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Knowledge
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An evidence review

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Acknowledgements

About CEBMa

The Center for Evidence-Based Management (CEBMa) is the leading authority on evidence-based practice in the field of management and leadership. It is an independent non-profit foundation providing support and resources to managers, leaders, consultants, facilitators or instructors, academics and others interested in evidence-based practice and decision-making. It enjoys the support of prominent universities including Stanford, Carnegie Mellon, the Australian National University, and the Free University of Amsterdam.

Publication information

1 Introduction

Rationale for this review

In the summer of 2013, a group of eight companies wished to understand what academic research has discovered about the determinants of knowledge worker performance. For each company the pay-off for enhancing knowledge worker performance would be huge, not only in terms of finance, but also in terms of innovation, which for some participants is a key success factor for long-term profitability and growth. Although all organisations used various measures and controls to monitor and enhance performance, they lacked a basic understanding of what really drives knowledge worker performance. For this reason, the organisations commissioned the Center for Evidence-Based Management (CEBMa) to conduct a rapid evidence assessment (REA) of the scientific literature on factors associated with knowledge worker productivity. In July 2019, the REA was updated. This update was funded by Novartis and Advanced Workplace Associates (AWA).

Main question: what will the review answer?

What is known in the scientific literature about factors associated with knowledge worker performance?

Supplementary questions:

1. What is 'knowledge work'?
2. Which of the factors that have an impact on the performance of knowledge workers are most widely studied and what is known of their effect?
3. Which six factors have the biggest impact on performance?
4. How do these six actors enhance the performance of knowledge workers and how can they be measured?

2 Methods

What is a rapid evidence assessment (REA)?

Evidence reviews come in many forms. One of the best-known types is the conventional literature review, which provides an overview of the relevant scientific literature published on a topic. However, a conventional literature review's trustworthiness is often low: clear criteria for inclusion are often lacking and studies are selected based on the researcher's individual preferences. As a result, conventional literature reviews are prone to severe bias. This is why 'rapid evidence assessments' (REAs) are being used. This type of review is a specific research methodology that aims to identify the most relevant studies on a specific topic as comprehensively as possible, and to select appropriate studies based on explicit criteria. In addition, the methodological quality of the studies included is assessed by two independent reviewers on the basis of explicit criteria. In contrast to a conventional literature review, an REA is transparent, verifiable and reproducible, and, as a result, the likelihood of bias is considerably smaller.

Search strategy: how was the research evidence sought?

The following three databases were used to identify studies: ABI/INFORM Global from ProQuest, Business Source Premier from EBSCO, and PsycINFO from Ovid. The following generic search filters were applied to all databases during the search:

- scholarly journals, peer-reviewed
- published in the period 1980 to 2019
- articles in English.

A search was conducted using combinations of different search terms, such as 'productivity', 'performance', 'knowledge work' and 'knowledge-based business'. We conducted six different search queries, which yielded a total of more than 600 studies. All queries, criteria and search results are described in detail in Appendix 1.

Selection process: how were the studies selected?

Study selection took place in two phases. First, the titles and abstracts of the 600+ studies were screened for their relevance to this REA. In case of doubt, lack of information or disagreement, the study was included. Duplicate publications were removed. This first phase yielded 52 (2013) and 66 (2019) studies.

Second, studies were selected based on the full text of the article according to the following inclusion criteria:

- only meta-analyses
- only studies in which the association with (knowledge worker) performance are measured
- only studies related to workplace settings
- only studies that were graded level C or above (see below).

Two reviewers worked independently to identify which studies will be included. Where the reviewers disagreed on inclusion, a third reviewer assessed whether the study was appropriate for inclusion with no prior knowledge of the initial reviewers' assessments. The decision of the third reviewer was final. This second phase yielded 35 (2013) and 44 (2019) meta-analyses, making a total of 79 meta-analyses. An overview of the selection procedure is provided in Appendix 2.

Critical appraisal: how was the quality of the studies included judged?

Methodological appropriateness

In almost any situation it is possible to find a scientific study to support or refute a theory or a claim, and sometimes to quite a large degree. It is therefore important to determine which studies are trustworthy (that is, valid and reliable) and which are not. The

trustworthiness of a scientific study is first determined by its methodological appropriateness. For cause-and-effect claims (that is, if we do A, will it result in B?), a study has a high methodological appropriateness when it fulfils the three conditions required for causal inference: co-variation, time–order relationship and elimination of plausible alternative causes (Shaughnessy and Zechmeister 1985). A study that uses a control group, random assignment and a before-and-after measurement is therefore regarded as the 'gold standard'. Non-randomised studies and before–after studies come next in terms of appropriateness. Cross-sectional studies (surveys) and case studies are regarded as having the greatest chance of showing bias in the outcome and therefore sit lower down in the ranking in terms of appropriateness. Meta-analyses in which statistical analysis techniques are used to pool the results of controlled studies are therefore regarded as the most appropriate design.

To determine the methodological appropriateness of the included studies' research design, the classification system of Shadish et al (2002), and Petticrew and Roberts (2006) was used. The levels of appropriateness used for the classification are shown in Table 1.

Table 1: Classification system for methodological appropriateness

Design	*Level*
Systematic review or meta-analysis of randomised controlled studies	AA
Systematic review or meta-analysis of controlled and/or before–after studies	A
Randomised controlled study	
Systematic review or meta-analysis of cross-sectional studies	B
Non-randomised controlled before–after study	
Interrupted time series	
Controlled study without a pretest or uncontrolled study with a pretest	C
Cross-sectional study	D

It should be noted, however, that the level of methodological appropriateness as explained above is only relevant in assessing the validity of a cause-and-effect relationship that might exist between a predictor/driver (organisational culture) and its outcomes (performance), which is the purpose of this review.

Methodological quality

In addition, a study's trustworthiness is determined by its methodological quality (its strengths and weaknesses). For instance, was the sample size large enough and were reliable measurement methods used? To determine methodological quality, all the studies included were systematically assessed on explicit quality criteria. Based on a tally of the number of weaknesses, the trustworthiness was downgraded and the final level was determined as follows: a downgrade of one level if two weaknesses were identified; a downgrade of two levels if four weaknesses were identified, etc.

Effect sizes

Finally, the effect sizes were identified. An effect (for example a correlation, Cohen's d or omega) can be statistically significant but may not necessarily be of practical relevance: even a trivial effect can be statistically significant if the sample size is big enough. For this reason, the effect size – a standard measure of the magnitude of the effect – of the studies included was assessed. To determine the magnitude of an effect, Cohen's rules of thumb (Cohen 1988) were applied. According to Cohen, a 'small' effect is an effect that is only visible through careful examination. A 'medium' effect, however, is one that is 'visible to the naked eye of the careful observer'. Finally, a 'large' effect is one that anybody can easily see because it is substantial.

Outcome of the critical appraisal

The overall quality of the studies included in this review is moderate to high. Most of the meta-analyses were based on cross-sectional studies, and were therefore qualified as level C. Twelve meta-analyses were graded level B or higher. An overview of all studies included is provided in Appendix 3.

3 Main findings

Question 1: What is knowledge work?

The term 'knowledge work' was coined in 1959 by Peter Drucker to describe work that occurs primarily because of mental processes rather than physical labour. In the past century, the proportion of the workforce engaged in knowledge work has increased dramatically, as organisations have moved from manual production to more knowledge-driven production, as these estimates suggest:

- 1920: 30% (Davenport et al 2002)
- 1956: 50% (Naisbitt 1982)
- 1980: 70% (Thomas and Baron 1994).

Since then, many definitions have been put forward and there are nearly as many definitions of both 'knowledge work' and 'knowledge workers' as there are publications on the topic. When examined closely, most definitions seem to have the following common elements:

- distribution or application of knowledge
- highly educated, autonomous professionals
- use of information technology as an integral part of the work process
- a work process that is difficult to standardise
- complex and intangible outcomes.

Most studies acknowledge that the difference between manual work and knowledge work is a continuum. In addition, even the highest level of knowledge work includes mundane tasks, such as storing information, returning telephone calls, and composing and responding to emails (Heerwagen et al 2004). To assess the level of knowledge work, different aspects of the job should be examined, such as:[1]

- autonomy (the degree of worker control over how a task is done)
- structure (the degree of established rules, policies or procedures about how a task is done)
- knowledge (the degree to which having previous knowledge and executing cognitive processes are part of the task)
- complexity (the degree to which a task offers difficulty in understanding or has confusing interrelated sub-tasks)
- routine and repetitiveness (the degree to which a task is part of a regular or established procedure characterised by habitual or mechanical performance of tasks)
- physical effort (the degree to which a task requires body strength, co-ordination and skill in order to be performed).

Question 2: Which of the factors that have an impact on the performance of knowledge workers are most widely studied and what is known of their effect?

A total of 85 factors were identified, accounting for more than 145 effect sizes. An overview of all factors and effect sizes is provided in Appendix 3.

Based on the analysis of the 66 included studies, we can assume that, with regard to the performance of knowledge workers, the factors presented in Table 2 are the factors that demonstrated a large effect size (that is, greater than $\rho=0.40$).

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[1] Adapted from: Ramirez, Y.W. (2006) *Defining measures for the intensity of knowledge work in tasks and workers*. Madison, WI: Department of Industrial Engineering, University of Wisconsin-Madison.

Table 2: Factors with a large effect on knowledge workers' performance

Factor	No. of studies	Level of evidence	Mean correlation weighed, by sample size
Social cohesion	40+	C	.49*/.70**
Perceived supervisory support	9	C	.53*
Perceived support for innovation	10	C	.58*
Vision/goal clarity	17	C	.49*
External communication	7	C	.48*
Information-sharing	50+	AA	.51*
Team empowerment	20+	C	.43*/.60**
Psychological safety	100+	B	.43*
Group goals	40+	AA	d=.8 /1.2

Note: * objective vs **subjective (self-rated) performance.

In the following sections, we present findings on:

Question 3: How do these factors enhance the performance of knowledge workers and how can they be measured?

Factor 1: social cohesion

Social cohesion refers to *'a shared liking or attraction to the group, emotional bonds of friendship, caring and closeness among group members, and enjoyment of each other's company'* (Chiocchio 2009). Social cohesion is not a stable trait; it can (and most likely does) change over time in both its form and intensity throughout the processes of group formation, group development, group maintenance and group dissolution (Carron and Chelladurai 1981). Although social cohesion is dynamic, it is unlikely to change dramatically on a moment-to-moment basis.

How does social cohesion enhance performance?

A high level of social cohesion among team members creates a psychologically safe environment in which team members feel free to explore new ways of doing things (Hülsheger et al 2009). The notion that a person is more willing to take risk in a situation in which they have a reliable bond with an important other has been confirmed in other areas of psychology, such as developmental psychology (for example, child development theories suggest that children who are well bonded with their parents engage in more exploratory and learning behaviour). Furthermore, knowledge workers who *'have strong feelings of belongingness and attachment to their colleagues are more likely to cooperate and interact with each [other]'*, and thus more likely to exchange ideas and share information (Hülsheger et al 2009). For example, operating room nurses are more likely to share innovative ideas to improve patient safety with surgeons when there is a high level of social cohesion between these two professional groups.

How can social cohesion be measured?

The level of social cohesion can be measured with the five questions adapted from the Group Cohesion Questionnaire (GCQ, Carless and De Paola 2000), which are listed in Appendix 4.

Factor 2: perceived supervisory support (PSS)

When knowledge workers interact with and receive feedback from their manager (supervisor), they form perceptions of how the manager supports them. This perception is based on how the workers feel the manager helps in times of need, praises the workers or the team for a task well done or recognises them for extra effort. This is known as perceived supervisory support (PSS). A related construct is 'support for innovation', which refers to the expectation, approval and practical support of a worker's attempt to introduce new ways of doing things.

Why does strong supervisory support enhance performance?

The construct of perceived supervisory support stems from the *'norm of reciprocity, which states that people treat others as they [would like to be] treated, repaying kindness with kindness and retaliating against those who inflict harm'* (Brunell et al 2013; Gouldner 1960). Put differently, when a manager helps their employees well in times of need or recognises them for extra effort, the employees will feel inclined to act in a way that is of value to the manager (such as meeting goals and objectives) and thus the organisation as a whole (Edmondson and Boyer 2013; Eisenberger et al 1986). The same applies to the construct of support for innovation: if workers experience approval and practical support for new ways of doing things, they are more likely to experiment and try out innovative solutions (Hüllsheger et al 2009).

How can perceived supervisory support be measured?

The level of perceived supervisory and organisational support can be measured with the six questions adapted from the validated Survey of Perceived Organisational Support (SPOS) by Eisenberger et al (1986), which are listed in Appendix 4.

Factor 3: information-sharing (IS)

Information-sharing (IS) refers to the extent to which teams are utilising the individual members' distinctive knowledge or expertise for the team's benefit. If complex problems have to be addressed, IS is indispensable in that it allows team members to share their knowledge and past experiences and exchange and discuss ideas, which is particularly important for the generation of new ideas (Hülsheger et al 2009).

Transactive memory system (TMS)

An important concept related to IS is that of the transactive memory system (TMS). The concept was originally developed through the observation of dating couples. Researchers noticed that

dating couples in a close relationship treat their partners as an external memory device. TMS within a team refers to a form of knowledge that is embedded in a team's collective memory. This collective memory works like an indexing system that tells members who knows what.

How does IS enhance performance?

It is believed that the more team members share information, the better the group decisions will be, and as a result the better overall group performance (Hackman 1990). In addition IS is believed to increase the awareness of who knows what in the group (TMS). A well-developed TMS is thought to improve team performance because it gives members *'[quick and] coordinated access to one another's specialized expertise'*, enabling them to effectively combine knowledge to solve complex problems (Hsu et al 2012).

How can IS and TMS be measured?

The level of IS and TMS can be measured with the five questions adapted from questionnaires by Bock et al (2005), Choi et al (2010), Lewis (2003) and Bunderson and Sutcliffe (2002), which are listed in Appendix 4.

Factor 4: vision and goal clarity

The notion of vision refers to an idea of a valued outcome that represents a higher-order goal and motivating force at work (Kouzes and Pozner 1987; West 1990). Several studies have demonstrated that a clear vision at the team level tends to have a positive effect on the performance of individual teams as well. In this sense the notion of 'vision' refers to the extent to which knowledge workers have a common understanding of objectives and display high commitment to those team goals. For this reason, 'vison' at the team level is also referred to as 'goal clarity'.

Why does a clear vision and goal clarity enhance performance?

Several researchers have pointed out that for a team to be effective, *'team members need to be committed to team objectives and should share a sense of purpose and responsibility'* (Hülsheger et al 2009). Such commitment can help to point a team of knowledge workers in the same direction, which enhances co-operative and goal-directed behaviour. In addition, clear goals help knowledge workers see connections between their personal values and the values of the team, which increases the degree to which they find meaning in their work (Wright and Pandey 2011). As such, a clear vision and commitment to long-term objectives play an important role in allowing 'freedom to act', while at the same time making sure knowledge workers are responsible for producing results (Simon et al 2011).

How can vision and goal clarity be measured?

The level of vision and (perceived) goal clarity can be measured with the five questions adapted from validated questionnaires by Rainey (1983), Locke et al (1984) and Simon et al (2011), which are listed in Appendix 4.

Factor 5: external communication

External refers to the ability of teams to span boundaries (team and organisational) to seek information and resources from others. Research has demonstrated that the more external communication knowledge workers experience with colleagues outside their team or organisation, the more likely they are to be innovative (Hülsheger et al 2009). For example, a study of over 400 California hospitals over ten years found considerable support for the relationship between interorganisational links and innovation in hospital services and technology (Goes and Park 1997).

How does external communication enhance performance?

External communication enhances the likelihood of obtaining new knowledge and discloses new perspectives. These in turn spark the development of new ideas (creativity) or the adoption of new ways of doing things (innovation). Knowledge worker teams whose tasks require creativity and innovation tend to experience enhanced performance when they undertake external communication (Ancona and Caldwell 1992).

How can external communication be measured?

The level of external communication can be measured with the three questions adapted from validated questionnaires by Teigland and Wasko (2003) and Ancona and Caldwell (1992), which are listed in Appendix 4.

Factor 6: team empowerment

Psychological empowerment refers to the perception that workers can perform their tasks competently and have autonomy to decide how to do their jobs, and that their behaviour makes a difference. As such, team empowerment refers to shared perceptions among team members regarding the team's collective level of empowerment. *'Teams that are more empowered feel that they have more intrinsically meaningful or worthwhile work and, as a group, have a higher degree of choice or discretion in deciding how they carry out their team tasks'* (Seibert et al 2011).

How does team empowerment enhance the level of performance?

Psychological empowerment has been associated with a wide range of outcomes, such as job satisfaction, organisational commitment and turnover intentions. It has been demonstrated, however, that psychological empowerment is also positively related to work performance. It is assumed that psychological empowerment enhances performance *'because it increases 1) the amount of information and control workers have over their work; 2) the level of work-related knowledge, skills, and abilities possessed by employees; and 3) the level of motivation employees have to achieve the goals of the organization'* (Seibert et al 2011).

How can team empowerment be measured?

The level of team empowerment can be measured with the six questions adapted from Kirkman and Rosen's (1999) team empowerment scale, which are listed in Appendix 4.

Factor 7: psychological safety

Psychological safety is a group-level phenomenon that refers to the shared belief held by members of a group that the group is safe for 'interpersonal risk taking' – *'a sense of confidence that [others] will not embarrass, reject or punish someone for speaking up'* (Edmondson 1999). Psychological safety is related to 'intra-team trust', but includes (1) respect for each other's competence, (2) caring about each other as people, and (3) trust in each other's intentions. Amy Edmondson, who first identified the concept of psychological safety in work teams in 1999, emphasises that psychological safety does increase by talking about the need for it or to urge others to trust, because it is determined by the group members' experiences.

How does psychological safety enhance the level of performance?

Psychological safety is assumed to be a prerequisite for group learning. If group members feel psychologically safe, they will (1) be more willing to ask for help, admit an error, seek feedback, and so on, and those actions (2) foster learning in the group, which (3) improves their performance.

How can psychological safety be measured?

The level of psychological safety can be measured with the seven questions adapted from Edmondson's (1999) psychological safety questionnaire, which are listed in Appendix 4.

Factor 8: group goals

In one's personal life, a goal is simply something you are trying to do or achieve. In the domain of management, a goal can be defined as an observational or measurable organisational outcome to be achieved within a specified time limit (Locke and Latham 2002). As such, organisational goal-setting can refer to desired work or business outcomes, as well as the intention or plan to act towards them. Goal-setting is one of the most researched topics in the field of industrial and organisational psychology. A large number of high-quality studies have consistently demonstrated that '*specific, difficult goals yield higher performance than nonspecific ("do-your best") goals, and specific difficult goals yield higher performance than specific easy goals'*. Several studies suggest that setting goals at the group level may yield higher performance than individual goals (Kleingeld et al 2011). In addition, it is assumed that group goals trigger unique motivational mechanisms, such as planning, co-operation, morale-building communication, and collective efficacy within a team.

How do group goals enhance the level of performance?

According to goal-setting theory, goals affect performance through four causal mechanisms. First, *'goals serve a directive function. They direct [an employee's] attention and effort towards goal-relevant activities and away from goal-irrelevant [ones].'* Second, *'goals have an energising function. [As such,] high goals lead to greater effort than low goals.'* Third, *'goals [also] affect persistence. When [employees] are allowed to control the time they spend on a task, hard goals prolong effort.'* Finally, *'goals affect action indirectly by leading to the arousal,*

discovery and/or use of task-relevant knowledge and strategies', which increases the odds for success (Locke and Latham 2002).

4 Conclusion

Knowledge worker productivity is widely studied, and the available evidence is rich in both quantity and quality. Based on this evidence, we conclude that there are a wide range of factors that are associated with knowledge worker productivity, of which social cohesion, perceived supervisory support, information-sharing, vision/goal clarity, external communication, team empowerment, psychological safety and group goals tend to demonstrate the largest associations.

Limitations

To provide a 'rapid' review, concessions were made in the breadth and depth of the search process. As a consequence, some relevant studies may have been missed.

A second limitation concerns the critical appraisal of the studies included: this REA did not incorporate a comprehensive review of the psychometric properties of the tests, scales and questionnaires used.

A third limitation concerns the fact that this REA focused only on the (zero-order) correlations and did not take into account possible moderators and/or mediators that may influence the impact of the effect sizes found.

Finally, this REA focused only on meta-analyses. As a consequence, new, promising findings published in primary studies may have been missed. Given these limitations, care must be taken not to present the findings presented in this REA as conclusive.

References

Ancona, D.G. and Caldwell, D.F. (1992) External activity and performance in organizational teams. *Administrative Science Quarterly*. Vol 37, No 4. pp634–65.

Bock, G.W., Zmud, R.W., Kim, Y.G. and Lee, J.N. (2005) Behavioral intention formation in knowledge sharing: examining the roles of extrinsic motivators, social psychological forces, and organizational climate. *MS Quarterly*. Vol 29, No 1. pp87–111.

Brunell, A.B., Davis, M.S., Schley, D.R., Eng, A.L., van Dulmen, M.H.M., Wester, K.L. and Flannery, D.J. (2013) A new measure of interpersonal exploitativeness. *Frontiers in Psychology*. Vol 4. p299.

Bunderson, J.S. and Sutcliffe, K.M. (2002) Why some teams emphasize learning more than others: evidence from business unit management teams. In: Sondak, H. (ed.). *Research on managing groups and teams: Vol. 4. Toward phenomenology of groups and group membership* (pp49–84). Oxford: Elsevier Science.

Carless, S.A. and De Paola, C. (2000) The measurement of cohesion in work teams. *Small Group Research*. Vol 31, No 1. pp71–88. https://doi.org/10.1177/104649640003100104

Carron, A.V. and Chelladurai, P. (1981) The dynamics of group cohesion in sport. *Journal of Sport Psychology*. Vol 3. pp123–39.

Chiocchio, F. (2009) Cohesion and performance: a meta-analytic review of disparities between project teams, production teams, and service teams. *Small Group Research*. Vol 40, No 4. pp382–420.

Choi, S.Y., Lee, H. and Yoo, Y. (2010) The impact of information technology and transactive memory systems on knowledge sharing, application, and team performance: a field study. *MIS Quarterly*. pp855–70.

Cohen, J. (1988) *Statistical power analysis for the behavioral sciences*. 2nd ed. Hillsdale, NJ: Lawrence Erlbaum Associates.

Davenport, T., Thomas, R. and Cantrell, S. (2002) The mysterious art and science of knowledge-worker performance. *MIT Sloan Management Review*. October.

Drucker, P. (1959) *The landmarks of tomorrow*. New York: Harper & Row.

Edmondson, A. (1999) Psychological safety and learning behavior in work teams. *Administrative Science Quarterly*. Vol 44, No 2. pp350–83. https://doi.org/10.2307/2666999

Edmondson, D.R. and Boyer, S.L. (2013) The moderating effect of the boundary spanning role on perceived supervisory support: a meta-analytic review. *Journal of Business Research*. Vol 66, No 11. p2186.

Eisenberger, R., Huntington, R., Hutchison, S. and Sowa, D. (1986) Perceived organizational support. *Journal of Applied Psychology*. Vol 71. pp500–507.

Goes, J.B. and Park, S.H. (1997) Interorganizational links and innovation: the case of hospital services. *Academy of Management Journal*. Vol 40, No 3. pp673–96.

Gouldner, A. (1960) The norm of reciprocity: a preliminary statement. *American Sociological Review*. Vol 25. pp161–78.

Hackman, J.R. (ed.) (1990) *Groups that work (and those that don't): conditions for effective teamwork*. San Francisco, CA: Jossey-Bass.

Heerwagen, J., Kampschroer, K., Powell, K. and Loftness, V. (2004) Collaborative knowledge work environments. *Building Research and Information*. Vol 32, No 6. pp510–28. doi: 10.1080/09613210412331313025

Hsu, J.S.-C., Shih, S.-P., Chiang, J.C. and Liu, J.Y.-C. (2012) The impact of transactive memory systems on IS development teams' coordination, communication, and performance. *International Journal of Project Management*. Vol 30, No 3. pp329–40. doi: 10.1016/j.ijproman.2011.08.003

Hülsheger, U.R., Anderson, N. and Salgado, J.F. (2009) Team-level predictors of innovation at work: a comprehensive meta-analysis spanning three decades of research. *Journal of Applied Psychology*. Vol 94, No 5. pp1128–45.

Kirkman, B.L. and Rosen, B. (1999) Beyond self-management: antecedents and consequences of team empowerment. *Academy of Management Journal*. Vol 42, No 1. pp58–74. https://doi.org/10.5465/256874

Kleingeld, A., van Mierlo, H. and Arends, L. (2011) The effect of goal setting on group performance: a meta-analysis. *Journal of Applied Psychology*. Vol 96, No 6. p1289. https://doi.org/10.1037/a0024315

Kouzes, J.M. and Pozner, B.Z. (1987) *The leadership challenge*. San Francisco, CA.: Jossey-Bass.

Lewis, K. (2003) Measuring transactive memory systems in the field: scale development and validation. *Journal of Applied Psychology*. Vol 88, No 4. pp587–604.

Locke, E.A., Frederick, E., Lee, C. and Bobko, P. (1984) Effect of self-efficacy, goals, and task strategies on task performance. *Journal of Applied Psychology*. Vol 69, No 2. p241.

Locke, E.A. and Latham, G.P. (2002) Building a practically useful theory of goal setting and task motivation: a 35-year odyssey. *American Psychologist*. Vol 57, No 9. p705. https://doi.org/10.1037/0003–066X.57.9.705

Naisbitt, J. (1982) *Megatrends*. New York: Warner Brooks.

Petticrew, M. and Roberts, H. (2006) *Systematic reviews in the social sciences: a practical guide*. Oxford: Blackwell Publishing.

Rainey, H.G. (1983) Public agencies and private firms: incentive structures, goals, and individual roles. *Administration and Society*. Vol 15, No 2. pp207–42.

Seibert, S.E., Wang, G. and Courtright, S.H. (2011) Antecedents and consequences of psychological and team empowerment in organizations: a meta-analytic review. *Journal of Applied Psychology*. Vol 96, No 5. p981. https://doi.org/10.1037/a0022676

Shadish, W., Cook, T. and Campbell, D. (2002) *Experimental and quasi-experimental designs for generalized causal inference*. Boston: Houghton Mifflin Company.

Shaughnessy, J.J. and Zechmeister, E.B. (1985) *Research methods in psychology*. New York: Alfred A. Knopf.

Simon, M., Staschel, C. and Covin, J.G. (2011) The effects of entrepreneurial orientation and commitment to objectives on performance. *New England Journal of Entrepreneurship*. Vol 14, No 2.

Teigland, R. and Wasko, M.M. (2003) Integrating knowledge through information trading: examining the relationship between boundary spanning communication and individual performance. *Decision Sciences*. Vol 34, No 2. pp261–86. https://doi.org/10.1111/1540–5915.02341

Thomas, B.E. and Baron, J.P. (1994) *Evaluating knowledge worker productivity: literature review*. Interim Report, No FF-94/27, USACERL, pp1–27.

West, M.A. (1990) The social psychology of innovation in groups. In: Farr, J.L. (ed.). *Innovation and creativity at work: psychological and organizational strategies* (pp309–33). Chichester: Wiley.

Wright, B.E. and Pandey, S.K. (2011) Public organisations and mission valence: when does mission matter? *Administration and Society*. Vol 43, No 1. pp22–44.

Appendix 1: Search terms and hits

ABI/Inform Global, Business Source Elite, PsycINFO peer-reviewed, scholarly journals, October 2013			
Search terms	**ABI**	**BSP**	**PSY**
S1: ab(productivity) AND su(meta-analysis)	33	42	18
S2: ab(performance) AND su(meta-analysis)	299	262	264
S3: ab(employee*) OR ab(worker*) OR ab(team*)	87,517	139,500	135,288
S4: S2 AND S3, limit > 1980	**81**	**49**	**17**

ABI/Inform Global, Business Source Elite, PsycINFO peer-reviewed, scholarly journals, May 2019			
Search terms	**ABI**	**BSP**	**PSY**
S1: ab(productiv*) OR ab(perform*)	312,784	445,239	438,353
S2: ab(work*) OR ab(employe*) OR ab(team*)	414,753	510,869	565,736
S3: S1 AND S2	83,977	102,518	86,745
S4: ti(meta-analy*) OR ab(meta-analy*) OR ti('systematic review') OR ab('systematic review')	7,894	8,270	na
S5: S3 AND S4, limit > 2010	**514**	**289**	**580**

Appendix 2: Selection of studies

Study selection, 2013

ABI Inform n=81	BSP n=49	PsycINFO n=17

duplicates *n*=58	←	Articles obtained from search n=147

excluded *n*=37	←	Titles and abstracts screened for relevance n=89

excluded *n*=17	←	critical appraisal & text screened for relevance n=52

included studies
n=3 5

Study selection, 2019

ABI Inform n=514	BSP n=289	PsycINFO n=580

duplicates *n*=342	←	Articles obtained from search n=1,383	→	included in '13 *n*=46

excluded *n*=929	←	Titles and abstracts screened for relevance n=995

excluded *n*=22	←	critical appraisal & text screened for relevance n=66

included studies
n=4 4

Appendix 3: Critical appraisal – factors associated with performance

Variable	Performance outcome	Knowledge work	Impact	ρ	k	Level	1st author & year
Task cohesion Shared commitment or attraction to the group task or goal as well as motivation to co-ordinate team efforts to achieve common work-related goals	Team performance (Hard outcome measures)	+	++	.38	185		
		-	-	.12	21		
Social cohesion Shared liking or attraction to the group, emotional bonds of friendship, caring and closeness among group members, enjoyment of other's company or social time together	Team performance (Hard vs Behavioural)	+	+++	B=.70 H=.49	40 30	C	Chiocchio, 2009
		-	++	B=.30 H=.14	160 131		
Group cohesion The commitment of team members to their work team and their desire to maintain group membership	Team innovation Team performance	+	++	I=.30 P=.19/.35	11 51 15	C/B	Hülsheger, 2009 Gully, 2012 Mathieu, 2015
Team member exchange (TMX) Horizontal relationships among team memberships	Team performance		+	.25	27	C	Banks, 2014
Teamwork training Teamwork refers to the range of interactive and interdependent behavioural processes among team members that convert team inputs into outcomes	Team performance	+	+++	d=.92	72	AA	McEwan, 2017
Interpersonal ties (instrumental and expressive) Patterns of informal connections (ties) among individuals within a team	Team performance	+	+	I=.15 E=.22	17 9		Balkundi, 2008
Collectivism Loyal to their in-group and sacrifice for the sake of the group	Team performance	+	+	.25	14		Bell, 2007
Team agreeableness Considerate, trusting, friendly: the degree to which team members engage in positive interpersonal processes	Team performance	+	+	.12	29		

	Outcome						Reference
Job-relevant /task-related diversity The heterogeneity of team members with respect to job- or task-related attributes, such as function, profession, education, tenure, knowledge, skills or expertise	Team innovation	+	+	.16 .20	15 3		Horwitz, 2007
				<.1	18		van Dijk, 2011
	Team performance	+/-	0	<.1	24		Horwitz, 2007
					48		Joshi, 2009
					55		van Dijk, 2011
Background /bio-demographic diversity Non-task-related differences such as age, gender or ethnicity	Team innovation	+	-	.13	8		Horwitz, 2007
				<.1	19		van Dijk, 2011
	Team performance	+/-	0	<.1	17		Horwitz, 2007
					69		Joshi, 2009
					84		van Dijk, 2011
					74	C	Schneid, 2016
Role ambiguity Lack of input from the environment to guide behaviour	Employee performance	+/-	-	−.24	114		Gilboa, 2008
Role/task conflict Situation of conflict over task assignments, as well as the scheduling of delivery Disagreements among team members about the content of the tasks being performed, including differences in viewpoints, ideas and opinions	Employee performance	+/-	-	.10	112		Gilboa, 2008
	Team innovation	+	0	<.1	13	C	Hülsheger, 2009
	Team performance	+/-	0	<.1	95		De Wit, 2012
Relationship conflict Social emotional conflicts stemming from interpersonal disagreements	Team innovation	+	0	<.1	6	C	Hülsheger, 2009
	Team performance	+	-	.16	80		De Wit, 2012

Employee satisfaction **Employee engagement**	Business unit performance	+/-	+	.22 .22	42?		Harter, 2002
Perceived organisational support	Individual task performance	+/-	+	.16/.23	80	C	Riggle, 2009 Kurtessis, 2017
Perceived supervisory support (*=boundary spanners, **=non-boundary spanners)	Employee performance	+/-	+/+++	.53* .18**	54	C	Edmondson, 2013
Support for innovation The expectation, approval and practical support of attempts to introduce new and improved ways of doing things in the work environment	Individual innovation Team innovation	+	+ +++	.26 .58	17 10	C	Hülsheger, 2009
Organisational commitment (affective/attitudinal)	Performance (white collar vs blue collar)	+/-	+	WC=.20 BC=.10	844		Riketta, 2002
Organisational identity The psychological bonds employees form with their work teams and organisations	Team performance		++	.31	39	C	Mesmer-Magnus, 2018

Family to work conflict	Employee performance	+/-	-	.19	10		Hoobler, 2010
				.13	10		
Work to family conflict			-				
				.12	12		Gilboa, 2008
Age	Performance (obj, subj, innovation, creative)	+/-	0	<.1	118		Ng, 2008
					95		Ng, 2013
Trait mindfulness The existence of a dispositional tendency toward mindfulness	Individual job performance		++	.34	270	C	Mesmer-Magnus 2017–1
Interpersonal competition	Individual task performance		0	<.1	65	C	Murayama, 2012
Organisational justice climate O=Overall; D=Distributive; P=Procedural; I=Interactional Employees' perceptions of how fairly they are treated by organisational authorities, including distinct perceptions of organisational decisions (that is, distributive justice), organisational decision-making procedures (that is, procedural justice), and the quality of interpersonal treatment received as part of these procedures (that is, interactional justice)	Team performance	+/-	++/ +++	O=.35 D=.50 P=.32 I=.34	22 6 21 7	C	Whitman, 2012
	Team effectiveness			O=.40 D=.42 P=.34 I=.50	38 9 34 11		

Construct	Outcome			Effect	N	Grade	Source
Team transactive memory TC: The manner in which knowledge important to team functioning is mentally organised, represented and distributed within the team and allows team members to anticipate and execute actions TTM: form of cognitive architecture that encompasses both the knowledge uniquely held by particular group members with a collective awareness of who knows what	Team (task) performance (objective)	+	++	.45	39	AA	Turner, 2014 DeChurch, 2010 Mesmer-Magnus, 2017–2 Bachrach, 2019
	Team performance (subjective)			.44	19 28	C	
	Team performance (creative)			.42	27		Bachrach, 2019
Team shared mental models	Team performance	+	++	.39	18	AA	Turner, 2014
Cognitive consensus	Team performance	+	++	.42	18	AA	Turner, 2014
Information-sharing	Team performance (general)	+	+++	.51	18	AA	Turner, 2014
	Team performance (objective)			.21	8		Mesmer-Magnus, 2009
	Team performance (subjective)			.51	4		
Information elaboration	Team performance	+	+++	.52	150	AA	Marlow, 2018
Knowledge-sharing	Team performance	+	++	.44			
Job crafting Proactive work behaviour that involves employees actively changing the (perceived) characteristics of their jobs	Individual task performance		++	R_2=.12	122	C	Rudoph, 2017
Occupational future time perspective Employees' perceptions of their future in the employment context	Individual task performance		+	.11	40	B	Rudolph, 2018

Positive/negative state affects Emotions, moods and dispositions	Individual job performance		+	n=−.14 p=.20	114	C	Shockley, 2012
Detachment from work The individual's sense of being away from the work situation	Individual job performance		0	<.1	91	C	Wendsche, 2017
Meaningful work The global judgement that one's work accomplishes significant, valuable or worthwhile goals that are congruent with one's existential values	Job performance (self-rated)		++	.33	5		Allan, 2019
Psychological capital Refers to the four positive psychological resources: hope, optimism, efficacy and resilience	Employee performance (objective)		+	.26	51		Avey, 2011
Team size	Team performance	+/-	0	<.1	26		Stewart, 2006
Team composition	Team performance		-	−.14	428	D	Carter, 2019
Team longevity	Team innovation	+	0	<.1	10	C	Hülsheger, 2009
Hierarchy Vertical differences between members in their possession of socially valued resources	Team performance		0	<.1	54	C	Greer, 2018
Role overload Refers to a situation in which work demands exceed the available resources to meet them	Employee performance	+/-	0	<.1	40		Gilboa, 2008
Team conscientiousness Hardworking, achievement-oriented, persevering, punctual	Team performance	+	+	.11	39		Bell, 2007
Perceptions of organisational politics	Task performance	+/-	-	−.20	14		Chang, 2009

Construct	Outcome			Effect	N	Cat	Reference
				−.11	20		Miller, 2008
Individual empowerment (psychological) Intrinsic task motivation reflecting a sense of control in relation to one's work and an active orientation to one's work role that is manifest in four cognitions: meaning, self-determination, competence and impact.	Task performance (self-rated)	+/-	+++	.54	12 (s)		
	Task performance (non-self-rated)	+/-	+	.27	22 (s)		
	Innovation at work	+/-	++	.33	9 (s)	C	Seibert, 2011
Team empowerment Refers to shared perceptions among team members regarding the team's collective level of empowerment	Task performance (self-rated)	+/-	+++	.60	6 (s)		
	Task performance (non-self-rated)	+/-	++	.43	18 (s)		
Empowering leadership	Task performance (individual > objective) (team > other rated)		+	I=.08 T=.24	27	C	Lee, 2018
Participative safety Participative safety is characterised by two components: participation in decision-making and intragroup safety.	Individual innovation	+	+	.17	17	C	Hülsheger, 2009
	Team innovation			.15	15		
Leader–member exchange (LMX) Vertical relationships among supervisors and subordinates	Team performance		+	.25	27	C	Banks, 2014
	Objective task performance		+	.24	146 to 19	C	Martin, 2016
Leader–member exchange (LMX) differentiation	Objective performance			0	<.1	41	C	Yu, 2018
	Subjective performance						
	Creative performance						
Team trust	Team performance	+	+	.33	112	B/C	Breuer, 2016 De Jong, 2016

Psychological safety The belief that the workplace is safe for interpersonal risk-taking	Task performance Information-sharing		+++	.43 .52	136	B	Frazier, 2017

Degree of virtual collaboration	Team performance	+	0	<.1	30		Ortiz, 2012
	Knowledge-sharing	+	-	.22	7		

Team-building components
  1 Goal-setting
  2 Interpersonal relations
  3 Problem-solving
  4 Role clarification
	Team performance	+/-	++	1=.37
				2=.26
				3=.24
				4=.35
					10
					13
					11
					5
							Klein, 2009

Job insecurity	Employee performance	+/-	-	.21	15		Cheng, 2008
				.14	11		Gilboa, 2008
Team openness to new experiences	Team performance	+	0	<.1	25		Bell, 2007
Employee turnover	Organisational performance	+ & -	0	<.1	48		Hancock, 2011
Task orientation Also called climate for excellence: a shared concern with excellence of quality of task performance in relation to shared vision or outcomes	Team innovation	+	++	.42	18	C	Hülsheger, 2009
Group goals (specific, difficult vs non-specific, and egocentric vs group-centric)	Group performance	+/-	+++	spec & diff: d=.8 group centr. d=1.2	49	AA	Kleingeld, 2011

Vision The extent to which team members have a common understanding of objectives and display high commitment to those team goals (syn: goal clarity or commitment to objectives)	Team innovation	+	+++	.49	17	C	Hülsheger, 2009
Internal communication Sharing of information and ideas within one's own team	Team innovation	+	++	.36	13	C	Hülsheger, 2009
External communication Sharing of information and ideas with people outside the team or organisation		+	++	.48	7		
Sense of humour Employees/leaders	Employee performance	+/-	++	E=.36 L=.16	3 9		Mesmer-Magnus, 2012
Task-focused leadership	Objective team performance	+/-	+	.19	89	C	Burke, 2006
Person-focused leadership		+/-	+	.18	89		Ceri-Booms, 2017
Shared leadership	Team performance	+/-	++	.21 .35	50 467	C	D'Innocenz, 2016a Nicolaides, 2014
	Subjective performance			.22	42	C	Wang, 2014
	Objective performance			.18			
Transformational leadership	Task performance (self-report & non-self-report)		++	s=.4 ns=.25	600	C	Ng, 2017

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Task interdependence The extent to which team members are dependent on one another to carry out their tasks and perform effectively	Team innovation	+	0	<.1	4	C	Hülsheger, 2009
Goal interdependence The extent to which team members' goals and rewards are related in such a way that an individual team member can only reach their goal if the other team members achieve their goals as well			++	.28	5		
Telework	Productivity (perceived)	+	+	.23	5		Harker, 2001
Flexible work (telecommuting)	Employee performance (self-rated)	+	0	<.1	9		Gajendran, 2007
	Employee performance (objective)	+	+	.18	4		
Flextime work (schedules)	Productivity	+/-	++	d=.45	4		Baltes 1999
	Performance (self-rated)	+/-	0	d=.04	5		
	Productivity	+/-	0	d=.04	4		
Compressed work schedules	Performance (supervisory rated)	+/-	++	d=.4	4		
Preference for teamwork	Team performance	+	+	.18	10		Bell, 2007
Voice Employee suggestions regarding opportunities and initiatives to improve future organisational functioning	Job performance		++	.30	189	C	Chamberlin, 2017

Situational constraints	Employee performance	+/-	-	.19	8		Gilboa, 2008
Emotional intelligence	Team performance	+	+	.18	6		Bell, 2007
Organisational cynicism Negative attitude toward one's employing organisation	Job performance (self-report)	+/-	0	<.1	4		Chiabaru, 2013
Intrinsic motivation	Performance quality	+/-	++	.35	183	C	Cerasoli, 2014
	Performance quantity			.26			
Intrinsic motivation and direct incentives	Performance			.30			
Intrinsic motivation and indirect incentives	Performance			.45			
Financial incentives (individual and team-based)	Job performance		++	g=.32 (ind) g=.45 (team)	146	A	Garbers, 2014
Collective pay for performance	Performance (financial, operational)		0	<.1	41	C	Nyberg, 2018
Employee ownership (for example employee stock ownership plans)	Firm performance		0	<.1	102	C	O'Boyle, 2017

Appendix 4: Measures for knowledge work performance

Below is a selection of measures that can be used to measure critical factors affecting performance in knowledge work. We recommend using the following 'tried and tested' questionnaire items, as they have been validated in scientific research.

The level of each factor can be scored as follows: strongly agree = 5; somewhat agree = 4; neither agree nor disagree = 3; somewhat disagree = 2; strongly disagree = 1. When the aggregate team score is low (for example below 3.5), this is a strong indication for low team performance.

Social cohesion

Example measures from the Group Cohesion Questionnaire (GCQ, Carless and De Paola 2000):

1   Members of our team like to spend time together outside of work hours.
2   Members of our team get along with each other.
3   Members of our team would rather get together as a team than go out on their own.
4   Members of our team defend each other from criticism by outsiders.
5   Members of our team help each other on the job.

Perceived supervisory support

Example measures from the Survey of Perceived Organisational Support (SPOS) by Eisenberger et al (1986):

1   My supervisor is willing to extend him/herself in order to help me perform my job the best of my ability.
2   My supervisor takes pride in my accomplishments at work.
3   My supervisor tries to make my job as interesting as possible.

Support for innovation

Example measures from Team-level Predictors of Innovation at Work by Hülsheger et al (2009):

1   People in this team are always searching for fresh, new ways of looking at problems.
2   In this team we take the time needed to develop new ideas.
3   People in the team cooperate in order to help develop and apply new ideas.

Information-sharing

Example measures from Bock et al (2005) and Bunderson and Sutcliffe (2002):

1   Our team members share their work reports and official documents with other team members.
2   Our team members share their experience or know-how with other team members.
3   Information to make key decisions is freely shared among the members of the team.

Transactive memory system

Example measures from Choi et al (2010), Lewis (2003) and Bunderson and Sutcliffe (2002):

1   Our team members trust that other members' knowledge is credible.
2   Our team members are confident of relying on the information that other team members bring to the discussion.

External communication

Example measures from Teigland and Wasko (2003) and Ancona and Caldwell (1992):

1   Our team members use information obtained from external teams every day.
2   Our team is contacted by outside teams for knowledge and information.
3   Our team scans the external environment for ideas and solutions.

Vision/goal clarity

Example measures from Rainey (1983), Locke et al (1984), and Simon et al (2011):

1   This team has clearly defined goals.
2   Our team goals are clear to everyone who works here.
3   It is easy to explain the goals of this team to outsiders.
4   I have specific, clear goals to aim for in my job.
5   If I have more than one goal to accomplish, I know which ones are most important and which are least important.

Team empowerment

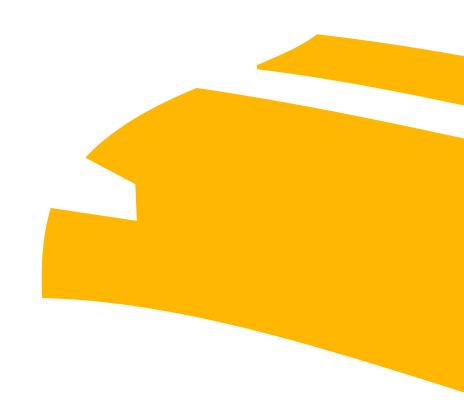*Example measures from Kirkman and Rosen's (1999) team empowerment scale:*

1   Our team can select different ways to do its job.
2   Our team determines how things are done.
3   Our team feels a sense of freedom in what it does.
4   Our team determines as a team what things to do.
5   Our team makes its own choices without being told by management.
6   Our team has a lot of choice in what it does.

Psychological safety

Example measures from Edmondson's (1999) psychological safety questionnaire:

1   When someone makes a mistake in this team, it is often held against him or her.
2   In this team, it is easy to discuss difficult issues and problems.
3   In this team, people are sometimes rejected for being different.
4   It is completely safe to take a risk on this team.
5   It is difficult to ask other members of this team for help.
6   Members of this team value and respect each other's contributions.

CIPD