

# Software engineers must speak the systemic intangible process assets language

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It is a fact that software and information technology (IT) plays a key role in the success of many organizations, providing added value to businesses in any field. Whether they like it or not, software engineers are part of this phenomenon. Software engineers speak the software and IT language. However, they have a mission to use their knowledge to help organizations to improve their business.

There follow several statements explaining a gap that we have identified and which software engineers are called upon to fill within their professional practice:

- Software engineers know about software and IT.
- Software, IT and knowledge are three of the most important drivers of the economy today.
- Software, IT and knowledge (in the form of intangible assets) are levers for improving businesses, and a guarantee for the long-term adaptability and survivability of companies.

The question is, are software engineers capable of choosing the best solution to help an organization to use its intangible assets as levers to achieve its strategic or business goals and improve its business? At present, we believe that they are not.

Two main claims by Selvy (Selvy, 2007) ratify this point:

- “Software designers, engineers, and managers must begin to understand and reason effectively about the connections between technical decisions and enterprise-level value maximization. Understanding these connections will drive decision makers at all levels to use better criteria and to make better choices. One important adjustment is that decision makers begin to think more strategically. Getting to this point requires that software specialists step out of “flatland” and away from purely technical criteria that are not linked to enterprise-level outcomes. The first step is to understand that the mismatch between the criteria that are used today and ones aligned with value creation has several identifiable and remediable causes.”
- “Most software designers and engineers are not taught to reason about value creation as an objective or about how technical parameters can be manipulated for value creation purposes. Rather, technical measures tend to dominate pedagogy. Such measures are necessary but insufficient.”

The Software Economics area of SWEBOK V3 (Bourque, 2014) provides support for these two claims. In this respect, it accounts for common software engineering economics practices to indicate how decision-making in software engineering includes or should include a business perspective. However, it does not yet defend the value of organizations taking a systemic strategic approach to “intangible” process assets. These intangible assets are what constitute the organization’s intellectual capital, and intellectual capital targets the valuation of intangible assets. Intangible assets are all the non-tangible resources that help the company to deliver its value proposition (Stewart, 1998; Marr, 2008).

Data correlations confirm the linear relationship between a country’s intellectual capital and gross domestic product (Stähle, 2012). Indeed, intellectual capital is increasingly recognized as a factor of production (Abhayawansa, 2014). Nevertheless, while the strategic role played by intellectual capital in value creation is well established in academia, it is not widely exploited in the corporate world (Demartini, 2013).

If software engineers are unaware of the importance of intangible process assets as strategic value providers for business, organizations and countries, they are neglecting a powerful tool for organizations and by extension global economies to achieve competitive advantage, sustainability and stability in the long term.

To be ready to face the challenges of this new era, software engineers will need to take a holistic or systemic view of the system, strategy, business and knowledge. Innovation should take into account the real needs of the business and people.

The Software Economics area of SWEBOK V3 (Bourque, 2014) should be updated to cover the perspective of intangible assets valuation and embrace systemic thinking on what solutions software and IT can provide to help organizations exploit one of their most valuable assets for improving their business, namely intangible assets in the form of organizational know-how.

### **Strategic importance of intangible process assets**

The ultimate expected benefit from acquiring or developing process assets is to help a company meet its business goals (Software Engineering Institute, 2010). In view of the strategic importance of process assets, their expected contribution to achieving company business goals and the definition of strategic management as the set of analyses, decisions and actions performed by an organization, software engineers must be able to answer four questions in order to build up and retain a competitive advantage and thereby meet organizational business goals (Dess 2004; Thompson 1993). They are: What process assets does the company have? How good are the company’s process assets? How do process assets influence the achievement of business goals? What decisions can be made with respect to process asset improvement and the resultant achievement of their associated business goals?

Despite the importance of process assets in the IT industry (Castro, 2013; Sanchez-Segura 2016; Saunders 2015; Project Management Institute 2013; Software Engineering Institute 2010) however, today’s software engineers are not able to determine the quality of process assets or their impact on company business goals and decision making in order to guarantee the long-term sustainability of the business through the solution they are providing.

## **Suggested Topic for Extending SWEBOK V3 Software Economics Area: Systemic and Strategic Intangible Process Assets Engineering**

Software engineers must be trained in the art and science of designing value-added solutions based on information and software technologies in any field. There should be an understanding of the intangible assets that endow the organization with intellectual capital and the business with strategic value.

Note that although value creation may not always have a direct impact on a company's account balance, it sometimes has an indirect effect as a consequence of the efficient and effective use of the company's intangible assets.

For this reason, software engineers must learn to speak the intangible assets and knowledge management language. Intangible assets are company knowledge held by people, relations with stakeholders, processes, tools, etc. The value of intangible assets can be measured as intellectual capital, which has a proven impact on customer satisfaction, the attraction of new customers, company stability and productivity. Apart from a microscopic impact on the business, it also has a bearing, at a macroscopic level, on the country's gross domestic product (Ståhle, 2012).

In order to develop and ensure this business value, software engineers must firstly discover the goal pursued by the company through the deployment of the technological solution. Secondly, they must position the goal at the strategic, business or product level in order to steer the problem-solving process and solution. To do this, software engineers must assess and rate the company's current intangible assets based on how they empower the identified goal.

Software engineers should put forward improvement plans for intangible assets or for identifying and developing hidden intangible assets based on the data yielded by this analysis (Sanchez-Segura, 2016). Improvement plans illustrate possible scenarios for different solutions, of which one should be selected by a multilateral decision made together with the senior management.

Summarizing, software engineers must be trained in:

- Mechanisms to manage —capture, store, recover and share— intangible assets (traditional knowledge management processes)
- Mechanisms to assess the status of the company's intangible assets related to the strategic/business/process goal to be achieved
- Mechanisms to rate the intangible assets insofar as they are able to empower the company's selected goals
- Mechanisms to define improvement plans, regarding which intangible process assets need to be modified, empowered, or even be retired
- Mechanisms to make decisions on the best improvement plan to be implemented
- System dynamics models to predict the performance of strategic or business goals regarding intangible process assets status evolution.

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## **Biography**

Dr. Maria-Isabel Sanchez-Segura is associate professor at Carlos III University of Madrid. Her research interests include software engineering with a focus on processes and intelligent organizations. She is an IEEE Senior Member. Her research interests include knowledge management, intellectual capital, software engineering processes and methodologies, value-based software engineering, software economics and discipline-based educational research (DBER) on software engineering.

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