The Theory for Analysing Human Capital Productivity at Public Organizations

Dr Marko Kesti, University of Lapland
Dr Jaana Leinonen, University of Lapland

Abstract
Public organisations are confronting fiscal distress as the service demand increases beyond the availability of monetary resources. Performance improvement at private companies has a long history, and the idea has been developed that public organisations’ productivity can be improved via the same measures as private companies. Thus, organisational performance improvement methods, such as Lean development, have been utilised in the public sector. The driving force for performance improvement is usually the aim to make unprofitable, underfunded services economically healthy. However, the results have not been good – public sector productivity has mainly declined in recent years. Managers and consultants have not realised that public organisations are more complex than private ones, meaning that performance improvement does not necessarily lead to economic gain. Conventional statistical productivity analyses in the public sector are unreliable and do not explain how organisations’ human assets can be utilised to obtain financial benefits. Therefore, public management requires more innovative and practical methods for analysing human assets’ true meaning for financial outcomes. This complex phenomenon can be explained via a new scientific theory of the function of human capital production.

In terms of human capital productivity, there are essentially two different type of public organisations. First, there are organisations where operative incomes from output services are greater than the variable expenses of the produced services. At these organisations, a productivity increase follows the service volume increase achieved from human capital performance improvement; thus, the phenomenon is similar to that in private companies. Second, there are municipal organisations where operative variable costs are greater than incomes from the produced services. Most government and municipal service providers fall into this category, where most of the production capacity is financed by tax incomes and government shares that are not directly connected with the service volume. Therefore, poorly managed human performance improvement may lead to economic loss, thereby having the opposite effect to the productivity and management objectives.

This paper describes a new human capital production function for public organisations. A case study is performed using a Finnish mid-sized town case organisation. The paper illustrates how different human capital development strategies affect the case public organisation’s service capacity and monetary productivity. In terms of productivity analysis, the paper describes a theoretically valid method for measuring and analysing human intangible asset performance utilisation. The paper makes a significant contribution to public sector research and management, as it explains the ontology and concept of public organisations’ performance and productivity.

INTRODUCTION

There are big differences in how effectively public organisations use their human resources (HR). The differences arise from organisational and structural factors related to how public services are provided. When increasingly strict conditions of the economy dominate, the public organisations must carefully consider the service task obligations that are needed in relation to capacity and quality. To balance public finance deficits in the long term, municipal organisations have to continuously improve the quality of their service production (Linna et al. 2008; Jääskeläinen & Lönnqvist 2011). In addition, studies
have shown that there are significant opportunities for productivity improvement in welfare services (Käpylä et al. 2008). For example, the difference between the most inefficient and efficient health-care centre, measured in terms of cost efficiency, was 14% (Kangasharju 2008).

Recent developments in information and communication technology have been shown to have great potential for further improvements in productivity in both the private and public sectors (e.g. Pohjola 2014). However, to utilise this technology and support social innovations, new methods of organising work and new structural solutions are needed to make productivity development possible. The enhancement of public organisations’ productivity requires multiple improvement actions, as well as comprehensive knowledge of the cause–effect fundamentals of the municipal organisation’s productivity system (e.g. Jääskeläinen 2010). For public service providers, measurement and analysis have to be emphasised, particularly concerning human capital productivity. In addition to the development of processes, attention must be paid to the structure of HR, workforce wellbeing and the development of staff know-how – in other words, issues related to HR management. An operational culture that strengthens human capital productivity and supports learning and development are needed (Laakoli & Peiponen 2012). The systematic and consistent training of human resources will help to improve the municipal economy (Virtanen & Stenvall 2014).

Our aim is to present an analytical model of human capital productivity that is suitable for municipal organisations. We show that the HR productivity improvement strategy should be focused differently depending on the public organisation’s financing and cost structure. We examine the productivity at the case organisation using the theory of the human capital production function. We define the enhancement of productivity so that attention can be paid to the significance of intangible human capital as an essential factor that affects the productivity of the municipal organisation.

PRODUCTIVITY

Starting points for the productivity of public service activity

In the traditional thinking, the development of productivity is a question of how output can be increased with the same input cost or how the required output can be achieved with as little cost as possible. Thus, it is a question of the relationship between the outputs and the inputs. Productivity is created in the real process, in those practical functions in which performance is implemented from different production factors. The productivity concept is clearly determined by this point of view: Productivity is a ratio between the outputs and the inputs, both of which can be measured in monetary units (Meklin 2008). In reality, however, this definition does not represent the whole picture of municipal organisation productivity because the value added is not always so clearly measurable with fiscal metrics.

The contribution outputs (work, capital, energy, etc.) of the product or service production process affect the productivity outcome. Productivity can be examined from the point of view of overall productivity or the productivity ratio. When measuring overall productivity, the total output value of the measured time period is divided by all of the inputs that have been used for production. In contrast, for the productivity ratio, the overall output value is proportioned to one input factor; when estimating, for example, the productivity of the work, the output is divided by the work contribution (the number of
people or the labour costs). Input costs are easy to measure when the input contribution is purchased from private sector; in the annual accounting, those costs are included as variable costs. However, the definition of output will be more problematic when the outputs are generated by internal public service providers. In such cases, customers are not charged or the services are offered for nominal compensation; thus, the output cost may not correspond to the real monetary market value of the contribution (Meklin 2008). In practice, special number-type indicators have also been used in the evaluation of productivity, for example, the number of doctor visits. Thus, productivity is usually quantitatively defined, in which case it is supposed that the quality will be a constant, or quality is examined as a separate phenomenon from actual productivity (see Grönroos & Ojasalo 2004).

In the future, the instruments used to develop productivity will be cooperation between the public and private sector and more efficient utilisation of information and communication technology. Correspondingly, the increase in customers’ role in the production of services will require productivity development, especially in terms of effectiveness and quality. Thus, users of services are seen as important actors in value formation. In addition, the working environment becoming more complex and thus more difficult to manage. This means that in the development of productivity, staff performance and commitment will be emphasised more than before (Käpylä et al. 2008; Syväjärvi & Kesti 2012).

### Human resources and productivity

In resource-based strategies, the attention is focussed on the innovativeness of the human resources of the organisation (creative resources) and intangible human resources (capabilities). In this strategy, it is essential to concentrate on those resources that will enable the organisation to grow and develop (Harisalo 2008). The starting point for the human capital production function has been the aim of mathematically describing the economic effects of tangible and intangible human resources and following the principles of critical realism. There has been a significant increase in the interest in business-related intangible human resources; in several fields, this is believed to generate the most important factor related to performance and productivity. The degree of utilisation of intangible human resource capital is measured via an organisation-specific human resource inquiry that has been validated for this purpose, such that it measures the quality of working life (QWL) connection to performance (Syväjärvi & Kesti 2012).

There are three areas related to the human capital production function, as follows: 1) the average working time distribution, 2) the degree of utilisation of intangible human resources (the quality of the working life) and 3) the business outcome of revenues and profit and loss accounts. The theoretical working hours used by the whole staff (full-time equivalent) make up one production factor, and this is divided into two main parts – auxiliary working time and time for work. Auxiliary working time is structural and includes holidays, absences, family leave, training, new workers’ orientation, HR practices and own workplace development; in other words, it includes those working hours that cannot be used for the actual purpose of the organisation. When auxiliary working time is removed, what is left is time for work. Time for work is further divided to two parts, namely effective working time and other working time.
In the human capital production function, revenue is generated through cumulative effective working time. The quality of the working life experienced by the organisation’s staff determines the share of effective working hours from the time for work. Properly focussed organisational development improves the quality of the working life; thus, the effective working time share will increase. If the organisational development is effective, it is also possible to increase the total effective working hours (Kesti & Syväjärvi 2013).

Kesti and Syväjärvi (2015) introduce a simplified human capital production function for the private sector using following equation:

\[
\text{Revenue} = K \times L \times TTW \times (1 - Aw) \times QWL
\]

where
- \( K \) = human resource business ratio ($/h)
- \( L \) = number of staff (FTE)
- \( TTW \) = theoretical regular yearly working time (h)
- \( AW \) = auxiliary working time (% of TTW)
- \( QWL \) = quality of the working life index (%)

In the equation, the amount of production is represented by the revenue. The business ratio \( K \) determines how much revenue one effective working hour produces. Operating profit is the revenue after all costs are taken into account (variable costs, staff costs and other fixed costs).

**HUMAN CAPITAL PRODUCTIVITY ANALYSIS OF THE MUNICIPAL ORGANISATION**

In the analysis of the human capital productivity, public organisations should be classified according to their financial structure which determine public organization capability to produce gross profit, which is the value after variable costs are reduced from operative incomes. If the organisation makes a positive operative gross profit, then it is categorised as a class 1 organisation; meanwhile, when the gross margin is negative, it is a class 2 organisation. These categories signify that class 1 organisations are able to improve their economic situation by increasing the effective volume of production, while class 2 organisations require extra funding if the effective volume is increased. An effective volume increase means that the organisation’s efficiency is improved, and as a result, the volume increases without adding fixed costs.

In companies, productivity can be improved by adding effective working hours, in which case the revenue can be improved while incurring the same fixed costs; as a result, the operating profit improves. By decreasing, for example, the hassle in the organisation, it is possible to increase the effective working hours, thereby increasing operating capacity; this applies to both private and public sector organisations. In class 2 municipal organisations, efficiency improvement may cause fiscal problems if the organisation is not prepared to increase operations funding. Consequently, the efficiency improvement leads to a decline in monetary productivity.

Indeed, this phenomenon is extremely important to understand when, for example, Lean improvement processes are implemented in class 2 public organisations. To prevent fiscal problems, the situation should be studied in advance; if funding cannot be increased, the effective working time increase should be spent on operations quality improvement and not a capacity increase. With the right information, management can lead organisations to sustainable productivity improvement that meets the strategic
goals; thus, an appropriate analysis is one of the management cornerstones of a successful municipal economy.

When the effective working hours are determined as a share (%) of the cumulative overall working time of the staff, the change in the human capital productivity can be more profoundly examined. In relation to the working time, intangible human assets have to be considered. QWL describes the degree to which immaterial human capital is used. If the QWL is at the level of 60%, then the effective working time share is 60% as well. Therefore, the effective working time may increase with the same amount of cumulative total working hours, and thus the same staff costs. QWL is an intangible production factor that may produce more effective working hours without a cost increase – it is HR related but not direct cost related. With the effective working time, the organisation may produce more or save indirect costs by realising the same amount of production with better quality. Both mechanisms lead to the rise of productivity, and they can be examined through the human capital production function of public organisations using equation 2:

\[
EC = K \times FTE \times T_{TW} \times (1 - Aw) \times QWL
\]  
(equation 2)

where

- \( EC \) = economic capacity, €
- \( FTE \) = staff size in full-time-equivalent, FTE
- \( T_{TW} \) = theoretical yearly working time, h
- \( K \) = coefficient for effective working time capacity relation, €/h
- \( QWL \) = quality of working life, %
- \( Aw \) = auxiliary working time, %
- \((1-Aw)\) = time share available for actual work (time spent at work)
- \((1-Aw)\times QWL\) = effective working time share from theoretical working time

The coefficient for effective working time capacity relation describes the service capacity ratio – in other words, the monetary value of the service produced by one effective working hour – and is calculated using equation 3:

\[
K = \frac{EC_0}{FTE_0 \times T_{TW0} \times (1 - Aw_0) \times QWL_0}
\]  
(equation 3)

where

- \( EC_0 \) = \( VC_0 + SC_0 + OC_0 \), economic capacity based on costs in the last year
- \( FTE_0 \) = full-time-equivalent in the last year
- \( T_{TW0} \) = theoretical yearly working hours in the last year
- \( Aw_0 \) = auxiliary working time in the last year
- \( QWL_0 \) = quality of working life in the last year

Annual profit and loss account at public organisations determine the operating profit according to equation 4:

\[
OP = OI - (SC + VC + OC)
\]  
(equation 4)

where

- \( OP \) = operating profit (€)
- \( OI \) = operating incomes (€)
- \( \frac{OI_0}{EC_0} \times EC \)
Determining the quality of working life

In the human capital production function, there is an index of QWL, which describes the intangible human assets’ connection to performance. With moderate reliability, this can be measured through a validated human resource inquiry. QWL includes the individual’s job-related well-being and experiences relating to job satisfaction, benefits, and work environment, the social environment of the organisation, organisational performance, employee participation, employee involvement and opportunities to develop human capacity (Greenhous et al. 1987; Sirgy et al. 2001; Totawar & Nambutini 2014). The QWL seems to be related to operational performance, which leads to better business outcomes (Abdeen 2002; Wright & Croppanzano 2004; Warr 2005; Wright & Bonett 2007). However, the quantified relationship between QWL and organisational performance is controversial and vague. It has been difficult to quantify QWL results such that the measurement correlates reliably with business performance.

Kesti et al. (2016) argue that there is no single human intangible asset that is generally more important than another, and it is a combination of psychological factors that determines human intangible asset performance. For example, emotional safety has a different effect on performance than creativity. This can be explained by a simple engineering analogy: Given three length measurements of 1, 2 and 3, it is easy to calculate the average: \((1+2+3)/3 = 2\). However, if the measurements are carried out using different units (1 ft, 2 in, 3 cm), the average length will be totally different than average result of the measured numbers (Kesti et al. 2016). The same phenomenon seems to emerge in terms of wellbeing inquiry measurement and its connection to performance, although this is somewhat more complicated. The indicator of the QWL gives information about the performance of the human resources, so the average of the results of the HR inquiry is not suitable for this purpose.

To obtain a more reliable index for intangible human capital performance, Kesti et al. (2016) propose a model in which there are three different self-esteem categories, each of which has a unique effect on performance. The self-esteem categories are as follows:

1. Physical and emotional safety (PE);
2. Collaboration and identity (CI); and
3. Objectives and creativity (OC).

According to phenomenography analysis, the chosen categories should be logically related, as well as having logical connections with the phenomenon of interest (Marton 1986; Uljens 1996; Marton &
Booth 1997). The QWL self-esteem categories’ connection to performance can be formed through the same phenomenon as in Kano’s (1984) model, where three different customer opinion categories (must-be, discussed and attractive) affect customer satisfaction. Also Losada’s (2004) study shows that positive feelings improve the performance, whereas negative feelings reduce performance.

![Figure 1. Self-esteem categories of QWL functions.](image)

In Hertzberg’s (1958) theoretical model, employee motivation comprises a combination of hygiene factors multiplied by motivation factors. Hygiene factors can be understood as items that cause distress and illness, whereas motivation factors are relate to self-esteem elements that boost performance. Hertzberg’s motivation theory is highly respected, but it seems to be incomplete, since it does not consider both self-esteem factors that may cause distress or increase motivation. In the QWL self-esteem model, the missing self-esteem factor is collaboration and identity (CI), which is found on the spectrum between distress and motivation. The self-esteem factors of CI and OC are considered motivators, while self-esteem PE is seen as a hygiene factor. In line with Herzberg’s theory, the QWL index is calculated using the following equation (Kesti et al. 2016):

\[
QWL = PE(x_1) \times \left( \frac{CI(x_2) + OC(x_3)}{2} \right)
\]

where

- QWL is calculated using the quality of working life index (0 ... 1)
- PE(x₁) is the value of the function of physical and emotional safety
- CI(x₂) is the value of the function of collaboration and identity
- OC(x₃) is the value of the function of objectives and creativity

The functions of the self-esteem categories are adjusted so that the result is always between 0 and 1 (0% ... 100%); thus, the QWL index describes the human intangible assets utilisation percentage. Kesti et al. (2016) argue that there are no general absolutely right equations to measure the connection between self-esteem and performance; rather, what is at issue, is the best theoretically reliable estimate. They suggest using the following equations:
\[
\begin{align*}
PE(x_1) &= 0.002 + 1.3 \times X_1 - 0.61 \times X_1^2 + 0.005 \times X_1^3 \\
CI(x_2) &= 1.02 \times X_2 + 0.09 \\
OC(x_3) &= 1.7195 \times X_3^3 - 0.92 \times X_3^2 + 0.32 \times X_3 + 0.64
\end{align*}
\]

**CASE STUDY OF A MUNICIPAL ORGANISATION**

The present case study is carried out for a mid-sized town organisation in Finland that provides services for children and youth. There are 1560 employees in full-time equivalent. The organisation operates in a steady environment where the town population growth is moderate. The town funding structure is sound, but in the future, challenges will arise due to poor market situation that threatens tax revenue.

**Determining the quality of working life index in the case organisation**

The organisation has carried out a yearly staff wellbeing survey, where the data are utilised to analyse the QWL index (see Figure 2).

[Figure 2. QWL evaluation for the case organisation.]

\[
QWL = PE \times \left(\frac{CI + OC}{2}\right) = 67.5\%
\]

Figure 2. QWL evaluation for the case organisation.

The QWL index gives a lower value than the average, which is 79%. This is because there is a lot of unutilised potential in terms of the objectives and creativity self-esteem. From a management point of view, this information is essential, because it indicates an opportunity to improve human capital productivity. Considering only the average values would lead to the incorrect conclusion that human intangible assets are in order.
Determining the classification of the financial structure

According the organisation’s profit and loss account, the case is a class 2 organisation, where operating gross profit is negative (see Figure 3).

Since the case organisation belongs to class 2, two strategic organization development approaches should be analysed and discussed. First there is strategy approach where aim is to increase service capacity and secondly there is approach that try to improve the cash reserves. According to the strategic analysis, a plan can be established to deal with capacity increase, resources, productivity improvement and cost savings allocations.

**Strategy approach 1: Increasing service capacity by improving internal efficiency**

The first strategy approach is the so-called output orientation strategy. The analysis shows the extent to which the operating capacity could be increased by developing the organisation’s efficiency, as well as how much additional funding is needed. The municipal organisation invests 2.0% of the theoretical regular yearly working time in staff training and development. The objective is to improve work motivation and the fluency of the work and this way increase the quantity of effective working hours.

Figure 5 shows that the effective working hours increase by 2.3%. The organisation’s production value is 100.4 M€; thus, the service capacity increase value is 2.3 M€ (100.4*0.023), which is achieved with the same number of staff. The production of increased services expands the variable expenses because they are related to the capacity. Operation incomes from the services are also dependent on the production of services; however, their share is smaller than that of the variable expenses. As a result, the financing deficit will be 320€ per employee. Therefore, the operation profit of the municipal organisation will be reduced by 0.5 M€, resulting in the need for extra funding.
Figure 4. Case strategy approach 1, where service capacity is increased by improving internal efficiency.

Strategy approach 2: Improving the economy by developing operative effectiveness

The second strategic approach is the so-called input orientation strategy, where the operating profit will be improved by developing the organisation’s efficiency. The objective is to focus human capital productivity development so that costs are reduced while the present service capacity is maintained.

Like in the previous strategy, the municipal organisation invests 2.0% of the theoretical regular yearly working time in staff training and development. With the improved effectiveness, the virtual labour increase corresponds to 19 full-time equivalents. This growth in effectiveness is focussed on cost savings, which can be described in terms of FTEs, as follows:
- 4 FTEs to reduce variable expenses (benefit of 0.16 M€);
- 3 FTEs to reduce overtime work (benefit of 0.18 M€); and
- 12 FTEs to reduce staff number (benefit of 0.49 M€; retirement plan).

The total profit improvement benefit is 0.8 M€, which is 510€ per employee. According to this strategy, it is important that the intangible human asset is well taken care of as a production factor when carrying out cost savings. Management should follow the principle that the work efficiency should be improved first; only then should the amount of staff be slightly reduced.
The calculation examples are simplified closed system analyses that illustrate the human capital function principle at the public organisation. The calculation does not consider the possible effects of organisational structural changes, cost index increases or the effects of technology investments on the K-coefficient.

**FUTURE TRENDS**

It is clear that this new theory and methodology should be further studied to obtain a complete picture and identify the benefits for organisational research and practice. For example, the study of diminishing returns of QWL is interesting. It seems that beyond a certain level, further improvement in QWL becomes so difficult and time-consuming that it will lead to diminishing economic profit. Some HR practices have better situational efficiency when it comes to improving the QWL index. To find the optimal HR improvement practices, the working society self-esteem map that determines the QWL index should be studied. Each HR practice has a positive cause–effect relationship with certain self-esteem factors, which all have a situational law of diminishing profit in accordance with the human capital production function. We have created a digital productive leadership game where the mathematical modelling is combined as a digital system, and leadership actions are simulated for different working culture challenges. Each challenge reduces a certain self-esteem factor, and each HR practice improves self-esteem.
with its nominal time consumption. Here, leaders and students can engage in human capital productivity in practice without the need to study the complex functions and cause–effect relationships.

In future studies, better methods and tools should be developed to measure staff’s QWL. We consider that at knowledge-intensive organisation, it is possible to measure QWL through continuous online surveys that updates the index automatically and can therefore be better used in different cause–effect follow-up studies. This can be accomplished through an optimally short questionnaire and digital survey that automatically ask several inquiry questions at convenient time periods. In addition to the organisational inquiry there is a need to improve the necessary data collection for the human capital analysis and change the follow-up. It seems that currently, the data are scattered throughout several different digital systems that do not communicate with each other, and if data are available, they are, for example, present at the wrong units.

In this paper, the human capital production function was illustrated in a simplified case study that represented a closed system study. For management decision making, this simplified analysis is adequate and realistic to implement. We produced an analytical tool for municipal organisation managers so that they can carry out analysis with relatively simple data from their organisation. This tool is available as freeware and needs to be adjusted for different working cultures and environments. We think that our research provides an excellent contribution to organisational research, and thus requires enthusiastic researchers to take it up.

CONCLUSIONS

This paper’s sample case showed that the human capital production function seems to be suitable for the strategic examining of the productivity of municipal organisations. When the mechanism of productivity is reliably described through a mathematical model, the same calculation methodology can be used for several different municipal organisations. When management decision making is based on predictive analytics, it is possible to make correct strategic choices that meet the strategic objectives, despite the complex nature of municipal organisations’ economic features.

The case raises the problem wherein the operative improvement of organisational effectiveness can improve capacity but decrease fiscal profitability. If management is not prepared for the need for extra funding, the financing problem can lead to cost cutting, which may diminish the benefits of the original organisational development. The human capital production function with QWL analysis can reveal hidden fundamental causes and effects that are essential in making optimal business decisions and scenarios. Using the methodology described in this paper, managers can use organisation-specific economic and HR data in decision making to improve the organisation’s public service capacity and reduce costs.

New QWL analyses provide the link between theory and practice. An organisation’s management can utilise QWL analysis in estimating HR practices and the HR development investment efficiency in practice. When qualitative HR issues can be analysed and quantified, they become important strategic value-adding production parameters that can be affected by organisational management and leadership.
The case study organisation inquiry was not quite comprehensive in terms of measuring self-esteem and thus determining the QWL index. There were only eight questions that measured employee self-esteem. Although the questionnaire was short, it was almost perfectly balanced amongst the three self-esteem categories. However, while the accuracy of the results may be crude, they were able to illustrate the role of QWL in the human capital production function and municipal organisation productivity.

REFERENCES


