Simplified Depiction of the Dynamics of Push–Pull and Mediating Forces in New Venture Internationalisation



Source: Adapted from Etemad (2004: 4). Reproduced with permission, © *Canadian Journal of Administrative Sciences*.

inertia may have been encumbering their efforts (Bloodgood et al., 1996). For example, a small home market and large demand abroad render internationalisation a necessity rather than a choice for survival (Evers, 2010). Enquiries conducted amongst smaller knowledge-intensive firms also found that some firms ignore their domestic markets from the outset and target 'led' markets by focusing on highly specialised global niches (Bell, 1995; Boter and Holmquist, 1996; Coviello and Munro, 1995, 1997; Madsen and Servais, 1997). New firms can be pulled to world markets by more favourable conditions than those found domestically (Evers, 2010; Thai and Chong, 2008).

Essentially, push and pull forces direct the firm's strategy towards internationalisation. This view is reinforced by the firm's perception that it may possess the capability of matching suppliers with the unique resources to meet the market demands abroad. This enhanced perception of a firm's resources and capabilities is due to the favourable contributions from both push and pull factors abroad. Also, the availability of resources in the form of knowledge and experience, as well as capital resources, can also be significant in the decision to exploit such opportunities for new firms. Hence, forces that push the firm out can be the unique capabilities and competencies of the firm to overcome barriers such as shortage of finance (Etemad, 2004) and multinational enterprise adversaries.

A third construct in this framework are 'mediating forces', also referred to by Bell, McNaughton, Young and Crick (2003) as the mental model of the mindset of the

entrepreneur, which can act as an intermediating force between push and pull factors. The mental model of the firm's founder can be characterised by his/her propensity to take risks and his/her international outlook and orientation in exploiting foreign opportunities. The manager's perception of his/her external environment also impacts on the mindset in international decision making and founder characteristics are particularly relevant for the manifestation of internationalisation at inception (Kundu and Katz, 2003). The mediating factors refer to those forces that result from the interaction between dynamics of the push and pull forces bearing influence on the firm. It is a mediated impact, inasmuch as the entrepreneur's mindset vis-à-vis opportunity influences the true course of a firm's internationalisation (Etemad, 2004).

Furthermore, the combined impact of push and pull forces is also intermediated by the firm's assessment of its internal resources and capabilities at inception; in the case of new firms it is the entrepreneur as key decision maker which renders him/her as a core intermediating force. Many researchers, including Rennie (1993), Hakansson and Snehota (1989), Gulati (1995) and Huber (1991) have acknowledged the possibility of such interactions and mediations. This review considers the entrepreneur as a pivotal force in the decision-making process of the firm; their mental model and mindset represent the intermediating forces at play with push and pull factors. Each key finding is discussed below.

Pull Forces

Global Dynamics of the Industry

It has been argued that the nature of the industry (see Table 2) has been influential in accelerating the internationalisation process of firms (Johnson, 2004). The nature of the industry, or the environment in which the firm operates, can have a significant 'pull' effect on the decision to internationalise for new ventures (Oviatt and McDougall, 1997; Porter, 1980). Coviello and Munro's (1997) study on New Zealand INVs found that patterns of firm internationalisation did not follow the traditional stages model (Johanson and Vahlne, 1977, 1990). Early internationalisation was influenced by the nature of the industry the firms were operating in, predominately a highly competitive high-tech sector, which features relatively short product life cycles. The degree of internationalisation of the sector that INVs operate in has been found to also add to our understanding of INVs in low-tech sectors. Studies on INVs have found that the decision to internationalise was reactive, in response to industry and market conditions (Bell, 1995; Evers, 2010). In a recent study of Irish INVs in the aquaculture industry, findings showed that early internationalisation was very much about survival, rather than the need to exploit proprietary knowledge and gain first-mover product advantage (Evers, 2010). New firms may go international immediately in certain sectors where there is already a pre-existing high degree of internationalisation and global integration in the sector (Evers, 2010).

Table 2: Factors Pulling New Ventures to Internationalise

Pull Forces/Reactive Motives	Key Studies
Dynamics of the industry	Jolly et al., 1992; Bloodgood et al., 1996; Boter and Holmquist, 1996; Roberts and Senturia, 1996; Coviello and McAuley, 1999; Oviatt and McDougall, 1999; Shrader et al., 2000; Rasmussen et al., 2001; Knight et al., 2001; Johnson, 2004; Evers, 2010
Global integration of the industry	McDougall, 1989; McAuley, 1999; Shrader et al., 2000; Fernhaber et al., 2007; Evers, 2010
Opportunity in global homogenous niche markets	Jolly et al., 1992; Oviatt and McDougall, 1994; Bloodgood et al., 1996; Knight and Cavusgil, 1996; Madsen and Servais, 1997; Madsen et al., 2000; Knight et al., 2001; Servais and Rasmussen, 2000; Larimo, 2001; Moen, 2002; Zucchella, 2002
Business networks	Coviello and Munro, 1995; McDougall et al., 1994; Larimo, 2001; Evers and O'Gorman, 2011; Erramilli and Roa, 1990; Bell, 1995; Hellman, 1996; Abouzeedan and Busler, 2007
Antecedent social ties	Kiss and Danis, 2009; Ellis and Pecotich, 2001; Zhou et al., 2007; Evers and O'Gorman, 2011

Global Homogenous Niche Markets

Deeper and wider global economic integration and the synchronisation and greater centralisation of economic activities have led to great market homogeneity across many industry sectors (Bloodgood et al., 1996; Knight et al., 2001; Madsen and Servais, 1997). McDougall et al.'s (2003) research has shown that INVs are common in globally integrated industries and are frequently found in international markets, which are fairly homogeneous worldwide. The nature of the industry directly influences the product offering and vice versa. The result of these market changes is that products can spread much more easily to markets all over the world than they could before. The fact that the needs and wants of the buyers have also become more homogeneous makes it easier for the sellers to use the same product and marketing in different countries. These new market conditions encourage firms to enter many new markets at a rapid pace.

However, there appears to be some disagreement in the literature in relation to the degree of product customisation. Mainstream research states that INVs are customer orientated and that they engage in product specialisation according to client requirements (Burgel and Murray, 2002; McKinsey & Company, 1993). This view has been challenged by findings which suggest that high-tech start-ups choose a business area with homogenous customers, because this involves minimal adaptation in the marketing mix as a means of lowering costs and achieving economies of scale globally (Jolly et al., 1992). This means that firms offer standard products to global niche markets where a minimal amount of customisation occurs. This point is further supported by a study of a traditional manufacturing sector (Zucchella, 2002) and the seafood sector (Evers, 2006), where, in the former case, Italian INVs adopted this global niche strategy by offering standard luxury goods without incurring costs of localisation. In the latter case, Irish seafood producers were found to offer standardised products as ingredients to international food processors. New firms in traditional sectors thus have been able to respond to global, homogenous niche opportunities facilitated by product and process technology. Despite some mixed findings, the emergence of global niche markets can provide opportunities for new firms to internationalise.

Business Networks

The 'increasing role of global networks and alliances' (Knight and Cavusgil, 1996: 56) means that SMEs are often pulled into their business network and forced to become international just to defend their position in the network (Johanson and Mattsson, 1988). If their clients go abroad, they may be obliged to follow their clients and engage in the clients' networks (Bell, 1995; Coviello and Munro, 1995). Many service firms have been forced to internationalise by following their customers when they entered foreign business networks, for example, insurance and advertising (Erramilli and Roa, 1990; Hellman, 1996). The fact that the customers of the firm are connected aboard, or are international, can also explain how the firm selects and enters the market. Bell (1995) found that client followership caused firms to internationalise early and rapidly in their life cycle, and thus is one of the reasons why firms internationalise early. Evidence of client followership, together with indications that some firms initiated exporting because of contacts with foreign suppliers, offers a plausible explanation as to how and why software firms with such networks internationalise (Bell, 1995). Roberts and Senturia (1996) also found that domestic and international clients of the firm exerted a pull towards early internationalisation.

Further developing the client network pull, the network theory of internationalisation suggests that firms can get pulled into a network. Coviello and Munro (1995) found that their case firms were able to internationalise quickly by linking themselves to extensive and established networks. Their decision to link into such networks is their decision to internationalise; that is to say, the firms did not set out with the deliberate intention of internationalising early. An unsolicited network can drag a domestic firm into foreign markets early in its life cycle, and thus can constitute a pull factor in the framework.

Some small suppliers can be part of a global business network from inception, and this automatically requires them to operate as international firms. These firms can engage in

indirect internationalisation, although they may regard themselves as domestic entities embedded in local networks. Their clients would be directly linked to this global supply network, and this can indirectly impact on the supplier in terms of competitor and business (Holmlund and Kock, 1998).

Antecedent Social Ties

One of the factors required to start internationalisation is an awareness of a particular market opportunity (Reid, 1981). Initial awareness of foreign market opportunities is often acquired through social ties (Komulainen et al., 2006; Lamont et al., 2000). This is because information is not spread evenly across actors, and access to it may well be dependent on former social contacts of entrepreneurs (Granovetter, 1985). The key actor in the internationalisation process of a small firm is commonly the entrepreneur (Ellis, 2000), as he or she often initiates the internationalisation, and it is through the entrepreneur's personal contacts that information is generally acquired (Holmlund and Kock, 1998). Alertness to foreign opportunities acquired through the antecedent social contacts of firms' founders has been found to increase initial resource commitment abroad and shorten the time gap between knowledge acquisition and the decision to enter the market (Evers and O'Gorman, 2011). Firms that are new in terms of the length of their establishment as legal entities are often much 'older' in terms of the length and variety of experiences of their owners and/or managers and the external network ties they tap into (Madsen and Servais, 1997; Welch and Luostarinen, 1988; Wickramasekera and Bamberry, 2001).

Social networks have been found to be particularly important to new ventures seeking to internationalise because emerging organisations typically lack established business ties (Aldrich and Zimmer, 1986; Greve and Salaff, 2003) and because the entrepreneur is not part of a structured international business network as suggested by previous studies (Bell, 1995; Chetty and Blankenburg-Holm, 2000; Coviello and Munro, 1997; Johanson and Mattsson, 1988; Holmlund and Kock, 1998). Antecedent ties of the founder may be a cluster of close, strong and personal informal ties and may be of a business or purely social nature (McDougall et al., 1994; Oviatt and McDougall, 1994). Weak ties were found to be important for the initial internationalisation of the INV firms (Sharma and Blomstermo, 2003). In contrast, and similar to Uzzi's support for the importance of strong ties for entrepreneurs (1997), other studies found that close social ties were key enablers and mitigators in influencing the new venture internationalisation process by identifying initial opportunities and customers and rendering the transition to foreign business at start-up easier (see Evers and O'Gorman, 2011; Zhou et al., 2007).

Push Forces

Limited Home Market

INV literature has also looked at the size of the home market, or the possibility of home market saturation, when explaining why firms go abroad (see Table 3). A number of studies on INVs have identified adverse home market conditions as a factor contributing to early internationalisation, particularly in small, open domestic economies, where limited

Table 3: Factors Pushing New Ventures to Internationalise

Push Forces/Proactive Motives	Key Studies
Limited home market	Miesenböck, 1988; Aaby and Slater, 1989; Coviello and Munro, 1995; Moen, 2002; Madsen and Servais, 1997; Bell, 1995; Zou and Stan, 1998; Coviello and McAuley, 1999; Knight et al., 2001; Evers, 2010
Superior high-tech market offering	Jolly et al., 1992; McKinsey & Company, 1993; Bell, 1995; Oviatt and McDougall, 1995; Bloodgood et al., 1996; Reuber and Fischer, 1997; Larimo, 2001; Moen, 2002; Johnson, 2004; Autio et al., 2000
Internet and ICT technologies	Hamill and Gregory, 1997; Kotha et al., 2001; Berry and Brock, 2004; Loane et al., 2004; Mostafa et al., 2005; Loane, 2006; Knight and Cavusgil, 1996; Madsen and Servais, 1997; Oviatt and McDougall, 1995, 1999; Autio et al., 2000; Madsen et al., 2000; Bell and McNaughton, 2000; Larimo, 2001; McDougall et al., 2003
Advancements in production/ process technology	Rennie, 1993; Bell and McNaughton, 2000; Knight et al., 2001
The profile of founder(s):	
International orientation	Jolly et al., 1992; McKinsey & Company, 1993; Oviatt and McDougall, 1994, 1995; Knight and Cavusgil, 1996; Eriksson et al., 1997; Harveston et al., 2000; Servais and Rasmussen, 2000; Larimo, 2001; Moen, 2002; McDougall et al., 2003; Etemad, 2004
International work experience of entrepreneur and TMTs	Oviatt and McDougall, 1994; McDougall et al., 1994; Shrader and Simon, 1997; Coviello and Munro, 1995; Bloodgood et al., 1996; Reuber and Fischer, 1997; Larimo, 2001; Kuemmerle, 2002; Harveston et al., 2000
Prior industry experience	Welch and Luostarinen, 1988; Reuber and Fischer, 1997; Rasmussen et al., 2001; Wickramasekera and Bamberry, 2001

opportunities may also be a driver to internationalisation (Bell, McNaughton, Young and Crick, 2003). Unattractive home markets validate immediate internationalisation (Bell, 1995). Equally, most firms recognise that this decision is a necessity more than an option (Zucchella et al., 2005) due to the saturation of domestic markets, the need to react to global competition, the need to reach a feasible market size in niche productions and the necessity of following the market (Etemad, 2004; Zucchella and Maccarini, 1999). Also, domestic

market limitations drove these firms to go abroad. Bell's (1995) cross-national study into the export behaviour of small computer software firms in Finland, Ireland and Norway featured small, open economies, limited domestic markets and small firm bases. These countries provide a good basis for a comparative study. These firms became highly export-dependent, despite being geographically isolated from their principle export markets.

Adverse domestic market conditions and niche product opportunities can lead new firms to become internationally proactive at start-up. Bell, McNaughton, Young and Crick (2003) found that the impetus to internationalise came from necessity (i.e. adverse domestic conditions and the need to generate revenues) rather from any proactive aspirations on the part of management. According to Zou and Stan's (1998) literature review, the relative attractiveness of the home and foreign market environments has received little attention in research. They found that most studies did not find a significant link between export market attractiveness and export performance. On the other hand, however, Aaby and Slater (1989) stated that an unfavourable domestic home market may create the incentive to go abroad. Few studies on INVs have confirmed that a small market base has been a key factor in stimulating the firm's interest to go abroad (Bell, 1995; Coviello and McAuley, 1999; Evers, 2010).

In light of the above discussion, it has been found that adverse domestic market conditions (in terms of small market size from limited demand and saturation) motivate firms to seek foreign markets early in their life cycle (Bell, McNaughton and Young, 2003; Moen, 2002). In these studies, however, this finding is primarily coupled with other more important factors, such as unique product opportunities, as noted earlier. Knight (1997) refers to triggers of internationalisation which may explain why a firm experiences both export pull and export push as well as the product/market conditions that necessitate early international involvement. However, his discussion does not offer more insight into this factor of demand and supply conditions. This point, however, appears to be one of the least examined factors pushing firms abroad. In the INV literature, there has been little reference to the nature of home and foreign market conditions (see Evers, 2010). For example, the market for Irish shellfish produce is international and thus necessitates Irish producers to export at start-up to satisfy the demand of greater seafood consumption levels abroad compared to miniscule levels in Ireland. Similarly, Bell (1995) found that the (small) home market size led Finnish specialised software suppliers of hotel management systems to chase revenues in their global niche hotel markets. Hence, studies of both low- and high-tech sectors have validated the idea that the external market environment is a pivotal factor in driving early firm internationalisation. Therefore, the interaction of small home market and home supply (push) and large foreign demand abroad (pull) can itself trigger immediate internationalisation (particularly for low-technology firms) (Bell, McNaughton, Young and Crick, 2003; Evers, 2010; Zucchella and Maccarini, 1999).

Superior High-Tech Market Offering

Probably the most common factor enabling these firms to internationalise early and quickly is the technological capability embedded in their products, production processes

and know-how. A venture may seek a global presence in order to capitalise on its unique set of resources, such as its management team and experience, and new product technologies. Early internationalisation is directly related to the use of product differentiation as a source of competitive advantage, especially when the product is perceived by management to be unique, it prompts early internationalisation (Bloodgood et al., 1996; Roberts and Senturia, 1996).

A strong motivating factor is the need to swiftly exploit proprietary knowledge as the main source of competitive advantage (Bloodgood et al., 1996; Crick and Jones, 2000; Oviatt and McDougall, 1994), particularly in sectors where rapid technological change, coupled with the difficulty of protecting intellectual capital and patents, contributes to narrow windows of commercial opportunity. The accelerated progress of INVs to international markets is driven by a desire to gain first-mover advantage and to lock in new customers. New firms must move quickly in the international markets because the result is dependent on getting to the market before competitors copy and undercut the firm. Once a knowledge-intensive product has been introduced, competitors will seek to uncover the embedded knowledge or to produce equivalent alternative knowledge. The INV literature suggests that INVs pursue narrowly focused niche strategies. Niche differentiation has been shown by high-tech firms, which differentiate on technological attributes (Coviello and Munro, 1995; Johnson, 2004).

Internet and ICT Technologies

Capitalising on the rapid developments in information, communication and digitised technologies, many new ventures of the 1990s were found to be early internationals (Hamill and Gregory, 1997; Knight and Cavusgil, 1996; Oviatt and McDougall, 1994, 1995). With greater advancements in information and communication technologies (ICT) since then, more studies on INVs have identified internet-based technologies as a key driver of new venture internationalisation, with the internet itself constituting a new mode of foreign market entry for knowledge-based products and services, e.g. Amazon, Google, Daft and many more. Berry and Brock (2004) identified the founder's prior internet experience as a critical factor driving the internationalisation activities of small high-technology firms. Loane et al. (2004) found start-ups in Europe and North America were embracing internet technologies from the outset and adopting an e-business format to be global from inception. Furthermore, internet-enabled firms were also found to be led by founders with a global focus at the outset (consistent with push forces), resulting in internationalisation from inception (Loane, 2006). Etemad (2004: 13) posits that 'Expanding fields of information systems and technologies empower internationally-orientated entrepreneurs to reach remote markets of the world much easier and faster than their traditional counterparts, in spite of time and resource constraints.'

Advancements in Process and Production Technologies

Other early internationalisation factors found in the literature include the advent of increased specialisation spurred by production and process technologies, which in turn

led to niche markets (McKinsey & Company, 1993; Rennie, 1993). The emergence of new market conditions, in the form of niche markets, has been driven by technological developments in the areas of production and communication. New production process technology means that small-scale operations may also be economically sound; therefore specialisation, customisation and niche production are more viable alternatives in today's markets.

Knight et al. (2001) recognise a number of recent trends and echo those identified by Knight and Cavusgil (1996) earlier in the article. Such trends are the increasing role of niche markets and technological improvements, which result in the possibility of low-scale production of advanced products. Small firms also have an inherent advantage in terms of quicker response time, flexibility and adaptability, and are therefore more likely to become an INV. Highlighting the importance of technological advancements, Bell and McNaughton (2000) suggest that INVs offer high-value-added products due to a significant breakthrough in process or technology. Research on New Zealand firms has shown that production technologies are an important factor in their internationalisation processes (Knight et al., 2001). For some traditional sectors, such as seafood, the strategy of first-mover advantage through innovative high-technology products does not apply. However, technology has been found to be a critical enabler for some sectors, such as INV seafood processors, in terms of production automation processes and advanced logistics technologies. Evers (forthcoming) found that advanced R&D in logistics developed by one Irish firm in collaboration with Trinity College Dublin allowed Irish live seafood exporters to avail of this technology and deliver their product into lucrative Asian markets.

The Profile of the INV Founder/Entrepreneur

Researchers of international entrepreneurship argue that some firms become international because of entrepreneur specific capabilities (Knight and Cavusgil, 1996; Bloodgood et al., 1996). The role of the entrepreneur has become a central force in explaining why a firm decides to internationalise early rather than later (Bell, McNaughton, Young and Crick, 2003; Larimo, 2001; Madsen and Servais, 1997; Oviatt and McDougall, 1994). These will be examined below.

International Orientation of the Entrepreneur(s) (Push Factor):

> The most distinguishing feature of INVs is that they tend to be managed by entrepreneurial visionaries, who view the world as a single, borderless marketplace from the time of the firm's founding (Knight and Cavusgil, 1996: 12).

Unsurprisingly, a global orientation and entrepreneurial vision have been the two most prominent characteristics of INVs, based on previous studies (see Table 2). This is especially clear when INVs are compared with locally based and/or traditional exporting firms that have been long established prior to exporting (Moen, 2002). There exists substantial evidence to support the assertion that INVs have internationally orientated managers/founders, which leads to the outcome of early rather than late internationalisation. Findings also suggest that a distinguishing factor between global and locally based non-exporting

firms was that the former had a stronger global orientation; this was suggested as a key factor explaining why some firms remain in their home market: the absence of a global orientation (Moen, 2002).

According to Knight (1997), a firm with 'international orientation' has global vision, proactiveness and customer orientation enacted by the founder/manager. Knight's definition has been used as the main reference in the empirical studies of Larimo (2001), Pulkkininen and Larimo (2002) and Moen (2002), which have investigated management orientation in internationalisation. Geocentrism (global orientation) is linked to the ability of INVs to make their own opportunities in the international marketplace (Knight and Cavusgil, 1996). However, managers of gradually globalising firms have been found to have more ethno-centric mindsets and only act when they are able to detect the opportunities and reduce the uncertainties of going abroad. In contrast, managers of INV firms are expected to have more geocentric mindsets with more positive attitudes toward internationalisation (Eriksson et al., 1997; Harveston et al., 2000). The international orientation of the founding entrepreneur has been important in shaping the future orientation of the firm and ties in with McDougall and Oviatt's (2000: 903) definition of international entrepreneurship: 'A combination of innovative, proactive, and risk-seeking behaviour that crosses national borders and is intended to create value in organisations.'

The reasons for a firm's international orientation towards foreign markets have been strongly connected with founder's possession of prior international work experience (McDougall et al., 1994). Global orientation stems from the prior international knowledge and experience of the founder. In other words, international work experience must exist in order for the founder to become internationally oriented.

Prior International Experience of the Entrepreneur and TMTs: As shown in Table 3, previous work (McDougall et al., 1994; Bloodgood et al., 1996: Nummela et al., 2004) postulates that managers with prior international work experience are more likely to be aware of the potential challenges and international profit opportunities. This assumption that international work experience is a prerequisite for early internationalisation and international orientation has been unanimously supported, suggesting that those enterprises with it are more likely to internationalise early than those without (McDougall et al., 2003). Furthermore, findings from a study on Spanish manufacturing firms experiencing rapid internationalisation suggest that international experience is a critical factor to be considered by entrepreneurs/managers when starting internationalisation (Bello-Martinez, 2006).

Many empirical studies on INVs (Bloodgood et al., 1996; Eisenhardt and Schoonhoven, 1990; Hambrick and Mason, 1984) have found that entrepreneurial teams have replaced the individual entrepreneur in the creating, leading and management of the INV. Many authors (Bloodgood et al., 1996; McDougall et al., 2003) have supported the assumption that TMTs make more appropriate subjects than founders themselves. In a more recent study led by McDougall et al. (2003), when distinguishing between INVs and domestic new ventures (DNVs), the authors adopt the position that TMTs are a critical resource for the venture. 'In making strategic decisions, ventures will rely on [the] experience of

the entire top management team, as opposed to the single entrepreneur' (McDougall et al., 2003: 61). This finding suggests that internationalisation is related to the international work experience of the entire TMT (a finding reflected in Bloodgood et al.'s (1996) study of US-based INVs). Furthermore, Reuber and Fischer (1997) found that many INVs were founded and managed by TMTs. Thus, managers of INV firms are likely to have higher levels of international experience than managers of gradual globalising firms, and they are more likely to perceive opportunities in an international arena.

Prior Industry Experience of the Entrepreneur(s): The ability to identify the opportunity is also embedded in the entrepreneur's possession of knowledge of the industry. Alertness to new business opportunities is influenced by previous experience in the industry (Casson, 1987). Actual, specific, local industry experience as a separate category has received less attention in the INV literature, as the main emphasis has been on experience solely of an international nature. However, studies have found that the founder's market knowledge and the work experience transmitted from former occupations are important factors (Larimo, 2001; Madsen and Servais, 1997; Moen, 2002; Pulkkininen and Larimo, 2002; Wickramasekera and Bamberry, 2001). The prior industry experience and background of the founders provided them with knowledge of the industry and their products from development right through to commercialisation (Cooper and Dunkelberg, 1986). This study reprioritises the founders' prior industry experience as an important source of industry and product knowledge in both high- and low-tech sectors, which influences the decision to go international at start-up (Evers, 2010; Larimo, 2001; Welch and Luostarinen, 1988; Wickramasekera and Bamberry, 2001).

The influence of the above forces is intermediated by the firm's internal dynamics in terms of the entrepreneur-founder mindset, behaviour and international orientation as discussed in the next section.

The Mental Model Entrepreneur (Key Mediating Force)

Gartner (1990) refers to entrepreneurs as individuals with unique personality characteristics and abilities. They are characterised as being risk-taking, the locus of control, autonomous (perseverant) and committed to vision creation. Also, studies have shown that entrepreneurship has a positive influence on the firm in exploiting opportunities and innovating for market requirements (Covin, 1991; Venkataraman, 1997). The majority of studies emphasise the role of alert founders who capitalise on market imperfections by linking resources around the world (Oviatt and McDougall, 1994). In SME internationalisation, Miesenböck's (1988) literature on the export behaviour of firms notes that it is generally agreed that an individual decision maker within the firm makes the decision to export and has influence on the foreign market orientation of the firm. However, most research has considered the individual decision to be at managerial level rather than at the level of the entrepreneurial founder. More recently, authors on international entrepreneurship argue that some firms become international because of entrepreneur specific capabilities (Knight and Cavusgil, 1996). The importance of entrepreneurs has been

highlighted in many studies on international firms and a positive relationship has been identified between the entrepreneur's international attitude, orientation experience and network, and the firm's international development (Ibeh and Young, 2001; Kuemmerle, 2002; Preece et al., 1999; Westhead et al., 2001). Below are examined those personal attributes that are found important in the literature for international entrepreneurial pursuit: *mindset*, *behaviour* and *alertness*.

Mindset

More attention and greater examination of the entrepreneur and managerial characteristics have been called for in international entrepreneurship research (McDougall et al., 1994). At the managerial level, the attitudes and mindset of the management team play an important role in determining the extent to which a firm engages in international activities. The managerial international mindset can be defined as the propensity of managers to engage in proactive and visionary behaviours in order to achieve strategic objectives in international markets (Harveston et al., 2000). Bartlett and Ghoshal (1989) argue that managers' cognitive processes affect the international strategic capabilities of the firm. Put more simply, the mindset of the entrepreneur and the top management team affects the firm's expansion into international markets. It has been argued in the literature that a global mindset is a prerequisite for INVs. Several studies have indicated that INV founders are characterised by a strong international orientation and global mindset. The managers are growth-oriented, entrepreneurial, proactive and committed to foreign markets (Nummela et al., 2004; Rennie, 1993).

Behaviour

In the context of the INV, the common denominator is the importance of the entrepreneur and entrepreneurial behaviour (McAuley, 1999; Knight and Cavusgil, 1996; Madsen and Servais, 1997; Madsen et al., 2000; Oviatt and McDougall, 1994; McDougall et al., 1994; Rennie, 1993; Zahra and George, 2002). These studies point out that analysis at the individual level is important in understanding firms' international behaviour. Rasmussen et al. (2001) try to incorporate the entrepreneurship literature in examining the founding process of the INV, stressing the interaction between the founder and his/her environment through two interconnected processes: sense making and networking. The role of the founder in terms of background, experience, knowledge, network ties and particularly entrepreneurial vision has been a prevalent theme in the empirical studies on INVs. Theory building has put the entrepreneur as the dominant determinant of the INV (McAuley, 1999; Knight, 2000; Madsen and Servais, 1997; Oviatt and McDougall, 1994).

Alertness

Opportunities and opportunity recognition are essential to entrepreneurship, which has been defined as 'a process by which individuals – either on their own or inside organisations – pursue opportunities without regard to the resources they currently control'

(Stevenson and Jarillo, 1990: 19). Cooper (1981) suggests that entrepreneurs intuitively perceive market opportunities. Barreto (1989: 9) states, 'They are people who are alert to information about potentially profitable resource combinations, when others are not.' Alertness is included in the mental model of the entrepreneur construct, and it represents a regulating force in our framework (see Figure 1 and Table 4). Entrepreneurial alertness is essential in identifying international opportunities abroad and further reinforces the argument for examining the role of the entrepreneur as the key decision maker in the internationalisation process of new ventures.

Table 4: Key Factors Mediating between Push–Pull Force and Firm's Propensity to Internationalise

Key Mediating Force	Key Studies
The founder's/founders'	
International orientation and global mindset	Bell, McNaughton, Young and Crick, 2003; Harveston et al., 2000; Loane et al., 2004
Alertness to international opportunities	Oviatt and McDougall, 2005; Oviatt and McDougall, 1994; Kuemmerle, 2002; Larimo, 2001; Rialp et al., 2005; Aspelund et al., 2007; Keupp and Gassmann, 2009

As part of the opportunity recognition process, entrepreneurs may also be aware of the value of the information that they come across. When entrepreneurs identify and exploit opportunities, there is a great deal of learning involved. Not all of them possess the same information or have access to the same information; neither do all of them possess the capacity and talent to recognise and interpret valuable information. The entrepreneur uses this superior information to create profit-making opportunities before others perceive them. Their attention is focused only on data deemed relevant according to their knowledge structure:

> Information is filtered through their subjective knowledge structure, which is built on personal experience and enables them to scan environments selectively (Prahalad and Bettis, 1986: 489).

This selectivity may also result in some opportunities going unrecognised. Prior international exposure changes knowledge structures so that information related to internationalisation is deemed relevant and the value of that information is recognised. Many studies suggest that the founder's *alertness* to foreign market opportunities is due to international orientation and mindset, prior international experience and background (Harveston et al., 2000; McDougall et al., 1994; Moen, 2002). Thus, entrepreneurial vision and the initial resource endowment of the firm are key enablers of early internationalisation.

CONCLUSIONS AND FUTURE RESEARCH DIRECTIONS

This paper draws a number of conclusions from the review and identifies areas for future research. Firstly, across the studies no one factor alone would be deemed to lead to the decision to internationalise early in the firm's life cycle. However, the entrepreneur or entrepreneurial team would be considered the central plank on which all other factors rest. The centrality of the entrepreneur's traits, knowledge base, networks and alertness emerge as important factors in the early and rapid internationalisation of the firm; and this may help explain why the entrepreneur decides to drive an early international start-up as opposed to a domestic-market-based venture.

Secondly, a key contrast in findings in the literature brings about two types of orientated firms: the predominantly internationally proactive firm and the predominately internationally reactive firm. Research has focused on the high-tech sectors, reflecting the knowledge-intensive nature of the product and the short life cycle as the main thrusters motivating the firm's decision to capitalise on its unique product by going abroad initially. The majority of studies on INVs have mainly found that these firms are highly internationally proactive towards foreign markets. Prior international work experience of the founder-entrepreneurs and their international proactiveness and orientation, and alertness to opportunities, are key distinguishing factors for INVs. Studies have coupled the TMT's experience with a unique knowledge-intensive product as one of the main factors influencing the decision to internationalise early. On the other hand, the INV literature has accepted that small firm internationalisation can come about in a reactionary way, through the pulling effect of the firm's network ties (Bell, 1995; Coviello and Munro, 1995); these network ties appear to be acquired after the young firm has established itself at home, and before it internationalises.

Thirdly, previous studies have suggested that entrepreneurs go abroad as a result of acquiring knowledge of foreign markets from their former international networks. Research on the role of antecedent business and social network ties in the decision to go abroad at inception has been limited. The role of industrial clusters in the INV's domestic market constitutes a platform for resource and network creation and building at local level. On this point, this research prompts further investigation into the role of purely locally based business and social ties in the internationalisation of new ventures.

Fourthly, much research has been paid to market and industry dynamics in the empirical studies on INVs. Studies in this review have confirmed that some firms ignored their domestic markets from the outset and targeted lead markets by focusing on global niches. INVs are prevalent in computer, high-tech and R&D knowledge-intensive businesses with short life cycles, and hence their orientation can be contingent on industry conditions. However, the supply and demand conditions in the home and foreign markets alone have been identified to be sufficient factors to create the environment for early firm internationalisation in more traditional sectors. Supply of product may exceed home demand, and firms in this situation will be forced to seek out foreign markets. Equally, some foreign markets may have a huge demand base for certain INV products, and therefore may be willing to pay higher prices, thereby achieving economies of scale for the producer. For

INVs in traditional sectors, the dynamics and level of internationalisation and integration of the industry can also be useful perspectives to examine INVs in other low and medium sectors – a less-researched context in international entrepreneurship.

Fifthly, INVs are mainly associated with the high-tech context, in terms of technology embedded in the market offering and the use of ICT to enable the transfer of knowledge assets. However, studies in traditionally based INVs have pointed to product and transport technologies as being critical in enabling early internationalisation. It has been noted that advancements in transportation and logistics have had a key influence on the decision by seafood firms in New Zealand and Ireland to internationalise.

Sixthly, successfully internationalising new ventures have been the primary focus of extant research, with no published research on INVs that fail to internationalise. Given the considerable amount of research conducted on domestic failed start-up firms, factors that impede new venture internationalisation would be an interesting avenue for further investigation.

Seventhly, there exists much consensus in the literature in this area that warranted this study and thus we were able to identify the most important reasons bringing out early firm internationalisation. There is clear evidence to suggest that push factors – internal, firm-specific factors, such as entrepreneurial attributes – combined with favourable pull factors – external environmental conditions for internationalisation, such as supply and conditions at home and a global niche market opportunity – lead to early and dedicated internationalisation. The strategic management theories of the resource-based view and the knowledge-based view of the firm may present useful frameworks to enable deeper insight into the internal dynamics of new venture internationalisation.

Finally, in an attempt to build a framework explaining the early internationalisation of small firms, this paper concludes that the confluence of push and pull forces (Etemad, 2004) can explain, to a large degree, a new venture's decision to internationalise early, with a key mediating force being the mental model of the founder. The new firm's response to these forces will not materialise (i.e. become an international firm) if the founder(s) does (do) not embody an entrepreneurial mindset, behaviour and alertness. The entrepreneur is a pivotal force in the decision-making process; his/her mental model and mindset represent the intermediating forces at play with dynamic push and pull factors. This research suggests that the decision to internationalise is process-driven and dynamically encompasses many factors other than just a good high-tech product. By using this proposed interactive framework, a deeper and more holistic understanding of new venture internationalisation is required.

NOTES

[1] The term 'born global' has been the most popular (Rennie, 1993; Knight and Cavusgil, 1996; Madsen and Servais, 1997; Bell and McNaughton, 2000; Rasmussen, Madsen and Evangelista, 2001; Larimo, 2001; Moen, 2002). Other names, such as 'global start-ups' (Oviatt and McDougall, 1995), 'high technology start-ups' (Burgel and Murray, 2000), 'global high-tech firms' (Roberts and Senturia, 1996), 'instant internationals' (Fillis, 2001)

and 'international new ventures' (INVs) (Oviatt and McDougall, 1994; McDougall et al., 1994; Oviatt and McDougall, 1997; Servais and Rasmussen, 2000), have also been used for designating these firms.

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Consumer Behaviour in Social Networking Sites: Implications for Marketers

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ABSTRACT

The objective of this research is to investigate the potential of social networking sites (SNSs) to be utilised as an effective marketing tool in engaging consumers to participate in marketing on SNSs. Qualitative research in the form of focus groups highlights that the main barrier to the effective use of these sites as a marketing tool pertains to how they are used by companies. A different approach is required by companies that 'pull' consumers in rather than 'push' marketing messages onto them. If the latter approach is adopted, consumers will have an adverse reaction to the marketing message and will express their dissatisfaction to others in their SNS. This can have a negative impact on a company and diminish the potential of SNSs as a marketing tool. As a result, developing the correct approach in using SNSs as a marketing tool is essential.

Key Words: consumer attitudes; consumer behaviour; social media; social media marketing; social networking sites

INTRODUCTION

Social media are tools that provide people with the ability to collaborate and communicate with one another online. Social media tools facilitate the creation and sharing of knowledge, information, media, ideas, opinions and insights, and allow people to actively participate in the media itself. This signals the move from passive consumption of marketing messages to facilitating interaction with messages. Online tools include social networking sites, blogs, wikis, podcasts, content aggregators and content communities. Of these social media tools, social networking sites (SNSs) and blogs have experienced the most prolific growth. SNSs account for nearly 17 per cent of total internet time. People are spending more time on SNSs and do so at the expense of traditional media (McGiboney, 2009). Hailed as a

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prospective new means of reaching and engaging consumers, Nielsen (2009: 1) highlights that 'the social networks and advertising industry haven't yet found that magic formula to make this happen'. Despite the increasing amount of time people are spending on SNSs (McGiboney, 2009), these sites have yet to be harnessed as a successful marketing tool for reaching and engaging consumers (Nielsen, 2009). SNSs enable their users to create, build and maintain relationships that were not previously possible with a large and extended network of contacts. They can also provide a company with the potential to reach this large network of contacts (Enders et al., 2008). As a medium that centres on communication between individual users, companies must employ a different approach if they are to engage consumers effectively via SNSs (Gillin, 2007), as consumers are essentially using SNSs to be social and to make themselves heard (McKinsey & Co., 2006). Therefore, the primary research question of this paper is: Can social networking sites be used as an effective marketing tool to engage consumers to participate in marketing on SNSs?

The next section investigates SNSs in greater detail, while the following section describes the research methodology. The research findings are then reported, followed by conclusions and recommendations for further research.

THE IMPACT OF SOCIAL NETWORKING SITES

Individual Motivations to Use Social Networking Sites

Communication and relationship maintenance are cited by Dwyer et al. (2007) as the main motivating factors for participation in SNSs. These motivating factors are reinforced by an Ofcom (2008) study of SNS users in which the primary reason for using these sites was to communicate with those people a person sees often and with those people they rarely see, and to rekindle old friendships. Social capital refers to connections within and between networks. SNSs help users to maintain and develop relationships with strong ties (those with whom they are close) and weak ties (those with whom they are less close), i.e. build their social capital. Developing and maintaining relationships with weak ties is known as bridging social capital and arises from the ability of SNSs to provide users with multiple means of maintaining more distant relationships (Steinfield et al., 2008).

Haythornthwaite (2005) reports that where people have access to devices that allow them to connect to the internet, they are presented with the opportunity to communicate with individuals previously unknown to them, known as latent social network ties. The creation of these connections would not be possible without the internet. Once communications are initiated between latent ties they become weak ties, with the potential to become strong ties. This latent tie development is possible since the internet facilitates connections that were not previously possible. The internet was at times seen as a medium that diminished social capital (Kraut et al., 1998). However, Wellman et al. (2001) outline that more recent studies have shown it maintains and supplements social capital when used in a social context. Friendships constitute an important role in SNSs by allowing users to find friends within a network and to discern the fabric of the community. Friendship in online social networks is stretched in a sense. Anyone can be a 'friend' by simply sending an invitation, regardless of whether they are known to members or

not (boyd, 2006). This development and maintenance of weak ties in online networks is important as this is where new information is most likely to be attained by members (Haythornthwaite, 2005).

The Empowered Consumer

The trend towards social media shows no sign of slowing, as studies report those born after 1982 consume fewer newspapers, magazines and scheduled television in favour of online activities (Gillin, 2007). Furthermore, people can easily consume these media via the internet using social media tools such as YouTube to watch TV shows and web feeds to receive and read the news (Gillin, 2008).

Rust and Oliver (1994) propose that the emergence of new technologies has caused traditional advertising to become increasingly obsolete. In addition, media and markets have become increasingly fragmented. The authors also emphasise that consumers will become more empowered and give way to 'a new era of producer–consumer interaction' (Rust and Oliver, 1994: 71). They argue that this era will be most prevalent by 2010 and will be enduring. These projections appear to be accurate as in August 2006 Mc Kinsey & Co. published a report which indicated that by 2010, traditional television advertising would only be one-third as effective as it was in 1990. Among the reasons for this decline in effectiveness is the fragmentation of both media and audiences. Smaller audience size has lessened the effectiveness of the traditional top-down mass 'interrupt and repeat' advertising model. Customers are also becoming 'broadcasters' who are no longer satisfied with just listening to company marketing messages but want to engage in meaningful conversations (McKinsey & Co., 2006).

Moreover, we have now witnessed the evolution of consumers into 'prosumers'. The concept of the prosumer itself is not new. The key difference between the consumer and prosumer is that the prosumer is highly knowledgeable about products and services and can play a key role in improving these products and services. Furthermore, these prosumers will be more wary of companies and 'accepting of exploitation only where they perceive that the exploiter provides a service and value-add in return' (Clarke, 2008: 40). Essentially, the prosumer is a new, empowered consumer. Kotler et al. (2002: 36) describe the prosumer in the context of the internet and marketing:

> Customers can use the internet to tell marketers what they want. The customer specifies the needs and the business delivers. Thus the customer changes roles from 'consumer' to 'prosumer'.

Traditional media allows a company to retain control over its marketing message and broadcast it to the consumer. Social media has contributed to the development of the prosumer by empowering consumers, allowing them to participate and assess content, share it with other consumers, and share opinions, attitudes and beliefs with one another in relation to that content, including company messages (Kozinets, 1999; Hoegg et al., 2006). Kozinets (1999: 258) argues that:

> The existence of united groups of online consumers implies power is shifting away from marketers and flowing to consumers. Although consumers are increasingly saying 'yes' to the Internet, to electronic commerce and to online marketing efforts of many kinds, they are also using the medium to say 'no' to forms of marketing they find invasive or unethical.

Due to the degree of connectedness and increased communication facilitated by social media and SNSs, consumers can in essence access the *power of the people* more readily in relation to companies through the online communities which have brought them together in single spaces. Given these factors, Kozinets (1999) argues that building relationships and engaging in conversations with consumers in online communities has become increasingly important. This relationship building he calls 'virtual relationship marketing'.

In addition, Gillin (2007: xiii) states that social media presents an opportunity for marketers to converse with customers. Central to this discipline, which Gillin (2007) refers to as 'conversation marketing', is dialogue. 'Conversation marketing' will require marketers to approach consumers in a new way and to not only take from consumers but give back to consumers. The empowered consumer will expect to receive something of value in return for their participation. Gillin (2007: xiii) concludes: 'it means understanding who your customers are, who influences them and how to engage with those influencers'. As a result, it is not the message and pushing it onto consumers that is important but creating a real and meaningful dialogue with them (Meadows-Klue, 2007).

Marketing Implications for Companies

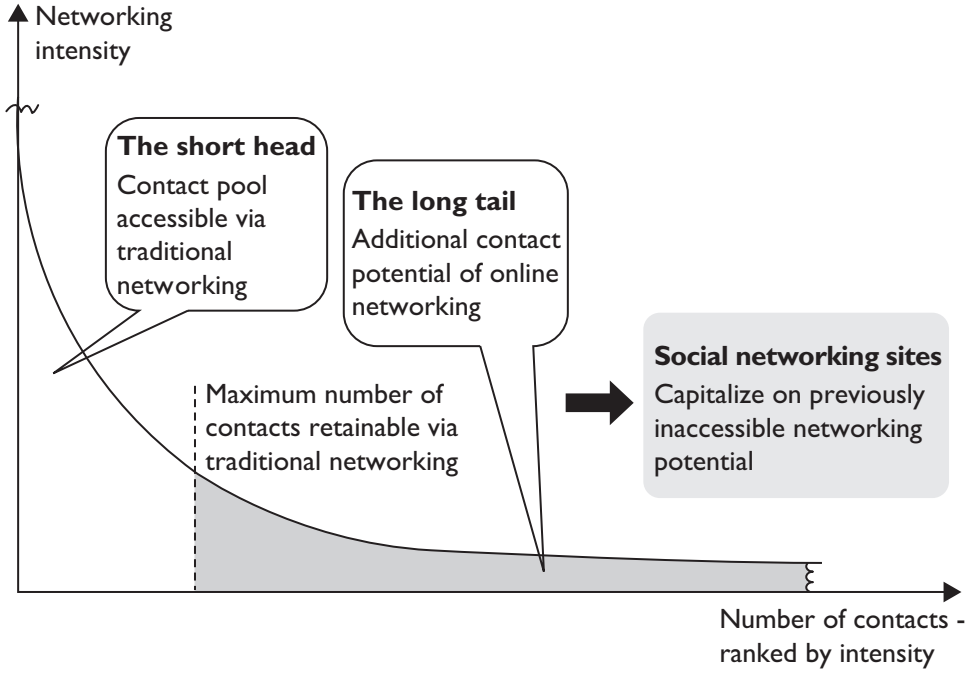
Given the level of connectedness facilitated by SNSs, Enders et al. (2008) highlight the potential these sites offer in terms of reaching a greater number of consumers. Building upon Anderson's (2006) model of the 'long tail', the authors propose the model shown in Figure 1.

As depicted in Figure 1, traditional social networks, i.e. those maintained offline only, are limited. The figure also illustrates the prolific network of contacts a company has the potential to reach through the use of online social networks.

Barabási and Bonabeau (2003) explain that the concept of 'scale-free' networks can also be applied in terms of the internet and SNSs. These networks contain nodes with a number of links that can spread to other nodes in many areas, i.e. networks linked to one another through common members. These networks work on the principles of growth and preferential attachment, and highlight the importance of connectedness and critical mass within SNSs. Where a member, or what the authors refer to as a 'node', is highly connected, they will have many friends and will be likely to develop relationships, links and more friends. This connectedness, in turn, will increase the likelihood of connections to other networks and thus increase communication capabilities and reach, increasing the size of the overall network. These networks can provide an ideal medium for marketers to generate word-of-mouth in relation to products and services (Barabási and Bonabeau, 2003).

Gladwell (2000) categorised influencer groups into mavens, connectors and salespeople. Eccleston and Griseri (2008) then found that these influencer groups could also

Figure 1: The Long Tail of Social Networking



Source: Enders et al., 2008: 7. Reproduced with permission, © *European Management Journal*.

be applied in an online context. Eccleston and Griseri (2008) further build upon these categories, applying them in the context of consumer behaviour. Mavens are people who gather product and service information and are asked by others to provide information in relation to these products and services. Connectors are those who essentially 'connect' to others and connect those they know to one another. This category of influencer is one who has discussed products and services with at least two other individuals. Salespeople are those who influence others to buy or refrain from buying products and services. Eccleston and Griseri (2008) explain that the majority of SNS members behave as connectors do. However, in exhibiting this behaviour, they are lacking a key element of Eccleston and Griseri's (2008) influencer types – they are not discussing products and services with each other via SNSs. Therefore, how to integrate themselves into these conversations and turn consumers into connectors is now the issue facing marketers.

MacKelworth (2007: 3) states in his research that:

> …technology enabled networks of interaction have extended the social network to become a global mechanism of exchange between social actors with important repercussions for the distribution and influence of marketing communications. Further, that

> it will affect the role of the consumer in the creation of added value to the brand proposition and product offering.

MacKelworth (2007) outlines the need for a different approach to reaching and engaging customers in online social networks and the subsequent power that has been bestowed upon consumers as the result of these networks. He finds trust and tie strength are essential factors influencing consumer purchasing decisions. In addition, a two-way dialogue between the source of information and the consumer will be of more influence than one-way communications. A survey conducted by MacKelworth (2007) with 899 business professionals in the business-to-business sector found respondents' professional contacts from their SNS were 'most worthwhile' or 'very worthwhile' (73 per cent) in terms of the level of influence their recommendations would have on respondents, although they did not often use their professional contacts as a means of acquiring recommendations. Business professionals surveyed did outline that their most trusted sources of information were friends and professional contacts. MacKelworth (2007: 30) states:

> What is important for the marketing paradigm is to dedicate resources to engaging with them to lower the reception threshold of marketing communications by encouraging influencers external to the company to promote and evangelise new service and product offerings.

Furthermore, Urban (2005) argues that given this increase in the power of consumers, customer advocacy should be at the forefront of marketing strategy. Consumers can source information to aid the decision-making process and purchase products from a variety of sources, much of which have been provided by technologies, in particular the internet. As a result, control is increasingly in the hands of the consumer. Urban (2005) reports that, traditionally, if consumers were dissatisfied, they may tell a few of those close to them, and, at worst, a company would lose only a small number of customers. However, the internet has enabled dissatisfied customers to tell numerous friends, the effects of which can be detrimental for a company. The potential advantages of this communication in terms of positive word-of-mouth, and the extent to which this consumer communication can reach, can also provide many opportunities for a company. Urban (2005: 157) states that customer advocacy signifies a move away from the traditional forms of marketing to that of a company providing 'open, honest, and complete information' to consumers. Rather than pushing messages onto consumers, it involves a dialogue between a consumer and a company based on trust. This is the future of marketing as it recognises that the consumer is in control.

In accordance with Clarke (2008) and Rust and Oliver (1994), Lewis and Bridger (2004) argue that information technology has led to the development of a consumer–producer collaborative relationship. The authors highlight that as consumers become less trusting of companies, the trust which does remain will be invested in those companies that collaborate with them regarding products and services. Consumers' trust does however, remain

steadfast in one another; they find one another more credible than advertising. The network value of consumers and their subsequent potential to pass on messages to numerous individuals should not be ignored. It must be remembered that a person's online social network may not just end with their immediate network, but messages can pass from one network to another based on members who are common to two or more networks (Domingos, 2005).

Consumers have trust in one another and SNSs hold potential as a word-of-mouth communications medium regarding products and services. The question facing marketers and companies is how to create this trust and dialogue with members and encourage them to become those connectors proposed by Eccleston and Griseri (2008) and pass on company messages and recommendations to one another.

Essentially, consumers primarily use SNSs to be social. They view SNSs as their own private spaces where they can broadcast and share their opinions, beliefs, insights, media and more with those who share the same interests. This ability to become broadcasters in their own right and share important information with one another has enabled consumers to become more powerful and dictate exactly what they want and expect from a company. This prosumer expects their demands to be met. With the right approach, SNSs can provide a means for companies to engage consumers and encourage them to pass on company messages throughout the extended network of contacts they have established on-site. Consumers have trust in one another on SNSs and companies must also be viewed as consumers' friends and garner their trust. As consumers spend more and more time on SNSs, engaging consumers in marketing on-site has become essential.

RESEARCH METHODOLOGY

The aim of this research is to explore if SNSs can be used as an effective marketing tool to engage consumers to participate in marketing on SNSs. Inducing consumers to engage with marketing on SNSs requires gaining perspectives on how they behave in these communities, and the attitudes they possess in relation to advertising on these sites.

Qualitative research in the form of face-to-face focus groups to gain an in-depth understanding of consumer attitudes and the reasoning behind these attitudes was conducted. Due to the profound and complex nature of attitudes, it was felt that face-to-face focus groups were more appropriate, as indicated by previous studies conducted in the area of SNSs (Coyle and Vaughan, 2008; PwC, 2008a; PwC, 2008b). SNSs are used for numerous reasons, among which are to maintain and develop ties with others created in the physical world. Sweet (2001) maintains that where interactions are conducted online only, online focus groups are preferred. Online interactions only are often not the case between individual members of SNSs as they will often have met those in their network in an offline context. Furthermore, consumers will often have interacted with a company previously in an offline context via other media. Therefore, offline focus groups are more appropriate.

Verbal cues such as tone of voice, body language and gestures add to the quality of the focus groups and provide insights as to how members relate to certain types of marketing used and also to one another. Visuals in the form of different types of advertisements and marketing techniques were also utilised with respondents being asked to

discuss and evaluate the various techniques. These were presented to respondents using picture boards during the focus group proceedings and they were then asked to express how they felt about these different types of marketing on SNSs. Pictures included placed advertisements, product placement in videos on SNSs, sponsorship of pages and/or videos, company groups on SNSs and company profile pages. As visuals are utilised in focus group proceedings, face-to-face focus groups are deemed more appropriate (Sweet, 2001). Face-to-face focus groups have been found to facilitate easier communication among respondents, which for the purposes of studying consumer attitudes will be useful for gaining insights into how consumer attitudes influence one another and to keep the pace of the groups at that in which respondents can reflect on how they feel and elaborate upon these feelings through discussion with others in the group (Reid and Reid, 2005). Taking into account that respondents may use a number of SNSs and different SNSs to other respondents, online focus groups may also prove difficult in obtaining a representative sample.

Five focus groups with SNS users were conducted. Categories comprised of the following age groups: 14–17, 18–24, 25–34 and 35+. This categorisation is based on the premise that different age groups use SNSs for different reasons, and may behave differently on-site (PwC, 2008a) and, as a result, may have varying attitudes towards marketing tactics. As the most active users of SNSs, two focus groups were conducted with the 18–24 age group (iProspect, 2007). This also facilitated the drawing of comparisons between students and non-students. The focus groups consisted of both male and female respondents as both use SNSs and interact with one another on-site. Respondents were chosen using convenience sampling due to ease of sample selection and data collection. The main limitation of using convenience sampling is its lack of representativeness. The researcher selected participants by asking them if they were SNS users and if they belonged to the necessary age categories.

The 14–17-year-old focus group was comprised of four males and four females; the first 18–24-year-old focus group, which was conducted with students (hereafter referred to as the student group), consisted of four females and three males; the second 18–24-year-old focus group, which was conducted with non-students (hereafter referred to as the non-student group), was comprised of four females and three males; and the 25–34- and 35+-year-old focus groups were comprised of four males and four females each.

FINDINGS

This section describes why those within the focus group proceedings are motivated to use SNSs. Participants' attitudes towards the types of marketing used on SNSs are then addressed to determine what tactics companies should both employ and avoid. The influence of friends on individuals within SNSs is then addressed, and their subsequent potential to initiate and engage in word-of-mouth behaviour regarding products and services on-site. Given these issues, the means by which companies can reach and engage consumers on SNSs is then discussed.

In concurrence with previous research, the primary reason for using SNSs by respondents is communication (Dwyer et al., 2007; Ofcom, 2008). While respondents from all age

groups noted the ability to meet new friends via these sites, they are used primarily to build and maintain relationships with those they had already met in an offline context. The majority of respondents in all focus groups had a large network of friends on their SNS. Few respondents had less than 100 friends on their SNSs, highlighting the extended network these sites can provide.

The **14–17 age group** outlined that while SNSs allow them to keep in contact with weak ties and those far away, they primarily use them to contact strong ties. The **student group** and **25–34 age group** use SNSs as a means of communicating with both strong and weak ties, close by and far away. **Non-students** emphasised that SNSs allowed them to keep in contact with weak ties and those far away. Respondents' usage patterns on SNSs are outlined in Table 1.

Table 1: SNS Usage Patterns of Respondents

Group / Usage	14–17	18–24 student	18–24 non-student	25–34	35+
Daily	4	1	5	5	6
3–5 times per week	2	3	—	2	2
Twice a week	1	1	1	—	—
Once a week	—	2	—	—	—
A few times a month	1	—	—	1	—
Rarely	—	—	1	—	—
Total	*8*	*7*	*7*	*8*	*8*

Aware of the presence of companies, products and brands on their SNSs, respondents tended to discuss marketing tactics that irritated them, as these annoying tactics were most memorable to them.

Negative Implications of Marketing on SNSs

Those in the **14–17 age group** initially discussed pop-up advertisements in relation to SNSs. The respondents felt that pop-up advertisements had become quite frequent on SNSs and often appeared unexpectedly, causing respondents to click on them by mistake. This mistake would then take them to a different site and away from what they were doing, which was found to be extremely annoying. One respondent noted icons for pop-ups would often be placed strategically. When going to click on something else such as a photograph on her SNS, she would often click on the advertisement by mistake as it was so close and a pop-up would appear. Banner advertisements that appeared while the profile page was loading were also found to be misleading. These advertisements would load last and respondents would often click on the advertisements by mistake in an attempt to click on a part of their profile.

Respondents also spoke of the appearance of advertisements within profile pages on their SNSs. The lack of choice in relation to these advertisements being placed within the content of their profile irritated respondents as they felt they had a lack of control over their online representations of themselves. Advertising within content was also noticed by respondents, for example, advertisements within videos. These advertisements could be closed by respondents yet they still felt the appearance of such advertisements took away from the user experience.

Placed advertisements are typically ignored by respondents. They are there to be social, not to look for advertisements. Respondents also stated that advertisements were rarely relevant to their age and interests and so there was no motivation to click on them. The potential for viruses and trust issues also affected respondents' willingness to click on advertisements.

Other advertisements that agitated respondents were those that started automatically with some sort of movement, dialogue or noise. These advertisements took away from what respondents were doing and they would typically only click on them to stop them and would then go back to what they were doing straight away. All respondents felt SNSs have become over-commercialised.

When discussing advertisements on SNSs with the **student group** it became apparent that trust was a major issue among respondents. They automatically felt advertisements were not secure and so they typically ignored them. Lack of familiarity with advertisements played a large role here. Respondents tend not to see any logo with which they are familiar and so ignore the advertisements. They also felt advertisements tended not to be relevant to them at all and so would not click on them.

Respondents automatically began to discuss pop-ups and roll-overs. Roll-overs occurred when users rolled the mouse over a part of the screen and an advertisement then took over the whole screen. Respondents found this irritating. These roll-overs interrupted what they were doing and they could not proceed without clicking on the advertisement to close it or to find out more information. Once back to what they were previously doing this tended to happen again when the mouse again rolled over that part of the screen, which respondents found frustrating.

In relation to advertisements on SNSs, respondents discussed advertisements associated with the area in which they lived. These advertisements would display someone they knew who wanted to talk to them. One respondent had clicked through this advertisement but found an application process in place to find out who this person was. The process of filling out their details on the application form was found to be off-putting and they went no further with the process as there was too much work involved.

Respondents outlined the argument that they never really take notice of advertisements on SNSs as they felt they did not stand out and tended to blend in. Banner advertisements, they noted, were not different or noticeable enough to stand out. For those who tended to block advertisements out completely, they felt clutter and the amount of advertisements were partially responsible for this.

The **non-student group** also expressed trust issues in relation to advertisements on SNSs and as a result would rarely click through on advertisements on SNSs. A male respondent said some advertisements did not take him to the website of the company that had placed the advertisement and for this reason he did not trust these advertisements. A female respondent felt the company's reputation and familiarity with a company were issues influencing click-through rates. If she did not trust the advertisement she would not click through on it for fear of viruses. Again, all respondents said advertisements were rarely if at all relevant to them and they often felt advertisements were just randomly placed on their pages.

Advertisements that flash and make noise were found to be irritating by respondents. Respondents also discussed advertisements that tell the user they have a new message or someone in their area likes them. These were not trusted by respondents and they did not believe the advertisements. Respondents said they would be curious about such advertisements in the beginning but this soon deteriorated. Two respondents (one male, one female) had clicked through on these the first time they saw them. However, they were taken to a different site and did not know these people who liked them and so they left the site. Being brought to another website would annoy respondents; particularly if it was not for the purpose they believed it to be, which often occurred.

Respondents in the **25–34 age group** were irritated by pop-ups as they appeared when they were in the middle of doing something and interrupted what they were doing. Only one male respondent stated that pop-ups did not bother him. One respondent had clicked on an advertisement relating to someone in their area having a crush on them. However, it required them to fill out information and call a number, which they did not trust and so would not do.

In relation to applications such as quizzes and polls, respondents reported that when they were getting their results from them, a number of advertisements would appear which they had to keep closing in order to get their results. Some respondents had stopped using applications for this reason. Pop-ups in content, such as those in videos, were also noted by respondents, who found them irritating and would never click through on them. The placement of advertisements was also discussed by respondents. When completing applications they were often placed extremely close to the button to continue on to the next part of the application and could then be clicked on by mistake.

Trust was also a major issue among respondents and was a driving force behind not clicking through on advertisements, particularly if their details were requested (for example, to enter competitions). A lack of trust of who you would be providing your details to, not knowing who would be viewing your information, fear of viruses and a lack of familiarity with companies were mentioned. The majority of respondents felt advertisements on SNSs are not relevant to them. Respondents tended to ignore or not even notice placed advertisements. They stressed they were there to talk to their friends, not to click on advertisements.

Respondents in the **35+ age group** said they would ignore advertisements on their SNSs the majority of the time. In relation to advertisements on SNSs, a female respondent

discussed those advertisements that notify people they have won a prize; these were quite distracting. The female respondent was often subjected to these, did not trust them and as a result she would ignore them. Pop-up advertisements had become such an occurrence that one male respondent used a pop-up blocker when he went online. Others agreed and felt pop-up advertisements were merely distracting and useless. A male respondent stated that these advertisements were especially aggressive in nature. A female respondent said she had encountered advertisements that even when clicked out of, would continually reappear, to which other respondents agreed. A male respondent did not trust the companies that placed such advertisements. He had provided his information to one betting company advertisement and had then started receiving a number of emails from other companies. He believed his information had been sold on and as a result did not trust such companies and advertisements. A male respondent also said he had clicked through on an advertisement on his SNS and while he could not remember what the advertisement was for, it did annoy him as he was taken to a site which he felt was not related to the advertisement itself and what he believed it to be.

All respondents had major trust issues with those advertisements that requested information from them if they were not familiar with the company because they could not be sure as to what their information was being used for. Respondents also felt that a fear of viruses plays a large part in deterring people from clicking on advertisements on SNSs.

Two female respondents stated that advertisements on SNSs were rarely relevant to them as consumers. However, a male respondent who tended to use more niche SNSs, such as art- and music-related sites, felt advertisements were often relevant to him as they were related to the content of the SNS itself. These advertisements are essentially tailored to meet the SNS users' needs and as a result encourage users to click through on advertisements more readily. All the respondents who participated in general SNSs felt approximately 80 per cent of advertisements were irrelevant to them. If they were relevant it would simply be a matter of coincidence.

Positive Implications of Marketing on SNSs

Marketing tactics respondents felt positively towards were a rare occurrence. However, the majority of the respondents in each focus group had joined groups within their SNSs. Reasons for joining groups included that respondents did not have to leave their SNS to take part, they allowed them to keep updated on their interests and taking part in the group was under their control.

Where groups were recommended to respondents by their SNS they felt they were recommended based on their interests and as they were relevant to them they did not mind. A male respondent in the **35+ age group** who used music SNSs stated that users can sign up to an application which analyses what music that user listens to on the SNS and makes new music recommendations based on that information. He felt this was a good way of finding out about new music and artists. Other focus group members responded positively to mechanisms such as these if they were to be used. Again it was their choice and only certain information was being used. The respondent stated it also tied in with

advertising in a subtle yet effective way in that if respondents liked the music, they were provided with a link where they could go and buy the artists' music. This was also the case when friends recommended groups, as respondents stated their friends would have similar interests to them and have them in mind when suggesting the group. This meant they were likely to join and take part in the group. Where items on SNSs were relevant to respondents they were likely to notice them more.

Some respondents had visited company pages, although to a much lesser extent than groups. Reasons outlined by respondents for visiting company profile pages included taking part in competitions, they were different, relevant, interesting, allowed them to take part, allowed them to make comments on the page, they were familiar with the company and they could relate to the content on the pages. However, respondents stressed that they disliked when companies requested them as friends and it should be under their control to take part.

Three respondents in the **non-student group** said they had clicked on advertisements on a SNS. While respondents had highlighted previously that advertisements were rarely relevant to them, in this case they were and so they clicked through on the advertisement for this reason. This was also the case for respondents in the **35+ age group**. Where advertisements were relevant to them, they would click through on them. Two respondents also argued familiarity with the advertiser would be a factor influencing click-through rates.

A male respondent who utilised art and music SNSs stated he would click through on some advertisements on these sites. Advertisements on these sites tended to relate to music and art and as they were more relevant and related to the theme of the site, he would click through on those that were of interest to him.

The Influence of 'Friends' on SNSs

There was a general consensus among the members of all the focus groups that if friends were to make comments regarding products, companies and brands on SNSs, it would have an impact on their attitudes towards that product, company or brand. They felt, however, that this was their decision to make and disliked when they were forced to recommend an application to others in order to access it themselves.

A respondent in the **non-student group** said if friends were to recommend something, it would be of interest to them too as friends share similar interests and they would have you in mind rather than just sending information to seemingly random people, the way companies may do. This way the respondent felt the information was pre-filtered.

However those in the **student**, **non-student** and the **25–34 age groups** could not recall any incidents where friends had made recommendations to them on their SNSs. Moreover, respondents in the **student group** said this was unlikely to happen and they would expect this from younger individuals as they tend to think more in the mindset of a group.

Respondents in the **14–17 age group** stated they have watched those advertisements and videos recommended by friends and have been influenced by their friends' opinions in relation to companies, products and brands. Three respondents in the **35+ age group** said the recommendations of friends had influenced their opinions about companies, products

and brands on their SNSs and would encourage them to learn more about a company and its offerings. Furthermore, if friends were to recommend that they stay away from a product or service, they would listen. Members of the **35+ age group** stated it all came down to the fact they would trust their friends more than companies.

Reaching and Engaging Customers on SNSs

Advertisements that did not take respondents to a new webpage, were more relevant to respondents' needs and wants, and were more trustworthy, noticeable, interesting and eye-catching were highlighted by respondents as means by which companies could effectively reach and engage them. All groups felt SNSs had become over-commercialised and advertisements were being pushed onto them, disrupting their online activities.

Respondents in the **14–17** and **35+ age groups** suggested knowing they would be taken away from their online activities would discourage them from clicking on advertisements and perhaps a mini-window that opened on the same page of the SNS would be effective. This would mean respondents could stay where they were and could easily close the advertisement if they wished. The **student group** argued familiarity with the advertiser was a key element influencing trust in advertisements and the **25–34 age group** said advertising on a medium such as television and radio could achieve this as these media are more trustworthy. These advertisements could then direct people to the SNS. A female respondent stated she had heard a radio advertisement directing her to a website so this had worked for her.

Possible means of making advertisements more eye-catching and attention-grabbing suggested by the **25–34 age group** were placing a price on the advertisement and offering free gifts and incentives to click on advertisements. The **non-student group** felt profile pages that could be used by respondents for their own personal profile pages are attention-grabbing and a good way of advertising, and they are also funny and different. They also stressed the importance of control and choice in the advertisements that they are exposed to. The **35+ age group** also felt permission-based advertisements would be more effective, particularly if respondents' profile information was to be used in targeting advertisements.

CONCLUSIONS AND RECOMMENDATIONS

The focus group findings illustrate clearly that SNSs represent a means of communication for their users, primarily to keep in contact with both strong and weak ties, but also to reactivate latent ties and generate new ties. The majority of respondents use their SNS on a weekly basis, and so communications with those in their network are made and updated frequently. Respondents were highly connected in terms of the number of friends they had accumulated on their SNS. Few respondents had less than 100 contacts as friends on their SNS, thus illustrating the extended network of contacts a company has the potential to reach (Barabási and Bonabeau, 2003). However, as SNSs serve as just that, social networks, focus group findings highlight that the vast majority of marketing tactics employed by companies on-site serve only to irritate consumers, therefore engaging consumers to participate in marketing on SNS may prove extremely difficult.

The focus group findings highlight the fact that marketing issues in relation to SNSs centre primarily on control. Literature shows that tools such as social media signify a move to the empowered consumer, who has control over the extent and type of messages they are exposed to. As control is increasingly in the hands of the consumer, creating and conveying the right message – one consumers want to receive and one to which they will respond positively – is necessary.

As Kozinets (1999) maintains, consumers will increasingly use social media to say no to forms of marketing that are being pushed upon them or that they do not agree with. This activity is taking place on SNSs as messages are continually pushed onto consumers. They are being denied control and are responding negatively towards these marketing tactics. Pop-ups, roll-overs, and flashing and noisy advertisements were prime examples divulged by respondents. These advertisements grabbed their attention but in all the wrong ways and served only to disrupt the user experience. All groups felt SNSs had become over-commercialised and served only to clutter sites.

In addition, the influence of friends is highly prevalent on SNSs. Respondents react and listen to their friends' comments, which in turn affects their attitudes. This point is illustrated in the dynamic of groups on SNSs, whereby if a respondent's friend joins a group and recommends it to friends, they are likely to enquire about the group and also join it. This influence extends to products and services. Thus, connections do have the capacity to influence others' opinions and attitudes towards companies, products and brands. This influence rarely happens as often companies fail to grab the attention of users sufficiently so that they might pass their messages on to their connections. Referring to Eccleston and Griseri's (2008) influencer groups, the **14–17 age group** takes part in the most connector behaviour in SNSs. As noted by respondents in the **student group**, this may be due to a group mentality or may signal that when consumers do respond positively to marketing on SNSs they will tell others about it. The strength of influence between connections on SNSs is clearly evident, yet while this potential exists, it has yet to be realised by the marketer.

In effect, focus group proceedings highlight that SNSs do hold potential as an effective marketing tool for reaching and engaging consumers, but only if utilised in the correct manner. If they are not, the complete opposite occurs, with consumers quickly forming adverse opinions not only towards the advertiser but advertising on SNSs in general. If this continues to occur, the potential of SNSs as a marketing tool may be diminished permanently. Therefore, more research in the area of SNSs and marketing and developing the correct approach in utilising them as a marketing tool on behalf of companies is essential.

Managerial Implications

Companies must seek to integrate advertisements and engage consumers rather than infringe on their privacy or irritate customers. If a company can engage consumers, they will choose to listen to the messages that are being conveyed and potentially pass these messages on to others. Engagement and dialogue are essential, yet rarely utilised.

Relevancy and timing are key factors in gaining the attention of SNS users. It must be remembered they are on these sites to communicate with one another, so if marketers are to grab their attention the advertisements must appeal to users' needs and wants at that time. Yet advertisements are often deemed to be irrelevant by users, who are of the consensus that they are just randomly placed. A significant number of respondents from focus group proceedings were open to the use of their information as a means of targeting more relevant advertisements at them. All respondents, although quite wary of advertisements on SNSs, would be more inclined to click through on those advertisements that were relevant to them. However, as consumers value ownership over their SNSs, to some the use of this information may be regarded as an invasion of their privacy. A possible means of counteracting this would be to communicate to users that the use of such information would result in more relevant advertisements. Assurance that data will not be misused is also appropriate.

Ceding control to consumers may provide a more effective means of reaching and engaging consumers. Permitting consumers to participate in advertising when they want, on their terms, without taking them away from what they are doing and rewarding them for their participation may be a potential technique for achieving this. These rewards must also be of value to consumers, whether it is recognition, information or incentives. This point signifies a constant between social and traditional media – knowledge of your consumers and their needs and wants is essential. Groups and company pages demonstrate the value of understanding customers. Using groups and company pages is at the discretion of members and company pages allow them to engage in conversation with a company itself, feel like they are involved with that company and make themselves heard in relation to that company. It creates an all-important dialogue between consumer and company through which trust can be created, which is a crucial element that emerged from the focus group proceedings. If familiarity can be created between respondents and companies, they will be more likely to click through on advertisements. Mixed media advertising, advertising design, honesty and personable, localised advertisements were suggested by respondents as possible means of achieving this.

Marketing on SNSs to date has adopted the traditional approach of attempting to engage a presumably passive consumer, whereas company pages and groups appeal to the empowered and active consumer and allow them to take part in the medium itself. SNSs can be used as an effective marketing tool for engaging customers if this is done in the right way.

The implication here for companies appears to be a more 'friendship'-based approach to consumers on these sites. As SNSs are built on relationships, companies should work to achieve just that – a relationship with their consumer. This relationship would see the company 'pull' consumers in rather than 'push' messages on them, which is what has been occurring in the majority of cases. This relationship will be one where company and consumers are on an equal footing and can engage in a proactive relationship with both the company and the consumer benefiting equally.

Research Limitations

Qualitative research was carried out in order to gain insights into the extent to which SNSs can be used as a marketing tool. Given that focus groups comprise a small number of members of the population of interest, whose member interactions and opinions may have an impact on responses, they do not afford statistical analysis (Stewart et al., 2006).

Also, the 35+ age group should be further expanded into older age categories. As the usage of SNSs continues to grow, those over the age of 35 are becoming increasingly active users. In the United States, more than 50 per cent of the population between the ages of 35 and 44 are users of SNSs and those in the over-44 age group are growing in terms of their SNS usage (Bernoff, 2009).

Suggestions for Further Research

Based on the focus group findings, quantitative research should also be undertaken to allow the generalisation of results in relation to the population of Irish SNSs users as a whole, thus enabling more definitive conclusions to be drawn. This qualitative approach was adopted in order to build a more holistic picture of how SNSs can be integrated effectively into marketing strategy.

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CSI: Career Success Investigation

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ABSTRACT

This paper investigates how researchers have responded to requests to encourage a broader definition of career success by conducting research with underrepresented groups. It investigates the sample populations that are researched, and the type of work experience that is studied, by reviewing 89 articles in journals concerned with the construct of career success from 1992 to 2009. The paper finds that such research principally focuses on managers, professionals and administrators, and the work-related experience considered is almost exclusively situated in the domain of paid employment, particularly full-time employment. It argues that the definition of career success tends to only relate to those in paid employment (predominantly full-time), and, by extension, those who are not in this realm do not have career success. Researchers are encouraged to incorporate those with non-traditional employment arrangements and those in non-paid work into studies, a call assisted by proffering a revised definition of career success.

Key Words: career success; paid employment; non-paid employment; non-traditional employment

INTRODUCTION

> Concentrate on what doesn't lie: the evidence.
> Gil Grissom, from the TV series *CSI: Crime Scene Investigation*

Career success research draws on career theory and, therefore, on the ideas included in career theory; that is, its underlying definitions, concepts, relationships and assumptions (Arthur et al., 2005). To take account of the change inherent in the conceptualisation of the contemporary career concept (e.g. Arnold and Cohen, 2008), and the resultant divergence in the way individuals enact their career patterns (e.g. Briscoe and Hall, 2006), there have been repeated calls to re-conceptualise career success to encourage a broader definition of the construct by conducting research with underrepresented groups (e.g. Sullivan and Baruch, 2009).

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This paper investigates how researchers have responded to these requests, investigating the sample populations that are researched, and the type of work experience that is studied when inquirers examine respondents' evaluations of their achievements during their work-related experiences, that is, their career success (Arthur et al., 2005). It begins by conceptualising the concept of career and its associated construct, career success. This is followed by a review of 89 articles in established journals concerned with the construct of career success over the period 1992 to 2009. It finds that such research predominantly focuses on managers, professionals and administrators, and the work-related experience that is studied is almost exclusively situated in the domain of paid employment, particularly the full-time variety of that realm. The paper discusses the implications of the inconsistent positions of scholars positing a conceptual inclusion of a broad church in the career success construct, whilst empirical researchers virtually exclude underexplored minorities from their studies, including those with non-traditional employment patterns and non-paid work experiences. It argues that the definition of career success, and associated research, to date tends to only relate to those in paid employment (predominantly full-time), and, by extension, those who are not in paid employment (predominantly full-time) do not have career success. A call is sounded for researchers to explicitly incorporate those with non-traditional employment arrangements, such as part-time employees, in addition to those in non-paid work, such as volunteers, into their studies. Their absence highlights a limitation in the empirical research, as it does not reflect the diversity of career patterns that individuals enact, thus not fully considering a person's evaluation of his or her achievements during his or her varied work-related experiences, regardless of status or context. A revised definition of career success is proffered to bridge this gap.

CONCEPTUALISING CAREER AND CAREER SUCCESS

Conceptualising Career

When considering the definitions given to career over the years, it is noticeable that in parallel with the changes occurring in society, there has been a shift in terminology: from jobs to experiences, and from organisational to post-organisational (Arthur et al., 2005; Dries, Pepermans and De Kerpel, 2008). Consequently, there has been a noticeable evolution in the way career has been defined. The Chicago School of Sociologists, epitomised by Hughes (1937), observe that a career consists, 'objectively, of a series of status and clearly defined offices' (Hughes, 1937: 409) and 'subjectively … is the moving perspective in which the person sees his life as a whole and interprets the meaning of his various attributes, actions, and the things which happen to him' (Hughes, 1937: 411). Wilensky (1961) refers to career as 'a succession of related jobs, arranged in a hierarchy of prestige, through which persons move in an ordered (more-or-less predictable) sequence' (Wilensky, 1961: 523). Super (1980: 286) defines a career as 'a sequence of positions held during the course of a lifetime'. A consensus seems to have emerged that the established description of career emanates from Arthur et al. (1989: 8) as: 'the unfolding sequence of any person's work experiences over time' (e.g. Arnold and Cohen, 2008; Arthur et al., 2005; Dries, Pepermans and Carlier, 2008).

In tandem with the changing definition of career, new concepts have emerged, devised to reflect an altered environment, with increased globalisation, rapid technological advancements, growing workforce diversity and the expanding use of outsourcing and part-time and temporary employees (Sullivan and Baruch, 2009). These events are said to have transformed traditional organisational structures, employer–employee relationships and the work context, creating divergence in how individuals enact their careers (Briscoe and Hall, 2006; Sullivan and Baruch, 2009).

The demise of the traditional, bureaucratic career has been oft mooted (e.g. Hall, 1976, 1996; Sullivan and Arthur, 2006), being replaced by more embracing notions of career, based on the accumulation of skills and knowledge and the integration of professional and personal life. Various concepts and metaphors have been developed to capture this shifting landscape. The protean career pertains to where the individual is able to rearrange and repackage his or her knowledge, skills and abilities to meet the demands of a changing workplace, in addition to his or her need for self-fulfilment (Hall, 1976, 1996). The boundaryless career describes a sequence of job opportunities that go beyond the borders of a single employer, so individuals are independent, rather than dependent on traditional organisational career arrangements (DeFillippi and Arthur, 1994). The post-corporate career refers to careers taking place outside of large organisations, whereby individuals enact a multitude of alternative options (Peiperl and Baruch, 1997). Career profiles combine the two components of the boundaryless career (psychological and physical mobility), plus the two factors of the protean career (values-driven and self-directed career management attitudes), yielding sixteen potential career profiles (Briscoe and Hall, 2006). Finally, the Kaleidoscope Career Model explains how individuals focus on three parameters (authenticity, balance and challenge) when making career decisions (Mainiero and Sullivan, 2005).

Both traditional and contemporary career theories propose an inherent two-sidedness of the career concept (Arthur et al., 2005). The objective element emulates the more or less publicly observable positions, situations and statuses that serve as benchmarks for gauging a person's movement through the social locale (Barley, 1989), comprising predictable stages and an ordered sequence of development. The subjective dimension reflects the individual's own sense of his or her career and what it is becoming (Stebbins, 1970), defined by the personal interpretations and values that identity bestows on them. These two sides, the objective and the subjective, are seen to be persistently dependent (Hughes, 1937) and this interdependence occurs over time (Lawrence, 1996).

Conceptualising Career Success

Career success is an outcome of a person's career experiences and involves the individual's evaluation of desirable work-related outcomes at any point during these experiences (Arthur et al., 2005; Gattiker and Larwood, 1990; Hennequin, 2007; Judge and Bretz, 1994; Poon, 2004). There are two broad strands of research in the career success literature: different ways of construing career success and how they are (or are not) related to each other; and what predicts and influences career success (Arnold and Cohen, 2008).

With regard to the first element, conceptualising and measuring career success, as with careers, there are two distinct ways of viewing career success: objective and subjective positions. Objective career success may be characterised as an external perspective that delineates more or less tangible indicators of an individual's career situation (Van Maanen, 1977). It reflects shared social comprehension, rather than individual understanding (Nicholson and De Waal-Andrews, 2005). Measures of objective career success may, therefore, involve factors such as occupation, mobility, task attributes, income and job level (Van Maanen, 1977). Subjective career success may be described as a person's internal apprehension and evaluation of his or her career, across any dimensions that are important to that individual (Van Maanen, 1977). As people place different values on the same issues, subjective career success consists of utilities that are only identifiable by introspection, not by observation or consensual validation (Nicholson and De Waal-Andrews, 2005). Measures of subjective career success, consequently, may include a person's reactions to actual and anticipated career-related attainments across a wide range of outcomes, such as job and career satisfaction (Boudreau, Boswell and Judge, 2001). It has been suggested that the depth and breadth of the career success construct can be harnessed by looking through both lenses simultaneously, typifying the duality and interdependence between the objective and subjective sides of career (Abele and Spurk, 2009; Barley, 1989; Walton and Mallon, 2004).

Whether career attainments lead people to experience career success is likely to depend upon the standards against which they are appraised. Objective and subjective career outcomes may be assessed relative to personal standards (self-referent criteria) or the achievements and expectations of others (other-referent criteria) (Heslin, 2005). Self-referent factors reflect an individual's career-related standards and aspirations, whereas other-referent elements involve comparisons with others. Individuals can, therefore, evaluate their career success using self-referent and other-referent criteria drawn from both the objective and subjective domains (Heslin, 2005).

Moving away from the first facet of career success research, the different ways of understanding the construct, to the second main area, predictors and influencers of career success (Arnold and Cohen, 2008), the meta-analysis conducted by Ng et al. (2005) is a key resource. The meta-analysis classifies the predictors of career success as four types: human capital (work centrality, hours worked, education level attained, international experience, political knowledge and skills); organisational sponsorship (supervisor support and organisational resources as a surrogate for organisational size); socio-demographics (gender, race, marital status and age); and stable individual differences (personality characteristics) (Ng et al., 2005). The study finds that there are discernible patterns: human capital and socio-demographic variables tend to correlate with salary; organisational sponsorship and individual difference variables are the better predictors of career satisfaction; promotion has few substantial correlates; and salary disadvantages emerge for women relative to men, and non-whites compared to whites (Ng et al., 2005).

Calls to Re-Conceptualise Career Success

Recently there have been calls to re-conceptualise career success to encourage a broader definition of the construct (e.g. Arnold and Cohen, 2008; Arthur et al., 2005; Dries, Pepermans and De Kerpel, 2008; Gunz and Heslin, 2005; Hall and Harrington, 2004; Hennequin, 2007; Heslin, 2005; Sullivan and Baruch, 2009). Table 1 outlines the comments from the key contributors to the debate, dividing such requests into appeals to conduct research with underrepresented groups and invitations to inquire into a variety of work experiences.

Table 1: Key Contributors to the Call to Re-Conceptualise Career Success

Author(s)	Comments Regarding Underrepresented Groups	Comments Regarding Variety of Work Experiences
Arnold and Cohen (2008)	'The lived experience of less privileged career actors might provide a useful antidote to the existing, largely elitist discourse … [such as] migrants.' (2008: 13)	'Career [success] research neglects a "whole person" perspective.' (2008: 19) 'The applicability of career theory in different contexts … requires much more thorough examination.' (2008: 34)
Arthur et al. (2005)	Not applicable	'If career success is to be measured relative to one's peer group, and if it is accepted that this peer group will commonly go beyond the employing organization … measure [it] … without regard for employment status or boundaries.' (2005: 195)
Dries, Pepermans and De Kerpel (2008)	'A more diversified perception of what career success might mean to different groups of employees … becomes inevitable.' (2008: 924)	Not applicable
Gunz and Heslin (2005)	'How do people with responsibilities for other people's lives – managers, parents, counsellors, teachers, policy-makers – frame what they say and do to affect those lives?' (2005: 109)	'How is [career] success defined in different social settings?' (2005: 109)

(*Continued*)

Table 1: (*Continued*)

Author(s)	Comments Regarding Underrepresented Groups	Comments Regarding Variety of Work Experiences
Hall and Harrington (2004)	Not applicable	'Career research should incorporate other, non-work related elements of a person's life.' (2004: 3)
Hennequin (2007)	'[The present study illustrates] the need to let blue-collar workers explain themselves in order to understand their career expectations.' (2007: 578)	Not applicable
Heslin (2005)	'More theory and research is needed on what career success means to people such as entrepreneurs, older workers, the self-employed, the physically and mentally challenged, migrant workers, expatriates, stigmatized workers (e.g. people living with HIV), teleworkers, the under-employed.' (2005: 128)	'More theory and research is needed on what career success means to people such as … single parents, volunteers, etc.' (2005: 128)
Sullivan and Baruch (2009)	'More research is still needed on underrepresented populations, such as blue-collar workers, immigrant workers, the disabled, and minorities, as well as on those making major transitions.' (2009: 1563)	'Additional investigation of how nonpaid work (i.e. volunteerism) contributes to people's careers is also needed.' (2009: 1563)

To complement the evolution of concepts and the development of new ideas in career theory, Table 1 illustrates that there have been repeated requests from scholars to study the various types of careers in today's complex workplace. The next section investigates how career success researchers have responded to these calls.

PRESENTING THE EVIDENCE

Introduction

A total of 89 articles are examined in a continuous timeframe (1992–2009). Summary data, listed chronologically, are provided in Tables 2 and 3, referring to the time intervals of 1992–2002 and 2003–2009 respectively. The review is tabulated sequentially to reflect the evolution of the career concept. The first period (1992–2002) is based on the work of

Arthur et al. (2005) and covers 68 articles. The second period (2003–2009) is founded on this author's own analysis and comprises 21 articles. The initial timeline reflects a comprehensive examination of articles on career success by Arthur et al. (2005). The latter period expands upon the earlier review, encompassing the recent research on the construct, on a full year basis, since the conduct of the original inquiry.

Following the recommendation of Arthur et al. (2005), additional terms relating to career success, such as 'career outcomes' (Campion et al., 1994), 'career advancement' (Burlew and Johnson, 1992), 'career satisfaction' (Nicholson, 1993) and 'managerial advancement' (Tharenou, 2001), are incorporated to provide a fuller picture of the research undertaken. Given the chosen timescale of the review (1992–2009), studies such as Gattiker and Larwood's (1986, 1988, 1989, 1990) conceptualisation of career success (job success, interpersonal success, financial success, hierarchical success and life success), are necessarily precluded. Theoretical or research articles concerned with various sub-dimensions of career effects (such as organisational attachment, work–family conflict, career patterns and career development) but not with career success as an outcome per se are not considered. In addition, the meta-analysis by Ng et al. (2005) is not incorporated for two reasons. Firstly, some of the research would inevitably be duplicated because this review covers similar studies to Ng et al. (2005). Secondly, it is difficult to ascertain the detail contained in the studies referred to in the meta-analysis.

Empirical Research on Career Success, 1992–2002

The first investigation of the empirical research on career success is based on an assessment of 68 articles by Arthur et al. (2005) from 1992 to 2002. Table 2 details the articles relating to objective and subjective career success in chronological order. It excludes studies pertaining to the predictors of career success, thus focusing on inquiries involving outcomes. The majority of the articles use the following definition of career success: 'The accomplishment of desirable work-related outcomes at any point in a person's work experiences over time' (Arthur et al., 2005: 179).

Table 2: Empirical Research on Career Success (1992–2002) in Chronological Order

Number	Year	Authors	Criteria	Participants
1.	1992	Burlew and Johnson	Career advancement – subjective career factors only	Professionals
2.	1992	Chi-Ching	Career success – objective and subjective career factors	Managers
3.	1992	Stroh et al.	Career advancement – objective career factors only	Managers

(*Continued*)

Table 2: (*Continued*)

Number	Year	Authors	Criteria	Participants
4.	1993	Aryee and Debrah	Career planning – subjective career factors only	Mixed hierarchical levels in a range of occupations
5.	1993	Nicholson	Career satisfaction – objective and subjective career factors	Managers
6.	1993	Peluchette	Subjective career success – subjective career factors only	Faculty members of university
7.	1993	Poole et al.	Perceived career success – objective and subjective career factors	Mixed hierarchical levels in a range of occupations
8.	1993	Schneer and Reitman	Career path – objective and subjective career factors	Managers
9.	1993	Whitely and Coetsier	Early career outcomes – objective and subjective career factors	Managers and professionals
10.	1994	Aryee et al.	Subjective career success – subjective career factors only	Managers
11.	1994	Campion et al.	Career outcomes – objective and subjective career factors	Mixed hierarchical levels in a range of occupations
12.	1994	Chao et al.	Career effectiveness – objective and subjective career factors	Professionals
13.	1994	Judge and Bretz	Career success – objective and subjective career factors	Mixed hierarchical levels in a range of occupations
14.	1994	O'Reilly III and Chatman	Early career success – objective career factors only	Mixed hierarchical levels in a range of occupations

(*Continued*)

Table 2: (*Continued*)

Number	Year	Authors	Criteria	Participants
15.	1994	Schneer and Reitman	Career path – objective and subjective career factors	Mixed hierarchical levels in a range of occupations
16.	1994	Tharenou et al.	Managerial advancement – objective career factors only	Managers
17.	1994	Turban and Dougherty	Career success – objective and subjective career factors	Managers and professionals
18.	1995	Gianakos	Perceived importance of job outcomes – subjective career factors only	Students
19.	1995	Judge et al.	Career success – objective and subjective career factors	Executives
20.	1995	Melamed	Career success – objective career factors only	Mixed hierarchical levels in a range of occupations
21.	1995	Orpen	Career success – objective career factors only	Mixed hierarchical levels
22.	1995	Schneer and Reitman	Career path – objective and subjective career factors	Managers
23.	1995	Tremblay et al.	Career plateau – objective and subjective career factors	Managers
24.	1996	Aryee and Luk	Career satisfaction – objective and subjective career factors	Mixed hierarchical levels in a range of occupations
25.	1996	Aryee et al.	Career success – objective and subjective career factors	Managers

(*Continued*)

Table 2: (*Continued*)

Number	Year	Authors	Criteria	Participants
26.	1996	Dreher and Cox	Career outcomes – objective career factors only	Mixed hierarchical levels and self-employed in a range of occupations
27.	1996	Melamed	Career success – objective career factors only	Mixed hierarchical levels in a range of occupations
28.	1996	Murrell et al.	Career outcomes – objective and subjective career factors	Managers
29.	1996	Taylor et al.	Past career success – objective career factors only	Managers
30.	1997	Chao	Career outcomes – objective and subjective career factors	Mixed hierarchical levels in a range of occupations
31.	1997	Konrad and Cannings	Managerial advancement – objective career factors only	Middle level managers
32.	1997	Lyness and Thompson	Work outcomes – objective and subjective career factors	Executives
33.	1997	Schneer and Reitman	Career success – objective and subjective career factors	Managers
34.	1998	Dreher and Chargois	Career outcome – objective career factors only	Mixed hierarchical levels in a range of occupations
35.	1998	Friedman et al.	Career optimism – subjective career factors only	Managers and non-managerial staff
36.	1998	Hurley and Sonnenfeld	Managerial career attainment – objective career factors only	Managers

(*Continued*)

Table 2: (*Continued*)

Number	Year	Authors	Criteria	Participants
37.	1998	Kirchmeyer	Career success – objective and subjective career factors	Managers
38.	1998	Lee and Nolan	Career advancement – objective and subjective career factors	Administrators
39.	1998	Orpen	Career success – objective career factors only	Employees in financial services – mixed hierarchical levels
40.	1999	Blake-Beard	Career success – objective and subjective career factors	Mixed hierarchical levels in a range of occupations
41.	1999	Judge, Higgins, Thoresen and Barrick	Career success – objective and subjective career factors	Mixed hierarchical levels in a range of occupations
42.	1999	Judge, Thoresen, Pucik and Welbourne	Career outcomes – objective and subjective career factors	Managers
43.	1999	Judiesch and Lyness	Career success – objective career factors only	Managers
44.	1999	Ragins and Cotton	Career outcomes – objective career factors only	Professionals
45.	1999	Seibert et al.	Career success – objective and subjective career factors	Mixed hierarchical levels in a range of occupations
46.	1999	Tharenou	Managerial career advancement – objective career factors only	Managers
47.	1999	Wayne et al.	Career success – objective and subjective career factors	Mixed hierarchical levels

(*Continued*)

Table 2: (*Continued*)

Number	Year	Authors	Criteria	Participants
48.	2000	Brown et al.	Career decision-making self-efficacy – objective and subjective career factors	Student athletes
49.	2000	Lyness and Thompson	Career success – objective career factors only	Executives
50.	2000	Peluchette and Jeanquart	Career success – objective and subjective career factors	Professionals
51.	2000	Spell and Blum	Career advancement – subjective career factors only	Mixed hierarchical levels in a range of occupations
52.	2000	Van Scotter et al.	Career outcomes – objective career factors only	Air force mechanics
53.	2001	Boudreau, Boswell and Judge	Career success – objective and subjective career factors	Managers
54.	2001	Boudreau, Boswell, Judge and Bretz	Career outcomes – objective and subjective career factors	Managers
55.	2001	Harris et al.	Career outcomes – objective and subjective career factors	Mixed hierarchical levels in a range of occupations
56.	2001	Higgins and Thomas	Career outcomes – objective and subjective career factors	Lawyers
57.	2001	Jansen and Stoop	Career success – objective career factors only	Managers
58.	2001	Murphy and Ensher	Perceived career success – subjective career factors only	Mixed hierarchical levels in a range of occupations
59.	2001	Seibert and Kraimer	Career success – objective and subjective career factors	Mixed hierarchical levels in a range of occupations

(*Continued*)

Table 2: (*Continued*)

Number	Year	Authors	Criteria	Participants
60.	2001	Seibert, Kraimer and Crant	Career success – objective and subjective career factors	Mixed hierarchical levels in a range of occupations
61.	2001	Seibert, Kraimer and Liden	Career success – objective and subjective career factors	Engineers
62.	2001	Tharenou	Managerial advancement – objective career factors only	Managers
63.	2001	Wallace	Career and emotional outcomes – objective and subjective career factors	Lawyers
64.	2002	Cable and DeRue	Career outcomes – objective and subjective career factors	Managers
65.	2002	De Fruyt	Intrinsic career outcomes – subjective career factors only	Mixed hierarchical levels in a range of occupations
66.	2002	Johnson and Stokes	Career outcomes – objective and subjective career factors	Mixed hierarchical levels in a range of occupations
67.	2002	Martins et al.	Career outcomes, career satisfaction – objective and subjective career factors	Managers and professionals
68.	2002	Wiese et al.	Subjective career success – subjective career factors only	Professionals

Source: Adapted from Arthur et al. (2005: 184–190). Table adapted with permission, © *Journal of Organizational Behavior*, John Wiley and Sons

As illustrated in Table 2, out of 68 studies, a total of 66 (97 per cent) concern employees in paid employment. The two remaining studies survey students. Regardless of the theoretical paradigm, research strategy or research method utilised, not one analysis considers those outside either paid employment or education. Focusing on the 66 studies directly oriented to the world of paid work, 36 inquiries (55 per cent) survey managers, professionals and executives only; 27 studies (41 per cent) refer to mixed hierarchical levels including managerial, administrative, front-line and operative grades across a variety of occupations;

2 studies (3 per cent) concentrate on non-managerial employees only and 1 (1 per cent) on faculty members. Taking all of the research together, the participants work in a range of industries (academic, financial services, information and communication technologies, insurance, pharmaceutical and healthcare, professional services, public administration and retail) and are employed in diverse organisational settings (private and public sector, large, medium-sized and small organisations, indigenous and foreign-owned).

When researchers have to make a choice about who to include and who to exclude from their research, for example, with participants in longitudinal studies or non-identifiable respondents, those who fall outside the scope of paid employment (predominantly full-time) are precluded. Four such situations are identified in the review (Blake-Beard, 1999; O'Reilly III and Chatman, 1994; Schneer and Reitman, 1994; Seibert, Kraimer and Crant, 2001). In Blake-Beard's (1999) research, respondents who are self-employed or worked for relatives are excluded because, it is argued, their mentoring experiences is expected to be significantly different from those respondents employed in traditional organisational settings. With regard to O'Reilly III and Chatman (1994), no reason is offered for the omission of those who are working part-time. In relation to Schneer and Reitman (1994), only those participants who report working full-time in the two timeframes of their longitudinal research are incorporated because, it is contended, current employment is necessary for the purpose of comparing career factors. The rationale for solely focusing on full-time employment in the Seibert, Kraimer and Crant (2001) inquiry is that the study expands on the findings of previous research by using longitudinal data to explore the intervening processes by which proactive personality is associated with career outcomes.

Empirical Research on Career Success, 2003–2009

After conducting a parallel analysis on journal articles connected with career success over the period 2003–2009, findings similar to the prior investigation are uncovered: the non-traditional employee and those with non-paid work experiences are largely excluded in the operationalisation of the construct of career success. Table 3 details the 21 articles, listed chronologically, that this author sourced and examined. To ensure consistency with the previous review, the focus of the assessment relates to objective and subjective career success, but precludes studies associated with the predictors of career success. Research conducted on periods of employment, unemployment and acting as a care-giver, but carried out in the career development not career success field (Huang et al., 2007) is also not integrated into the review. As with the preceding perusal, the preponderance of articles use the following definition of career success: 'The accomplishment of desirable work-related outcomes at any point in a person's work experiences over time' (Arthur et al., 2005: 179).

Table 3: Empirical Research on Career Success (2003–2009) in Chronological Order

Number	Year	Authors	Criteria	Participants
1.	2003	Eby et al.	Career satisfaction, internal and external marketability – subjective career factors only	Mixed hierarchical levels in a range of occupations
2.	2003	Heslin	Career success – subjective career factors only	Mixed hierarchical levels in a range of occupations
3.	2003	Nabi	Job success – objective and subjective career factors	Support personnel
4.	2004	Bozionelos	Career success – objective and subjective career factors	Blue-collar workers
5.	2004	Judge et al.	Career success and sponsorship – objective and subjective career factors	Organisational psychologists
6.	2004	Poon	Career commitment and career success – objective and subjective career factors	Managerial, professional and technical
7.	2004	Walton and Mallon	Career development – objective and subjective factors	Mixed hierarchical levels in a range of occupations
8.	2005	Reitman and Schneer	Career satisfaction – objective and subjective career factors	Managers
9.	2006	Dyke and Murphy	Career outcomes – objective and subjective career factors	Mixed hierarchical levels in a range of occupations
10.	2006	Gelissen and de Graaf	Career success and personality – objective and subjective career factors	Mixed hierarchical levels in a range of occupations
11.	2006	Harris and Ogbonna	Career success strategies – objective and subjective career factors	Mixed hierarchical levels in a range of occupations
12.	2006	Kirchmeyer	Career success – objective career factors only	Faculty members
13.	2006	Lee et al.	Personal outcomes – objective and subjective career factors	Professionals (part-time)

(*Continued*)

Table 3: (*Continued*)

Number	Year	Authors	Criteria	Participants
14.	2007	Hennequin	Career and emotional outcomes – objective and subjective career factors	Blue-collar workers
15.	2007	Lau et al.	Entrepreneurial career success – objective and subjective career factors	Entrepreneurs and their employees
16.	2008	Dries, Pepermans and De Kerpel	Perception of others' career success – objective and subjective career factors	Mixed hierarchical levels in a range of occupations in a university and students
17.	2008	Dries, Pepermans and Carlier	Interpersonal and intrapersonal career outcomes – objective and subjective career factors	Managers
18.	2009	Abele and Spurk	Career success – objective and subjective career factors	Professionally qualified graduates in a range of managerial positions
19.	2009	Blickle et al.	Career outcomes – objective and subjective career factors	Recently qualified business graduates in a range of managerial positions
20.	2009	De Vos et al.	Career outcomes – objective and subjective career factors	Recent graduates from diverse disciplines in managerial positions
21.	2009	Dries et al.	Career success – objective and subjective career factors	Managers

The 2003–2009 investigation, depicted in Table 3, indicates that managerial, professional and technical staff participated in 43 per cent of the studies (9 out of 21 articles), whereas

employees from mixed hierarchical levels including managerial, administrative, front-line and operative roles comprised 38 per cent of the respondents (8 out of 21). (One of the mixed hierarchical level studies also includes students, but it is not possible to glean the percentage breakdown of employees and students participating in the research.) Of the remaining 4 (19 per cent), 3 concentrate on non-managerial grades only and 1 on faculty members.

Comparing the 1992–2002 review with the 2003–2009 analysis, there has been a general broadening of the construct of career success by incorporating wider issues into the research. For example, Kirchmeyer (2006) explores the impact of the family on objective career success and Lee et al. (2006) report research findings based on studies focused on the experiences of professionals and managers in reduced-load work arrangements. Similar to the initial examination, however, when career researchers in the 2003–2009 review period have a choice to make about whether those outside of non-traditional employment patterns and/or non-paid work arrangements are to be included or excluded, they opt to omit them (Abele and Spurk, 2009; De Vos et al., 2009; Reitman and Schneer, 2005). Participants with interrupted career paths, for reasons of parental leave, are excluded in the Abele and Spurk (2009) study because, it is claimed, the respondents cannot provide career success data for their parental leave time(s), thus the researchers are unable to estimate this missing data, as it is not random. The De Vos et al. (2009) analysis leaves out part-time employees, but no explanation is offered for this decision. The Reitman and Schneer (2005) study seeks to determine the long-term impact of career interruptions on income and career satisfaction, and focuses on full-time employment because, it is maintained, the respondents need to be fully engaged in their careers to compare the effects of the gaps on later career success measures.

Comments on the Empirical Research on Career Success (1992–2009)

This review reinforces the comment by Arthur et al. (2005: 193) that 'career theory and career success research are considerably out of step with one another'. Scholars have called on those researching the construct of career success to conduct studies with underrepresented groups and to inquire into a variety of work experiences. Despite such requests, an examination of empirical studies over an eighteen-year period illustrates that the operationalisation of the construct is situated within the paid employment environment, particularly focused on managers, professionals and administrators working in a full-time capacity, to the virtual exclusion of those outside that milieu. Of the 89 articles considered between 1992 and 2009, 45 (51 per cent) focus on managers, professionals and executives and 35 (39 per cent) survey mixed hierarchical levels, including managers and administrators. The remaining 9 articles (10 per cent) concentrate on non-managerial grades (5 articles), university faculty members (2 articles) and students (2 articles). In addition, the non-traditional employee and/or those with non-paid work experiences are excluded in 7 articles (8 per cent). The rationale for their omission is explained in five of the studies; explanations this author questions in the next section.

QUESTIONING THE EVIDENCE AND RE-FRAMING THE CASE

Questioning the Evidence

Appeals to encourage a diversification of research sites and subjects in the career success field appear to have gone unheeded. The established definition of career refers to 'work experiences' (Arthur et al., 1989: 8), and the description of career success used in the majority of the articles reviewed also concerns 'work experiences' (Arthur et al., 2005: 179). Neither of these definitions delineates the status or the context of this work experience. Notwithstanding this, researchers have largely focused on those inhabiting the realm of paid employment (predominantly full-time). This author raises four issues regarding this concentration.

Firstly, scholars have realised that long-held theories of the traditional, linear career no longer adequately explain reality for many people, so new, more dynamic models have emerged (e.g. protean and boundaryless careers). These concepts reflect the change from individuals relying on organisations for career development to assuming responsibility for their own career management and employability. Acquiring a portfolio of competencies and displaying resilience, flexibility and adaptability are hallmarks of this new existence (Sullivan and Baruch, 2009). This upskilling, the paper contends, can be achieved regardless of employment status (full-time or part-time, non-paid worker or self-employed), or organisational environment (private, public or not-for-profit sectors).

Secondly, the current operationalisation of the construct of career success disregards the inseparability of work and life, as it neglects a 'whole person' perspective (Arnold and Cohen, 2008: 19). The evolving relationship between one's career and one's life is recognised in the Kaleidoscope Career Model (Mainiero and Sullivan, 2005). Activities such as the pursuit of personal interests, spousal relations, parenting and community involvement (Hall and Harrington, 2004) influence the evaluation of one's 'accomplishment of desirable work-related outcomes' (Arthur et al., 2005: 179), and, in turn, this assessment shapes a person's participation in such endeavours. By explicitly acknowledging this duality, the construct of career success, and its associated research, would, therefore, this paper argues, be located in the ever-changing contexts of a person's life, a central tenet of contemporary career theory.

Thirdly, the identification of the work experience with paid work has been observed by a number of commentators (e.g. Bauman, 1999; Taylor-Gooby, 1991), which results in portraying non-paid activities, such as care-giving and volunteering, as enterprises that do not possess social and economic value (Collins et al., 2010; Lister, 2002). Research indicates that societies that cherish such efforts are more equal and have fewer health and social problems (Wilkinson and Pickett, 2009). The need to recognise voluntary work and caring duties has indeed been acknowledged by the Irish government (Department of Social, Community and Family Affairs, 2000; Department of the Taoiseach, 2006) and by organisations such as Social Justice Ireland (Collins et al., 2010). This paper maintains that incorporating non-paid work experiences in career success research would demonstrate appreciation for the estimated 350,000 people providing non-paid care (Central Statistics Office, 2010a) and the 475,000 volunteers working for charitable organisations (Collins et al., 2010) in Ireland.

Fourthly, and finally, individuals differ in the types of criteria they emphasise when evaluating their career outcomes, particularly regarding the subjective domain (Heslin, 2005). There may be gender differences (Dyke and Murphy, 2006) and occupational and sectoral variations (Judge and Cable, 2004) when people assess their career success. The current operationalisation of the construct, this paper claims, potentially does not reflect the dissimilar preferences in personal styles, values and life goals of, for example, the 410,200 part-time workers in Ireland, of which 72 per cent are women (Central Statistics Office 2010b), and workers in underexplored industries, such as construction, with 125,300 workers, and transportation and storage, with 89,700 employees (Central Statistics Office, 2010b).

Re-Framing the Case

Combining these four observations with the analysis of articles on career success directs our attention to what is assumed and accepted. By not fully considering people with non-traditional employment patterns and those in non-paid employment in career success research, they are de facto excluded. How can we re-frame research into the construct of career success? How can a new chapter be composed? This author suggests that the scholars who study and research the construct write on one side of the page only; they concentrate on the meaning of the phrase, the synonym, obscuring its antithesis, the antonym. There is an obvious twist to the tale that seems to have been ignored: does the virtual exclusion of these groups from the research imply that they have career failure? To stimulate a conversation around this issue, a list of questions is proffered in Table 4, which could possibly pave the way to re-conceptualise research into the construct of career success.

Table 4: Questions to Re-Conceptualise Research into Career Success

Who has a career?
Who has career success?
Who does not have a career?
Who does not have career success?
Why do some groups have a career and have career success?
Why do some groups not have a career and not have career success?
What experiences are included in the current conceptualisation of career success?
What experiences are not included, i.e. excluded?
What experiences should be included in a revised conceptualisation of career success?
What experiences should not be included, i.e. excluded?
When is a career considered successful?
When is a career not considered successful, i.e. a failure?
How does a career become successful?

A debate on these questions could provoke a discussion on what the work experience comprises. This, in turn, could possibly promote a re-formulation of the definition of career success to: 'The accomplishment of desirable work-related outcomes at any point in a person's work experiences *(paid or non-paid, full-time or part-time)* over time.' Such a revised description could facilitate a 'rapprochement between career theory and career success research' (Arthur et al., 2005: 197), by encouraging researchers to incorporate those with non-traditional employment arrangements, such as part-time employees, in addition to those in non-paid work, such as care-givers and volunteers, into their studies. This could, therefore, enhance our understanding of contemporary careers by reflecting the diversity of patterns that individuals enact, and allow for a more complete consideration of a person's evaluation of his or her achievements – using self-referent and other referent criteria drawn from the objective and subjective domains (Heslin, 2005) – during his or her varied work-related experiences, regardless of status or context.

CONCLUSION

The response to the question 'Why include those with non-traditional employment patterns and those in non-paid employment in the operationalisation of career success?' should evoke George Mallory, an English mountaineer who climbed Mount Everest in the early 1920s. Mallory is said to have replied to the query, 'Why do you want to climb Mount Everest?' with the retort, 'Because it is there.' Why embrace these groups in the operationalisation of the construct of career success? Because they are there; they are part of society. Everyone should have an opportunity to assess the outcome of their work experiences; it should not be an activity confined to those in paid (predominantly full-time) employment. Work experiences, whether paid or non-paid, full-time or part-time, influence a person's identity, affect his or her perception of the future and contribute to his or her positioning in the social and cultural world. Such experiences may also impact on a person's next role by facilitating him or her to revise his or her view as to what is important in life, and how work fits into his or her new value system.

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Simulation–Optimisation Methods in Supply Chain Applications: A Review

Waleed Abo-Hamad* and Amr Arisha*

ABSTRACT

The competitiveness and dynamic nature of today's marketplace is due to rapid advances in information technology, short product life cycles and the continuing trend in global outsourcing. Managing the resulting supply chain networks effectively is challenged by high levels of uncertainty in supply and demand, conflict objectives, vagueness of information, numerous decision variables and constraints. With such levels of complexity, supply chain optimisation has the potential to make a significant contribution in resolving these challenges. In this paper, a literature review – based on more than 100 peer-reviewed articles – of state-of-the-art simulation-based optimisation techniques in the context of supply chain management is presented. A classification of supply chain problems that apply simulation–optimisation techniques is proposed. The main criteria for selecting supply chain optimisers are also identified, which are then used to develop a map of optimisation techniques. Such a map provides guidance for researchers and practitioners for a proper selection of optimisation techniques.

Key Words: supply chain management; modelling and simulation; optimisation; supply chain optimisation

INTRODUCTION

Experience and intuition are often the basis of most critical decisions in enterprises. However, due to today's dynamic marketplace, these decisions are far from optimum and lead to a deterioration in performance. Supply chain (SC) managers face many decision-making challenges at different levels of a SC, including supplier selection, facility location and resource planning. These challenges emerge from the increasing complexity of SC networks which is imputable to a high level of uncertainty in supply and demand, conflicting objectives, vagueness of information, and numerous decision variables and constraints. Hundreds and thousands of individual decisions are made along a SC with different importance levels.

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Robust tools are needed to support these decisions and to enable managers to evaluate the impact of decisions before their actual implementation. System modelling (Aguilar-Savén, 2004) is used in such cases to abstract important details of real systems. An example of an abstraction of an SC is given in Figure 1, where modelling techniques are used to capture important aspects of the underlining real-world problem, and transform these aspects into a model that describes the input–output behaviour of the system.

Despite their computational efficiency, analytical models are impractical in SC settings. This is due to the imposed simplifications on the model which hinder the modelling of important details and features of real industrial systems (Byrne and Heavey, 2006). Simulation models, on the other hand, provide the flexibility to accommodate arbitrary stochastic elements, and generally allow modelling of all the complexities and dynamics of real-world SCs without undue simplifying assumptions (Terzi and Cavalieri, 2004).

While simulation models try to explain the relationships between input and output of complex systems, they do not provide the capability of finding the optimum set of

Figure 1: Mapping of a Real System to a Model Using Modelling Techniques

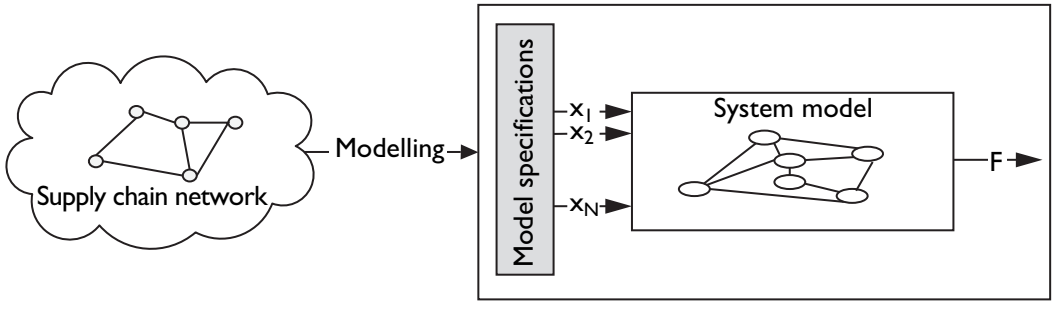
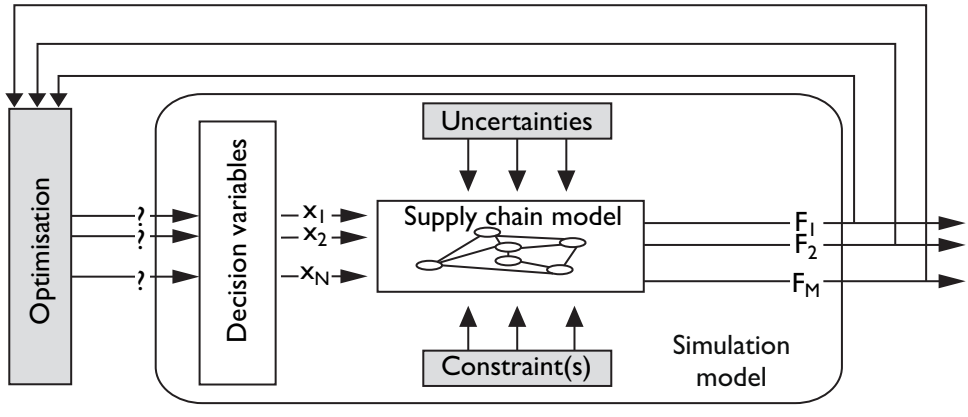


Figure 2: Interaction between Simulation Model and the Optimisation Module



decision variables in terms of predefined objective function(s). This is the purpose of optimisation models, which allow decision makers to find the best possible alternatives while their impact on the system performance is evaluated using simulation models. Figure 2 shows the interaction between the simulation model and the optimisation model. Therefore, integrating simulation and optimisation, known as 'simulation–optimisation', into an SC framework provides decision makers with a comprehensive solution toolbox.

Problem Formulation

The resemblance of SCs to dynamic engineering systems is extremely helpful when developing an integrated management framework. Most business problems can be described as:

$$\begin{array}{lll} \text{optimise} & f_i(x) & i = 1, ..., I, \\ \text{subject to:} & g_j(x) \leq 0 & j = 1, ..., J, \\ & h_k(x) = 0 & k = 1, ..., K \end{array}$$

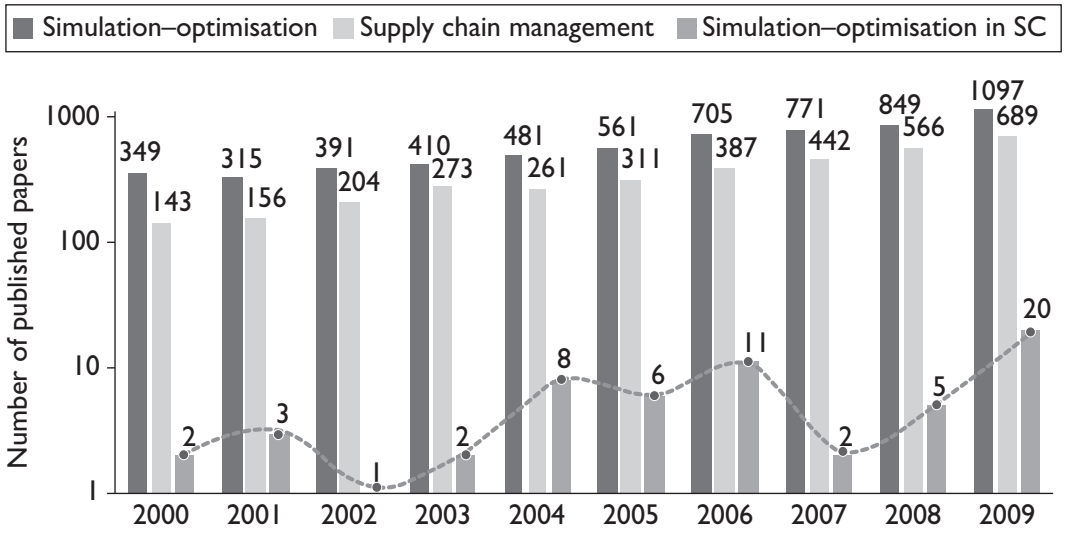
Where $f_i(x)$ is the objective function i, x represents the decision variables vector, and $g_i(x)$ and $h_k(x)$ are the set of inequality and equality constraints. Finding the set of values of decision parameters (x) that optimise (minimise/maximise) the performance criterion (f) faces many challenges:

- Firstly, obtaining a mathematical description of $f_i(x)$ is not attainable due to the unclear relationships between the system components that define its performance.
- Secondly, SCs are usually characterised by multi-objectives, which may imply conflicting objectives and ambiguous preferences between alternatives (Min and Zhou, 2002).
- Thirdly, the existence of a large number of decision variables and alternatives which are unfeasible to enumerate or simulate. In computational complexity theory, these kind of problems are known as non-deterministic polynomial-time hard (NP-hard) problems (Pardalos, 2005), and they need more sophisticated optimisation algorithms to guide the search for optimum or near-optimum solutions in a reasonable timeframe.
- Finally, optimisation methods have to consider the uncertainty embedded in SCs to provide reliable solutions (Van der Vorst and Beulens, 2002). Therefore, adjustment of traditional techniques is required to deal with different sources of uncertainty.

Research Motive

Although the potential is significant, the joint research in applying simulation–optimisation in SC applications is small. We highlighted this gap by a quick search of journal articles in the last decade having the phrase 'simulation optimisation for supply chain' either in their title, abstracts or key words by a selection of the main active publishers in business, management, decision sciences, computer science, engineering and mathematics. As shown in Figure 3, the number of papers published in applying simulation–optimisation

Figure 3: A Research Gap in Applying Simulation Modelling and Optimisation to the Supply Chain Context



for supply chain problems, from 2000 to 2009, is significantly less than those published in simulation–optimisation in general or supply chain management in general.

The purpose of this paper is to review the literature in the field of applying simulation–optimisation to supply chain applications and to provide a basis and guidelines for researchers and practitioners to link simulation–optimisation with real-world applications. Based on this premise, the scope of this review is limited to the literature that uses simulation modelling and optimisation in the context of supply chain management. In this review the following research questions are addressed:

- What are the main simulation-based optimisation techniques that are used in the context of supply chain management?
- What are the main areas of the supply chain that have applied simulation–optimisation techniques?
- What are the main criteria for choosing a supply chain optimiser?

Review Methodology

The main criterion for including an academic paper in this review is that the paper should describe an application of simulation–optimisation in one or more areas concerning supply chains in the period 2000–2009. Papers that discuss theoretical aspects of simulation–optimisation methods are also included to give a background to these techniques. Papers that discuss only simulation or optimisation methods for supply chains have been excluded.

Acknowledging that academic journals are the main resource used to acquire information and release new findings, conference papers, masters' theses, doctoral dissertations, textbooks, technical reports and unpublished working papers have been excluded.

An initial list of 250 papers was created based on reading the abstract of the papers, and a final list of 100 papers was selected based on reading the entire paper. Following the selection of papers, the following attributes were extracted from each article:

- Orientation: Does the paper discuss an application of simulation–optimisation in supply chain or a theoretical background of optimisation techniques used in a supply chain context?
- Optimisation technique: Does the paper apply a particular type of simulation–optimisation technique? If yes, what type of technique is used?
- Supply chain application: Does the article describe an application of simulation–optimisation in a particular supply chain area? If yes, what kind of supply area is described? Which kinds of decisions are considered: strategic, tactical or operational?

SIMULATION–OPTIMISATION METHODS

Generally, an objective function or performance measure cannot be described using a mathematical model because of the high level of uncertainties in SCs. Simulation models are then used to evaluate the different system configurations to be optimised (Kleijnen, 2005). This type of optimisation is known as simulation–optimisation (Tekin and Sabuncuoglu, 2004), and it is classified into four main types: gradient-based methods, meta-model-based methods, statistical-based methods and meta-heuristics methods.

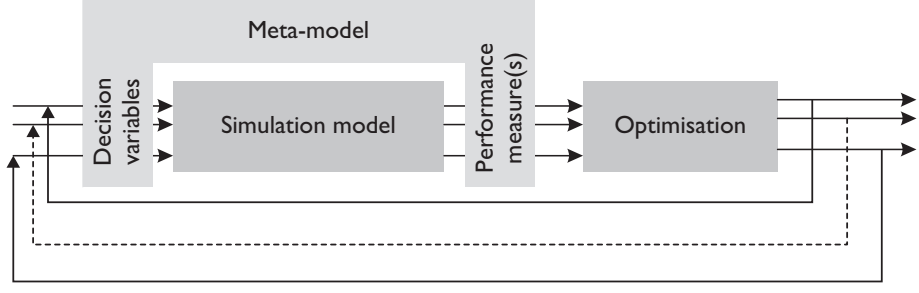
Gradient-Based Methods

Differentiation in the gradient context is usually used to simplify the objective function in order to find an optimum solution. The gradient-based approach requires a mathematical expression of the objective function. When such a mathematical expression cannot be obtained, there is a need to use an estimation technique to start the solution procedure. The estimated gradient's direction guides the search process to move from one potential solution to another in an iterative scheme in a process called stochastic approximation (Robbins and Monro, 1951). Infinitesimal Perturbation Analysis (IPA) is one of the gradient estimators that is considered unbiased (Glasserman, 1991). Its convergence rate has been studied in L'Ecuyer and Perron (1994), while variance reduction and efficient implementation of IPA was investigated in Dai (2000). Another important gradient estimator is Finite Difference Estimation (FDE), which determines partial derivatives of the system performance measures (Dong and Krylov, 2005). In order to estimate the gradient at each search point, at least $(n + 1)$ evaluations of the simulation model are necessary, where n is the number of decision variables. For a more reliable estimate, multiple observations for each derivative are required. On the other hand, Likelihood Ratio Estimator (LRE) estimates the derivative of the performance measure by mathematically differentiating the underlying probability measure of the system (Glynn, 1990).

Meta-Model-Based Methods

While gradient-based estimators are used to estimate the derivatives of the objective function, meta-model-based techniques use an analytical approach to approximate the objective function. The meta-model can then replace part of the simulation model with a mathematical function that mimics the input–output behaviour of that part. Such integration of meta-models simplifies the simulation model in terms of computation time, and consequently simplifies the optimisation process (Reis dos Santos and Isabel Reis dos Santos, 2009). In Figure 4, the optimisation model interacts with the meta-model, whilst the metal-model approximates the input–output behaviour of the simulation model.

Figure 4: How the Meta-Model Interacts with the Simulation Model and the Optimisation Module



Response Surface Methodology (RSM) is based on procedures that allow regression models to be applied to simulation model responses that are evaluated at several values of decision variables using the design of experiments (DOE) methods. A comprehensive study of the use of statistical designs integrated with simulation models can be found in Kleijnen (1998), which focuses on how RSM combines regression analysis, statistical designs and the steepest descent/ascent method to optimise the objective function of the simulated system. On the other hand, Kriging (Hussain et al., 2002; Keys and Rees, 2004) is an interpolation method that predicts unknown values of a stochastic function which are more flexible than polynomial models and less sensitive to small changes in the experiment design (Meckesheimer et al., 2002). Another method is Artificial Neural Networks (ANNs), which has proven to be an effective method to approximate arbitrary smooth functions and can be fitted using stochastic response values (Fonseca et al., 2003). ANNs are developed to mimic neural processing, the inputs and outputs of which are linked according to specific topologies.

Statistical Methods

Gradient-based and meta-model-based methods are used for continuous decision parameters. In discrete decision parameters, the problem is to select one of the predetermined system configurations. The task of optimisation algorithms is then to select one of these

configurations that optimise system performance based on the selected criteria. Since the system performance is not deterministic, further statistical analysis is required to compare alternatives. Different types of approaches were developed for such optimisation problems, including Ranking and Selection (R&S), Multiple Comparison Procedures (MCP) and Ordinal Optimisation (OO).

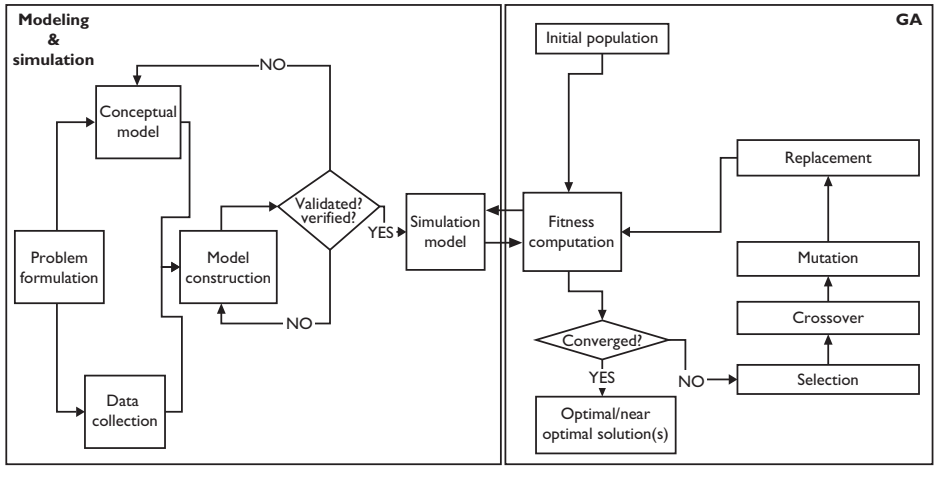
In R&S, there are two main approaches. The first is the indifference zone approach, which finds the decision variables values that make the value of performance measure different from the optimal performance by at most a small amount (i.e. the indifference zone). On the other hand, subset selection is used to reduce the feasible solution region to a small subset that at least contains the best solution. The indifference zone approach does not require extensive computation efforts and can be applied to a single replication from each solution (Kim and Nelson, 2001). The idea of MCP is to run a number of replications and then evaluate system performance by constructing confidence intervals (Swisher et al., 2003). However, it is difficult to precisely determine the best alternative from a set of predefined solutions in terms of absolute values. OO determines which solution is better, rather than focusing on the quantitative difference between the available solutions. In addition, instead of looking for the best alternative, OO selects a good enough solution (Ho et al., 2000). This crucial feature of OO makes it a robust optimisation choice when the number of alternatives is very large (He et al., 2007).

Meta-Heuristics

Statistical methods were successfully used in the case of discrete decision parameters. However, it is computationally infeasible to evaluate every possible alternative or all parameter combinations when the solution space is very large. Consequently, determining which alternative(s) to be simulated and evaluated is crucial. Besides, most of the aforementioned optimisation techniques fail to find an optimum solution when the solution space is high-dimensional and discontinuous, or when the decision variables are qualitative. Meta-heuristics are used in such cases to efficiently guide the search process towards potential solution points (Bianchi et al., 2009). They ultimately provide balance between exploration of solution space and exploitation of *good* solution(s) in an iterative process by initially starting with a solution (point-based) or set of solutions (set-based or population-based), then in each iteration the search progresses to new possibly better solution(s) in the neighbourhood of the current solution. Each meta-heuristic method has its own mechanism to define the neighbourhood structure (Andradottir, 2006). Simulated Annealing (SA) is one of the main meta-heuristics that starts with an initial solution, generally chosen randomly. A neighbour of this solution is then generated by a suitable mechanism. The performance of this solution is then calculated. If an improvement occurs, the generated neighbour replaces the current solution. If there is no improvement in the performance, the SA algorithm may accept this solution with some probability to avoid entrapment in a local optimum (Kirkpatric et al., 1983). Another famous meta-heuristic method is Genetic Algorithm (GA), which works on a population of solutions in such a way that poor solutions are excluded, whereas good solutions evolve to reach their optimum solution (Chaudhry

and Luo, 2005). It generates an initial population of solutions. These solutions are then evaluated through a simulation model which is followed by a selection process in which genetic operators are applied to produce new solutions that are inserted into the population. Figure 5 demonstrates the integration process between a GA and a simulation model. This process is repeated until some stopping criterion is reached. Tabu Search (TS) is a constrained search procedure, where each step consists of solving a secondary optimisation problem (Glover et al., 2007). At each step, the search procedure removes a subset of the search space. This subset changes as the algorithm proceeds and is usually defined by previously considered solutions which are called the reigning tabu conditions (Chelouah and Siarry, 2000).

Figure 5: A Genetic Algorithm (GA) Integrated with a Simulation Model (Fitness Computation)

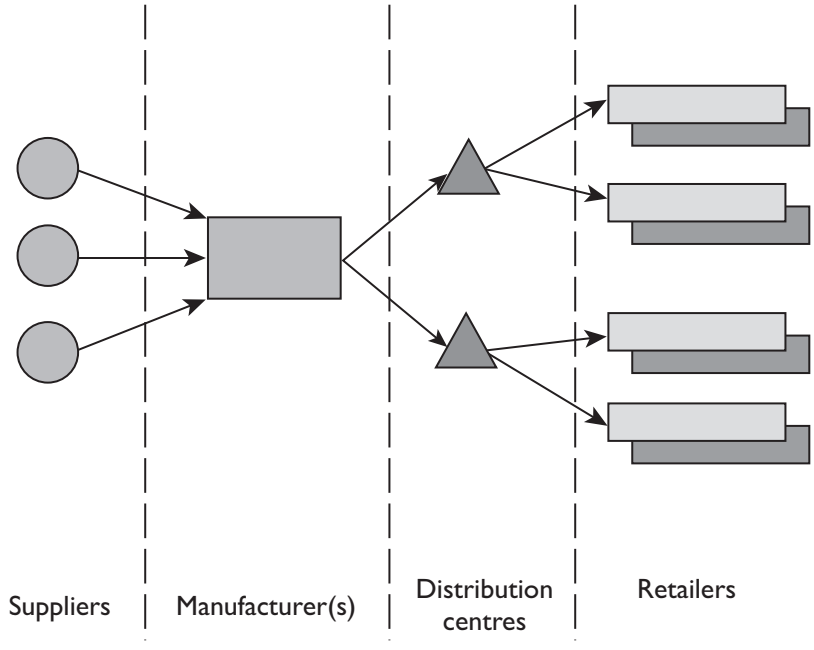


SUPPLY CHAIN APPLICATIONS

An SC can be defined as a set of entities (e.g. echelon or business tier) directly involved in the upstream (i.e. supply) and downstream (i.e. distribution) flows of products, services, finances and/or information between a source and a customer (Mentzer et al., 2001) (see Figure 6).

Managing such a chain of networks is a complex and challenging task due to current trends in globalisation, increased outsourcing, shorter product life cycles and advances in information technology. In this review, decision areas in supply chain management are classified into four main areas: inventory management, production planning and scheduling, transportation and logistics management, and supply chain collaboration, coordination and design.

Figure 6: A Simple Model of a Supply Chain



Inventory Management

The strategic impact of inventory stored at different stages of the SC is significant. Determining the minimum and maximum levels of inventory and the quantity of order to be placed are major challenges for decision makers. An (*s*, *S*) ordering policy specifies these decision variables by placing an order when the level of inventory is below *s* units, and by specifying the amount of the order by the difference between maximum inventory level (*S*) and the current inventory position. Provided that determining the optimal values of (*s*, *S*) is computationally expensive, simulation-based optimisation is a potential tool for analysing alternatives and finding these optimal values. IPA is used by Gavirneni (2001) to compute the appropriate order-up-to level in a capacitated SC. Gavirneni (2001) measured the benefit of sharing the inventory parameters of the retailer's ordering policy and demand data with the supplier, which reduced the supplier's cost by a value from 1 per cent to 35 per cent. Ranking and Selection procedures and SA are combined by Ahmed and Alkhamis (2002) to find optimal values of (*s*, *S*) inventory policy with the objective of minimising the inventory holding cost, shortage cost and ordering cost. An efficient selection-of-the-best scheme called Sequential Selection with Memory (SSM) is proposed by Pichitlamken et al. (2006) to be used during the neighbourhood search. A hybrid between

simulation and GA is presented by Köchel and Nieländer (2005) to define optimal order policies in a multi-echelon inventory system. Additionally, the causal relation between the inventory decision variables and SC performance can be constructed using meta-models. Subsequently, the constructed meta-model can be used to determine the base stock levels of different SC stages in order to minimise the backlogging costs at warehouses and the holding costs at SC nodes. As an example for such integrated framework, Wan et al. (2005) optimised inventory levels for a three-stage SC where each production node has inventories for raw materials and products. In the same fashion, GA can be used to generate base stock levels while being evaluated by simulation models. This integration can be used to minimise the sum of holding and shortage costs in the entire SC (Daniel and Rajendran, 2005, 2006).

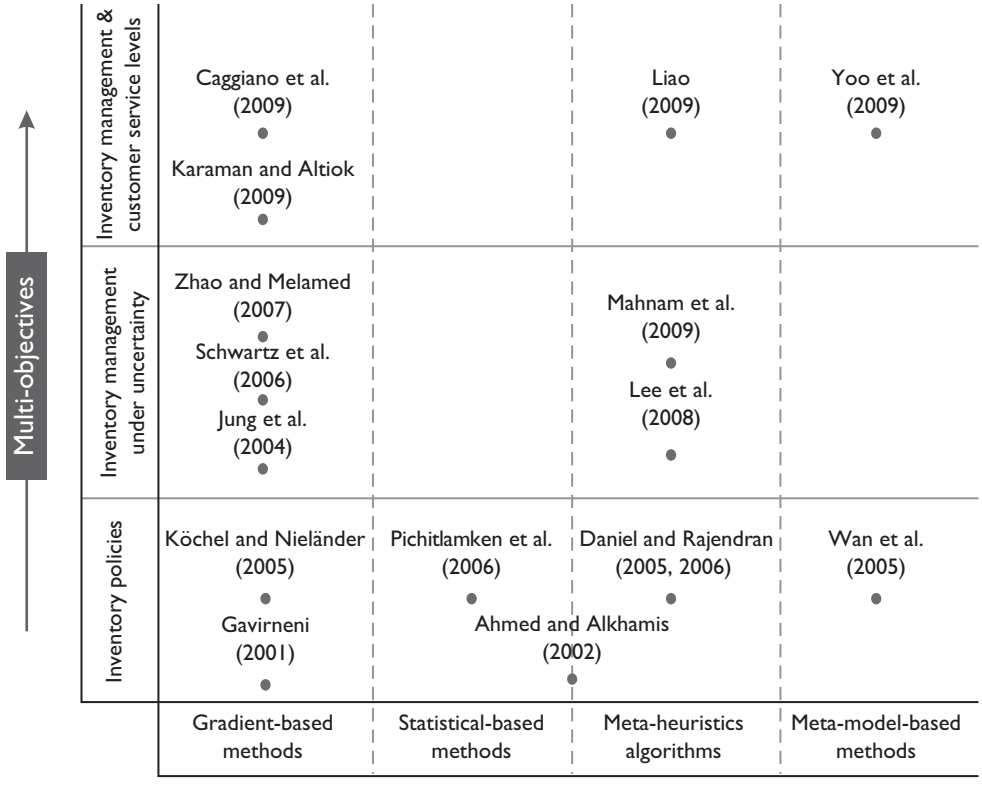
Determining optimal values of stock levels in the stochastic environment of the SC is challenged by various sources of uncertainty in the SC, resulting from the variability in customers' demand or the unreliability of external suppliers. To cope with this uncertainty in demand, Jung et al. (2004) proposed a simulation-based optimisation approach that incorporates the concept of safety stock as a time-independent lower bound on the inventory level. However, a key limitation of their approach lies in the large computing times required to address SC problems of increasing scope and scale, which consequently may result in more difficulties in determining the relationship between inventory decision variables and SC performance. Due to its gradient estimation capabilities, simultaneous perturbation stochastic approximation (SPSA) (Spall, 1998) can be used in these cases to effectively determine the optimal values of inventory stock levels (Schwartz et al., 2006). Similarly, IPA is used by Zhao and Melamed (2007) to control inventory levels in a single-stage, single-product make-to-stock production under demand uncertainty and random production capacity conditions.

Demand and production uncertainty are usually coupled with optimising more than one objective, such as total inventory cost and customer service levels. Lee et al. (2008) have presented a multi-objective simulation–optimisation framework that integrates simulation, computing budget allocation and multi-objective evolutionary algorithms to optimise inventory and replacement policies. Another multi-objective inventory model is proposed by Mahnam et al. (2009) for a multi-echelon SC that integrates multi-objective particle swarm optimisation and simulation–optimisation. Possibility theory and fuzzy numbers (Zadeh, 1999) are incorporated into their simulation model to handle the uncertainty in SCs. This incorporation has resulted in a flexible decision-making framework that allows linguistic expressions to be used for modelling the reliability of suppliers and to optimise both total inventory cost and fill rate simultaneously.

Inventory control is directly related to the quality of customer service, which is one of the key performance measures in successful SC management. Customer service levels can be computed as the percentage of times that received customer orders are fulfilled by on-hand inventory. The requirements of service levels in a multi-item, multi-echelon distribution system is studied in Caggiano et al. (2009) by developing a comprehensive simulation model to compute optimal fill rates over a wide range of base stock levels. In

Karaman and Altiok (2009), production management is linked to stock levels in a multi-echelon SC where a simulation-based optimisation framework is developed to analyse SC performance using time averages of inventory, back order levels and customer service levels as the key performance metrics of the SC. The metrics are then used by the optimisation algorithm to design the SC in order to minimise the expected total system costs. In Yoo et al. (2009), a framework is proposed to maintain customer service levels close to the target by stock levels of products at both wholesalers and manufacturers. Simulation-based experiments were performed on a three-stage SC to test the performance of the proposed framework. Such trade-offs between customer service levels and total inventory cost is further detailed in Liao (2009). A summary of the literature work in inventory management is given in Figure 7.

Figure 7: Summary of the Literature in the Area of Inventory Management



Production Planning and Scheduling

A key role in SC planning is the integration of production functions such as capacity planning, process planning, scheduling and process control. Capacity planning involves

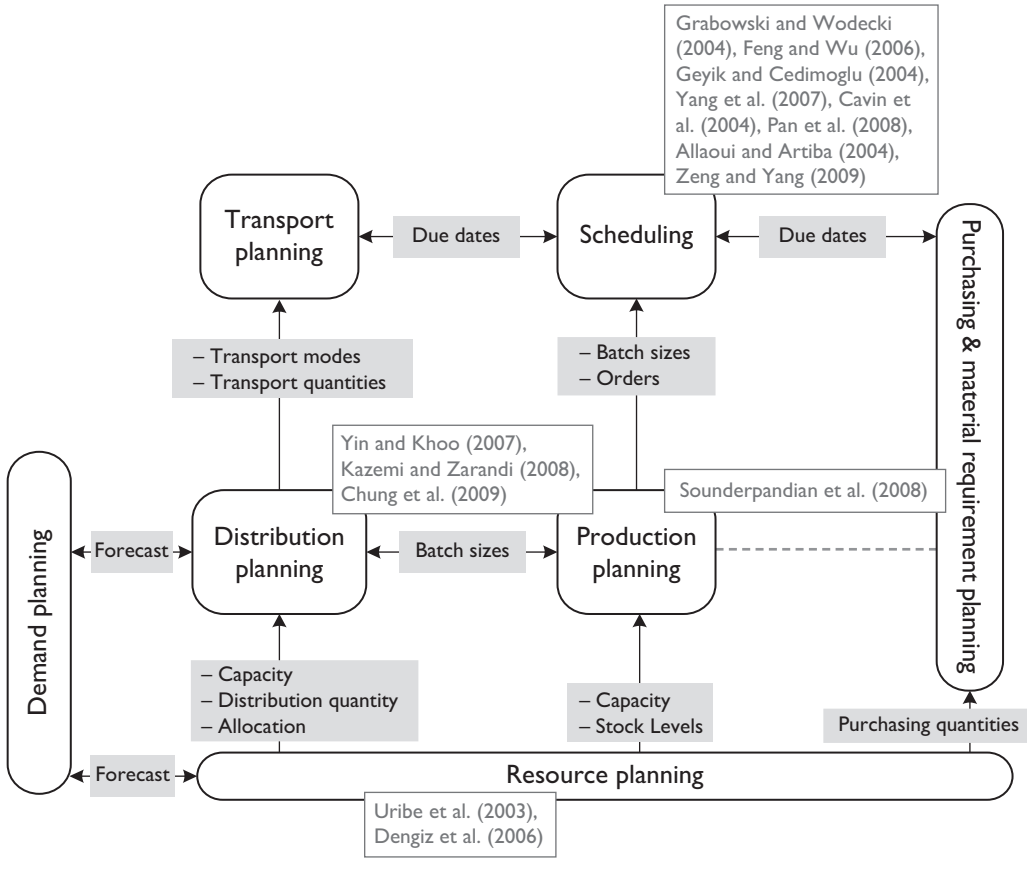
deciding how resources will be allocated to meet customer demand. However, demand uncertainty makes capacity planning a difficult task, whether the uncertainty in demand is because of the variations in forecasts of direct demand or by upstream variability in a SC. A two-stage simulation–optimisation framework for rough-cut capacity planning under demand uncertainty is presented in Uribe et al. (2003) for a semiconductor manufacturer. The first stage in their framework characterises the optimal response of the manufacturing system under demand uncertainty while these characterisations are used in the second stage to select a tool set with the addition of budget constraints. Moreover, required labour force and machines can be predicted by building a multiple regression meta-model based on simulating manufacturing systems (Dengiz et al., 2006).

Different TS strategies has been investigated in Grabowski and Wodecki (2004) and Geyik and Cedimoglu (2004) for job-shop parameters for an efficient resource allocation. TS is used by Cavin et al. (2004) to find the optimal batch design in a multi-purpose batch plant where simulation is used as a black box for the evaluation of batch processes. The intelligent search capabilities of GA are incorporated with simulation in Feng and Wu (2006) to find the optimal dispatching schedule for a batch plant. The modelling capability of discrete event simulation and GA is presented in Yang et al. (2007) for solving a multi-attribute combinatorial dispatching problem in a flow shop in a manufacturing plant. Factorial experimental design was used to collect structured data from simulation results which are then used to construct a response surface to optimise the parameters of GA. The Pareto dominance concept is applied in Pan et al. (2008) for solving no-wait flow shop scheduling problems with make-span and maximum tardiness criteria. Another integrated simulation–optimisation framework is developed in Zeng and Yang (2009) to minimise the make-span for operations scheduling; operations sequences were improved through GA while a simulation model is used to evaluate objective functions under different scheduling schemes. Meanwhile, a surrogate model based on artificial neural networks (ANN) is designed to predict objective function to decrease the times of running the simulation model.

A large production loss can occur if machines' downtime and maintenance actions are neglected during the production scheduling process. Consequently, maintenance and repair strategies for the manufacturing plant have to be considered. The flexibility of simulation models allows the inclusion of several practical aspects of these activities, such as stand-by operation modes, deteriorating repairs, aging and sequences of periodic maintenances. An optimisation method can then be utilised to optimise the components' maintenance periods and the number of repair teams (Marseguerra and Zio, 2000). A hybrid flow shop scheduling with machine unavailability intervals (due to breakdowns and preventive maintenance) is considered in Allaoui and Artiba (2004) to minimise flow time and due date. In Allaoui and Artiba's (2004) integrated framework, the simulation module evaluates the solutions generated by SA, which are combined with different dispatching rules. GA is modified in Chung et al. (2009) to deal with distributed scheduling in a multi-factory production with machine maintenance considerations.

Apparently, production facilities are more complex than other stages in SC, such as warehouses and distribution centres, in terms of resource constraints and the dynamic of production (Griffiths and Margetts, 2000). Such dynamics and variations in factory schedules might degrade the overall performance of an SC. Consequently, integrating production planning and scheduling with other SC units became evident. Figure 8 shows the application of simulation–optimisation for the planning activities in supply chain.

Figure 8: Examples of Planning Activities in Supply Chain Management



A coordination between two successive stages of an SC is discussed in Mansouri (2005) for a sequencing problem to minimise total set-ups and to minimise the maximum number of set-ups between the two stages. For solving these two NP-hard problems, a multi-objective genetic algorithm solution was proposed which had proven its capabilities of finding

Pareto-optimal solutions. An integrated framework based on GA and TS is presented in Yin and Khoo (2007) for a distributed hierarchical model for SC planning and scheduling optimisation with a consideration of SC capacity, business strategies and customer requirements. A simulation–optimisation framework is demonstrated in Sounderpandian et al. (2008) for production planning, which considered the interdependency between demand and material supplies and the uncertainties emanating upstream and downstream in the SC. Production plans were generated by GA while simulation is used for their evaluation. A joint production–distribution planning is suggested by Kazemi and Zarandi (2008) for multi-stage, multi-product SCs where the coordination level between SC components is increased by the parallel processing capabilities of their agent-based simulation framework. Stockton et al. (2004) have discussed a wide range of planning decision types, such as aggregate planning, lot sizing within material requirements planning, and production line balancing using GA.

Transportation and Logistics Management

Logistical activities may involve transporting raw materials from a number of suppliers, delivering them for manufacturing, movement of the products to various warehouses, and eventually distribution to customers. Effective management for these activities may lead to a considerable reduction in SC costs (Christopher, 1999). Due to the volatility of today's market, other crucial elements have to be considered besides logistics costs, such as customer satisfaction levels. Consequently, restructuring distribution networks to cut costs and to achieve higher customer service is another challenge that SC managers face (Jing and Jin-Fei, 2006). With such dynamics and uncertainties of SC networks, simulation modelling can be an attractive approach for analysing logistics and distribution networks (Iannoni and Morabito, 2006).

The design and deployment of a distribution logistics system using a simulation–optimisation approach has been presented by Rao et al. (2000) for a multiple-echelons SC with capacity constraints, uncertain demand and multiple products. They used an integrated model composed of network flow techniques, inventory theory and simulation-based optimisation (IPA) in order to find the optimal configuration of the distribution network of the SC that maximises the total revenues and minimises the total SC cost. Another hybrid optimisation–simulation modelling approach is presented in Ko et al. (2006) for a multi-period, two-echelon, multi-commodity, capacitated SC where GA is used to determine the dynamic distribution network structure while uncertainty in customer demands, order picking time and travel time are captured by a simulation model. However, GAs cannot cope with certain types of disturbances, such as order cancelation during the logistics scheduling process, which necessitate re-optimisation of the whole problem by GA. On the contrary, ant colony optimisation (ACO) is able to find new optimisation solutions without re-optimising the problem (Silva et al., 2008). Due to its flexibility, ACO has been used, not only for scheduling logistics that consider supplier–logistic systems, but also for a full distributed optimisation that consider all echelons of the supply chain. A generic SC model with suppliers, logistics and distributors is demonstrated in Silva et al. (2009) with

the objective of minimising the tardiness (i.e. the difference between the release date and the delivery date of the order) of the total orders, minimising the number of orders that are not delivered or delayed, maximising the number of orders that delivered at the correct date, and minimising the total travelling costs of vehicles.

Optimising product delivery from suppliers to customers by vehicles is known as the vehicle routing problem (VRP). TS is investigated in Fu et al. (2004) as a way of solving a special kind of VRP called Open-VRP, where vehicles have to revisit their assigned customers in the reverse order. A truck and trailer vehicle routing problem (TT-VRP) is considered in Tan et al. (2006) with the objective of minimising the routing distance and the number of trucks required. A hybrid multi-objective evolutionary algorithm (HMOEA) is applied to find the Pareto optimal routing solutions for such TT-VRPs. Another GA is presented in Lacomme et al. (2006) based on the non-dominated sorting genetic algorithm (NSGA) for the bi-objective capacitated arc routing problem (CARP). Both the total duration of trips and the duration of the longest trip (make-span) are to be minimised. Another type of VRP is known as VRP-TW, the objective of which is to serve a number of customers within predefined time windows (TW) at a minimum travelled distance, considering the capacity and total trip time constraints for each vehicle. Such a combinatorial optimisation problem is investigated in Tan et al. (2001) by applying TS and SA. However, there is a variation in the travel time from one customer to another. Such time-varying windows are regarded by Zheng and Liu (2006) as fuzzy variables. They developed a hybrid intelligent algorithm integrating simulation and GA to minimise the total travel distance of all vehicles. Besides service time, customer demand is another parameter that may feature variability. This vehicle routing problem with stochastic demand (VRP-SD) is addressed in Tan et al. (2007) by using a hybrid between multi-objective evolutionary algorithms (MOEA) and simulation. MOEA searches and generates routes while simulation is used to evaluate the costs of routes in terms of travelling distance, driver remuneration and number of vehicles required. Fuzzy variables are used in Erbao and Mingyong (2009) to deal with these uncertainties in customer demand by integrating simulation and evolution algorithms to minimise the total travelled distance for vehicles. A summary of reviewed articles on vehicle routing problem is given in Table 1.

Table 1: Optimisation of Vehicle Routing Problems (VRPs)

Author(s)	VRP Problem	Optimisation Algorithm	Objective Functions
Fu et al. (2004)	Open-VRP	Tabu Search	- Number of vehicles - Total travelling cost
Tan et al. (2006)	TT-VRP	HMOEA	- Number of trucks - Routing distance
Lacomme et al. (2006)	CARP	NSGA	- Total trip duration - Longest trip (make-span)

(*Continued*)

Table 1: (Continued)

Author(s)	VRP Problem	Optimisation Algorithm	Objective Functions
Tan et al. (2001)	VRP-TW	Tabu Search Simulated Annealing	- Total travelled distance
Zheng and Liu (2006)	VRP-TW	Genetic Algorithm/ Fuzzy	- Total travelled distance
Tan et al. (2007)	VRP-SD	MOEA	- Total travelled distance - Number of vehicles - Driver remuneration
Erbao and Mingyong (2009)	VRP-SD	DEA/Fuzzy	- Total travelled distance

Supply Chain Collaboration, Coordination and Design

In today's volatile market environment, business organisations interact together in a collaborative manner in order to gain more benefits in different dimensions, such as a faster response to customer demands, greater flexibility for market changes, a greater reduction in inventory stocks, and higher levels of customer satisfaction (Barratt, 2004). A central coordination system is proposed by Chan et al. (2004) to model collaboration rules and to optimise demand allocations in a three-echelons SC network. The coordination system is equipped with a multi-criteria GA to optimise two types of criteria, qualitative and quantitative. Qualitative criteria include quality of supply, accuracy of due date fulfilment and accuracy of quantity fulfilment, while quantitative criteria include total cost, total lead time and equity of utilisation.

Internal coordination between SC nodes and external integration (informational consistency between the organisation and the market) are key aspects to secure price and availability of necessary supplies in the face of volatile global demand. A simulation-based optimisation study is presented by Crespo Marquez and Blanchar (2004) to define, characterise and simulate three generic types of suppliers with varying degrees of security and flexibility. Demand uncertainty is addressed by adding in-transit and warehoused inventories to asynchronous production and shipping lead times. Optimisation is then applied to measure the tradeoffs between alternative suppliers. Due to the recent increase in outsourcing, the decision-making process of supplier selection has been complicated by the fact that various criteria must be considered simultaneously. These criteria have been analysed in Ding et al. (2005) by considering purchasing costs, transportation costs, inventory costs and total backlogged demands as the target key performance indicators (KPIs). The estimated values of these KPIs – generated by a simulation model – are used to evaluate candidates' supplier portfolios. Such portfolios are created by a GA optimiser, which continuously searches different configurations of the SC, by selecting one or more suppliers plus corresponding transportation modes. This work has been extended in Ding

et al. (2006) by adopting a multi-objective genetic algorithm for achieving the trade-off between conflicting objectives, e.g. costs and customer service level. Additionally, the framework addressed not only strategic decisions (e.g. network configuration), but also operational aspects of each proposed network configuration, such as inventory control parameters and transportation allocation.

The process of sequential decision making under uncertainty is investigated in Mele et al. (2006) to maximise the profit of an SC by finding decisions related to the operational/tactical levels. The presented framework relies on the use of a hybrid simulation–optimisation strategy involving two nested loops. The inner loop generates different scenarios that are then simulated using a multi-agent simulator for the SC, whereas the outer loop involves an optimisation process based on GA. Koo et al. (2008) demonstrated another application of simulation–optimisation to support optimal design and operation decisions in an integrated SC network. Decision variables (e.g. safety stock levels, investment throughput, capacity investment, production cycle time and procurement cycle time), which form a candidate solution, are passed from the optimisation module to the simulation module to be evaluated. After simulation, the performance of the candidate solution – in terms of total revenue, total procurement cost, total operating cost, total product inventory cost and customer satisfaction index – is passed back to the optimisation module, which then proposes new candidate solution(s), if necessary. In To et al. (2009), a coordination between SC nodes is addressed in terms of process design and control. Irregularity of information and data interchange among isolated functional and enterprise activity tasks are major challenges that have been addressed in their study. GA is used to find the optimum process structural model while a dependency-based process simulation is used for performance evaluation.

SELECTION CRITERIA OF SUPPLY CHAIN OPTIMISERS

Improper selection of the optimiser may result in inadequate strategic decisions made by managers. The suitability of the optimisation technique depends on many factors related to the SC application and the optimisation technique. These factors have been identified based on reviewing simulation–optimisation for a wide range of SC applications, which are discussed in the following subsections.

Decision Variables Space

In a discrete space, decision variables take a discrete set of values such as the number of machines, locations of depots, scheduling rules or policies, etc. On the other hand, in a continuous space, the feasible region consists of real valued decision variables such as order quantity and reorder quantity in inventory problems. Decision variables can be qualitative (e.g. queuing strategies) or a mixture of discrete and continuous values.

Solution Space

Solution space is the space of all possible solutions that satisfy all the constraints. Some categories of optimisation methods are preferred when the search space is finite (i.e. decision

alternatives are small or the combination of variable values has a small range), whilst other categories are more effective when the solution space is very large or infinite.

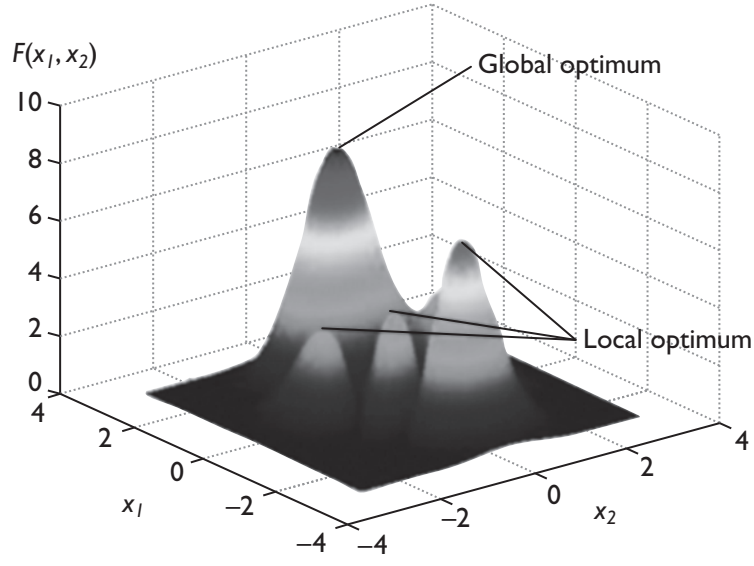
Modelling Approach

Traditionally, mathematical programming methods (Fourer et al., 1990) are used for problems that can be modelled with equations that describe the constraints and objectives of the underlined problem. Developing such analytical expressions for real-world problems is challenged by the embedded complexity and uncertainty within these systems. Instead, simulation models (Ryan and Heavey, 2006) are potent tools for analysing the dynamics of complex systems. An optimisation algorithm then interacts with the system model to provide optimal values of decision variables. Not all optimisation methods are suitable for working with both types of modelling.

Optimisation Searching Mechanism

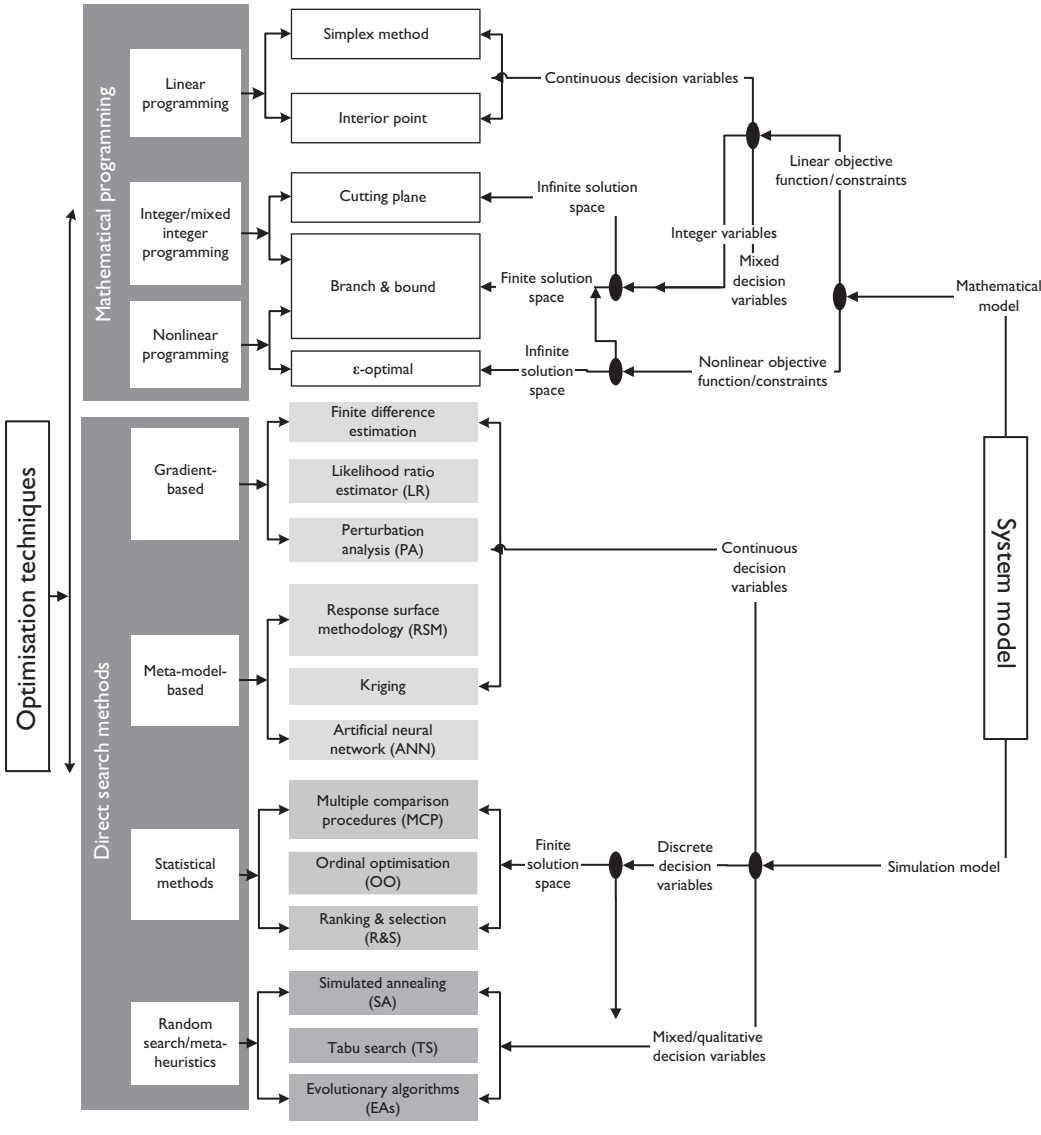
Optimisation methods use different mechanisms for searching for the optimal solution. This is highly dependent on many factors, such as the modelling approach, problem complexity and the objectives of the decision makers. The optimum solution is the vector that gives the global optimum value (maximum/minimum) of the objective function, and avoids the local optimum (see Figure 9). Based on the reviewed articles, optimisation methods can be characterised as local search methods, global search methods or guaranteed optimal methods.

Figure 9: Global Optimum vs Local Optimum



A variety of schemes have been proposed in the literature for classifying optimisation techniques. Decision variables can be used to classify optimisation methods into continuous input parameter methods and discrete input parameter methods (Swisher et al., 2000). Continuous input parameter methods include gradient and non-gradient methods; on the other hand, discrete input parameter methods include statistical methods, ordinal

Figure 10: Optimisation Techniques Map (OTM)



optimisation and meta-heuristics algorithms. The shape of the response surface (i.e. global as compared to local optimisation) can be used also to categorise optimisation techniques into local optimisation techniques and global optimisation techniques (Tekin and Sabuncuoglu, 2004). Local optimisation techniques are further divided into discrete decision space methods and continuous decision space methods; global optimisation techniques include meta-heuristics, sampling algorithms and gradient surface methods. However, simulation models are only considered in the aforementioned classifications, which neglect other modelling approaches. Different modelling methods have to be considered to provide a consistent and comprehensive classification of optimisation methods (Beyer and Sendhoff, 2007).

In this review, the factors that control the choice of optimisation technique for SC applications are considered concurrently: optimisation mechanism, decision variables, solution space and modelling approach. The classification scheme is named Optimisation Techniques Map (OTM) (see Figure 10), which can be viewed from two perspectives: from the right, the OTM starts with the modelling approach to classify the optimisation techniques into mathematical programming and direct search methods. Afterwards, decision variables and solution space are used respectively for further categorisation. On the other hand, the OTM can also be viewed from the left side of the figure as a classification of methods in terms of the optimisation mechanism: mathematical programming, gradient-based, meta-model-based and statistical methods, and meta-heuristics.

DISCUSSION

The articles discussed in this review have been published in a wide range of journals (see Figure 11), which reflects the multi-disciplinary characteristics of applying simulation modelling and optimisation in the SC context. A variety of concepts from different disciplines, such as operations research, economics and management science, engineering, artificial intelligence, expert systems and simulation modelling, come together to provide reliable and flexible tools for SC managers.

Due to the large number of daily decisions that have to be taken, inventory management and production planning and scheduling represent about 68 per cent of reviewed articles (see Figure 12). This high percentage sheds light on the powerful capabilities of simulation to incorporate more details at the operational and tactical levels.

Among other application areas of SCs, there is more emphasis on inventory management. This is because all nodes within SCs, from manufacturing plants and distribution centres to retailers, have an element of inventory management. Gradient-based optimisation methods are suitable for inventory management; for example, perturbation analysis (PA) can estimate all gradients of the performance measure by tracking the propagation of simulation results sensitivity through the system (Ho, 1985). However, to have these tracking capabilities, a deep understanding of the simulation model is required to allow system optimisers to integrate their algorithms into the model. SPSA overcomes this problem by considering the simulation model as a black box (Sadegh and Spall, 1998). However, some inventory problems have only discrete variables which prevent the use

Figure 11: The Distribution of Reviewed Articles in Academic Journals Reflects the Multi-Disciplinary Characteristic

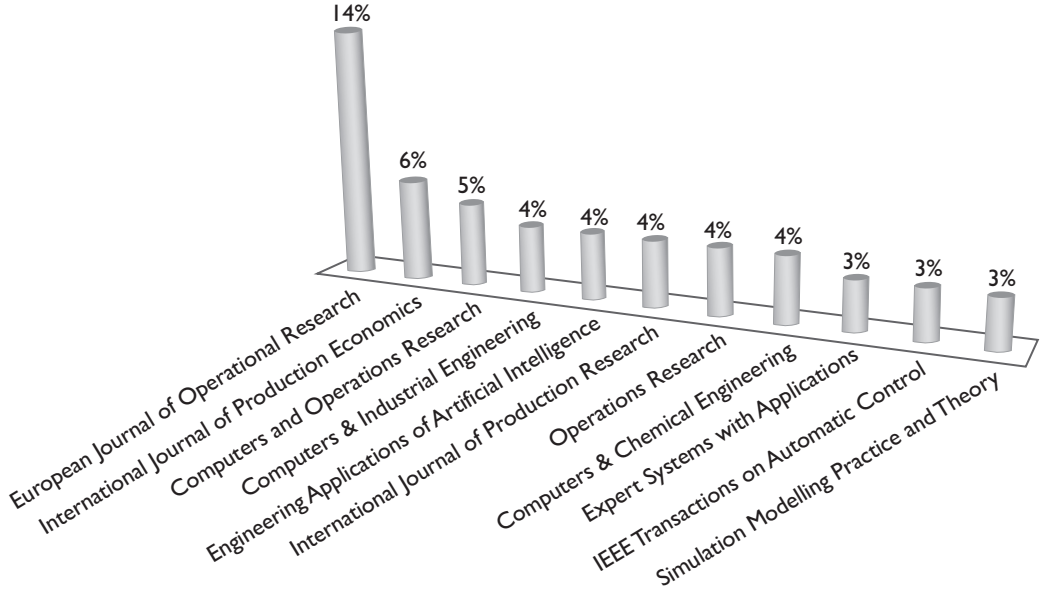
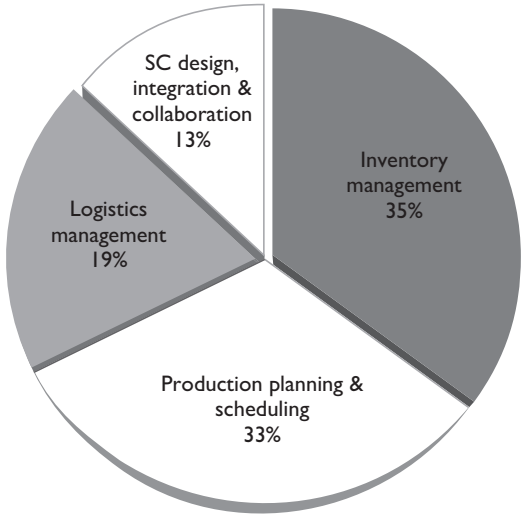


Figure 12: Percentage of Applications Area in the Literature Review

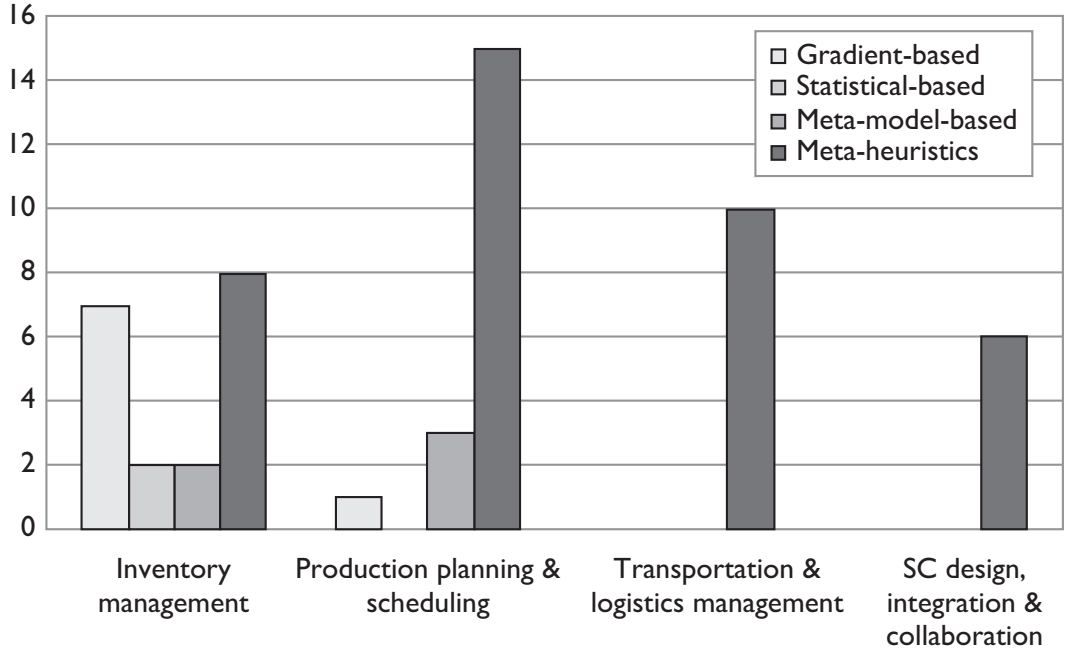


of gradient-based techniques. Statistical methods are then used for this type of problem. Subset selection approaches are most useful when the number of alternatives is quite large. Indifference zone approaches could then be used to select a single solution alternative that is within a pre-specified difference from the true optimum. The major disadvantage of ranking-and-selection procedures is the requirement of independence over competing solutions, which precludes the use of most variance reduction techniques as common random numbers. Ranking-and-selection and multiple-comparisons procedures are only powerful for optimisation when the parameter set is finite.

In the area of production planning and scheduling, these limitations of gradient-based methods and statistical techniques are avoided by more emphasis on meta-models and meta-heuristics. A key advantage of response surface methodology is its ability to optimise objective functions with unknown variance along with high levels of uncertainty (Kleijnen et al., 2004). Moreover, it can be extended to allow multiple random system responses with multi-constraints (Kleijnen, 2008). However, for some meta-model-based methods such as ANN, special attention for the training set has to be given to avoid over-fitting approximation, which directly affects the meta-model predictive accuracy (Alam et al., 2004).

As shown in Figure 13, the range of application domains solved by meta-heuristics is far greater than other methods. Problem-specific knowledge (e.g. non-standard goals,

Figure 13: Simulation-Optimisation Techniques for Each Application Area in the Supply Chain



constraints, objectives and conditions) can be more easily incorporated into the solution process, which broadens the range of problems to which multi-objective methods are applied. Besides, meta-heuristic algorithms can handle models with integer variables, discrete variables and/or qualitative variables, whereas continuous variables have to be approximated before the meta-heuristic is applied. However, more computational efforts are needed at this stage in order to increase the degree of accuracy. Moreover, meta-heuristic methods are not function optimisers. That is, their purpose is to seek and find good solutions to the problem, rather than a guaranteed optimal solution. Therefore, if the model is sufficiently simple, it is more efficient to use conventional methods to obtain an optimal solution, rather than meta-heuristics. However, most of the reviewed articles deal with complex real-world problems for which there is no conventional method that is guaranteed to find the optimal solution. A major disadvantage of meta-heuristic algorithms is the fact that there are a larger number of parameters to be set by the optimiser in meta-heuristics than in other methods. In many cases, the solution is sensitive to these parameters and hence different parameter settings are needed before a good solution is obtained. Finally, none of the multi-objective evolutionary algorithms has a proof of convergence to the true Pareto-optimal solutions (Marco et al., 2002).

CONCLUSION

Understanding and improving the performance of SCs is challenged by a high level of uncertainty, conflicting objectives, a large number of constraints and inter-connected decision variables. Making decisions that lead to the optimum performance of SCs seems to be impossible. Despite their computational efficiency, analytical models are impractical in SC settings due to their limitations in modelling important details and features of real industrial systems. On the other hand, simulation models provide the flexibility to accommodate arbitrary stochastic elements, and generally allow modelling of all the complexities and dynamics of real-world SCs. Optimisation methods are then used by decision makers to find the optimum set of decision variables and the best possible alternatives while their impact on the system performance is evaluated using simulation models. Therefore, integrating simulation and optimisation provides decision makers with a comprehensive solution toolbox. This paper presents a state-of-the-art literature review of simulation modelling and optimisation techniques in the context of SC management. Based on the literature, SC applications have been classified into four main application areas: inventory management, production planning and scheduling, transportation and logistics management, and SC collaboration, coordination and design. Moreover, a classification of optimisation techniques is provided that considers the optimisation mechanism, the type of decision variable and the search space. Meta-heuristic algorithms are presented for SC applications because of their global optimisation capabilities in stochastic environments. Statistical methods and meta-model-based methods can be incorporated with meta-heuristics to provide more reliable solutions in a reasonable timeframe. The absence of a clear guideline that considers problem factors (e.g. constraints handling, multi-objective and robust solutions) makes the decision to select an optimisation technique considerably hard. The review has identified the main criteria of

selecting an SC optimiser in order to provide guidance for researchers and practitioners for a proper selection of optimisation technique.

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Book Review

The Leadership Code: Five Rules to Lead By
by Dave Ulrich, Norm Smallwood and Kate Sweetman
Boston: Harvard Business Press, 2008

Alma McCarthy*

INTRODUCTION

The search for an understanding of effective leadership has been ongoing for centuries and there are thousands of books and publications which aim to shed light on various dimensions of leadership theory, approaches and outcomes. Practitioners and academics are preoccupied with the concept of leadership and what constitutes effective leadership. In the case of leadership, perhaps the French novelist Remy De Gourmant (in Bass and Bass, 2008: 3) is accurate in stating that 'a definition of leadership is a sack of flour compressed into a thimble'. We know good (and poor) leadership when we see it, yet it is not easily distilled into a 'one-size-fits-all' approach.

The Leadership Code: Five Rules to Lead By is written by a prominent author and commentator in the human resources field, Dave Ulrich, and two colleagues of his. The authors reviewed the extant leadership literature and conducted interviews with 'thought leaders' to inform the book. The authors claim that the same five essentials of effective leadership were repeated in interviews with highly regarded thought leaders, including Richard Boyatzis, Jay Conger, Marshall Goldsmith, Gary Hamel, Jack Zenger and Joe Folkman. The book is organised around five key principles, or codes, which enable effective leadership.

The authors do not necessarily reveal any new solutions or theories on becoming a 'great leader'. Rather, this book synthesises the thicket of leadership competency models into a unified view of leadership. In writing the book, the authors' goal is to 'identify an underlying framework of knowledge, skills and values common to all effective leaders' (p. 5). This model, the Leadership Code, is based on the premise that being an effective leader starts with one's self. The leader must model what they want others to master. This dimension of 'personal proficiency' is at the core of effective leadership. Without personal proficiency it is not possible to keep the other dimensions in balance. The Leadership Code

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maps across two dimensions: time and attention. In short, the model presents both a long-term and short-term perspective on the organisation and the individual. According to the authors, they:

> …have examined the broad field, talked in depth with the smartest leadership people [they] know, and passed all that information through the screen of [their] hundred years of experience in the field. Through the process, [they] have discovered and validated what [they] now know to be the five essential rules all leaders must follow (p. 25).

The book is organised around the five rules of effective leadership and a chapter is dedicated to each of the five rules, which are as follows:

RULE 1: SHAPE THE FUTURE

Meeting current business challenges in a global environment requires strategic leadership. The strategist keeps the long-term perspective of the organisation foremost in their minds. The leader must know the direction they are going and ensure everyone else does too. They must not just envision the future but must also be able to create it. While preferring to live in the abstract and the future world of strategy, they ensure that they remain up to date with the ever-changing external landscape of the macro environment, such as technology, demographics and political realities. The key constituents of the strategist domain are strategic vision, creating a customer-centric view of strategy, engaging the organisation in developing strategy, and creating a strategic footing in the organisation. The authors claim that this long-term organisational level perspective is one of the key rules of effective leadership.

RULE 2: MAKE THINGS HAPPEN

The leader who demonstrates the ability to make things happen, also termed 'the executor' by the authors, translates strategy into action, assigning accountability and ensuring teams work well together. Executors keep the near-term perspective of the organisation to the forefront. The executor element of the leader focuses on the question, 'How will we make sure we get to where we are going?' (p. 15). The key components of the executor domain are making change happen, following a decision protocol, ensuring accountability, building teams and ensuring technical proficiency.

RULE 3: ENGAGE TODAY'S TALENT

A talent manager gets important things done in a short period of time in a way that builds engagement and commitment within the team. People in organisations need to work together collectively toward a common goal, and at the same time they need to be able to express who they are individually. Talent managers identify what skills are required, develop people, engage them and ensure that employees put in their best efforts. According to the authors, talent managers maintain a near-term perspective on the human resources in the organisation. Furthermore, they assert that talent managers know how to identify,

build and engage talent to achieve the results in the short term. The critical elements of the talent manager domain are the ability to communicate with a clear and consistent message, to create an aligned direction and to clearly articulate that direction to internal and external stakeholders.

RULE 4: BUILD THE NEXT GENERATION TALENT

Having networks and relationships are important both inside and outside the organisation. A long-term perspective on people and capability in the organisation is central to the human capital developer domain of effective leadership. Human capital developers focus on the next generation, ensuring the organisation has the long-term competencies required for future strategic success. They maintain a clear line of vision between the future strategy and the competencies and skills required by the organisation to deliver that strategy. They possess the skills to coach and sponsor their staff to enable the right talent to be developed for the future. The decisive aspects of this domain are the leaders' ability to map the workforce to build the next generation, to align organisation and employee expectations, to support career development, and to encourage networking and relationship building.

RULE 5: INVEST IN YOURSELF

Personal proficiency is the ultimate rule of leadership, and it starts with leaders knowing and understanding themselves in terms of their strengths and development needs, among others. The authors contend that 'at the heart of the leadership code literally and figuratively is personal proficiency' (p. 17). They believe that at the core of the Leadership Code are the personal qualities and characteristics of the leader. Furthermore, they assert that an effective leader cannot be measured just by what they know and do; it is also about who they are as human beings and how much they can accomplish with and through other people. The defining elements of this domain are for the leader to know themselves, to have the ability to practice clear thinking, to be able to tolerate stress, to tend to character and integrity, and to demonstrate personal energy and passion to ultimately deliver results. The authors argue that if leaders are not grounded through their values and beliefs, credible through their judgement and decision making, emotionally mature, and willing to learn and grow as a leader, they will not be prepared to be a strategist, executor, talent manager or human capital developer. Investing in this self-knowledge results in personal proficiency where leaders know their predispositions, strengths and weaknesses.

CONCLUSION

The book concludes by discussing how organisations can ensure 'better leaders' and 'better leadership' by establishing a clear theory of leadership important to the organisation, assessing leaders against this framework, investing in leadership development and aligning organisational practices. The book provides a useful platform through which managers and leaders can reflect on their personal leadership behaviours and assess their own strengths and development needs. There is an associated 360-degree feedback assessment methodology which is underpinned by the Leadership Code. This assessment

process can be used to assess leadership capability against the five rules of effective leadership. Given that the book is quite recently published, there is a dearth of academic studies which explore the statistical validity of the theory and this will be a welcome development in the field. The latter is necessary to demonstrate that these five leadership dimensions are distinct factors and act as antecedents to effective leadership in practice.

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Book Review

Science for Sale: The Perils, Rewards, and Delusions of Campus Capitalism
by Daniel S. Greenberg
Chicago, IL: University of Chicago Press, 2007

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> In a field that has produced jeremiads from the critics of science for sale, and many fairy tales from the enthusiasts, what follows is an explorer's report (p. 8).

The above quote conveys the core inspiration of Daniel Greenberg's book. In a captivating, thought-provoking read, Greenberg distinguishes both the jeremiads from the critics and the fairy tales from the enthusiasts of academy–industry interactions. The outcomes of academy–industry engagement are increasingly observed as a potential contributor to the economic growth of a country and there have been significant increases in university patenting and licensing activity during the last three decades. The ideological beginning of these relationships can be traced back to post-war United States (US) government science policy, which encouraged interactions between universities and industry. While the general topic of technology transfer has a distinctive contemporary relevance and importance, Greenberg's investigation into the complexity of academy–industry interactions delivers an understanding and appreciation of the competing schools of thought on the matter. On one hand, there are strong concerns regarding the burgeoning academic scientist and industry romance as critics fear 'commercialism's power to chip away at the sacred pillars of academic culture' (p. 56). In contrast, the enthusiasts argue 'the academic–industrial research system produces beneficial results' (p. 56). Greenberg presents a balanced view of both the jeremiads and fairy tales and argues that neither ideology, in its purest form, is inherently right or wrong.

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OVERVIEW OF BOOK

Science for Sale is divided into three parts. The first section, 'The Setting and the System', evaluates the transformation that has occurred in US universities as they embrace the 'third mission' of technology transfer from academy to industry. Greenberg outlines the history and current situation of research spending in universities, and declares funding is always a problem for universities as they aspire for growth. He describes the persistent 'academic cup-rattling endeavors' (p. 17). Increased government spending facilitated the growth of the entrepreneurial universities in the late 1970s and early 1980s as reflected by the establishment of technology transfer offices and entrepreneurship courses on campus. The chapter proceeds by outlining the contrasting jeremiads and fairy-tale accounts of the effect of increasing levels of entrepreneurial activity on campus.

FAIRY TALE: TECHNOLOGY TRANSFER OFFICES MAKE MONEY

Greenberg disputes the enthusiasts' fairy-tale claim that technology transfer efforts reap huge financial successes all of the time. There is no denying that there have been some successes, such as at the University of Wisconsin Alumni Research Foundation, which had profits related to Vitamin D. Also, the success of Gatorade patents has provided more than $80 million to the University of Florida. However, Greenberg argues that the costs of the majority of technology transfer efforts are greater than the returns from the licensing of the patents produced. The obvious question is whether the unit responsible for the commercialisation – the technology transfer office – should be run as a for-profit entity. This brings Greenberg to the debate on what one should expect from the commercialisation of research and he devotes two chapters to discussing the conflicts of interest that emerge from the commercialisation of research amongst academic scientists, government agencies and industry.

JEREMIAD: CORPORATIONS WILL TAINT SCIENCE FOREVER

In spite of some dangers of commercialisation, Greenberg does refute the critics who bitterly lament the state of science and argues the future is hopeful:

> …the changes and trends are hopeful … shame and embarrassment exercise great force in academic and scientific affairs. Pride plays a big role, too. Scientists, their managers, and their institutions normally care deeply about their reputations (p. 258).

Although Greenberg's arguments, at times, lean towards cutting the ties between academic science and industry, he does accept that this is not feasible and academy–industry interactions can accelerate the transfer of knowledge from embryonic scientific discovery to application, thus advancing knowledge and contributing to economic and social benefit.

The second section, 'As Seen from the Inside—Six Conversations', adds further insight into the academy–industry engagement with a selection of interviews conducted with researchers, administrators and technology transfer specialists from over twenty large and middle-size universities and research centres. As each interviewee evokes their positive

and negative experiences of engaging with industry, it becomes clear to the reader that there is little consistency in their accounts, thus reinforcing the complex nature of the academy–industry relationship as no one experience can be deemed identical. In the last section, 'Fixing the System', Greenberg provides recommendations and calls for higher levels of transparency in academy–industry relationships.

WHAT GREENBERG DOES WELL

The account of Greenberg's extensive research is an interesting read. He offers a balanced account of the gains and losses, both economic and social, in regard to the nascent relationship between academia and industry. He acknowledges at the beginning of the book that:

> The subject is too big and too varied from university to university, and even within universities, to capture the whole story, which is rich in nuances, misleading appearances, hyper-polemics, self-delusions, deliberate evasions, and overlooked realities sitting in plain sight (p. 8).

In spite of this caveat, his knowledge of the past and present academy–industry technology transfer actors and activities is impressive. Greenberg's journalistic writing style makes this an enjoyable read as the reader is entertained and educated with vivid, authentic stories. This story-telling helps capture the nuances and complexity of the academy–industry relationship as Greenberg captures the embryonic journey that academic science is undergoing as industry becomes a more significant presence on campuses in the US and worldwide.

WHAT GREENBERG DOES NOT DO WELL

While Greenberg does an excellent job of presenting the story of academy–industry relations, the final section, 'What's Right and Wrong, and How to Make It Better', is somewhat disappointing. After setting out the ethical dilemmas of academy–industry relationships in the preceding chapters, there is an expectation that Greenberg would outline concrete recommendations on how to solve such dilemmas. He discusses the need for transparency in order to 'maximise the benefits of collaboration and minimise the risks and liabilities' (p. 284). He calls for academic individuals, institutions and commentators such as the press and bloggers to advocate open access to the intricacies of commercial contracts and to be vigilant for suspicious deals and acts. However, the chapter lacks depth and specificity, giving no revolutionary advice. He briefly mentions the Kauffman Foundation's suggestions for reforms, however he does not examine whether their policies of open science, encouraging faculty to own intellectual property and introducing competition among technology transfer offices might encourage and create more transparency. Unfortunately, from my perspective, Greenberg missed some obvious solutions to this conundrum. He failed to situate his recommendations for greater transparency within a practical framework.

WHO WOULD HAVE AN INTEREST IN THIS BOOK?

This book would be of interest to all actors involved in academy–industry interactions, be they policy makers, academic entrepreneurs, venture capitalists or university management teams. Greenberg successfully presents a number of moral questions for the aforementioned participants to contemplate as they progress with the 'third mission' of the universities. Such questions as:

> Have today's commercial values contaminated academic research, diverting it from socially beneficial goals to mercenary service on behalf of profit-seeking corporate interests? (p. 2)

and

> Can academic institutions, with their insatiable appetite for money, reap financial profits from their production of valuable knowledge without damage to the soul of science and the public? (p. 2)

encourage reflection of the process. In spite of not offering any significant suggestions for change, the book is most definitely worth a read to understand the present and recent past of how academy is entwined with industry. Although the interviews are held with American universities and there is copious discussion around the role of the federal US Bayh–Dole Act, the book is of interest and relevance to Irish policy makers, university management, researchers, administrators and technology transfer professionals, and those who have an interest in the changing role of the university. As university–industry technology transfer is on the strategic agenda of Irish universities and policy makers this book is of key importance as it chronicles the complex yet intriguing interactions between academia and industry.