# Success factors of knowledge sharing for a social collaboration platform – an empirical investigation in the specialty chemical industry

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## ABSTRACT

This study examines success factors of knowledge sharing for a social collaboration platform in a specialty chemical institution. Organizational performance and innovative capabilities are positively related to intraorganizational knowledge sharing (Wijk, Jansen & Lyles, 2008), emphasizing the importance of stimulating employees. Molding factors for knowledge sharing hypothesized in this study are the organization, the individual, the content and cooperation. Knowledge sharing is operationalized via the number of contacts and the activity in the internal community. A sample of 139 employees working in a specialty chemical institution was retrieved. Using a multiple regression analysis, a model explaining success factors for knowledge sharing was built. The theoretical framework is an expansion on previous research by Hashim et al. (2016). The results indicate that employees experiencing an organizational culture stimulating cooperation and encouraging the learning of new skills, tend to share more knowledge. The findings demonstrate, that top management involvement in knowledge sharing is not the main driver motivating employees. One of the key elements to increase knowledge sharing are incentives such as rewards and recognition. The reliability of content shared and the trust in social collaboration platforms are prerequisites for successful knowledge sharing. It is assumed, that the key elements identified in this study improve knowledge sharing among employees and in this context exploit the internal innovative potential of the crowd.

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## Keywords

*Knowledge sharing, social collaboration platform, organizational knowledge management, organizational learning, internal knowledge management systems, knowledge transfer*

# 1. INTRODUCTION

R&D institutes face various intensified challenges in recent years, asking for new instruments to manage knowledge sharing activities (Chang & Li, 2007). Since social netw

orking sites have been shown to be positively related to firm performance, many companies implement them into their organizational structure (Rendi Hartono & Margaret L. Sheng, 2016). Over 90% of the Fortune 500 entities had launched social collaboration platforms until the end of 2013 (Lee et al. 2013).

As knowledge is consensually seen as the most important resource of a firm (Osterloh & Frey, 2000; Connor & Prahalad, 1996; Kogut & Zander, 1996; Carillo & Gaimon, 2004; Grant, 1996), it is fundamental to manage it wisely. It is essential for organizations, to consider how to transfer expertise and knowledge from experts who have it to novices who need to know (Hinds, Patterson, & Pfeffer, 2001). Instead of building stocks of knowledge, organizations must promote the sharing of knowledge (Boh, 2007).

An empirical investigation by Wijk, Jansen and Lyles (2008) showed that intraorganizational knowledge sharing has had a significantly larger impact on firm performance than interorganizational knowledge sharing. Knowledge-based resources can be gained throughout the organization between employees as well as within and across teams (Cabrera & Cabrera, 2005; Damodaran & Olphert, 2000; Davenport & Prusak, 1998).

Large companies with different departments and sites make it difficult for employees to receive the right information and data for particular tasks. For employees within the company 'Chemical Industries AG', a multinational specialty chemistry manufacturer, finding the right expert in more than 100 locations worldwide can be complicated and time consuming. In order to improve exchange of information and knowledge, the company launched the social collaboration platform ´Seek & Solve´, hereafter referred to as S&S.

On the platform, employees are invited to ask any company related questions, which the community is supposed to answer. The main objective of the platform is to synthesize knowledge from multiple disciplines and increase organizational knowledge by approaching the community using the intranet as medium. Another business objective that emerged when implementing S&S was to resolve internal problems more quickly and straightforward.

The platform consists of selected *IBM Connections* modules (forum, wiki and file storage), with the landing page as the center of applications. The page's structure is kept simple, in order to enable easy access and usage for new members.

Even though the platform had existed for a year, knowledge sharing and participation of the employees was rare and the success of the platform is questioned. Worldwide over 33,000 people are employed by Chemical Industries AG. Only around 900 of these utilized the platform at the beginning of this research, with the majority of users working in the R&D department. The need to form a widely used platform that stimulates and enhances cross-departmental communication and knowledge sharing emerged over time.

Existing research indicated, that certain organizational structures support the knowledge sharing behavior of individuals within the company (Hashim, Judi, Meriam, & Wook, 2016). The research of Hashim et al. (2016) emphasized that there are success factors, which were related to the knowledge sharing behavior of individuals. The study examined 4 non-technical coefficients, which were identified to be success factors for knowledge sharing. These were categorized as "Organization", "Individual", "Content" and "Cooperation". Within the study, open questions were asked to individuals, with the objective to identify the underlying concepts related to knowledge sharing. The research was limited to identifying and categorizing the success factors.

The presence of the success factors might be perceived differently among individuals. The subjective perception depends in individual attitude and assessment of the status quo in the company.

Although the influence of organizational and individual factors on knowledge sharing has been widely discussed, scientific research is absent, which investigates, whether the knowledge sharing behavior of individuals is actually related to the perception of individuals of these factors. The research question asks, whether knowledge sharing behavior is related to the individual perception of success factors identified in the literature. The goal is to identify factors, which are crucial for active knowledge sharing and on the basis of this data give advice for conceivable modifications within the company. Understanding the behavior of the employees, one can provide a better environment for knowledge sharing and enlarge the potential for innovation. Reluctance of individuals to share their knowledge is a great barrier for the company and it is important to incentivize each employee to exploit the wisdom of the crowd.

# 2. LITERATURE REVIEW

## 2.1 Knowledge sharing

### Knowledge sharing

Scientific literature does not distinguish between knowledge exchange, knowledge transfer and knowledge sharing (Wang & Noe, 2010). Davenport and Prusac (1998) define knowledge sharing as "employees [who] apply organizational knowledge by utilizing knowledge already present in the organization." In accordance with Cummings (2004), Pulakos, Dorsey & Borman (2003) knowledge sharing refers to the provision of task information to support collaboration with the purpose of solving issues, expand new concepts, or implementing practices and procedures. Numerous organizational assets can be acquired by knowledge sharing, such as a firm's accomplishments and innovation (Collins & Smith, 2006), competitiveness (Argote & Ingram, 2000), faster product development and lower production costs (Lin, 2007; Hansen, 2002). Other advantages include knowledge appliance and competitive advantages for the firm (Berman, Down & Hill, 2002; Jackson, Chuang, Harden & Jiang, 2006). In a professional context, sharing knowledge highly relies on shaped understandings of individuals on knowledge sharing as well as the depth and width of their network (Cabrera & Cabrera, 2005). This was also linked to innovation, which, according to Kreiner and Schultz (1993) "emerges from employees' relationships with and membership in internal [and external] communities, where they may acquire and absorb new knowledge and deepen existing knowledge." Another way to assess knowledge sharing behavior of individuals is the recent approach by Langen (2015). According to the literature, user engagement in social collaboration platforms is an indicator of knowledge sharing. User engagement is defined by the amount of postings, comments and community activity of the individual.

## 2.2 Organizational context

### 2.2.1 Organizational culture

Organizational culture indicates "shared assumptions, values and norms" (Schein, 1985). There is much evidence, that organizational culture is a key success factor for organizational performance (Deal & Kennedy, 1982; Denison, 1990).

The effect of organizational culture on knowledge sharing has been examined in many studies. The benefits of new technology structures were shown to be deprived, if organizational values were not contributory across units (De Long & Fahey, 2000). The culture of a firm was identified to correspond to individual knowledge sharing, to the firm´s capability of knowledge exchange and to the implementation of intranet-based Knowledge Management Systems (KMS) (Chiu, Hsu, & Wang, 2006; Collins & Smith, 2006; Liao, 2006; Ruppel & Harrington, 2001).

According to Hashim et al. (2016), for employees to share ideas, information and experiences, they need an environment encouraging them to do so and a culture inside the company that actively stimulates cooperation in knowledge sharing.

### 2.2.2 Organizational structure

According to Tagliaventi and Mattarelli (2006), a functionally segmented structure likely prohibits knowledge sharing across units. On the other hand by implementing a less centralized organizational structure, knowledge sharing may be simplified (Kim and Lee, 2006). It is important for organizations, to create opportunities for communication across departments, exceeding rankings and hierarchy (Yang & Chen, 2007). Previous studies detected three key elements that support knowledge sharing: A structure encouraging the flow of communication between departments or units; positioning confidentiality status of a document at a level that makes it not too difficult to share and practicing a bureaucratic approach that is comprehensible (Hashim et al., 2016).

### 2.2.3 Management support

Management support is a key factor for the effective implementation of knowledge management systems (Chee-Sing, Raman, & Thong, 1996).
Connelly and Kelloway (2003) have investigated the positive connection between management support and employees eagerness to share knowledge. The level and quality of knowledge sharing could be influenced through management support (Lee et al. 2006). Employees perceiving support from supervisors and colleagues not only tended to expand their knowledge exchange, but also cherished knowledge sharing more (Kulkarni, Ravindran, & Freeze, 2006). The study by Hashim et al. (2016) preceding this research showed that employees valued management support on three different levels: Encouragement, involvement and financial support.

### 2.2.4 Rewards and Recognition

When considering knowledge management, one crucial success factor is to reward and motivate your employees (Ahmad, Madhoushi, & Yusof, 2011). Hashim et al. (2016) detected three main drivers, motivating employees to share knowledge: promotion, consideration in performance evaluation and innovation development. Previous literature outlines that in a successfully implemented knowledge management system rewards are crucial (Du Plessis, 2008).

## 2.3 Individual factor

Cheng, Ho, and Lau (2009) defined the individual factor as the individual's internal incentive obtained through confidence, perception, expectation, attitude, and emotion. Furthermore, according to Chen (2007) individuals' expectations also do play a crucial role when it comes to continuous participation in social networks. The parties involved in the knowledge sharing process need to be considered individually with regards to their personal attitude towards knowledge sharing (Cheng, Ho & Lau, 2009). The empirical investigation by Hashim et al. (2016) showed that successful knowledge sharing rests on two prerequisites: Firstly awareness of social collaboration platforms and tools and secondly the trust in these.

## 2.4 Content context

The content of the platform needs to be perceived as relevant by the users. Important factors to be considered are the quality and value of shared content (Cheng, Ho & Lau, 2009). Validity and accuracy must be ensured, since users emphasized the importance of trustworthy sources (Vargo et al., 2003). In previous research, the importance to monitor the content shared was outlined (Hashim et al., 2016). According to Langen (2015) a qualitative assessment of the relevance of content can be based on feedback mechanisms in form of likes or ratings.

## 2.5 Cooperation context

The cooperation factor entails the cooperation process and the enhancement of the communication network (Norizah et al., 2005). Moreover, the monitoring and coordinating of the content is relevant in the cooperation context (Phang et al., 2009). Through cooperation, transfer and enhancement of knowledge can take place (Hashim et al., 2016). This factor consists of two elements: The structure of cooperation (memorandum of understanding, clear guidelines, issue a circular) and the communication network (strength of the network and face-to-face communication) (Hashim et al., 2016).

# 3. HYPOTHESES BUILDING

The relationship of particular organizational structures with knowledge sharing behavior of individuals was investigated in past research (Hashim et al., 2016). To my knowledge, only a qualitative research involving a semi-structured interview has been conducted. The literature speaks of technical and non-technical factors. By virtue of the limitations of this research, we will only focus on the non-technical factors. The four factors investigated are the key factors identified above (see sections 2.2-2.5): the organization, the individual, the content and the cooperation. On the basis of existing literature an extensive quantitative framework was compiled to examine the validity of the key factors. The theoretical model employed can be found at the end of chapter 3 (Figure 1).

*Organizational factor and knowledge sharing*

The correlation between a firm's culture and individual knowledge sharing has been investigated in previous literature (Chiu, Hsu & Wang, 2006). The perception of the culture for the individual might differ within the company and thus might influence the knowledge sharing behavior of individuals. The organizational structure can, to some extent, influence successful knowledge sharing. A structure that encourages the flow of communication between departments and units and further practices a comprehensible bureaucratic approach, simplifies knowledge exchange (Hashim et al., 2016). Another important element which enhances employees' knowledge sharing is top management support. Thus, I propose the following hypotheses:

H1: The more employees perceive the organizational culture and structure as positive the more they are likely to share knowledge

H2: The more employees perceive management support for knowledge sharing, the more they are likely to share knowledge

*Individual factor and knowledge sharing*

A clear objective and vision of the company provides a structure within the company and influences the behavior patterns of employees.
Research implied, that knowledge sharing is unnatural and requires incentives and motivation (Davenport, 1997; Book et al., 2001). Hence it is assumed, that rewarding employees affects their knowledge sharing behavior.
Social collaboration platforms facilitate new methods of communications inside the company intranet, but initially this intangible tool raises suspicion among employees. A prerequisite for a successful collaboration platform is the relevance of the content. Users who do not experience an interest in the topics discussed are less likely to be active on the platform.
Therefore, I hypothesize:

H3.a: The more employees perceive the organization's objective and vision as clear, the more they are likely to share knowledge

H3.b: The more employees perceive rewards and recognition as motivation, the more they are likely to share knowledge

H4: Employees perceiving the awareness and trust in social collaboration platforms are more likely to show higher levels of knowledge sharing

*Content factor and knowledge sharing*
In case a social collaboration platform is unsupervised, the substance of the content cannot be guaranteed. Previous literature depicts, that sources need to be reliable to be used by the employees (Vargo et al., 2003). It was argued, that monitoring of the contents enriches the quality of contents and raises knowledge sharing of individuals. The derived hypothesis states:

H5: Employees perceiving that the shared content is sufficiently monitored are more likely to show higher levels of knowledge sharing

*Cooperation factor and knowledge sharing*

In principle, the cooperation in knowledge sharing ensures enhanced knowledge (Hashim et al., 2016). Underlying assumptions are clear guidelines and a basic understanding. The communication network plays a crucial role when considering the cooperation factor. Moreover, the user must perceive a need to strengthen the communication network to feel encouraged to share knowledge. Hence, I propose:

H6: Employees perceiving that the cooperation process structure, communication network, and coordinating and monitoring are present are more likely to show higher levels of knowledge sharing
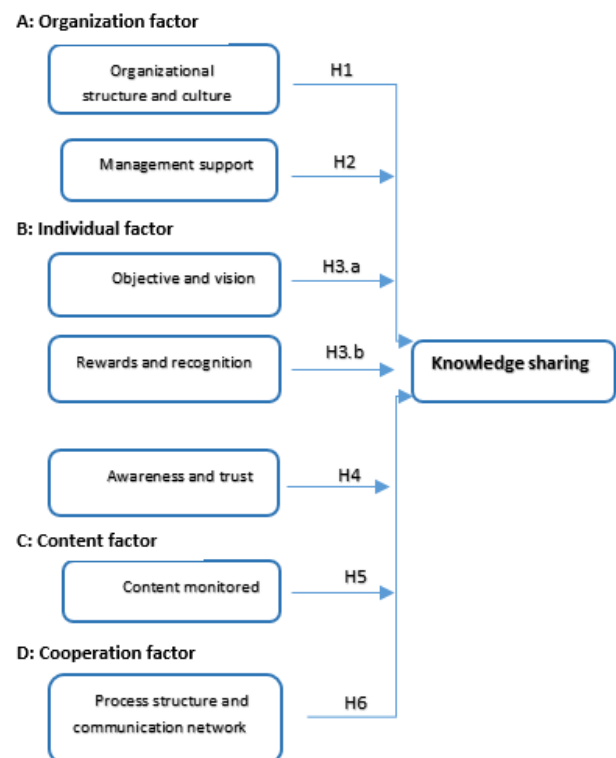


*Figure 1: Research Model*

# 4. METHOD

### Sample

For this study, 500 employees of the company Chemical Industries AG were approached via probability sampling. The sample was addressed to a wide range of operations, including R&D, marketing and technical disciplines. This variety is representative for the labor arrangement within the company. All hierarchical levels were requested. Employees new to the company were considered in the same way as long-standing ones. The group of individuals not participating in the community Seek & Solve was of particular interest. Pre-selection of the sample was done in such a way as to put this group of individuals in the focus of the study. Initially, individuals were categorized via two approaches.

The first approach was the number of contacts in the community. In this case the community was the internal social software platform, provided by IBM Connections. The number of contacts in the selected group ranged from individuals with relatively few contacts (27 contacts) to those strongly interlaced within the company (272 contacts). The contacts in the community can be beyond the limits of the site. Each employee is in the position to establish a global network including all international sites of the company. The network is used for knowledge exchange, communication and collaboration.

The second approach for classification was the activity in the community. Activity was measured as the number of postings, comments and activities in forums of the individual. A record of these items over a period of 26 weeks (November 2015-April 2016) enabled classification. The timeframe should ensure equality among long standing and recent employees. The activity in the community ranges from 1-83. The classification enabled a differentiation between individuals with less knowledge sharing activities and those exposing extensive knowledge sharing behavior.

The operationalization of the concept is derived from theoretical frameworks in the literature. The content is comprised of four factors, which should cover the scope of the independent variables to ensure validity. The relevance of the factors was proven in earlier research, in which they were identified as 'success factors' in the context of knowledge sharing. The dependent variable knowledge sharing was operationalized via two approaches to enhance the explanatory power of the outcomes. The two dependent variables are not coherent and are different measurements of the knowledge sharing behavior of the individual.

Completion of the questionnaire was voluntary and the respondents were asked to fill it in during working hours. Out of the 500 contacted employees, 139 valid responses could be retrieved, which equals to a response rate of 27.8 %.

## 4.1 Measurement of Independent Variables

The individual was asked to report their perceptions on factors, which are assumed to support knowledge sharing. These factors were classified according to the empirical assessment by Hashim et al. (2016). The four factors organization, individual, content and cooperation were rated on a 5-point Likert scale ranging from 'strongly disagree' to 'strongly agree'. In total, 24 items were used in the questionnaire to measure how the individual perceives these factors, each being measured with 1-10 questions. Sample questions included: 'The organizational culture encourages sharing of ideas, information and experiences among employees' and 'The organizational culture stimulates cooperation in knowledge sharing to solve problems' for the organization factor. 'Is knowledge sharing a criterion for promotion?', 'Is the organization objective and vision clearly communicated?' and 'Do you perceive knowledge shared by colleagues as reliable?' were questions related to the individual factor. For the independent variable content, the operationalization looked as follows: 'Is the quality of shared content sufficiently monitored within the company?'. 'Are you familiar with the purpose and functionality of the platform?' and 'Do you perceive a need to strengthen your communication network?' are exemplary questions for the cooperation factor.

## 4.2 Measurement of Dependent Variable

### Knowledge sharing

The dependent variable knowledge sharing was defined by various ways in previous literature. Considering two different approaches in the study should give insights into their compatibility.

To assess the dependent variable *knowledge sharing*, two objective measurements were used. As mentioned by Cabrera & Cabrera (2005), knowledge sharing can be differentiated based on the depth and width of each individuals' internal network. A study by Chiu et al. (2006) investigated, that the number of direct ties in social communities was positively related to the quantity and value of knowledge shared. The number of contacts within the community ranged from 27 to 272 within the sample.
According to Langen (2015) user engagement can be equated to knowledge shared. This involves posts/comments and community activity. The acquired data involves the user engagement within IBM Connections within the last 26 weeks, ensuring equality among recent and long-standing employees. The selected sample reflects community engagement in a range from 1 to 83 activities.

The data was acquired via an analysis of the individual profiles, where one can read out the quantity of contacts and the activity in the community. The data collection took place before the delivery of the questionnaire and resulted in a numerical classification of the sample based on their knowledge sharing behavior.

## 4.3 Procedure

Initially, the questionnaire was electronically sent to a testing sample of 10 employees, whose input and assessment was used for refinement and clarification of the questions. The distribution of the survey took place via email to the randomly selected sample of 500 employees in May 2016. Employees were asked to complete the survey within 2 weeks, which ensured a high response rate. A reminder after the first week completed the sampling procedure.

# 5. RESULTS

To validate the questionnaire, the factor structure must be assessed in the first instance. Hair, Black, Babin & Anderson (2010) rate values smaller than 3 for $X^2/df$ as being sufficient. The indices show a good model fit, supporting that the underlying 4 factors rendered knowledge sharing.

| Factor | $X^2$ | df | $X^2/df$ |
|---|---|---|---|
| **Organization** | 183.9 | 138 | 1.32 |
| **Individual** | 131.2 | 138 | 0.94 |
| **Content** | 164.6 | 138 | 1.18 |
| **Cooperation** | 33.3 | 138 | 0.23 |

*Table 1: Model fit*

For the description of the relationship between the success factors and the individual knowledge sharing behavior, a correlation matrix was utilized. For a clear overview each success factors was assigned an identification letter (Table 2).

The independent variables were classified into four factors: A, B, C and D. The factors were analyzed as a summation of the respective single elements (i.e. $A_T = A_1+A_2+...+A_9$) (see Appendix). The dependent variable was operationalized via two approaches.

| Variable | Factor |
|---|---|
| $A_T$ | Organization factor |
| $B_T$ | Individual factor |
| $C_T$ | Content factor |
| $D_T$ | Cooperation factor |
| $E_1$ | Number of contacts |
| $E_2$ | Activity in the community |

*Table 2: Legend of the correlation matrix*

For the statistical analysis of the sample, the correlation coefficient and sample size have to be considered. For this research the convention by Cohen (1988) was taken for the assessment of the correlation coefficient. Hence, correlations with a value under 0.1 were considered insignificant. Correlations above 0.1 are considered weak, above 0.3 intermediate and above 0.5 strong correlations. Standardized β indicate a significant effect of individual knowledge sharing behavior on the success factors identified.

Initially the two variables, which were supposed to be an indicator of knowledge sharing behavior ($E_1$ & $E_2$) were tested on their compliance. According to the Pearson correlation, we find a weak correlation (0.202). This proves, that the two approaches are not concurring and will most likely lead to different statistical outcomes. Thus, one cannot classify the sample unequivocally. In the following, the independent factors were tested on their relationship with the dependent variables separately.

The dependent variable $E_1$ (number of contacts), is skewed to the left, with some very extreme values at the right edge of the histogram. The second dependent variable $E_2$ (activity in the community) is also skewed to the left. More than half of the sample (51.8%) was only active 1-2 times within the last 26 weeks. Hence, it was concluded that a large share of the sample did not display much activity in knowledge sharing.

For the investigation of the influence of the four probed success factors on individual knowledge sharing behavior a Pearson correlation analysis was taken. The Pearson correlation coefficient measures the linear relationship between two variables (Cleff, 2012). There are five assumptions that are made with respect to Pearson's correlation: variables must be interval/ratio measurements; variables must be approximately normally distributed; linear relationship between the two variables; outliers are kept to a minimum; homoscedasticity of the data.

A correlation analysis for the two dependent factors $E_1$ and $E_2$ with the four independent factors $A_T$; $B_T$; $C_T$ and $D_T$ respectively was performed.

For the number of contacts within IBM Connections ($E_1$), there was no significant relationship with the four independent factors. Hence, the in-depth discussion for this variable was omitted.

For the second dependent variable ($E_2$), strong correlations with $A_T$ (0.851), $B_T$ (0.83) and $C_T$ (0.784) were found. The Pearson-Correlation with $D_T$ resulted in an intermediate correlation (0.444). All outcomes were statistically significant with $p < 0.01$. Except for the variable $D_T$, all factors had strong correlations amongst each other (Table 4). Thus, multicollinearity was existent in the regression analysis for $A_T$, $B_T$ and $C_T$.

When testing the independent variables for Cronbach´s alpha, the interpretation by George & Mallery (2002) was applied.

Values for α of 0.929 and 0.938 for $A_T$ an $B_T$ respectively displayed excellent internal consistency of these two factors (Table 3). Factor $C_T$ only entails one variable, which is why the measurement was not applicable. $D_T$ (0.464) showed an inacceptable consistency (<0.5). The single elements within $D_T$ all showed insignificant correlations with $E_2$.

| Factor | Cronbach´s Alpha | N of Items |
|---|---|---|
| $A_T$ | 0.929 | 9 |
| $B_T$ | 0.938 | 10 |
| $D_T$ | 0.464 | 4 |

*Table 3: Cronbach´s Alpha*

The normal distribution of the factors is a condition for the correlation analysis. The organization factor ($A_T$) has an acceptable normal distribution, with some outliers on the right-hand side. The same applied to the individual factor ($B_T$), where the outliers were slightly more spread to the right side. For the content factor ($C_T$) a normal distribution was observable, with one outlier with exceptionally low value close to the mean. The cooperation factor ($D_T$) was almost perfectly normally distributed.

For these reasons, an additional analysis was run with an adjusted normal distribution, only considering values in the 90% confidence interval. For $A_T$ and $B_T$ these outcomes were listed in the related sections of the factors.

|  |  | E₂ | Aₜ | Bₜ | Cₜ | Dₜ |
|---|---|---|---|---|---|---|
| **E₂** | Pearson- Correlation | 1 | ,851** | ,830** | ,784** | ,444** |
|  | Significance (2-sided) |  | ,000 | ,000 | ,000 | ,000 |
|  | N | 139 | 139 | 139 | 139 | 138 |
| **Aₜ** | Pearson- Correlation |  | 1 | ,929** | ,824** | ,619** |
|  | Significance (2-sided) |  |  | ,000 | ,000 | ,000 |
|  | N |  | 139 | 139 | 139 | 138 |
| **Bₜ** | Pearson- Correlation |  |  | 1 | ,810** | ,610** |
|  | Significance (2-sided) |  |  |  | ,000 | ,000 |
|  | N |  |  | 139 | 139 | 138 |
| **Cₜ** | Pearson-Correlation |  |  |  | 1 | ,512** |
|  | Significance (2-sided) |  |  |  |  | ,000 |
|  | N |  |  |  | 139 | 138 |
| **Dₜ** | Pearson- Correlation |  |  |  |  | 1 |
|  | Significance (2-sided) |  |  |  |  |  |
|  | N |  |  |  |  | 138 |

*Table 4: Correlation table*

*Organization factor and activity in the community*

The single elements of the organization factor demonstrated a positive correlation with the activity in the community ($E_2$), with exception of $A_6$. No significant correlation was found between the activity in the community and a bureaucratic approach towards knowledge sharing.

Significant values were found for correlations between knowledge sharing behavior and encouragement to share ideas ($\beta$=.229, p<0.05) as well as the stimulation to cooperate ($\beta$=.323, p<.001). A positive correlation between encouragement of discussions among institutions ($\beta$=.105, p=.149) and the activity in the community confirmed Hypothesis 1.

Top management support was determined not to be the main driver for knowledge sharing. Financial support, encouragement and involvement of top management exhibited a correlation with individual knowledge sharing behavior, however the outcomes were not statistically significant (p>.001). Hence, Hypothesis 2 could only be verified to a certain degree. The result depicted, that only 22.9% of the sample felt that top management encouraged them to learn new skills.

An analysis of the correlations between the elements within $A_T$ showed that those, who felt encouraged to share ideas amongst each other ($A_1$) also perceived the culture to be stimulating cooperation ($A_2$) and encouraging discussions ($A_3$). There was no strong correlation between the degree, to which top management was involved in knowledge sharing ($A_9$) and the remaining elements of the organization factor. This questioned the meaning and validity of this variable and depicts a need for more extensive future investigation.

Considering only the values in the 90% confidence interval of $A_T$ showed, that the remaining 120 cases resulted in a decreased significance of the correlation with $E_2$ ($\beta$=.74, p<.001).

*Individual factor and activity in the community*

The analysis of the individual factor showed that the extent to which participants perceived the objective and vision as clearly communicated was positively correlated to knowledge sharing behavior ($\beta$=.239, p=.001). There was no significant relationship between knowledge sharing and individuals confidence to contribute new knowledge ($\beta$=.067, p=.365). In other words, self-assurance of the content shared, had no influence on how much knowledge individuals shared. In summary, Hypothesis 3.a could be confirmed with limitations on $B_6$.

Testing Hypothesis 3.b, the research showed that those who were perceiving promotion and innovation as criterions for knowledge sharing, were more likely to be active in the community and thus shared more knowledge. There was a significant positive relation for promotion ($\beta$=.197, p<.05) and innovation ($\beta$=.207, p<.05) confirming the hypothesis.

Encouragement to widen knowledge significantly showed positive correlation with knowledge sharing behavior ($\beta$=.45, p<.001). The same held true for the potential exploited within the company ($\beta$=.36, p<.001). Those who perceived the knowledge shared by colleagues as reliable, tended to share more knowledge, however the outcome was not statistically significant ($\beta$=.126, p=.089). The individuals in the study, who considered themselves willing to help others by sharing knowledge apparently did not actively share their knowledge. However, this result was not significant (p=.798) and the outcome seems paradoxical.

Thus, the statistical analysis did not allow for an explicit confirmation of Hypothesis 4.

It appears, that those, who considered themselves willing to help others by sharing knowledge ($B_7$) tended to perceive knowledge shared by colleagues as reliable ($B_9$). An analysis of the frequencies of $B_5$ revealed that only 31.5% of the sample

thought, that knowledge sharing is important in the learning process. In addition, the majority of the sample (69.1%) did not feel confident to contribute new knowledge ($B_6$).

An analysis of those cases in the 90% confidence interval for $B_T$ still gave a significant correlation with $E_2$, with N=119 ($\beta$=.719, p<.001). The 20 cases, which did not lie in this interval did not significantly influence this study.

*Content factor and activity in the community*

The content factor analysis showed that those, who perceived the quality of shared content sufficiently monitored shared significantly more knowledge ($\beta$=.784, p<.001), confirming Hypothesis 5. Only 16% of the sample perceived the content as sufficiently monitored within IBM Connections.

*Cooperation factor and activity in the community*

The analysis for the cooperation factor did not reveal a homogeneous outcome. The need to strengthen one's communication network was positively correlated with knowledge sharing behavior ($\beta$=.336, p<.001). Similar findings could be retrieved for face-to-face communication in correlation with knowledge sharing ($\beta$=.229, p=0.06). On the basis of the analysis, there was no significant relation between the familiarity with Seek & Solve and knowledge sharing ($D_1$ & $D_2$). $D_1$ had a weak negative correlation with the dependent variable, whereas the other three factors ($D_2$, $D_3$, $D_4$) showed a weak positive correlation. This can be interpreted as the majority of the sample not being familiar with the social collaboration platform Seek & Solve ($D_1$), and also explains the reasons for the guidelines not being perceived as clear ($D_2$). The negative $\beta$- coefficient (-0.875) for $D_T$ is an indicator for an inadequate measurement for this variable. The validity of the cooperation factor needs to be proven in further research requiring rejection of Hypothesis 6.

With respect to the 90% confidence interval of $D_T$, 124 valid cases could be retrieved. There was a statistical weak but significant correlation ($\beta$=.483, p<.001).

# 6. DISCUSSION

This study focused on factors employees perceive as important for knowledge sharing and to what extent these affect their individual knowledge sharing behavior. The four factors identified in previous literature, namely organization, individual, content and cooperation have been hypothesized to explain deviations in employees´ individual knowledge sharing behavior. Moreover, the dependent variable knowledge sharing has been operationalized via two approaches. Modelled after the empirical investigation by Hashim et al. (2016) the impact of the factors on individual knowledge sharing behavior was assessed.

The two dependent variables, number of contacts and activity in the community, did not show correspondence with each other. The number of contacts within the company appeared not to be a meaningful indicator for knowledge sharing behavior, whereas the activity in the community was significantly correlated to three of the four factors for knowledge sharing. Consequently, this research focused on the second variable as an indicator for knowledge sharing.

The results indicated that employees perceiving the organizational, individual and content factor as positive showed enhanced knowledge sharing behavior. Opposed to the assumptions made, the cooperation factor did not contribute to individual knowledge sharing substantially. The validity of this factor was questioned, due to contradictive outcomes. Hence, the operationalization of this factor should be redefined for future research.

Particularly noticeable is the large number of respondents not demonstrating much knowledge exchange in the company. There is a huge potential of mutual knowledge exchange untouched. Management should consider changes to stimulate more knowledge sharing and exploit the internal capacities. This could be addressed by incorporating the participation in social collaboration platforms in the target agreement for employees. This way, the importance of the knowledge management process is highlighted and each individual is being incentivized to participate. Another approach could be a reward scheme for participation, focused around a virtual currency.

Initially each employee is given a contingent of this virtual currency, called *miles* for example. During a specified period, each individual is asked to assign these to colleagues, who made their knowledge available to others. The following questions could be criteria for assessment: *Who has actively supported me in solving problems?* and *Who has shared his experiences with me?* In the final stage, the collected miles can be exchanged with material awards.

It appears, that the organizational structure and culture have a strong impact on the individual behavior in the company. Employees being stimulated to cooperate in order to solve problems and being encouraged to share ideas, information and experiences among each other, share significantly more knowledge. Employees' contribution to knowledge sharing is linked to rewards and recognition for their activities. Apparently, a large number employees do not feel sufficiently esteemed for sharing knowledge. Management should rethink the status quo and implement rewards and recognition for commitment of the employees. This could be attained in terms of an internal award for those, who are very supportive and share a lot of knowledge with their colleagues. Thereby, they receive attention from their supervisors encouraging their colleagues to emulate this behavior. Moreover, a financial reward for active knowledge sharing could stimulate employees. A key indicator for knowledge sharing behavior is the perceived trust in social collaboration platforms. To achieve this, one should assign a person responsible to prove read the content of comments, before they are uploaded to the platform.

Opposing to the initial hypothesis, management support does not influence the behavior of individuals significantly. The findings are contrary to the identified factors proposed by Hashim et al. (2016). In alignment with the proposed hypothesis, a clear communicated objective and vision and the confidence to contribute new knowledge, contribute to individual knowledge sharing. A recommendation might be, to inform new recruits on the values and objectives of the company by means of a workshop. Also, efforts should be made to convey the message, that mistakes are allowed and are part of the learning curve.

A contradictory outcome was found for the willingness to help others by sharing knowledge and the actual behavior of individuals. It seems, that those who tend to share more knowledge perceive themselves as less open to assist their colleagues and vice versa. The reasons for this can be manifold. The operationalization for knowledge sharing only recognized the online activities of the individual, whereas the question does

not explicitly ask for willingness to support colleagues via this approach. This means, that individuals who are less active according to the definition, might be more active in sharing what they know with colleagues in their direct environment. This might be applicable for the group of people who are not digital natives. In order to verify this, a control variable *age* could deliver new insights. Another explanation might be, that knowledge sharing is not only defined by supporting others, but also posts/comments to general topics. Therefore, those who rank high in knowledge sharing by means of the definition, might primarily demonstrate this in terms of commenting and not consciously supporting colleagues. By virtue of these findings, an integration of a control variable should be considered when conducting in-depths research in this direction.

The cooperation factor did not demonstrate strong correlations with individual knowledge sharing behavior. The results for the individual elements showed only a positive correlation between the perceived need to strengthen the communication network and knowledge sharing. For the remaining elements the results were not significant. For this sample only employees were considered who were not participating in the social collaboration platform. Because of this, many individuals were not familiar with its guidelines. As a consequence, a full understanding of the questions in this category was limited. This could explain absence of a correlation and prospects a need for further research.

The developed model of factors influencing individual knowledge sharing behavior puts emphasis on particular sectors. Attention should be raised to these, when considering internal knowledge management. A variety of managerial implications for theory and practice can be deducted.

Certain aspects influencing knowledge sharing behavior can be explained by this research and enabled gaining new insights. However, the entire scope of factors, which influence individual behavior could not be covered. Residual factors, which might influence knowledge sharing are the temporal length of employment relationship, department, gender and age of the individual.

One of the findings of this research is the need for reward systems. It is expected, that these will result in an increased quantity of knowledge sharing. An interesting question for future research might be, to what extent this influences the quality of knowledge exchange. Assuming, that employees are obliged to participate in knowledge sharing as part of their target agreement, how much effort do they put into their activity to generate value? How is this going to be quantified? Is this the right approach to achieve the ultimate goal, improving innovativeness?

# 7. IMPLICATIONS AND LIMITATIONS

The methodological approach and the result of this study add to the discussion on knowledge sharing and give new insights for managerial activities.

Firstly, the extension of the developed framework by Hashim et al. (2016) and the conversion into a quantitative research yielded new findings. It enabled more extensive research on a larger sample size. Hence, researchers should be emboldened to conduct further investigations applying this framework.

Secondly, the study allows a more in-depth understanding of employees' individual knowledge sharing behavior. Distinct

managerial implications can be drawn from the new insights. The proposed success factors for knowledge sharing (Hashim et al. 2016) imply encouragement of a more communicative culture. These provide instruments for knowledge exchange beyond the boundaries of departments and can improve company performance significantly. The impact of management support on knowledge sharing behavior cannot be supported. Special attention should be payed to the monitoring of the content shared. Apparently, a great variety of employees perceive a need to raise supervision of social platforms. This could be a barrier, preventing employees to share their individual knowledge.

Thirdly, concrete advice for the social collaboration platform Seek & Solve can be derived from the findings. Of the sample, only 7.2% is familiar with the purpose and functionality of the platform. This also explains, why the number of participants is inadequate. Thus, increased attention should be placed on the clarification of the functioning. A way to approach this issue could be an advertising campaign, where a colleague is asked to formulate a relevant question he currently faces. The successful problem solving process is then reported and advertised in the campaign.

With respect to the managers in the company, some recommendations for action can be given. To begin with, the importance of knowledge sharing should be highlighted in regular meetings. Top management should act as a pioneer to practice this approach and communicate the tools available in the company. Apart from implementing a reward system, efforts should be made to reduce the fear of employees to say something wrong. A possible way to implement this, could be the exposure of own mistaken decisions in the past. Further advice would be, to introduce new employees immediately to the vision and mission of the company.

Despite the present implications, the study underlies some limitations. One criticism may be a missing control variable, giving insights into potential differences in sex or age of the sample. Lin (2006) identified differences between genders in the context of knowledge sharing, strengthening the need to prove this variable. By reasons of confidentiality, no personal data of the employees could be gathered.

The sampling procedure was based on self-evaluation of the individual. Thus an erroneous assessment could have occurred in single cases. In order to avoid this bias, an external valuation of individual behavior would help out.

It appeared, that some of the items within the questionnaire were not understood by the sample. A reason might be, that the questionnaire was sent in English language and the respondents were not all native speakers. A future advice would be to approach all respondents in their mother tongue.

Future research should consider a redefinition of the dependent variable 'knowledge sharing behavior of the individual'. It appears, that the operationalization in form of 'number of contacts' was not representative for the sample. Also, the 'activity in the community' might not cover all aspects of the variable. Employees might also share their knowledge by other means, which should be considered in the operationalization.

Concluding, this study shows the importance of employees' perception for the relevance of success factors for knowledge sharing within the company and their individual knowledge sharing behavior. It expands on previous literature on this theme and emphasizes where to draw attention to in order to enhance knowledge exchange.

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# APPENDIX:

**Organization factor ($A_T$) consists of:**

| Element | Question |
|---------|----------|
|         | Does the organizational culture within Chemical Industries AG… |
| $A_1$ | …encourage sharing of ideas, information and experiences among employees? |
| $A_2$ | …stimulate cooperation in knowledge sharing to solve problems? |
| $A_3$ | …encourage discussions between institutions to gain knowledge? |
|         | Does the organizational structure of Chemical Industries AG… |
| $A_4$ | …encourage the flow of communication between departments or units? |
| $A_5$ | …set the confidentiality class of a document at a level that makes it easy to share? |
| $A_6$ | …exercise a bureaucratic approach towards knowledge sharing? |
|         | Does top management … |
| $A_7$ | …provide aid and financial support for knowledge sharing? |
| $A_8$ | …encourage the learning of new skills? |
| $A_9$ | Is top management involved in knowledge sharing activities? |

**Individual factor ($B_T$) consists of:**

| Element | Question |
|---------|----------|
|         | Is knowledge sharing a criterion for … |
| $B_1$ | …promotion? |
| $B_2$ | …performance evaluation? |
| $B_3$ | …innovation? |
|         | Is the organization objective and vision … |
| $B_4$ | …clearly communicated? |
| $B_5$ | Do you feel that knowledge sharing in the learning process is important? |
| $B_6$ | Do you feel the confidence to contribute new knowledge? |
| $B_7$ | Do you consider yourself willing to help others by sharing knowledge? |
| $B_8$ | Do you feel yourself encouraged to widen your knowledge within the company? |
| $B_9$ | Do you perceive knowledge shared by colleagues as reliable? |
| $B_{10}$ | Do you perceive knowledge potential as exploited within the company? |

**Content factor ($C_T$) consists of:**

| Element | Question |
|---------|----------|
| $C_1$ | Is the quality of shared content sufficiently monitored within IBM Connections? |

**Cooperation factor ($D_T$) consists of:**

| Element | Question |
|---------|----------|
| $D_1$ | Are you familiar with the purpose and functionality of the platform Seek & Solve? |
| $D_2$ | Are the guidelines of the platform Seek & Solve clear? |
| $D_3$ | Do you perceive a need to strengthen your communication network? |
| $D_4$ | Do you conduct face-to-face communication within Chemical Industries AG to clarify pressing issues? |