Building a Data Literate Business Workforce

Marketa Smolnikova[a]

Department of Information Technologies, Prague University of Economics and Business,
W. Churchill Sq. 4, Prague, Czech Republic

Keywords: Data Literacy, Data Strategy, Competency Model, Strategic Management.

Abstract: Data literacy and problem-solving with data has been a hot topic in the academic, government as well as business world for several years. However, the current research hasn't provided companies and organizations with a specific or easy-to-follow guide how to enhance data literacy of the most proliferated business roles. This paper aims to map what different business roles require to do with data in their work tasks and to propose a way how to improve data literacy of these roles by focusing on the right competences. To fulfil these aims, authors analyzed job tasks of the most generic business roles to derive their objectives regarding the use of data and gathered feedback from businesses via a preliminary web-based survey. Consequently, mapping of the distinct data literacy competencies and priority work objectives of the selected job roles serves as a manual where to focus training efforts to enhance company's data literacy. This theoretical framework could be further improved by a real-time automatic evaluator of the survey respondents' inputs which would deliver recommendations towards priority data literacy competencies customized to a respondent's response.

1 INTRODUCTION

The use of data in business is motivated by numerous incentives – to create new revenue streams or generally stay competitive by improving the product development, the customer service, the operational excellence, or discovery of new markets (Lim et al. 2018, IE University 2019, Slansky 2019, Balakrishnan et al. 2020). It must be said that according to Ransbotham et al. (2016) realizing a competitive advantage with data is becoming harder and harder as many companies have been successfully exploiting the data commodity and staying ahead of the industry thanks to data requires much more effort and investments than ever before.

To achieve the aforementioned goals, we identified two general factors that companies must deal with – the ability to extract value from data (Accenture 2019, Balakrishnan et al. 2020, Engler 2020) and the strategic use of this data incorporated in the company's culture (Ross et al. 2013, Fergusson 2014, Accenture 2019). Beside technology and the data itself, the organizational ability to derive value from data requires appropriate workforce skills (Gekara, Thanh Nguyen 2018) as well as set data

management rules. The second factor depends on cultivating a data-driven culture (Fosso Wamba et al. 2020), having and implementing a clear strategy to unlock the data potential (Dallemule, Davenport 2017, KPMG 2019) and the ability to translate analytics into business outcomes (Kiron et al. 2015, Ransbotham et al. 2016, Lin, Kunnathur 2019).

By decomposing these basic success factors, it seems straightforward what to focus on even though this general approach certainly needs to be adjusted to different business fields. Nevertheless, the implementation falls behind the theory and the current research emphasizes these barriers to the data use excellence – lacking the right skills at different organizational levels (Ransbotham et al. 2016, Bersin, Zao-Sanders 2020, WEF 2020), missing the analytical culture in terms of values, approach or a leadership support (Fergusson 2014, WEF 2020) and lacking a solid data strategy and its implementation (Dallemule, Davenport 2017, Accenture 2019).

Even though the research of the general necessary data skills or rather data literacy, an ability to understand and make use of data, has been on the rise along with many commercial initiatives (Ridsdale 2015, Frank et al. 2016, Wolff et al. 2016,

---

[a] https://orcid.org/0000-0002-2631-920X

Bonikowska et al. 2019, QlikTech 2020, Data to the People 2021, Jones 2021), it hasn't been able to define knowledge and skill necessities for different business roles (Wolff et al. 2016, QlikTech 2020). However, we believe this specification is a steppingstone for the successful enhancement of data literacy in companies as it would offer a concrete manual for the management on which skills to focus their training efforts. Therefore, this paper aims to propose a way how to map what different business roles require to do with data in their work tasks and to improve data literacy of these roles by focusing on the right competences.

2 DEFINING DATA LITERACY NEEDS FOR DIFFERENT BUSINESS USERS

The journey of building a data literate workforce starts with defining what data skills the employees need to have to fulfil their work tasks. As QlikTech in cooperation with Accenture suggest in their report The Human Impact of Data Literacy (2020), "*different groups (of employees) will be accountable for creating value with data in different ways*". This calls for specification of generalized types of data users which allows to group diverse occupations by common characteristics in handling data and consequently to strategically focus on upskilling of these newly defined groups.

2.1 Data Roles in the Literature

We can find a few of such efforts in the recent literature. In the pursuit of establishing a common ground for data literacy teaching and learning Wolff et al. (2016) identified four types of data literate citizens – *Readers* who identify the need to consume and interpret an increasing amount of data, *Communicators* whose main mission is to gain insight into data and help others understand these interpretations, *Makers* (or *Hobbyists*) who acquire ad-hoc advanced data skills according to their focus of innovation in order to contribute to solving a real-world problem and *Scientists* representing data specialists whose occupation requires strong technical skills related to handling data. However, these roles were defined for the public in the context of smart cities projects and don't reflect the needs of business data users whose motivation to work with data or goals to achieve with data may differ from

these roles. Also, the roles as stated in Wolff et al. (2016) may overlap in the business environment.

QlikTech and Accenture (2020), on the other hand, differentiate four types of users typical for companies – *Business Users* are identified as consumers of simply presented information which is necessary for their work, *Analyst Users* are more inquiring and provide Business Users with deeper explanations of "why", *Discovery Users* focus on the innovation enabled by data for which they need to apply advanced technical skills and *Data Scientists* are occupied with enhancing and developing data models. These roles already cover the data task needs we can typically encounter in the business environment, and they may serve as a basic categorization for the company's data literacy strategy as these roles won't be so prone to significant changes compared to constantly evolving data skills. Nevertheless, their one-sentence-long specification doesn't offer to the management responsible for company's data strategy and workforce's level of skills sufficient instructions or a straightforward manual for upskilling the employees.

As Bersin and Zao-Sanders (2020) pointed out: "*Too frequently, general-purpose corporate learning systems start off claiming to do everything for everyone and, lacking a tangible purpose, end up doing little for anyone*". That is why we need to focus on specific job-related skills. On that account, the aim of this research is to define necessary data literacy competences for business workforce at the level of required knowledge and skills and to map these competences to the most generic business roles which would facilitate companies' data strategy development regarding employee training plans.

2.2 Data Literacy Needs in the Business Environment

Our research focuses on data literacy of business workforce – different levels of managers and generic office job roles like marketing specialists, financial accountants, or sales representatives. It arises from a hypothesis that work tasks of different business roles require different data literacy competencies. To fulfil the research aims, the research is divided into two steps. Firstly, we inquired into the needs of selected business roles to deal with data in their work tasks via a web-based survey. Secondly, we linked the identified business needs with knowledge and skills related to handling data – competencies in our data literacy competency model.

2.2.1 Data Literacy Objectives

We defined the work objectives of selected business roles that are achieved by working with data and get the feedback of a broad group of business users on those instead. These objectives require a certain level of data knowledge and skills to be successfully achieved, thus we call them the data literacy objectives.

Our goal was to examine the data literacy objectives of the most generic business roles. Therefore, we needed to identify the most often represented business functions in companies, to select the representative roles of these functional departments and to derive the data literacy objectives for the selected roles. The distinct job roles used in our survey were derived from The Occupational Information Network (O*NET) which serves as a public database of almost 1,000 occupations that cover the entire U.S. economy, and which is developed under the sponsorship of the U.S. Department of Labor/Employment and Training Administration.

Afterwards, each job task of the listed O*NET occupations was analyzed in the optics whether the task was realized based on working with data and we could mark it as a data task. By further analysis of the marked data tasks of managerial occupations, we arrived at the conclusion that the data literacy objectives (the work objectives which are achieved with these data tasks) are the same for executive and mid-level management and the business function they represent didn't play a significant role in specifying these objectives. Nevertheless, we expected that these two levels of managers could assign different priority to the same objectives. These conclusions then led to the establishment of an executive management role (C-suite level managers and directors) and a mid-level management role and a set of managerial data literacy objectives which are presented in Table 1.

Table 1: Managerial Data Literacy Objectives.

Managerial Data Literacy Objective	Full Description
To ensure collection of the right data	To ensure collection of relevant data (internal and also external if applicable) to support solving a specific business problem
To have available relevant data	To have available relevant data (internal and also external if applicable) to resolve a certain business problem/to make qualified decision in that matter
To be able to trust the company's data	To be confident about the evidence the company's data is telling
To identify problems, causes or opportunities	To identify a change in data while monitoring reports and dashboards on day-to-day basis
To derive actionable insights	To discover the pattern in data or a relationship between variables that you didn't previously know existed. To be actionable, these findings need to provide insight into the "why" of the finding.
To monitor company data and evaluate information	To monitor company data for a selected domain and evaluate information from data analysis in a given context
To inform decisions and to be able to direct	To use data and insights to make qualified decisions and to manage the assigned department or unit
To be able to plan	To plan company's/department's future needs as well as revenues
To be able to forecast or predict future development	To predict expectable outcomes and events that can ifluence company's strategy
To control accuracy of the company's data and reports	To ensure data reliability by giving feedback to report builders and database administrators on company's data accuracy
To ensure compliance with regulatory requirements	To ensure that the company's sensitive digital assets are guarded to meet legally-mandated minimum standards or to ensure reporting legally required data to the designated authority
To back ideas and decisions with evidence	To support ideas or decisions with evidence when presenting at meetings, consulting or negotiating with others
To convicingly and compellingly present information from data	To win others over for your business objectives by compelling data storytelling based on evidence (no faked or distorted data)
To keep a competitive advantage in a data-centric business environment	To keep a sustainable competitive advantage in a data-centric business environment by identifying and implementing emerging data analytics scenarios to deliver business innovation

When analyzing the data tasks of operational level occupations, we identified two groups of data users – while the occupation like *Accountant* is supposed to focus on the correct data entry, the compliance with regulatory requirements or analyzing discrepancies in data, *Market Analysts* can be also responsible for gathering external data, cleaning and transforming data and preparing complex reports and dashboards. It is obvious that these roles will require different data literacy skills to achieve their work objectives. But for simplicity of the survey and the opportunity to identify more advanced analytical roles in the current business environment despite the O*NET database not proposing so at the moment, we summarized all possible data literacy objectives of operational roles inTable 2.

2.2.2 The Survey

The collection of a preliminary survey responses was underway in November and December 2021. The survey took a form of a web-based questionnaire accompanied by a dedicated webpage with detailed description of the survey and the evaluated objectives

for managerial and operational roles. The respondent's pool was generated primarily from alumni and corporate partners of our university.

As we recognize that different business roles can have different objectives and different priorities regarding data analysis aims, we asked the survey respondents to confirm or disprove the data literacy objectives listed for their business role and to assign priority to each of them on the 5-point Likert scale from Very Low to Very High. The operational level of R&D occupations as well as academic occupations were not subjects of the survey for its specificity regarding the role of data in their work tasks. We believe that these roles deserve their own data literacy research.

2.2.3 Data Literacy Competency Model

Data literacy encloses all the competencies that are required for working with data. It has two sides of a story – a knowledge part (what is needed to know) and a skills part (what is needed to be able to do). In our perspective, data literacy is "an ability to understand data and to make use of data" with emphasis on the context it is used within (Smolníková

Table 2: Operational Data Literacy Objectives.

Operational Data Literacy Objective	Example
To record, store and maintain data	Using accounting software to record, store, and maintain data about receivables and liabilities
To ensure correct data entry	Checking figures, correct customer codes or invoice codes while entering or reviewing financial data
To collect data for analysis	Gathering data on competitors or conducting research on consumer opinions
To clean and transform data	Cleaning and transforming collected data into a target structure (e.g. for a specific visualization method or for appropriate reporting data model)
To comply with regulatory requirements	Maintaining and submitting financial data to authorities in compliance with regulations
To monitor and verify discrepancies in data	Monitoring status of loans and accounts to ensure that payments are up to date
To analyze and evaluate data	Examining all relevant information to assess validity of customer complaints and determine possible causes OR evaluating employee selection techniques by reviewing data of supervisors' satisfaction with the hired candidates
To prepare reports and dashboards	Compiling budget data and documents and preparing summary reports in spreadsheets or visualizing data with tables and charts in data visualization tools
To propose ideas and give recommendations based on evidence	Conferring with management to develop or implement personnel policies based on data about employee fluctuation
To inform decisions	Determine depreciation rates to apply to capitalized items or redesigning the movement of goods to maximize value and minimize costs based on logistics data

et al. 2021). We focus on defining necessary data literacy competencies for business workforce – managers at any level and generic business roles like accountants, marketing specialists or HR specialists.

Our model is a result of a synthesis of several existing models of data literacy competencies (Prado, Marzal 2013, Ridsdale et al. 2015, Grillenberger, Romeike 2018) which were evaluated in the context of usefulness for our target audience. We identified five categories of competencies in which knowledge areas (A and B sections) represent ability to understand basic concepts necessary for data analysis and skills areas (C, D and E sections) cover ability to apply those concepts in real-case data scenarios.

- A. Data Concepts, Ethics, and Protection
- B. Analytical Principles and Methods
- C. Data Collection and Preparation
- D. Data Analysis and Evaluation
- E. Data Interpretation, Communication and Decision-Making

We also assumed two levels of mastery within these competencies. First level should preferentially cover *data analytics consumer* needs, while the second level comprises of the first level competencies and adds up especially data preparation skills to prepare a person to become *a data analytics power user*.

3 RESULTS

By the end of November 2021, we acquired 53 responses to the survey out of which 32 respondents were operational level employees and 21 respondents were managers at different levels (1 CEO, 1 self-employed owner, 4 CXOs, 6 directors or equivalent, 9 managers or equivalent). More than half of the respondents was from companies with more than 1000 employees (60 %). Respondents from small companies (up to 49 employees) represented only 11 %. Despite of the pervasive number of operational level employees among respondents, more than a half of respondents (53 %) has more than 5 years' experience at their position.

From the perspective of respondents' industry background, these fields were the most pervasive: Information Technology (17), Manufacturing (11), Retail and Wholesale Trade (6), Banking and Financial Services (4) and Education (4). As we intentionally also collected responses from data specialists to compare whether they tend to be biased and simply indicate every data literacy objective as highly important and to use their requirements of Business Intelligence/Data Analysts as the opposite

pole to the researched (more administrative) positions, Data Analytics department (10) is along with Marketing & Sales department (10) the most represented. They are followed by other IT departments (9), Human Resources (6), Operations & Production (4) and R&D (3). 75 % of respondents' companies operate in the Czech Republic, 11 % in Germany and 8 % in the USA. Visualized results for the further analysis are available online (see References – Smolníková 2022).

3.1 Managerial Data Literacy Objectives

The managerial data literacy objectives were evaluated only by respondents at managerial positions. The objectives' priority was assessed for 2 levels - chief executives & directors and mid-level management. The results for the first group are visualized in Figure 1, for the second in Figure 2. The survey results in Figure 1 suggest that the chief executives' and directors' highest priority is to reach these work objectives with data:

- To inform decisions and to be able to direct (80 % responses of Very high priority)
- To be able to trust the company's data (70 % responses of Very high priority)
- To be able to forecast or predict future development (70 % responses of Very high priority)
- To have available relevant data (65 % responses of Very high priority).

The top priority objectives for mid-level management (Figure 2) are less definite compared to executive level objectives, however, we can still identify several high priority objectives:

- To have available relevant data (65 % responses of Very high priority)
- To be able to trust the company's data (50 % responses of Very high priority)
- To identify problems, causes and opportunities (50 % responses of Very high priority)
- To inform decisions and to be able to direct (65 % responses of High priority)
- To ensure collection of the right data (50 % responses of High priority)

Besides the top priorities, we can see tendencies regarding certain objectives – while objectives *To ensure collection of the right data, To monitor the company's data and evaluate information* and *To control accuracy of the company's data and reports*

Managerial objective	None	Very low	Low	Medium	High	Very high
To ensure collection of the right data	5,00%			30,00%	35,00%	30,00%
To have available relevant data	5,00%			5,00%	25,00%	65,00%
To be able to trust the company's data				5,00%	25,00%	70,00%
To identify problems, causes or opportunities				10,00%	35,00%	55,00%
To derive actionable insights				20,00%	30,00%	50,00%
To monitor the company's data and evaluate information			5,00%	40,00%	35,00%	20,00%
To inform decisions and to be able to direct					20,00%	80,00%
To be able to plan				15,00%	40,00%	45,00%
To be able to forecast or predict future development					30,00%	70,00%
To control accuracy of the company's data and reports			10,00%	35,00%	40,00%	15,00%
To ensure compliance with regulatory requirements		5,00%	25,00%	35,00%	15,00%	20,00%
To back ideas and decisions with evidence			5,00%	20,00%	45,00%	30,00%
To convincingly and compellingly present information from data			5,00%	15,00%	50,00%	30,00%
To keep a competitive advantage in a data-centric business environment			5,00%	20,00%	30,00%	45,00%

Figure 1: Priority data literacy objectives for CXOs and directors.

Managerial objective	None	Very low	Low	Medium	High	Very high
To ensure collection of the right data				10,00%	50,00%	40,00%
To have available relevant data				5,00%	30,00%	65,00%
To be able to trust the company's data				15,00%	35,00%	50,00%
To identify problems, causes or opportunities				5,00%	45,00%	50,00%
To derive actionable insights				35,00%	45,00%	20,00%
To monitor the company's data and evaluate information			5,00%	10,00%	50,00%	35,00%
To inform decisions and to be able to direct				10,00%	65,00%	25,00%
To be able to plan				25,00%	45,00%	30,00%
To be able to forecast or predict future development			5,00%	25,00%	40,00%	30,00%
To control accuracy of the company's data and reports	5,00%		15,00%	15,00%	50,00%	15,00%
To ensure compliance with regulatory requirements	10,00%	10,00%	10,00%	25,00%	25,00%	20,00%
To back ideas and decisions with evidence				20,00%	45,00%	35,00%
To convincingly and compellingly present information from data			5,00%	30,00%	30,00%	35,00%
To keep a competitive advantage in a data-centric business environment	5,00%		10,00%	25,00%	40,00%	20,00%

Figure 2: Priority data literacy objectives for mid-level management.

are more important for mid-level managers, objectives like *To create actionable insights, To convincingly and compellingly present information from data* and *To keep a competitive advantage in a data centric business environment* play a more important role in executive management.

Regarding the influence of data analytics background on managerial objectives, there are not enough respondents at managerial position in the results to make any statistical inferences.

3.2 Operational Data Literacy Objectives

In contrast to the managerial objectives, the operational data literacy objectives could be evaluated by both the operational level employees and managers at any level. Nevertheless, the employees were in the evaluation far more numerous. Given the representation of data specialists in the sample, the highest number of evaluations was received by the role of Business Intelligence/Data Analysts (9). It is followed by Marketing Specialists/Marketing Analysts and Sales Representatives which have the same number of evaluations (7) as they both represent the same department (Marketing & Sales) and thus got assessed together. Project Management Specialists with 7 evaluations are also among top assessed as they were chosen to be an operational level role for several departments (Operations & Production and R&D).

The Business Intelligence/Data Analysts role represents the antipole of most of the examined business roles, in other words the highest bar of data analytical skillset to reach, and therefore it will serve as a reference. As the results which were generated by respondents at similar position show, the Data Analyst's job is focused on collecting data (89 % of respondents marked High or Very high priority), cleaning and transforming data, analyzing and evaluating data and preparing reports from data (for all these objectives 78 % respondents marked High and Very high priority).

When comparing the results of the Data Analyst role with other roles' results, Marketing Specialists/Marketing Analysts seem to have the most similar profile. They also tend to have the highest proportion of "High" and "Very high" responses for objectives like *To collect data for analysis* (86 % of responses), *To clean and transform data* (71 %), *To analyze and evaluate data* and *To prepare reports and dashboards* (both 86 %). However, they significantly outweigh Data Analysts in designated IT department in proposing ideas and giving recommendations based on evidence which situates 100 % responses in High and Very high priority. These results may point out that there are more analytical positions within a company that require appropriate training in working with data. What is more, marketing specialists/analysts as subject matter experts are more likely to deliver new ideas rather than just prepare reports for others to consume.

We can recognize a similar trend for a role of HR Specialists too. The survey results evince even higher requirement of data collection by HR Specialists – 46 % respondents perceive it as a Very high priority compared to 29 % in case of Marketing Specialists/Analysts. Cleaning and transforming data remain one of the priorities (69 % of responses within High and Very high priority) along with analyzing and evaluating data (also 69 %) and preparing reports and dashboards (77 %). However, the results also show the heighten importance of ensuring correct data entry (84 % of responses within High and Very high priority) and the very high importance of data for informing decisions (92 % within High and Very high priority compared to 43 % within the same scope for Marketing Specialists/Analysts). On the other hand, it is not surprising that complying with legal requirements is much more important for HR Specialists (70 % with High and Very high values) compared to Marketing Specialists/Analysts (30 %). These results may suggest that HR Specialists also require deeper analytical and data preparation skills, nevertheless, based on the priorities the training should focus more on data quality or decision-making based on data compared to Marketing Specialists/Analysts.

Based on the results of this limited survey, we can already say that the reality of data user types in companies is more complicated than in QlikTech and Accenture's report (2020). Combining their user types and our results for example HR Specialists, we might say that this role blends in a Business User with an Analyst User and possibly a Discovery User as well. If HR Specialists worked with outcomes of advanced data models, we could even name them

Data Scientists according to that vague, one-sentence-long definition of the user type. Our preliminary results therefore suggest that to cater different needs of examined roles, the recommendations regarding data literacy skills need to be more specific.

3.3 Linking Data Literacy Competencies to Business Roles' Needs

In order to fulfil the paper's aim of providing organizations with an easy-to-follow manual uncovering required data literacy competencies for different job roles, the second part of our research deals with mapping the identified business needs in the form of our survey results with concrete data literacy competencies.

Firstly, we mapped all data literacy objectives with adequate data literacy competencies. As most of the skill competencies inevitably apply concepts from the theoretical competencies and logically assume the usage of these knowledge competencies, we listed only the most critical skills in the main mapping table. Let's propose an example of the Marketing Specialists/Analysts role. The survey results revealed that the top priority objectives are:

- To collect data for analysis
- To clean and transform data
- To analyze and evaluate data
- To prepare reports and dashboards
- To propose ideas and give recommendations based on evidence

Therefore, to make Marketing Specialists/Analysts the most effective in their priority work tasks, their managers should focus on cultivating the data literacy competencies that support these activities (Table 3).

We can continue in the same manner for other examined business roles. However, the training plans need to be aligned with the context of the company and its technological possibilities. Even though the aim of this research is to offer more targeted approach to the data skills training, we can't avoid some sort of results generalization to accommodate the needs of the most companies. The generalization is for example already contained in the effort to define data literacy skills for the most common job roles in the business environment and also in the fact that any employee of a given department can evaluate a typical job role of his department regardless of his/her own position. On that account, before applying any of suggestions, it is necessary to assess the company's strategy and orientation and reflect on its business

Table 3: Marketing Specialists/Analysts Required Data Literacy Skills.

Objective	Operational level objectives	Competency	Data Literacy Competency
O_3	To collect data for analysis	C1.1	Ability to define business requirements of data
O_3	To collect data for analysis	C1.2	Ability to identify relevant data sources for a given problem
O_3	To collect data for analysis	C2.1	Ability to access data, to extract and to store data in a required structure
O_3	To collect data for analysis	E1.5	Ability to adhere to data ethics and legal limitations
O_4	To clean and transform data	C2.2	Ability to recognize data quality issues and to apply basic methods to clean data
O_4	To clean and transform data	C2.3	Ability to transform data into the target structure
O_4	To clean and transform data	C2.4	Ability to use and creat complex metadata
O_7	To analyze and evaluate data	D1.1	Ability to apply basic analytical methods
O_7	To analyze and evaluate data	D1.3	Ability to read basic graphs and tables
O_7	To analyze and evaluate data	D1.4	Ability to apply analytical methods used in business
O_7	To analyze and evaluate data	D2.1	Ability to apply knowledge of basic statistical methods used in data analysis
O_7	To analyze and evaluate data	D2.4	Ability to read more complex visualizations
O_7	To analyze and evaluate data	E1.3	Ability to derive actionable insights
O_8	To prepare reports and dashboards	D1.1	Ability to apply basic analytical methods
O_8	To prepare reports and dashboards	D1.2	Ability to apply elementary visualization methods
O_8	To prepare reports and dashboards	D1.4	Ability to apply analytical methods used in business
O_8	To prepare reports and dashboards	D2.1	Ability to apply knowledge of basic statistical methods used in data analysis
O_8	To prepare reports and dashboards	D2.2	Ability to create a simple dimensional model
O_8	To prepare reports and dashboards	D2.3	Ability to apply advanced visualization methods
O_9	To propose ideas and give recommendations based on evidence	E1.1	Ability to adapt the communication of data to the business problem and the expected audience
O_9	To propose ideas and give recommendations based on evidence	E1.2	Ability to clearly and coherently present arguments and analytical outcomes
O_9	To propose ideas and give recommendations based on evidence	E1.3	Ability to derive actionable insights

needs – for example whether a highly data literate marketing analyst is one of the means for staying competitive or by which technology the company can afford to accompany and support the application of a newly acquired data analytical skills of its employees.

4 CONCLUSIONS

The aim of this research was to map what different business roles require to do with data in their work tasks and to propose a way how to improve data literacy of these roles by focusing on the right competences. We approached the research intent by analysing work tasks of selected business roles from

which we derived occupational objectives that are achieved by working with data – the data literacy objectives. We identified groups of objectives common for all managers and for selected operational level roles. Nonetheless, we assumed that achieving these objectives can have different priority for different roles.

To find out, which objectives are important for which roles or positions, we launched a preliminary web-based survey among alumni and partners of Prague University of Economics and Business in November and December of 2021. The preliminary results of 53 respondents mostly confirmed assumed trends and findings which we could use in the further research. For example, the highest priority of data

literacy objectives of chief executives and directors were informing decisions and ability to direct, ability to trust the company's data and ability to forecast or predict future development. The first two objectives were also important for mid-level management, however, with a bit lower priority. On the other hand, the mid-level management is much more responsible for ensuring correct data collection. Even though revealing these priorities is not surprising, the survey results still serve as a validation of the data skills necessity and verify the recent business needs.

Despite the limited pool of respondents, the survey results also confirmed that examined business roles prioritize different work objectives which leads to different requirements of skills for working with data. By assessing results for operational roles, we could identify roles like Marketing Specialists/Analysts or HR Specialists whose distribution of priority among the data literacy objectives highly resemble occupational requirements of Business Intelligence/Data Analysts. However, we could still recognize differences – for example proposing new ideas and recommendations based on data is more important for Marketing Specialists/Analysts than Data Analysts.

In addition, as the survey results supports the fact that different job roles use data differently (they prioritize different skills to achieve their goals), there are different levels of data literacy necessary within a company. For example, while Marketing Specialists/Analysts are supposed to rely on data preparation quite heavily, Sales Representatives role lays out the priority more evenly among more priority values. We could than assume that Sales Representatives require data preparation skills, but most likely on different level of mastery than Marketing Specialists/Analysts which opens door to different levels of data literacy in the company.

Based on our previous research of data literacy competencies and the survey results, we could then map the data literacy objectives with specific data literacy competencies to validate the developed data literacy competency model and verify its completeness. What is more, the discovered different priority of data literacy objectives for selected job roles allowed us to propose how to make data literacy trainings job-position-specific and therefore more effective. Even though it requires a certain level of generalization, it is the most particular guideline for different job positions available. It must be said that it shouldn't be applied without taking the company's business as well as information strategy into account.

We would also like to contribute to the data literacy enhancement in companies by allowing business users to measure their current level of data literacy. As what can't be measured, can't be improved, the measurement tool would naturally accompany the survey tool. The second one helps to state the employees' needs to focus on, while the assessment tool would allow them to measure whether the efforts are sufficient. In addition, the data literacy measurement of trained employees could help the company management to track how the investment in training is paying off.

ACKNOWLEDGEMENTS

REFERENCES

Accenture. (2019, August 29). Closing the Data Value Gap. Accenture.https://www.accenture.com/_acnmedia/PDF-108/Accenture-closing-data-value-gap-fixed.pdf#zoom =50

Balakrishnan, R., Das, S., & Chattopadhyay, M. (2020). Implementing Data Strategy: Design Considerations and Reference Architecture for Data-Enabled Value Creation. Australasian Journal of Information Systems, 24, 1–27. Scopus. https://doi.org/10.3127/ajis.v24i0.2541

Bersin, J., & Zao-Sanders, M. (2020, February 12). Boost Your Team's Data Literacy. Harvard Business Review. https://hbr.org/2020/02/boost-your-teams-data-literacy

Bonikowska, A., Sanmartin, C., & Frenette, M. (2019). Data Literacy: What It Is and How to Measure It in the Public Service [Report]. Government of Canada. https://www150.statcan.gc.ca/n1/pub/11-633-x/11-633-x2019003-eng.htm

Dallemule, L., & Davenport, T. (2017, May 1). What's Your Data Strategy? Harvard Business Review. https://hbr.org/2017/05/whats-your-data-strategy

Data To The People. (2021). Databilities. Data To The People. https://www.datatothepeople.org/databilities

Engler, S. (2020, July 1). Lack of Skills Threatens Digital Transformation. Gartner. https://www.gartner.com/smarterwithgartner/lack-of-skills-threatens-digital-transformation

Ferguson, D. K., Pamela Kirk Prentice and Renee Boucher. (2014, May 12). The Analytics Mandate. MIT Sloan Management Review. https://sloanreview.mit.edu/projects/analytics-mandate/

Fosso Wamba, S., Queiroz, M. M., Wu, L., & Sivarajah, U. (2020). Big data analytics-enabled sensing capability and organizational outcomes: Assessing the mediating effects of business analytics culture. Annals of Operations Research. Scopus. https://doi.org/10.1007/s10479-020-03812-4

Frank, M., Walker, J., Attard, J., & Tygel, A. (2016). Data Literacy—What is it and how can we make it happen? The Journal of Community Informatics, 12(3), Article 3. https://doi.org/10.15353/joci.v12i3.3274

Gartner. (2018, January 29). 3 Top Take Aways From The Gartner Chief Data Officer Survey. Gartner. https://www.gartner.com/smarterwithgartner/3-top-take-aways-from-the-gartner-chief-data-officer-survey

Gekara, V. O., & Thanh Nguyen, V.-X. (2018). New technologies and the transformation of work and skills: A study of computerisation and automation of Australian container terminals. New Technology, Work and Employment, 33(3), 219–233. Scopus. https://doi.org/10.1111/ntwe.12118

Grillenberger, A., & Romeike, R. (2018). Developing a theoretically founded data literacy competency model. WiPSCE. https://doi.org/10.1145/3265757.3265766

IE University. (2019, November 27). Data is the current and future source of competitive advantage. IE Driving Innovation. https://drivinginnovation.ie.edu/data-is-the-current-and-future-source-of-competitive-advantage/

Jones, B. (2021). Data Literacy. https://dataliteracy.com/

Kiron, D., Ransbotham, S., & Prentice, P. K. (2015). Minding the analytics gap. MIT Sloan Management Review, 56(3), 63-.

KPMG. (2019, November 5). What you should do now to unlock the power of data. KPMG. https://home.kpmg/ph/en/home/insights/2019/10/what-you-should-do-now-to-unlock-the-power-of-data.html

Lim, C., Kim, K.-H., Kim, M.-J., Heo, J.-Y., Kim, K.-J., & Maglio, P. P. (2018). From data to value: A nine-factor framework for data-based value creation in information-intensive services. International Journal of Information Management, 39, 121–135. https://doi.org/10.1016/j.ijinfomgt.2017.12.007

Lin, C., & Kunnathur, A. (2019). Strategic orientations, developmental culture, and big data capability. Journal of Business Research, 105, 49–60. https://doi.org/10.1016/j.jbusres.2019.07.016

Prado, J. C., & Marzal, M. A. (2013). Incorporating data literacy into information literacy programs: Core competencies and contents. Libri, 63(2), 123–134. Scopus. https://doi.org/10.1515/libri-2013-0010

QlikTech. (2020). The Human Impact of Data Literacy. Qlik, Accenture. https://thedataliteracyproject.org/files/downloads/Qlik_Accenture_Human_Impact_of_Data_Literacy.pdf

Ridsdale, C., Rothwell, J., Smit, M., Ali-Hassan, H., Bliemel, M., Irvine, D., Kelley, D., Matwin, S., & Wuetherick, B. (2015). Strategies and Best Practices for Data Literacy Education: Knowledge Synthesis Report [Report]. https://doi.org/10.13140/RG.2.1.1922.5044

Ross, J. W., Beath, C. M., & Quaadgras, A. (2013). You May Not Need Big Data After All. Harvard Business Review, 91(12), 90-.

Sam Ransbotham, David Kiron, & Pamela Kirk Prentice. (2016). Beyond the Hype: The Hard Work Behind Analytics Success. MIT Sloan Management Review, 57(3). https://sloanreview.mit.edu/projects/the-hard-work-behind-data-analytics-strategy/

Smolníková, M., Chalupová, H., Potančok, M., Novotný, O., & Puskas-Juhasz, R. (2021). Building and testing a comprehensive data literacy model for business users. 125–132. Scopus.

Smolníková, M. (2022). Data Literacy Objectives Survey results analysis in Power BI. https://app.powerbi.com/view?r=eyJrIjoiZmI0NDJjNGYtNGQ3Ni00YzVkLTg3MzItZDgzMGM2YjU4NTQ2IiwidCI6IjJiNTFhNGIzLTQ0M2YtNDQwNi04Y2E0LTE5MDU2YTc5YTQ0NCIsImMiOjh9

WEF. (2020). The Future of Jobs Report 2020 [Report]. World Economic Forum. https://www.weforum.org/reports/the-future-of-jobs-report-2020/

Wolff, A., Gooch, D., Cavero Montaner, J. J., Rashid, U., & Kortuem, G. (2016). Creating an Understanding of Data Literacy for a Data-driven Society. The Journal of Community Informatics, 12(3). https://doi.org/10.15353/joci.v12i3.3275