Designing Agile Product Development Processes by Transferring Mechanisms of Action Used in Agile Software Development

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Abstract : Due to the fugacity of markets and the reduction of product lifecycles, manufacturing companies from high-wage countries are nowadays faced with the challenge to place more innovative products within even shorter development time on the market. At the same time, volatile customer requirements have to be satisfied in order to successfully differentiate from market competitors. One potential approach to address the explained challenges is provided by agile values and principles. These agile values and principles already proofed their success within software development projects in the form of management frameworks like Scrum or concrete procedure models such as Extreme Programming or Crystal Clear. Those models lead to significant improvements regarding quality, costs and development time and are therefore used within most software development projects. Motivated by the success within the software industry, manufacturing companies have tried to transfer agile mechanisms of action to the development of hardware products ever since. Though first empirical studies show similar effects in the agile development of hardware products, no comprehensive procedure model for the design of development iterations has been developed for hardware development yet due to different constraints of the domains. For this reason, this paper focusses on the design of agile product development processes by transferring mechanisms of action used in agile software development towards product development. This is conducted by decomposing the individual systems 'product development' and 'agile software development' into relevant elements and symbiotically composing the elements of both systems in respect of the design of agile product development processes afterwards. In a first step, existing product development processes are described following existing approaches of the system theory. By analyzing existing case studies from industrial companies as well as academic approaches, characteristic objectives, activities and artefacts are identified within a target-, action- and object-system. In partial model two, mechanisms of action are derived from existing procedure models of agile software development. These mechanisms of action are classified in a superior strategy level, in a system level comprising characteristic, domain-independent activities and their cause-effect relationships as well as in an activity-based element level. Within partial model three, the influence of the identified agile mechanism of action towards the characteristic system elements of product development processes is analyzed. For this reason, target-, action- and object-system of the product development are compared with the strategy-, system- and element-level of agile mechanism of action by using the graph theory. Furthermore, the necessity of existence of activities within iteration can be determined by defining activity-specific degrees of freedom. Based on this analysis, agile product development processes are designed in form of different types of iterations within a last step. By defining iteration-differentiating characteristics and their interdependencies, a logic for the configuration of activities, their form of execution as well as relevant artefacts for the specific iteration is developed. Furthermore, characteristic types of iteration for the agile product development are identified.

Keywords : activity-based process model, agile mechanisms of action, agile product development, degrees of freedom
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