



# The link between organisational citizenship behaviours and open innovation: A case of Malaysian high-tech sector



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## KEYWORDS

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**Abstract** We examine the role of organisational citizenship behaviours (OCBs) in two types of open innovation—inbound and outbound. Data were collected using the questionnaire survey technique from middle and top managers working in high-tech industries in Malaysia. Results show that OCBs positively predict both inbound and outbound open innovation. A closer look reveals that OCBs relate positively to out-bound open innovation in aggregate and in isolation. However, OCBs relate to in-bound open innovation in aggregate only. The implications of these results are discussed and limitations of the study are highlighted.

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## Introduction

The shift of organisations from the closed to the open innovation paradigm has received considerable attention in the past 10 years. This mostly seems to be due to the benefits that open innovation entails. As against the case in closed innovation—a model that involves limited interaction with external sources of knowledge and assumes that the innovation processes need to be controlled by the firm—boundaries

of a firm in the open innovation model are porous and there is more interaction with partner firms (Chesbrough, 2003a; West, Vanhaverbeke, & Chesbrough, 2006a). Greater interaction results in greater acquisition and exploitation of technology, and important strategic innovations provide firms with a competitive advantage and several other benefits (Chesbrough, 2003a).

Research has highlighted many open innovation success stories. For instance, the success of Cisco Systems in adopting an external knowledge strategy and embracing open innovation is often highlighted (Chesbrough, 2003a). However, while examples of success in the open innovation paradigm exist, failures have also been reported (Lindgaard, 2013a, 2013b). Failures in the open innovation paradigm could be due to several factors that may be firm- or individual-level, or a combination of both (Chesbrough & Crowther, 2006; van de Vrande, de Jong, Vanhaverbeke, & de Rochemont, 2009).

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A look at the emerging open innovation literature shows that barring some exceptions (Deegahawature, 2014; Naqshbandi & Kaur, 2014), the focus has mainly been on studying open innovation at the firm level (Fey & Birkinshaw, 2005; Laursen & Salter, 2006). The individual-level factors affecting open innovation have thus received less or no attention (Deegahawature, 2014). One such unstudied individual-level factor, organisational citizenship behaviours (OCBs), shown by the employees can play a crucial role in the success of open innovation projects (Naqshbandi & Kaur, 2011a). Organisational citizenship behaviours are known to have a beneficial impact on organisational operations and effectiveness (Organ, 1988), and can enhance the ability of an organisation to adjust to environmental changes (Podsakoff & MacKenzie, 1997). As embarking on the open innovation paradigm involves adapting to new external environment changes and conditions, OCBs are likely to facilitate open innovation (Naqshbandi & Kaur, 2011b). Beginning from such considerations, we study the effect of OCBs on open innovation. Specifically, the objective is to explore whether OCBs promote or impede open innovation.

The data for this empirical study were collected in 2012 from Malaysian high-tech companies. We chose the high-tech sector because despite the significant contribution of this sector to Malaysia's economy, not much is documented about open innovation in this sector (Lindgaard, 2012). Besides, high-tech industries are primarily knowledge-driven industries (Hatzichronoglou, 1997), and the incidence and adoption of open innovation is anticipated to be stronger in such industries, thus meriting immediate attention (van de Vrande, de Jong, Vanhaverbeke, & de Rochemont, 2009).

This study fills an important gap by exploring an individual-level determinant of open innovation. As a result, the study is expected to serve as a precursor and shift the focus of future research to individual-level determinants of open innovation. In addition, most of the previous open innovation research has focussed on the U.S. Therefore, examining open innovation in a non-Western context is important as it can help in clearly identifying the prerequisites and limits of open innovation (West et al., 2006a). The study adds to the body of knowledge by providing empirical evidence about open innovation in the Asian context, and widens the scope of the open innovation debate with this new evidence. Practitioners can benefit from the findings of this study as well, by promoting the relevant OCBs in their organisations to facilitate open innovation.

## Explication of constructs

### Open innovation

Open innovation as a paradigm has a fairly recent history in innovation literature. Henry Chesbrough, who is credited with coining this term, called open innovation a new approach to innovation based on a different knowledge landscape, with a different logic about the sources and uses of ideas (Chesbrough, 2003b). Chesbrough defined open innovation as "the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively" (Chesbrough, 2006, p. 1).

Embracing the open innovation model can result in important strategic innovations, providing firms with competitive advantage (Chesbrough, 2003a). In the open innovation model, boundaries of a firm become porous and there is more interaction between partner firms that results in greater technology acquisition and exploitation (West et al., 2006a). Consequently, there is a greater amount of resources and expertise at hand than expected in the closed innovation model.

The current literature highlights two main types of open innovation: in-bound and out-bound open innovations. In-bound open innovation, sometimes also called outside-in open innovation, is the use of discoveries that others make. It involves firms opening up and establishing relationships with external firms so as to access their competencies to improve firm innovation performance. In-bound open innovation thus implies purposive inflows of knowledge or technology exploration relating to innovation activities that aim at capturing and benefitting from external sources of knowledge to improve current technological developments. Out-bound or inside-out open innovation implies that firms can search for external players that have better fitting business models to exploit and commercialise a particular technology than just depend on internal paths to market (Vanhaverbeke, 2006). Thus, out-bound innovation refers to the purposive outflows of knowledge, or technology exploitation, meant to leverage existing technological capabilities outside the boundaries of the organisation. The exploitation of external knowledge and technology can be pursued in several ways, such as by selling intellectual property rights and multiplying technology by diverting ideas to the external environment (Gassmann & Enkel, 2004).

### Organisational citizenship behaviours (OCBs)

Organisational citizenship behaviours are positive, voluntary employee behaviours often revealed by activities of employees aimed towards other employees in the office or in the organisation, such as helping co-workers, being conscientious towards the work environment, and communicating new and critical information (Yen, Li, & Niehoff, 2008). Organisational citizenship behaviours exhibited by the employees of a firm surpass the minimum job requirements anticipated by the employer, thus advancing the well-being of the co-workers and the organisation or work groups in general. Organisations rely on the employees' practice of OCBs to encourage a positive work atmosphere, to assist other employees with any problems, to be more tolerant of any inconveniences, and to protect the resources of the firm (Witt, 1991). Consequently, OCBs result in high organisational effectiveness (Katz & Kahn, 1978).

Organ (1988) argued that good citizenship behaviours are characterised by traits of altruism, conscientiousness, sportsmanship, and courtesy among the employees. These discretionary and unrewarded behaviours, though insignificant when isolated, contribute collectively to the operations and effectiveness of an organisation. Graham (1991) argued that organisational citizenship can be conceived of as a global concept which involves all positive, organisationally relevant behaviours of employees, regardless of whether they are in-role, extra-role, or political behaviours.

Organisational citizenship behaviours are known to contribute to superior performance (Podsakoff, Whiting, & Podsakoff, 2009; Yen et al., 2008) and organisational effectiveness (Podsakoff & MacKenzie, 1997). In general, OCBs can contribute to organisational performance as these behaviours provide an effective means of managing the interdependencies between members of a work unit and resultantly increase the collective outcomes achieved. Organisational citizenship behaviours also enhance organisational performance in that OCBs lubricate the social machinery of the organisation, reducing friction, and increasing efficiency (Bateman & Organ, 1983; Smith, Organ, & Near, 1983). Moreover, OCBs may also lower the requirement of firms to dedicate scarce resources to maintenance functions. Fewer resources devoted to maintenance means more resources are available for immediately productive purposes (Organ, 1988; Smith et al., 1983).

The construct of OCBs has been variously dimensionalised. Smith et al. (1983) proposed "altruism" and "generalised compliance" as the components of OCBs. Organ (1988) proposed five dimensions, namely, altruism, conscientiousness, courtesy, civic virtue, and sportsmanship. Van Dyne, Graham, and Dienesch (1994) proposed interpersonal helping, organisational loyalty, organisational obedience, and organisational participation, whereas Podsakoff and MacKenzie (1994) proposed helping behaviours, sportsmanship, and civic virtue as the dimensions of OCBs. Over time, the framework by Organ (1988), encompassing the five dimensions highlighted above, has become widely accepted, and the one treated consistently over a fairly large number of studies (LePine, Erez, & Johnson, 2002). These five dimensions are briefly discussed below:

1. **Altruism:** It refers to voluntary behaviours displayed when one member of the organisation helps the other in completing his/her work under unusual circumstances (Organ, 1988). For instance, being helpful, cooperative, and other instances of extra-role behaviour, which help a specific individual with a given work related problem (Podsakoff & Philip, 1990).
2. **Conscientiousness:** It refers to how punctual an employee is, how high the employee scores in attendance, and if the employee exceeds normal requirements or expectations in the work place. In other words, it refers to a member of an organisation performing his/her tasks (in-role behaviour) beyond expectation (Podsakoff & Philip, 1990).
3. **Sportsmanship:** It refers to an employee emphasising the positive aspects of an organisation more than the negative ones. It describes employees who tolerate inevitable irritants at the workplace, exhibiting behaviours that show tolerance of less than ideal working conditions without complaining (Podsakoff & Philip, 1990).
4. **Courtesy:** It refers to behaviours that are aimed at helping someone prevent a problem from occurring (Organ, 1988). It is different from altruism in the sense that altruism involves helping someone in trouble, while courtesy involves assisting in preventing the problems, and performing thoughtful or considerate actions towards others (Podsakoff & Philip, 1990).
5. **Civic virtue:** Derived from Graham's (1991) concept of organisational "citizens", civic virtue refers to the

employees' commitment to the organisation as a whole (Ackfeldt & Coote, 2005; Yen et al., 2008). It relates to the employee's behaviours that deal with the political life of the organisation, such as the expression of ideas.

## Hypothesis development

### OCBs and in-bound open innovation

In the closed innovation paradigm, organisations pay little or no attention to the business model in organising for innovation (West, Vanhaverbeke, & Chesbrough, 2006b). However, in the open innovation paradigm, specifically in in-bound open innovation, organisations often need to redesign their business models to capture both the internal and the external ideas, and focus on system integration. The transformation of the business model and shift of focus to system integration inevitably bring changes to the work methods, procedures and policies of the organisation. Such changes, in turn, reset norms and the working environment of the organisation. As a result, employees in organisations embracing the in-bound open innovation model face challenges that are typical in the open innovation context, such as low reciprocal commitment, lower social cohesion and unsafe learning climate, high diversity and cognitive distances, high level of uncertainty, low resource availability and absence of traditional hierarchical lines, and power differences (du Chatenier, Verstegen, Biemans, Mulder, & Omta, 2010). Under such circumstances, OCBs of the employees can be expected to facilitate in-bound open innovation.

Firstly, OCBs help employees cope with uncertainty, environmental changes and resource scarcity, all of which entail the in-bound open innovation process (Lindgaard, 2010; Podsakoff, Ahearne, & MacKenzie, 1997). Specifically, Podsakoff and MacKenzie (1997) argued that employees who exhibit sportsmanship enhance the organisation's ability to adapt to changes in its environment by demonstrating a willingness to take on new responsibilities or learn new skills. Sportsmanship behaviours, such as being willing to take on new roles in the open innovation process, will ultimately contribute to open innovation being successfully adapted into the business model of an organisation. Besides, Podsakoff and MacKenzie (1997) showed that helping behaviours (altruism) had a positive impact on productivity and product quality, as helping coworkers "learn the ropes" made them more productive employees faster. Hence, it is expected that helping behaviours would help co-innovators obtain required innovation knowledge faster and get familiar with the open innovation procedures more quickly.

Secondly, OCBs can enhance internal networks and collaborations of the organisation, which in turn benefit in-bound open innovation. Previous literature shows that internal networks are crucial for a company to be organised in ways that would facilitate them to acquire external knowledge effectively, and hence to achieve innovation goals quickly (Hansen, 2002; Hansen & Nohria, 2004). High levels of OCBs build a strong spirit of teamwork both among members of the innovation team and among different units of the organisation, leading to a cohesive work environment full of support, mutual trust, and reciprocal commitment. Studies also show that OCBs lubricate the social machinery of the organisation, reducing

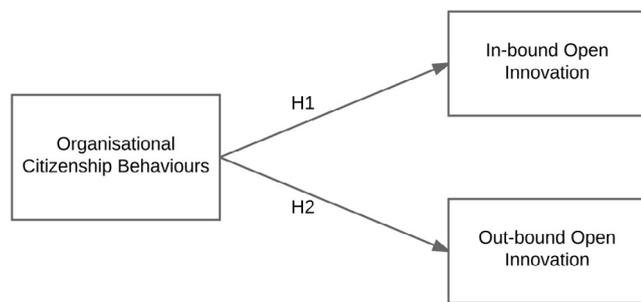


Figure 1 Research model.

friction, and increasing efficiency (Bateman & Organ, 1983; Smith et al., 1983). These changes that OCBs bring about in an organisation are known to enhance organisational performance, and can be expected to benefit the process of in-bound open innovation.

The third argument for expecting a positive relationship between OCBs and in-bound open innovation is the influence OCBs can have on inter-organisational relations. The in-bound open innovation model requires the organisation to deal with a mix of talent and expertise working collectively to achieve faster innovation. Such a mix of talent and expertise is usually present both inside and outside the organisation. As innovation activities go beyond the boundary, inter-organisational relationships become essential to the success of the in-bound open innovation model. Organisational citizenship behaviours exhibited by talents from both sides of the partnership can improve the inter-organisational relationship by harmonising conflicts between the goals of the internal business and the external partners. Moreover, employees who are courteous and have civic virtues tend to have less friction with others, hence building good inter-organisational relationships. In addition, conscientious employees would put in extra time and effort to adopt the externally developed technology or knowledge in their organisation, thus creating favourable conditions for open innovation. Besides, talents with strong sportsmanship can be expected to tolerate partners coming from different working cultures, and to work cooperatively to achieve mutual innovation goals. Based on these arguments, we hypothesise that:

**Hypothesis 1 (H1).** Organisational citizenship behaviours displayed by the employees of a firm relate positively to in-bound open innovation (Fig. 1).

### OCBs and out-bound open innovation

Out-bound open innovation involves firms that seek to commercialise a particular technology than just depend on internal paths to market (Vanhaverbeke, 2006). As such an innovation model involves transformation of business models, changing of work culture, and high degrees of uncertainty in the process of diverting ideas to the external environment, OCBs are expected to affect out-bound open innovation. When a company is over-committed to maintain exclusive control

over its products and technology, it becomes reluctant to out-license (Lichtenthaler & Ernst, 2007). Research has shown that protective attitudes of employees impede the success of out-bound open innovation process (Lichtenthaler, Ernst, & Hoegl, 2010). Hence, OCBs are expected to play a role in shifting employee attitudes and facilitate out-bound open innovation. For instance, sportsmanship-oriented and altruistic employees, with a positive look at market success and a loyal thought of seeking mutual benefits, would recommend their firm's direct innovation ideas to outside partners, or out-license their technologies. Moreover, pursuing out-bound open innovation implies a complicated process of screening potential partners with better fitting business models to commercialise the technology. For example, conscientious employees would make extra efforts to select optimal partners, and provide due after-market services to the licensees. As is well-known, employees who display high levels of OCBs are likely to generate high levels of customer satisfaction (Bell & Menguc, 2002). Organisational citizenship behaviours can thus help avoid market failure, and eventually enhance the management's confidence to stick to out-bound open innovation and profit from it (Fig. 1). Therefore, we hypothesise that:

**Hypothesis 2 (H2).** Organisational citizenship behaviours displayed by the employees of a firm relate positively to out-bound open innovation (Fig. 1).

## Methodology

### Sample and procedures

The population of this study is the middle and top managers working in Malaysian manufacturing firms operating in four industries classified as high-tech: aerospace, computers and office machinery, electronics and communication, and pharmaceuticals. We chose the middle managers and top managers as our respondents as they are most likely to have knowledge of the strategic orientation of their firms. The respondents who had served the same organisation for at least five years were administered the questionnaire. We explored the high-tech manufacturing sector as against exploring the services sector as some recent studies have done (for instance—Janeiro, Proença, & Gonçalves, 2013) because the industries in this sector are primarily knowledge-driven industries (Hatzichronoglou, 1997), and the incidence and adoption of open innovation are anticipated to be stronger in this sector (van de Vrande et al., 2009). Since open innovation is a rather new concept, more so in the Asian context, much of the existing research shows that the adoption of open innovation is higher among high-tech industries than in asset-intensive, mature industries—and hence we selected the high-tech sector. The data were collected from January 2012 to May 2012. In line with the guidelines of the Oslo Manual (2005), firms responding to our questionnaire were required to have a research and development (R&D) department.

A two-stage sampling procedure (Davis, 2005) involving stratified sampling and convenience sampling techniques was used. The first stage involved using stratified sampling wherein the high-tech industry was sub-divided into four industries.

**Table 1** Characteristics of the sample.

|                          | Categories                     | Frequency | Percent | Cumulative |
|--------------------------|--------------------------------|-----------|---------|------------|
| Type of industry         | Aerospace                      | 73        | 21.5    | 21.5       |
|                          | Computers and office machinery | 87        | 25.7    | 47.2       |
|                          | Electronics and communications | 76        | 22.4    | 69.6       |
|                          | Pharmaceuticals                | 103       | 30.4    | 100        |
| Respondent position      | Middle Management              | 153       | 45.1    | 45.1       |
|                          | Top Management                 | 186       | 54.9    | 100        |
| Respondent years in firm | 5–10 years                     | 217       | 64.0    | 64.0       |
|                          | 11–15 years                    | 95        | 28.0    | 9.0        |
|                          | 16–20 years                    | 24        | 7.1     | 99.1       |
|                          | Above 20 years                 | 3         | 0.9     | 100        |
| Firm ownership           | Publicly owned                 | 26        | 7.7     | 7.7        |
|                          | Privately owned                | 161       | 47.5    | 55.2       |
|                          | State owned                    | 16        | 4.7     | 59.9       |
|                          | Foreign ownership              | 110       | 32.4    | 92.3       |
|                          | Mixed ownership/Joint venture  | 26        | 7.7     | 100.0      |

The second stage involved the use of convenience sampling to select firms from the four industries identified in the first stage. Two sampling frames were used. We took the first sampling frame from the [Malaysian Manufacturers' Directory \(2011\)](#). In addition, some data related to the pharmaceuticals industry were collected in a three-day exposition held in Kuala Lumpur from April 17 to 19, 2012. In this exposition, after ensuring that the participating firms met the criteria mentioned above, we distributed the questionnaires randomly. The second sampling frame of this study involved the fourth high-tech industry, the aerospace industry, and was taken from the Aerospace Industry Report (AIR) Online Database. In total, we distributed 900 questionnaires personally and by email. Three hundred and sixty six were returned from 139 firms—68 by email and 298 in person. We followed the suggestion of [Hair, Black, Babin, and Anderson \(2010\)](#) and discarded the questionnaires with more than 10% missing values. Electronically received questionnaires did not have any missing values. Finally, 339 usable responses, from 133 firms, were considered “clean” and used for further data analysis. The response rate thus achieved is 37.66%.

The number of respondents from the four surveyed industries was roughly proportionate. From the pharmaceutical industry came 30.4% of the respondents, while 25.7%, 22.4%, and 21.5% of the respondents came from the computers and office machinery industry, the electronics and communications industry, and the aerospace industry respectively. A majority of the respondents (54.9%) were in top management positions while roughly half the number of respondents (45.1%) occupied middle management positions. Most of the respondents (64.0%) had worked in the “current” organisation for 5–10 years; 28% had worked in the same firm for 11–15 years, 7.1% for 16–20 years and 0.9% for more than 20 years. A majority (47.5%) of the firms were owned privately, while 32.4% had foreign ownership, 7.7% were publicly-owned, 7.7% had mixed ownership and 4.7% were state-owned ([Table 1](#)).

## Measurements

### Organisational citizenship behaviours

The OCBs framework by [Organ \(1988\)](#) is the only one that has been treated consistently over a fairly large number of studies ([LePine et al., 2002](#)). The five dimensions of OCBs—altruism, courtesy, conscientiousness, sportsmanship, and civic virtue—as proposed by [Organ \(1988\)](#), have become widely accepted ([Yoon, 2009](#)). However, [Podsakoff and Philip \(1990\)](#) revealed that altruism is highly correlated with courtesy ( $r = 0.86$ ), implying that using one of the dimensions is sufficient to describe both of them. Besides, [LePine et al. \(2002\)](#) found sportsmanship and civic virtue overlapping. We thus consider only three dimensions of OCBs in this study to avoid redundancy. We used the scale employed in the study by [Bell and Menguc \(2002\)](#). This scale draws on the work of [Podsakoff and Philip \(1990\)](#) and was preferred in this study since it is comparatively recent and easier-to-understand (particularly in the context of an Asian country). The responses were assessed on a 7-point Likert scale ranging from “strongly disagree” to “strongly agree”. Twelve items in total (four items each) measure the three dimensions of OCBs. The items of OCBs allowed the respondents (middle and top managers) to evaluate their contact employees on every item.

### Open innovation

We used the scale developed by [Sisodiya \(2008\)](#) to measure in-bound open innovation. Six items, anchored on a 5-point Likert scale ranging from “strongly disagree” to “strongly agree”, were used to measure in-bound open innovation. To measure out-bound open innovation, we adopted a four-item scale from past studies ([Jaworski & Kohli, 1993](#); [Lichtenthaler, 2009](#)). The four items captured a firm’s willingness to commercialise technological knowledge and were anchored on a 5-point scale ranging from “strongly disagree” to “strongly agree”.

## Reliability and validity of measures

### Pilot study

We carried out a pilot-test before distributing the questionnaire on a full scale. An online questionnaire was compiled and distributed among post-graduate students (with previous work experience) from three faculties of the University of Malaya in Kuala Lumpur. Most of the respondents were full-time working professionals pursuing their MBA in an executive programme as part-time students. Researchers have successfully used MBA students in the past for pilot studies to test their instrument and improve its reliability (Atuahene-Gima & Murray, 2004; Frels, Shervani, & Srivastava, 2003; Sisodiya, 2008). Sixty-three responses were collected for the pilot study and the respondents did not highlight any impediment in answering the questions. Some respondents however suggested including an option in the questionnaire that allowed them to tick one of the four industry types they belonged to, rather than asking them to write the name of the industry—this change was made in the final questionnaire. We assessed reliability of the scales using this data and found Cronbach's alpha, a measure of internal consistency, to be above .80 for all the variables. This provided evidence in favour of reliability of the measurements used in this study (Hair et al., 2010).

### Exploratory factor analysis and confirmatory factor analysis

The constructs investigated in this study have not been previously tested in the Malaysian setting. Therefore, we first conducted exploratory factor analysis (EFA) and then took a confirmatory approach by conducting confirmatory factor analysis (CFA). The EFA of OCBs and open innovation, measured using 22 items, formed five factors. These five factors seemed to be consistent with past OCBs and open innovation studies. However, three items, two measuring in-bound open innovation and one measuring out-bound open innovation, were eliminated due to low factor loadings (Hair et al., 2010). Exploratory factor analysis was conducted again without these "offending items" and the five factors obtained together explained 71.84% of the variance with eigenvalue of more than 1. These five factors were labelled in accordance with previous, related studies. The Kaiser-Meyer-Olkin (KMO), a measure of sampling adequacy, was found to be acceptable at 0.83, while Bartlett's Test of Sphericity was found to be significant ( $\chi^2 = 3258.59$ ,  $P < .000$ ). All the five factors were highly reliable measurements with reliability coefficients ranging from 0.82 to 0.91 (Tables 2 and 3). Guided by the results of the EFA, we also conducted the CFA. The

initial model fit index for OCBs and open innovation with all the 22 items showed an acceptable fit: CMIN/DF = 1.53; CFI = .976; RMSEA = .040. However, when the three items with low factor loadings indicated as "offending" in EFA were dropped, a better model fit was obtained: CMIN/DF = 1.392; CFI = .976; RMSEA = .034.

### Convergent and discriminant validity

We assessed validity of the constructs including convergent validity (correspondence or convergence between similar constructs) and discriminant validity (discrimination between dissimilar constructs) (Garver & Mentzer, 1999). As Table 4 shows, maximum shared squared variance (MSV) and average shared squared variance (ASV) are less than average variance extracted (AVE) for all the variables, providing evidence in favour of discriminant validity of the variables (Hair et al., 2010). Similarly, composite reliability (CR) for all the variables is greater than AVE and AVE is 0.5 or greater for all the variables, indicating convergent validity of the variables (Hair et al., 2010). In addition, CR for all the variables is greater than 0.7 while factor loadings of all the items are above the cutoff point of 0.5. This provides evidence of unidimensionality of the variables and reliability of the measures used in this study (Hair et al., 2010).

### Non-response and common method biases

Non-response bias can sometimes influence results of a study. Therefore, to rule out potential problems that could arise as a result of non-response bias (Boström et al., 1993; Sheikh & Mattingly, 1981), we used t-test to compare the mean difference between 40 early and 40 late respondents for all the variables. No significant differences were found between the two groups, indicating absence of non-response bias.

Like non-response bias, common method bias (CMB) and common method variance (CMV) (Nunnally, 1978) can also bias results of a study. As a result, we took several precautionary measures right from the questionnaire designing stage to reduce any potential effects of CMB and CMV. For instance, we mixed up items measuring different variables and inserted psychological separators between items. To be doubly sure, we still decided to use Harman's single factor test to assess any possible method bias (Podsakoff, MacKenzie, & Podsakoff, 2012). To conduct this test, exploratory factor analysis was performed on all the items with the number of factors constrained to 1 and the unrotated solution was analysed. If CMB is present, a single factor accounts for the majority of variance (usually more than 50%) in the model. In this study, results of the EFA with the number of factors constrained to 1 showed no signs of a single factor explaining majority of the variance. It was therefore concluded that the data are free from CMB.

### Control variable

Innovation studies in the past have accounted for the differences between firms within an industry and those within a sector, and differences between industries and sectors (West et al., 2006a). In this study, a one-way ANOVA conducted to compare in-bound and out-bound open innovation showed significant difference among four industries with respect to in-bound open innovation ( $F = 14.38$ ,  $p < .000$ ) and out-bound

**Table 2** Results of Kaiser-Meyer-Olkin (KMO) and Bartlett's Test.

| KMO and Bartlett's Test                         |                    |  |          |
|---|--------------------|--|----------|
| Kaiser-Meyer-Olkin Measure of Sampling Adequacy |                    |  | .828     |
| Bartlett's Test of Sphericity                   | Approx. Chi-Square |  | 3258.599 |
|   | df                 |  | 171      |
|   | Sig.               |  | .000     |

**Table 3** Exploratory factor analysis of organisational citizenship behaviours and open innovation.

| Rotated Component Matrix |           |       |       |       |       |                        |                  |
|--------------------------|-----------|-------|-------|-------|-------|------------------------|------------------|
|                          | Component |       |       |       |       | Item-total correlation | Cronbach's alpha |
|                          | 1         | 2     | 3     | 4     | 5     |                        |                  |
| OCB.Alt.1                |           |       | .850  |       |       | .735                   | .845             |
| OCB.Alt.2                |           |       | .806  |       |       | .633                   |                  |
| OCB.Alt.3                |           |       | .790  |       |       | .688                   |                  |
| OCB.Alt.4                |           |       | .788  |       |       | .672                   |                  |
| OCB.Spo.1                | .855      |       |       |       |       | .769                   | .909             |
| OCB.Spo.2                | .885      |       |       |       |       | .844                   |                  |
| OCB.Spo.3                | .869      |       |       |       |       | .800                   |                  |
| OCB.Spo.4                | .843      |       |       |       |       | .768                   |                  |
| OCB.Con.1                |           | .762  |       |       |       | .611                   | .854             |
| OCB.Con.2                |           | .860  |       |       |       | .748                   |                  |
| OCB.Con.3                |           | .847  |       |       |       | .738                   |                  |
| OCB.Con.4                |           | .798  |       |       |       | .687                   |                  |
| IBOI.1                   |           |       |       | .674  |       | .543                   | .826             |
| IBOI.2                   |           |       |       | .755  |       | .621                   |                  |
| IBOI.5                   |           |       |       | .877  |       | .746                   |                  |
| IBOI.6                   |           |       |       | .845  |       | .705                   |                  |
| OBOI.1                   |           |       |       |       | .827  | .667                   | .822             |
| OBOI.3                   |           |       |       |       | .824  | .686                   |                  |
| OBOI.4                   |           |       |       |       | .838  | .694                   |                  |
| Eigenvalue               | 4.51      | 3.90  | 2.00  | 1.67  | 1.55  |                        |                  |
| Variance Explained       | 16.59     | 14.75 | 14.39 | 14.19 | 11.92 |                        |                  |

Notes: Extraction method used: Principal Component Analysis.

Rotation method used: Varimax with Kaiser Normalisation.

OCB, Organisational Citizenship Behaviours; Alt, Altruism; Spo, Sportsmanship; Con, Conscientiousness; IBOI, In-bound Open Innovation; OBOI, Out-bound Open Innovation.

**Table 4** Discriminant validity, convergent validity and reliability of measures.

| Construct                             | Dimensions                | Items          | CR   | AVE  | ASV  | MSV  | Sqr AVE |
|---------------------------------------|---------------------------|----------------|------|------|------|------|---------|
| Organisational citizenship behaviours | Altruism                  | OCB.Altruism.1 | .846 | .579 | .025 | .125 | .761    |
|                                       |                           | OCB.Altruism.2 |      |      |      |      |         |
|                                       |                           | OCB.Altruism.3 |      |      |      |      |         |
|                                       |                           | OCB.Altruism.4 |      |      |      |      |         |
|                                       | Sportsmanship             | OCB.Sports.1   | .910 | .717 | .119 | .244 | .847    |
|                                       |                           | OCB.Sports.2   |      |      |      |      |         |
|                                       |                           | OCB.Sports.3   |      |      |      |      |         |
|                                       |                           | OCB.Sports.4   |      |      |      |      |         |
|                                       | Conscientiousness         | OCB.Consent.1  | .855 | .600 | .023 | .125 | .774    |
|                                       |                           | OCB.Consent.2  |      |      |      |      |         |
|                                       |                           | OCB.Consent.3  |      |      |      |      |         |
|                                       |                           | OCB.Consent.4  |      |      |      |      |         |
| Open innovation                       | In-bound Open innovation  | IBOI.1         | .835 | .560 | .302 | .540 | .748    |
|                                       |                           | IBOI.2         |      |      |      |      |         |
|                                       |                           | IBOI.5         |      |      |      |      |         |
|                                       |                           | IBOI.6         |      |      |      |      |         |
|                                       | Out-bound Open innovation | OBOI.1         | .826 | .612 | .050 | .129 | .783    |
|                                       |                           | OBOI.3         |      |      |      |      |         |
|                                       |                           | OBOI.4         |      |      |      |      |         |
|                                       |                           |                |      |      |      |      |         |

Note: CR, Composite reliability; AVE, Average variance explained; ASV, Average Shared Variance; MSV, Maximum Shared Variance; Sqr AVE, Square root of Average variance explained.

**Table 5** Results of regression analysis.

| Criterion Variables →                 | In-bound Open Innovation  |           |      |          | Out-bound Open Innovation |           |      |          |
|---------------------------------------|---------------------------|-----------|------|----------|---------------------------|-----------|------|----------|
|                                       | Standardised coefficients |           |      | R Square | Standardised coefficients |           |      | R Square |
|                                       | Beta                      | Std Error | t    |          | Beta                      | Std Error | t    |          |
| Organisational citizenship behaviours | .279**                    | .004      | 5.49 | .144     | .401**                    | .005      | 8.00 | .170     |

\* $p < 0.05$ ; \*\* $p < 0.01$ .

**Table 6** Results of dimension-wise regression results.

| Criterion Variables → | In-bound Open Innovation  |           |        |          | Out-bound Open Innovation |           |       |          |
|-----------------------|---------------------------|-----------|--------|----------|---------------------------|-----------|-------|----------|
|                       | Standardised coefficients |           |        | R Square | Standardised coefficients |           |       | R Square |
|                       | Beta                      | Std Error | t      |          | Beta                      | Std Error | t     |          |
| Altruism              | .040                      | .042      | .782   | .214     | .245**                    | .053      | 4.69  | .190     |
| Sportsmanship         | .384**                    | .020      | 7.818  |          | .225**                    | .026      | 4.52  |          |
| Conscientiousness     | -.067                     | .042      | -1.297 |          | .198**                    | .053      | 3.792 |          |

\* $p < 0.05$ ; \*\* $p < 0.01$ .

open innovation ( $F = 137.42$ ,  $p < .000$ ). We thus controlled for the effect of industry type in all regression analyses.

## Results

### Hypothesis testing

Table 5 presents a summary of the regression results. As is shown in the table, H1, that hypothesised a positive relationship between OCBs and in-bound open innovation, is supported ( $\beta = .279$ ;  $p < .001$ ). H2, hypothesising a positive relationship between OCBs and out-bound open innovation, is also supported ( $\beta = .401$ ;  $p < .001$ ). Since OCBs have three dimensions, we decided to delve deeper and understand how each dimension relates to the dimensions of open innovation. We found that only sportsmanship relates positively and significantly to in-bound open innovation ( $\beta = .384$ ;  $p < .001$ ), while altruism ( $\beta = .040$ ;  $p > .05$ ) and conscientiousness ( $\beta = -.067$ ;  $p > .05$ ) do not. In the case of out-bound open innovation, it was found that all dimensions of OCBs namely altruism ( $\beta = .245$ ;  $p < .001$ ), sportsmanship ( $\beta = .225$ ;  $p < .001$ ) and conscientiousness ( $\beta = .198$ ;  $p < .001$ ) relate positively to it. These results are presented in Table 6.

## Discussion

This study set out to explore the role of OCBs in the open innovation process. We tested two hypotheses, both of which predicted OCBs to be positively associated with in-bound and out-bound open innovations. It emerged that in aggregate, OCBs significantly relate to both the dimensions of open innovation. However, when we looked closely at the impact of the dimensions of OCBs on in-bound open innovation, we found that only sportsmanship affects in-bound open innovation significantly, while altruism and conscientiousness did

not relate to in-bound open innovation. This finding confirms the pioneering work of Organ (1988), which noted that in isolation any one instance of OCBs may be insignificant, but in the aggregate this discretionary behaviour has a major beneficial impact on organisational operations and effectiveness. In the context of this study, the beneficial impact is found to be on open innovation. Thus, exhibiting OCBs on the part of the employees can promote open innovation.

Innovation has been called a highly complex social process requiring effective interaction of a large number of individuals and sub-units within the innovating organisation (Zaltman, Duncan, & Holbek, 1973). On the other hand, open innovation involves a high degree of uncertainty both in terms of exploration for better partners and outcomes of such partnerships. It is therefore not surprising that OCBs in general and sportsmanship in particular are found to positively affect in-bound open innovation. In fact, this positive relationship is logical. Shifting from a closed innovation paradigm to an open innovation paradigm can entail scarcity or unpreparedness of resources or teething problems. In addition, managers may not be able to foresee all uncertain events or fully expect the activities that they may desire or need employees to perform (Katz & Kahn, 1978; Organ, 1988). In such a situation, OCBs shown by the employees, as this study shows, can go a long way in facilitating in-bound open innovation. Organisational citizenship behaviours like sportsmanship help employees maintain a positive attitude even when things go wrong or when there are minor setbacks. When needed, an organisation's employees may even be willing to give up personal interests for the good of the organisation and show tolerance of less than ideal working conditions without complaining (Podsakoff & Philip, 1990). Thus employees who exhibit sportsmanship, by demonstrating a willingness to take on new responsibilities or learn new skills, enhance the organisation's ability to adapt to changes in its environment (Podsakoff & MacKenzie, 1997), a trait valued in the open innovation paradigm.

This study also showed that OCBs affect out-bound open innovation positively in aggregate as well as in isolation. There does not seem to be any existing literature that supports or refutes this finding. An explanation for the positive association between OCBs and out-bound open innovation could be that employees feel a “sense of pride” in seeing the commercialisation of the internal knowledge and technology that they helped develop, particularly since employees are required to work continuously to broaden and deepen internal resources and capabilities (in the form of knowledge or technology). Moreover, the fact that the internally-developed knowledge and technology is demanded by outsiders adds to its potency, thus encouraging citizenship behaviours in favour of out-bound open innovation.

The process of out-bound open innovation, just like the process of in-bound open innovation, involves a high degree of uncertainty both in terms of exploration for better partners and outcomes of such partnerships. In addition, in the out-bound open innovation process, firms want to license their own technology to other firms either exclusively or in addition to its application in their own products (Lichtenthaler, 2010). This is where OCBs could contribute in promoting out-bound open innovation, as the findings of this study show that OCBs strongly predict out-bound open innovation.

This finding can be explained in light of programmes such as the “integrated technology commercialisation roadmap” and the “strategic technology planning for outward technology transfer” which, as Lichtenthaler (2010) suggests, can help organisations overcome managerial difficulties in actively licensing technology. Since OCBs were found to positively impact out-bound open innovation in the firms surveyed for this study, organisations can make OCBs a focus of such programmes which will in turn help managers deal with the problems involved in commercialisation of technology. Currently, it is unclear as to what factors affect the success of out-bound open innovation. Lichtenthaler and Ernst (2009) mention one factor, strategic openness, as a necessary condition for actively licensing technology. However, the authors note that this factor is most likely insufficient for establishing a successful out-licensing programme. In view of the results of this study, it seems that OCBs performed by the employees of an organisation also play a significant role in facilitating out-bound open innovation. Organisations can thus foster OCBs to facilitate out-bound open innovation by developing practices related to recruitment and selection, training and development, and performance appraisal and compensation/benefits (Bolino, Turnley, & Averett, 2003).

Bolino et al. (2003) and Grant and Mayer (2009) discuss ways in which OCBs can be fostered in organisations. Organisations, for instance, can use selection procedures that are predictive of employee citizenship or they can seek out applicant pools comprising individuals committed to causes than to themselves. Similarly, organisations can sponsor training programmes that teach cooperation or the importance of taking initiatives and exceeding one’s formally prescribed job duties. In addition, organisations can reward citizenship behaviours by focussing on the extent to which employees engage in such behaviour besides their prescribed job duties. Compensation systems can also be linked to group- or organisational-level outcomes, while employees engaging in competitive or non-cooperative behaviours that are inconsistent with the notion of good citizenship should not be

rewarded. All these steps—in addition to initiating a flexible and family-friendly workplace that shows appreciation for employees and makes it easier for them to go beyond the call of duty—can positively impact the out-bound open innovation efforts of an organisation.

## Implications of the study

The results of this study, suggesting that OCBs promote open innovation, can help managers reap benefits in the open innovation paradigm which is catching up fast with organisations from around the globe. The examples of pioneering firms like Procter & Gamble indicate that a firm’s strategic planning activities play a critical role in developing successful technology management programmes (Chesbrough, 2007). Therefore, managers should pay attention to increasing employees’ OCBs in order to facilitate open innovation in their organisations. This study recommends that practitioners consider OCBs as an important individual-level predictor of open innovation. Along with the structural, group, policy, and cultural interventions to promote open innovation, managers should also focus, at the individual-level, on establishing a mechanism which can promote OCBs among the employees. We suggest some of the following initiatives to promote OCBs at the workplace:

- a. Rewarding and recognising employees who exhibit OCBs at the workplace
- b. Linking OCBs with performance management system and performance appraisals
- c. Providing motivational and mindset building training to the employees to encourage the display of OCBs.
- d. Top management/leaders exhibiting their strong commitment to and appreciating OCBs at the workplace, and
- e. Linking and incorporation of OCBs into organisational norms and values

This study is not without limitations. Firstly, this study restricted analysis to a specific sector and surveyed only the high-tech sector in Malaysia. Therefore, the findings of this study may not be completely relevant and generalisable to other sectors like the medium- and low-tech sectors. Secondly, this study used a cross-sectional sample to collect data. Bono and McNamara (2011) argue against using cross-sectional data as such data, unlike longitudinal data, may not be appropriate to test hypotheses that involve causality. We however justify using cross-sectional data on the grounds that in open innovation research many previous studies (such as Parida, Westerberg, & Frishammar, 2012; Salmi, 2012; Valentina, Raffaella, & Luisa, 2010) have used cross-sectional data, and thus use of such data in this study seems justified.

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## Appendix

### Appendix A

Table A1 Descriptive statistics and correlations.

| Variables                | Mean | SD   | 1      | 2      | 3      | 4      | 5 |
|--------------------------|------|------|--------|--------|--------|--------|---|
| Altruism                 | 5.41 | .73  | 1      |        |        |        |   |
| Sportsmanship            | 4.39 | 1.46 | -.035  | 1      |        |        |   |
| Conscientiousness        | 5.35 | .73  | .309** | .036   | 1      |        |   |
| Inbound Open Innovation  | 4.26 | .60  | .008   | .397** | -.039  | 1      |   |
| Outbound Open Innovation | 4.16 | .75  | .294** | .226** | .284** | .162** | 1 |

\*\*Correlation is significant at the 0.01 level (2-tailed).

### Appendix B—Measurements

#### Organisational citizenship behaviours (1–7 Likert scale)

1. Help others who have heavy workloads
2. Help others who have been absent
3. Represent the office by participating in different sporting activities
4. Willingly give their time to others who have work-related problems
5. Consume a lot of time complaining about trivial matters
6. Tend to make problems bigger than they are
7. Constantly talk about wanting to quit their job
8. Always focus on what is wrong with their situation, rather than a positive side
9. Are always punctual
10. Never take long breaks
11. Do not take extra breaks
12. Obey company rules, regulations, and procedures even when no one is watching

#### Open innovation (1–5 Likert scale)

1. My organisation constantly scans the external environment for inputs such as technology, information, ideas, knowledge, etc.
2. My organisation actively seeks out external sources (e.g., research groups, universities, suppliers, customers, competitors, etc.) of knowledge and technology when developing new products.
3. My organisation believes it is good to use external sources (e.g., research groups, universities, suppliers, customers, competitors, etc.) to complement our own R&D.
4. My organisation often brings in externally developed knowledge and technology to use in conjunction with our own R&D.
5. My organisation seeks out technologies and patents from other firms, research groups, or universities.
6. My organisation purchases external intellectual property to use in our own R&D.
7. Generally, in my organisation all technologies are externally commercialised (i.e. sold to outside firms)
8. In my organisation, external technology commercialisation is restricted to technologies that are not used internally.

9. In my organisation, external technology commercialisation is restricted to relatively mature technologies.
10. In my organisation, external technology commercialisation is restricted to non-core technologies.

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