APPENDIX A
SEARCH STRINGS

Database	Search string	Result
ScienceDirect	TITLE-ABSTR-KEY((("innovation") AND ("evaluat*" OR "assess*" OR "measur*" OR "metric*" OR "indicator" OR "determinant" OR "driver" OR "key element" OR "attribute" OR "capabilit*" OR "matur*"))) Searched inBusiness management and accounting, Computer Science, Economics, econometrics and finance, Social Science	2920
Engineering Village (Inspec & Compendex)	((((((("innovation") AND ("evaluat*" OR "assess*" OR "measur*" OR "metric*" OR "indicator" OR "determinant" OR "driver" OR "key element" OR "attribute" OR "capabilit*" OR "matur*"))) WN KY) AND (JA WN DT) AND (English WN LA)) NOT (({921} OR {922.2} OR {723.2} OR {914.1} OR {921.6} OR {716} OR {931.1} OR {e0210j} OR {432} OR {409} OR {e0230} OR {443.1} OR {714.2} OR {451.1}) WN CL))	574
Scopus	TITLE-ABS-KEY((("innovation") AND ("evaluat*" OR "assess*" OR "measur*" OR "metric*" OR "indicator" OR "determinant" OR "driver" OR "key element" OR "attribute" OR "capabilit*" OR "matur*"))) AND DOCTYPE(ar) AND (EXCLUDE(SUBJAREA, "MEDI") OR EXCLUDE(SUBJAREA, "NURS") OR EXCLUDE(SUBJAREA, "ENVI") OR EXCLUDE(SUBJAREA, "AGRI") OR EXCLUDE(SUBJAREA, "PSYC") OR EXCLUDE(SUBJAREA, "MATE") OR EXCLUDE(SUBJAREA, "DECI") OR EXCLUDE(SUBJAREA, "HEAL") OR EXCLUDE(SUBJAREA, "EART") OR EXCLUDE(SUBJAREA, "ENER") OR EXCLUDE(SUBJAREA, "CENG") OR EXCLUDE(SUBJAREA, "BIOC") OR EXCLUDE(SUBJAREA, "PHYS") OR EXCLUDE(SUBJAREA, "MATH") OR EXCLUDE(SUBJAREA, "CHEM") OR EXCLUDE(SUBJAREA, "PHAR") OR EXCLUDE(SUBJAREA, "ARTS") OR EXCLUDE(SUBJAREA, "MULT") OR EXCLUDE(SUBJAREA, "NEUR") OR EXCLUDE(SUBJAREA, "DENT") OR EXCLUDE(SUBJAREA, "IMMU") OR EXCLUDE(SUBJAREA, "VETE") OR EXCLUDE(SUBJAREA, "Undefined")) AND (EXCLUDE(EXACTSRCTITLE, "VDI Berichte") OR EXCLUDE(EXACTSRCTITLE, "Journal of Construction Engineering and Management") OR EXCLUDE(EXACTSRCTITLE, "Construction Management and Economics") OR EXCLUDE(EXACTSRCTITLE, "Transportation Research Record") OR EXCLUDE(EXACTSRCTITLE, "Expert Systems with Applications") OR EXCLUDE(EXACTSRCTITLE, "Futures") OR EXCLUDE(EXACTSRCTITLE, "Prometheus") OR EXCLUDE(EXACTSRCTITLE, "Telecommunications Policy") OR EXCLUDE(EXACTSRCTITLE, "Computers and Education") OR EXCLUDE(EXACTSRCTITLE, "Automotive Industries AI") OR EXCLUDE(EXACTSRCTITLE, "Internet Research") OR EXCLUDE(EXACTSRCTITLE, "Info") OR EXCLUDE(EXACTSRCTITLE, "Sea Technology") OR EXCLUDE(EXACTSRCTITLE, "Signal Processing") OR EXCLUDE(EXACTSRCTITLE, "Acta Astronautica") OR EXCLUDE(EXACTSRCTITLE, "Telematics and Informatics") OR EXCLUDE(EXACTSRCTITLE, "Geoforum") OR EXCLUDE(EXACTSRCTITLE, "IEEE Communications Magazine") OR EXCLUDE(EXACTSRCTITLE, "Ekonomicky Casopis") OR EXCLUDE(EXACTSRCTITLE, "Automatica") OR EXCLUDE(EXACTSRCTITLE, "Proceedings of the IEEE") OR EXCLUDE(EXACTSRCTITLE, "ZWF Zeitschrift Fuer Wirtschaftlichen Fabrikbetrieb") OR EXCLUDE(EXACTSRCTITLE, "International Journal of Automotive Technology and Management") OR EXCLUDE(EXACTSRCTITLE, "Journal of Health Economics") OR EXCLUDE(EXACTSRCTITLE, "Jane S Defence Weekly") OR EXCLUDE(EXACTSRCTITLE, "IEEE Transactions on Signal Processing") OR EXCLUDE(EXACTSRCTITLE, "OECD Observer") OR EXCLUDE(EXACTSRCTITLE, "Education and Training") OR EXCLUDE(EXACTSRCTITLE, "Revista Venezolana De Gerencia") OR EXCLUDE(EXACTSRCTITLE, "Journal of Economic Geography") OR EXCLUDE(EXACTSRCTITLE, "Jane S Defence Industry") OR EXCLUDE(EXACTSRCTITLE, "Economic Geography") OR EXCLUDE(EXACTSRCTITLE, "GPS World") OR EXCLUDE(EXACTSRCTITLE, "IEEE Transactions on Automatic Control") OR EXCLUDE(EXACTSRCTITLE, "Jahrbucher Fur Nationalokonomie Und Statistik") OR EXCLUDE(EXACTSRCTITLE, "Public Health") OR EXCLUDE(EXACTSRCTITLE, "Jisuanji Jicheng Zhizao Xitong Computer Integrated Manufacturing Systems CIMS") OR EXCLUDE(EXACTSRCTITLE, "ZEV Rail Glasers Annalen") OR EXCLUDE(EXACTSRCTITLE, "Aviation Week and Space Technology New York") OR EXCLUDE(EXACTSRCTITLE, "Teaching and Teacher Education") OR EXCLUDE(EXACTSRCTITLE, "Electronic Journal of Information Technology in Construction") OR EXCLUDE(EXACTSRCTITLE, "CIRP Annals Manufacturing Technology") OR EXCLUDE(EXACTSRCTITLE, "IEEE Transactions on Education") OR EXCLUDE(EXACTSRCTITLE, "Schweissen Und Schneiden Welding and Cutting") OR EXCLUDE(EXACTSRCTITLE, "Zeitschrift Fur Wirtschaftsgeographie") OR EXCLUDE(EXACTSRCTITLE, "Journal of Ship Production") OR EXCLUDE(EXACTSRCTITLE, "Studies in Educational Evaluation") OR EXCLUDE(EXACTSRCTITLE, "International Journal of Advanced Manufacturing Technology") OR EXCLUDE(EXACTSRCTITLE, "Undefined")) AND (EXCLUDE(EXACTSRCTITLE, "Proceedings of the Institution of Mechanical Engineers Part B Journal of Engineering Manufacture") OR EXCLUDE(EXACTSRCTITLE, "First Monday") OR EXCLUDE(EXACTSRCTITLE, "Manufacturing Engineering") OR EXCLUDE(EXACTSRCTITLE, "Tijdschrift Voor Economische En Sociale Geografie") OR EXCLUDE(EXACTSRCTITLE, "Tourism Management") OR EXCLUDE(EXACTSRCTITLE, "New Electronics") OR EXCLUDE(EXACTSRCTITLE, "AI and Society") OR EXCLUDE(EXACTSRCTITLE, "Sensor Review") OR EXCLUDE(EXACTSRCTITLE, "Transportation Planning and Technology") OR EXCLUDE(EXACTSRCTITLE, "Wirtschaftsinformatik") OR EXCLUDE(EXACTSRCTITLE, "International Journal of Contemporary Hospitality Management") OR EXCLUDE(EXACTSRCTITLE, "Frontiers of Health Services Management"))	6682

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Database	Search string	Result
IEEE	(((((’innovation’) and (’evaluat*’ or ’assess*’ or ’measur*’ or ’metric*’ or ’determinant’ or ’driver’ or ’key elements’ or ’indicator*’ or ’attribute’ or ’capabilit*’ or ’matur*’)))<in >ti) <or >((((’innovation’) and (’evaluat*’ or ’assess*’ or ’measur*’ or ’metric*’ or ’determinant’ or ’driver’ or ’key elements’ or ’indicator*’ or ’attribute’ or ’capabilit*’ or ’matur*’)))<in >ab)) Exclude: IEEE Periodicals, IET Periodicals, AIP/AVS Periodicals, IEEE Standard	16
ACM	(((Title:”innovation”) AND (Title:”evaluat*” OR Title:”assess*” OR Title:”measur*” OR Title:”metric*” OR Title:”determinant” OR Title:”driver” OR Title:”key elements” OR Title:”indicator*” OR Title:”attribute” OR Title:”capabilit*” OR Title:”matur*”)) or ((Abstract:”innovation”) AND (Abstract:”evaluat*” OR Abstract:”assess*” OR Abstract:”measur*” OR Abstract:”metric*” OR Abstract:”determinant” OR Abstract:”driver” OR Abstract:”key elements” OR Abstract:”indicator*” OR Abstract:”attribute” OR Abstract:”capabilit*” OR Abstract:”matur*”))) and (PublishedAs:journal)	3
BSP	TI (((”innovation”) AND (”evaluat*” OR ”assess*” OR ”measur*” OR ”metric*” OR ”determinant” OR ”driver” OR ”key elements” OR ”indicator*” OR ”attribute” OR ”capabilit*” OR ”matur*”))) or AB (((”innovation”) AND (”evaluat*” OR ”assess*” OR ”measur*” OR ”metric*” OR ”determinant” OR ”driver” OR ”key elements” OR ”indicator*” OR ”attribute” OR ”capabilit*” OR ”matur*”))) or SU (((”innovation”) AND (”evaluat*” OR ”assess*” OR ”measur*” OR ”metric*” OR ”determinant” OR ”driver” OR ”key elements” OR ”indicator*” OR ”attribute” OR ”capabilit*” OR ”matur*”))) Limiters - Full Text; Scholarly (Peer Reviewed) Journals; Publication Type: Academic Journal; Document Type: Article Search modes - Boolean/Phrase	3402

APPENDIX B
DEFINITIONS OF INNOVATION

	Source	Definitions
1	[64]	'Innovation has two parts: the generation of an idea and the conversion of that idea into a useful application.'
2	[87]	'Innovations are generated as products move through various processes from the research laboratory to the factory.'
3	[57]	'Innovation is a process that begins with an invention, proceeds with the development of the inventions, and results in the introduction of a new product, process or service to the market-place.'
4	[86]	'Innovation is the successful exploitation of new ideas.'
5	[47]	'Product innovation is a continuous and cross-functional process involving and integrating a growing number of different competencies inside and outside the organisational boundaries. Simply put, it is the process of transforming business opportunities into tangible products and services.'
6	[77]	'Innovation is defined as the adoption of an idea or behavior whether a system, policy, program, device, process, product or service that is new to the adopting organization.'
7	[45]	'Innovation behavior can be defined as all individual actions directed at the generation, introduction and application of beneficial novelty at any organization level.'
8	[63]	'Innovation refers to a process that begins with a novel idea and concludes with market introduction.'
9	[78]	'Innovation is an idea, practice or object that is perceived as new to an individual or another unit of adoption.'
10	[74]	'Innovation refers to the creation of new product within the firm.'
11	[55]	'Organizational innovation has been consistently defined as the adoption of an idea of behavior that is new to the organization. The innovation can either be a new product, a new service, a new technology, or a new administrative practice.'
12	[66]	'Innovation is usually understood as the introduction of something new or significantly improved, like products (goods or services) or processes.'
13	[85]	'Innovation can be seen as representing a change in the status quo and has been defined as involving the discovery of new things and the commercialization such discoveries.'
14	[84]	'Innovations are new ideas that are valued in the marketplace.'
15	[68]	'Innovation is defined as "a technologically new or significantly enhanced product compared to the firm's previous product" which has been commercialized on the market.'
16	[130]	'Creativity is the recognition of an opportunity of the inspiration that develops an idea. Innovation is the implementation of all ideas - big and small.'
17	[75]	'Product innovation is defined here as the introduction of technologically new (or significantly improved) products which are new to the firm (it does not have to be new to the world).'
18	[52]	'Re-innovation is defined as the part of new product development which studies the extension of existing innovation, which can only happen after the first generation of a new product is launched.'
19	[54]	'Innovation understood as a process entails the generation, development, adoption, implementation and eventual termination of a new idea or behavior.'
20	[67]	'Innovation is an iterative process initiated by the perception of a new market and/or new service opportunity for a technology-based invention which leads to development, production, and marketing task striving for the commercial success of the invention. Innovativeness is the capacity of new innovation to create a paradigm shift in the science and technology and/or market structure in an industry. Innovativeness is the capacity of a new innovation to influence the firm's existing marketing resources, technological resources, skill, knowledge, capabilities, or strategies.'
21	[49]	'Innovation is defined as all intentional results of action (products or processes) that bring about perceived changes within the organization.'
22	[70]	'A product innovation can be described as a novel product, which is clearly different from the previous one. Radical innovations that are of interest at this point are characterized by a new technological basis and a novel utility experience to the customer.'
23	[56]	'Innovations vary in complexity and can range from minor changes to existing products, processes, or services to breakthrough products, and processes or services that introduce first-time features or exceptional performance.'
24	[83]	'Successful launching of a product/process or a service that is either new or incorporates new or additional scientific output, known as innovation.'
25	[12]	'Innovation is the generation, adaptation of an idea or behavior, new to the adopting organisation. The first successful application of a product or process. Innovation is conceived as a means of changing an organization, either as a response to changes in the external environment, or as a pre-emptive action to influence the environment. Innovation is the process of successfully creating something new that has significant value to the relevant unit of adoption. A radical innovation is a product, process or service with either unprecedented performance features or familiar features that offers significant improvements in performance or cost that transform existing markets or create new ones. A successfully exploited radical new product, process, or concept that significantly transforms the demand and needs of an existing market or industry, disrupts its former key players and creates whole new business practices or markets with significant societal impact.'

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	Source	Definitions
26	[15]	'Organizational innovation was conceptualized as the tendency of the organization to develop new or improved products or services and its success in bringing those products or services to the market. Innovation is defined as the successful implementation of creative ideas within an organization.'
27	[131]	'Innovation is a fundamental process for overcoming the rigidity of mass production and transiting toward an increasingly quality-based competitive system.'
28	[58]	'Innovation can take several forms: product innovation: changes in the things (products/services) which an organization offers, process innovation: changes in the ways in which they are created and delivered, position innovation: changes in the context in which the products/services are introduced, paradigm innovation: changes in the underlying mental models which frame what the organization does.'
29	[82]	'An innovation is defined by the first economic utilization or application of an invention to achieve corporate goals.'
30	[3]	'Innovative capability is defined as the capacity of developing new products satisfying market needs, the capacity of applying appropriate process technologies to produce these new products, the capacity of developing and adopting new product and processing technologies to satisfy the future needs, the capacity of responding to accidental technology activities and unexpected opportunities created by the competitors.'
31	[59]	'Innovation as new products, processes and organisational arrangements that are new to the firm rather than new to the world.'
32	[72]	'Radical innovations are innovations that 'involve the discovery of new technologies and the creation of new markets'. Radical innovations are defined as those involving the creation of new technologies and/or markets and that 'are conceptual shifts that make history'.'
33	[132]	'Product innovativeness differs from the term product innovation, to mean the degree of newness in 'the development of new products changes in design of established products, or use of new materials or components in the manufacture of established products.'
34	[50]	'Distinction between invention and innovation is the former referring to the first occurrence of an idea for a new product or process, while the latter to its first commercialization. Software innovativeness can be related to several aspects of the product, such as its features . . . the impression of its newness, the novelty of architectural structure.'
35	[80]	'Innovation is an application of knowledge to produce new knowledge.'
36	[76]	'Product innovation relates to the introduction into the market of any new or significant improved products (goods or services). Process innovation: relates to the introduction of any new or significantly improved production process (but not delivery, unless this is integral to the process of production/ delivery). Delivery innovation: relates to the development of changes in how the enterprise delivers its products (goods or services) to its customers. Examples include introduction of just-in-time delivery, consumer e-commerce, introduction of new or significantly improved home shopping services. Strategic innovation: relates to the implementation of new or significantly modified business strategies. Examples include targeting different markets, implementing new or significantly modified missions. Managerial innovation: relates to the implementation of new or significantly modified managerial techniques. Examples include the introduction of knowledge management practices, quality circles. Marketing innovation: relates to the implementation of new or significantly modified marketing strategies and concepts. Examples include the introduction of new or significantly improved marketing methods.'
37	[69]	'Incremental innovations involve relatively minor changes in technology and provide relatively low incremental customer benefits per dollar. Markets breakthroughs are based on core technology that is similar to existing products but provide substantially higher customer benefits per dollar. Technological breakthroughs adopt a substantially different technology than existing products but do not provide superior customer benefits per dollar. Radical innovations involve substantially new technology and provide substantially greater customer benefits per dollar.'
38	[5]	'Innovation = Invention + commercialization. In situations where the innovation relates to an internal activity, the word "implementation" can be substituted for "commercialization.'
39	[133]	'Innovation as a process that involves the generation, adoption, implementation and incorporation of new ideas, practices or artifacts within the organization.'
40	[134]	'Innovating means putting new ideas to gainful use.'
41	[135]	'Innovation processes generate new products and new routines of an innovating firm.'

APPENDIX C
DETERMINANTS OF INNOVATION

Determinants of innovation are classified based on the meaning of the each determinant written in the original paper. Every category that is marked with '*' means that the determinants have been reported to be studied in software industry. Every determinant that have been reported has negative impact on innovation is marked with '(-)' and '(0)' for determinants that have no positive or negative impact on innovation.

C.1 Internal Determinants

Internal collaboration*	
Determinants	Metrics
Internal collaboration (spans business divisions, technical disciplines, product technologies, and target markets reaching across disciplines and functions within the enterprise to consolidate expert knowledge) [136]	Percentage of stages of product development process during which the plan was engaging in technology transfer [137]
Involvement of front-line employees [138]	
Multifunctional teams [138]	
(-) Cross-functional integration [139]	
Inter functional coordination (enables communication and exchange about customers competitors and environmental threats and opportunities among functional departments of a firms) [3]	
Technology transfer (collaboration between the plants within a group of companies) [137]	
Collaboration [86] [140]	
Team work quality [141]	
Interaction of human and social capital[142]	
Internal organisation [138]	

Customer orientation*	
Determinants	Metrics
Customer orientation (understanding target buyers now and over time to create superior value for them) [3] [64]	Focus on new customers [70]
Customer acceptance [143]	
Responsive to the customer and the market [144]	
(-)Lack of customer focus [47]	
Recognition of user needs [89]	

Champions*	
Determinants	Metrics
Champions, Innovation catalyst (the main innovation driver with organisational authority and responsibility for the entire innovation process)[24] [63] [89]	Project champion (the existence of a project champion) [51]
	Product champions [4]

Human resources*	
Complexity of the division of labour [55]	Personnel in product development and technical functions who have worked in more than one function [94]
Human resource policy [145]	Percentage of projects delayed, cancelled due to lack of human resources [94]
The technical qualification of its employee [146]	Importance given to Innovation in human resource management [147]
Human resources [148]	
Task Autonomy [60]	
Training [60]	
Performance-based pay [60]	
Flexible working hours. [60]	
Standby contracts [60]	
Skill and experience [139]	

Strategy*	
Innovation strategy (it designates to what degree and in what way a firm uses innovation to perform a business strategy and to develop its performance) [3] [47] [149]	Strategic orientation [86]
Strategic attention (existence of concrete objective on innovation) [45]	Strategic leadership [86]
Innovation vision (vision based on factual customer and market insights with few focused and explicit objectives based on understanding of market needs and own capabilities) [100]	
Analysis of strategy (provides information about trends and events in their environment and facilitates to recognise innovation opportunities) [3]	Aggressiveness of strategy [3]
Futurity of strategy (concerns the innovation opportunities based on the determination of future changes and developments in the environment as well as estimation of future market needs) [3]	Analysis of strategy [3]
Proactiveness of strategy (the ability to create new opportunities or the ability to recognise or anticipate an act on opportunities) [3]	Defensiveness of strategy [3]
Riskiness of strategy (encourage the behaviour of market opportunity seeking and transforming of these opportunities into innovative products and processes) [3]	Futurity of strategy [3]
(-) Aggressiveness of strategy (emphasises a combative posture in exploiting market opportunities and relates to firm advances to become the first mover in the market place to develop radical innovation before competitors even at expense of profitability and to give priority to innovation projects that involve high levels of risk and returns) [3]	Pro-activeness of strategy [3]
(-) Defensiveness of strategy (concerns the firms need to defend it current position in the market place) [3]	Riskiness of strategy [3]
Clear vision and goals with freedom realisation [150]	

Networking*	
Determinants	Metrics
Strength of ties with clients [76]	Ecosystem relationships [24]
Environmental input from the community and other organisations [151]	Clusters of suppliers and customers [70]
Networking [152]	
External contacts (frequency of having contacts with suppliers, customers and people from other companies in the same market) [45]	
Technology incubation programme [153]	
Informal co-operation [154]	
Networking (inter firm relationship) [137]	
Relational capital [155]	

Leadership*	
Determinants	Metrics
Leadership (competent, visionary, committed, knowledgeable and outward looking leaders who excel at inspiring employees) [53] [94] [47] [85] [156] [157]	Number/percentage of members from technical functions/product development in the main and subsidiary/divisional boards [94]
Transformational leadership (which transforms followers' personal values and self-concepts, moves them to higher levels of needs and aspirations and raises their performance expectations) [15] [158] [159]	Percentage of employee aware of, sharing the innovation policies and values [94]
Leadership commitment [100]	Percentage of executives' time spent on strategic innovation rather than day-to-day operations [14]
	Percentage of managers with training in the concepts and tools of innovation [14]
	Number of times during the past 5, 10, and 20 years in which senior management has redefined the company's core business [14]

Marketing	
Determinants	Metrics
Demand pull (market pull) [45] [148] [160]	Market focused core competencies [70]
Market differentiation [45]	Market-focused organisation [70]
Market orientation (organisation culture that creates the necessary behaviours for creation of superior value for buyers) [161] [88]	Timing of market entry (whether the firm was first to market, an early follower, a late follower, or a late entrant) [147]
Demand growth [137]	Product quality [147]
Market concentration (competitive forces firm is exposed e.g. number of competitors) [162]	Marketing synergy [147]
(0) Competitor orientation (ability of firm to define, analyse competitors' activities and to response to them) [3]	Proficiency of market launch [147]
Market change (a series of factors relating the firms market and its marketing arrangement) [163]	Environmental hostility [147]
Product/market mix (supply its existing products to traditional markets or it chooses to expand its current product line into other markets or it seeks new products for new markets) [163]	Intensity of market competition [147]
Customer base [163]	
Market research [9]	
Good marketing [53]	

Technology	
Determinants	Metrics
Technology [139, 151]	Technical performance [94]
Specialised knowledge and experience in science and engineer [23]	Percentage of products on CAD database [94]
IT investments [5]	Number of licenses in/out over the last 3 years [94]
Technology diversification (diversity in the knowledge system and principles underlying the nature of products and their methods of production. Expansion of corporations technological competence into a broader range of technical and discipline areas) [5]	Self-citing ration [153]
(0)technological orientation (acquiring technical knowledge to perceive technological opportunities before competitors) [1]	Technological uncertainty (amount of technological uncertainty that characterised the project) [154]
Technology capabilities (firm's technological competencies, derived from in-house R&D) [34, 152]	Technical inexperience (the firm's inexperience and lack of knowledge about the project's required scientific and technical expertise) [154]
Technology adoption [119]	Firm's technical capability (the adequacy of the firm's technical capability supports the project's complexity) [51]
Product life-cycle[151]	
Information technology (for better information sharing and systematically gathering information on competitor services and new customer needs) [128]	

Policy	
Public policy [67]	Government regulation effect (the degree of negative effects associated with government regulations) [92]

Tool support	
Determinants	Metrics
Funnel tools (tool support for developing concept maps and definition of requirements for customer acceptance)[138]	Tools for innovation project management [86]
Systems and tools [94]	

Research & development	
Determinants	Metrics
R&D performance [164]	R&D accounting data (expenditure on R&D) [25] [165]
R&D investment (expenditures) [55] [13] [57] [125] [166] [167] [168] [104]	R&D Intensity (percent of annual sales spent on R&D) [147] [167]
R&D [76] [119] [163]	Expenditure of R&D as a percentage of GNP [169]
Experimentation [170]	R&D intensity (R&D employment in the plan as a percentage of whole employment) [137]
	R&D census data (number of employees in R&D) [25] [147]

Alignment	
Determinants	Metrics
Alignment (six alignment factors for alignment around innovation) [24]	Corporate fit (the degree to which the project objectives fit in with corporate goals and strategies) [92]
Market and entrepreneurial orientation alignment [147]	Project mission (the level of clarity with which the project mission is defined from start to end)[92]
Co-alignment (between employee-centric behaviours and the competitive environment, organisation's ability to constantly re- or self-align itself with change is the key to fostering ongoing innovation)[170]	
Alignment throughout the organisation and its extended enterprise [100]	

Organisational resources	
Determinants	Metrics
Organisation capital [142]	Percentage of projects delayed, cancelled due to lack of funding [94]
Human capital [142] [169]	Percentage of projects on which specific tools are applied [94]
Social capital [75] [142]	Certified processes [94]
Internal sources [171]	Capital output ratio [83]
Basic research infrastructure [148]	Capital per Employee [83]
Social capital (trust and associational activity) [169]	
(-) Social capital (norms of civic behaviour) [169]	
Organisation capabilities [100]	
Innovation infrastructure (employee skills and learning, technological and financial support) [170]	
Presence of organisational resources [133]	
Strategic capabilities [72]	
Organisational slack [172]	
Adequate resources [89]	
Resource orientation [88]	

Financial	
Determinants	Metrics
Financial resource constraints [173]	Innovation cost (cost of spending on design and engineering and above all on production investment connected with the introduction and diffusion of innovation processes) [94]
External slack less debt more innovation [74]	Technology cost (radical innovations require more resources to successfully commercialise. Thus the decision to do research in certain knowledge areas or to implement certain technologies will incur this cost) [174]
Finance (funding the innovation project) [160]	Non-specific investments [70]
(-)The degree of indebtedness of the company [146]	Total innovation expenditure (covers both R&D and non R&D innovation expenditure) [103]
(-)The potential cost of the innovation [146]	

Empowerment	
Determinants	Metrics
Agile decision making (gathering and using various levels of information and involving diverse people to make a decision)[64]	
Empowerment (skilled people have ownership to innovate in their area) [64] [156] [170]	
Meaningful work (work that each person knows has impact in the organisation and with customer) [64]	
Job challenge [45]	
Autonomy (employees are allowed to decide themselves 'how to do a job') [45]	

Knowledge management	
Determinants	Metrics
Knowledge management system [175]	Citation [24] [176] [177]
Organisational learning capabilities [64] [156] [158] [170] [175] [178]	Life-long learning [70]
Knowledge management policies and strategies [76] [122]	Knowledge flow [179]
Organisational capital (aspects of explicit knowledge that may be documented and kept written)[75]	Number and type of conferences they have sponsored and attended[24]
Knowledge flow [71]	Knowledge repository (number of patents brought into the repository, for codified knowledge) [86]
Technological potential (scientific, technological and organisational knowledge relevant to a firm's innovative activity) [162]	Measures of customer information contacts (the extent the organisation makes use of customers as source of information) [86]
Ideas [149]	Measure of the linkage that the innovating groups maintains the external organisations and resources [86]
Innovation influence (knowledge management, sphere of influence) [170]	Measures of internal information gathering processes [86]
Variety of knowledge sources [76]	Percentage of designers/engineers trained to design for manufacture [94]
Types of knowledge exchanged with clients (tacit or explicit) [76]	Percentage of team leaders trained in creativity techniques [94]
Capability of knowledge accumulation [180]	Percentage of designer/engineers with access to CAD screens [94]
Knowledge and technology transfer (KTT) [181]	Knowledge sharing [182]
Knowledge diffusion [177]	
Firm's absorptive capacity [119]	
Internal knowledge sources [119]	
External knowledge sources [119]	
Training and education of personnel [138] [183]	
Information flow (flow of information inside and outside the organisation) [86]	
Idea generation [139]	
Knowledge sharing [182]	

Culture	
Determinants	Metrics
Learning orientation, acknowledge mistake and focus on learning [178] [184]	Innovation culture metrics [185]
Culture and climate [47] [149] [156]	KEYS survey instrument [186]
Risk-taking culture (open culture to allow everyone to try new ideas) [64]	Entrepreneurial culture [179]
Entrepreneurial culture [179]	Entrepreneurial orientation [147]
Culture (Hofstede) [66]	Peer support (the degree of support for the project from other groups and individuals within the firm) [92]
Supportive climate (support from the colleagues) [45]	
Open communication (speaking out, supporting change and feeling that it is acceptable to challenge practices that do not seem to add value) [64]	
Creative climate stimulants [91]	
(-) Creative climate obstacles [91]	
Flexibility [187]	
Innovative organisational culture [161]	
Employee willingness to donate and collect knowledge 186	
Willingness to exchange ideas [133]	
Belief that innovation is important [133]	
(-) Lack of shared understanding [47]	
(-) Confusion over what innovation actually is within an organisation [188]	
The input of a performance gap [55]	
Sharing information [138]	
Self-monitoring [183]	
Incentive provision [183]	
Active encouragement of initiatives [6]	
Problems ownership among project members [150]	

Management	
Determinants	Metrics
Managerial roles [189]	Business inexperience (the firm's inexperience and lack of knowledge about the project's required business practices) [174]
Corporate mindset [190]	Management involvement [147]
Good management [89] [156]	
Willingness to abandon investments [70]	
Process [149]	
Management of technical aspects [89]	
Willingness to cannibalise [69]	
(-) Where other business executives think much too narrowly about R&D and the form of innovation partnerships [188]	
(-) More confusion over the management methods needed to deliver continuous value from external or open innovation activities, especially when they involve tens if not hundreds, of business partners [188]	

External collaboration	
Determinants	Metrics
Collaboration with supplier and customers [47] [86]	
External collaboration (reaching across suppliers, customers and alliances in order to maximise business potential) [136]	
Cooperation with customers and research institutes [191]	

Risk	
Determinants	Metrics
Climate of smart risk taking [149]	Risk / Return balance [86]
Freedom and risk taking [184]	
Willingness to take risks [133]	

Trust	
Determinants	Metrics
Trust that benefit (when employees believe that they will share the benefits they make more suggestions, but this belief has no effect on whether their ideas are actually implemented) [192]	
Trust that heard (employee trust that the organisation will listen to them has a direct effect on ideas implementation but not on the suggestions they make) [192]	
Trust & openness (acknowledge the mistakes and discuss them and focus on learning)[184]	

Communication	
Determinants	Metrics
Communication [6] [47] [89] [150]	Communication (facilitates the dispersion of ideas within an organisation)[86]
(-) Poor communication and knowledge transfer [47]	Communication cost per employee [83]
	Communication cost per output [83]

Organisation Structure	
Determinants	Metrics
Structural characteristics of organisation, e.g. size and complexity [151]	
Organisation structure [54] [180] [193] [194]	
Decentralised structure [133]	
Structure and performance [47]	

Individual	
Determinants	Metrics
Individual [151]	
Thinking skills [195]	
Individual creativity mechanism [196]	
Emotional capability [197]	
Entrepreneurship [198]	

Commitment	
Determinants	Metrics
Organisational creativity mechanism [196]	Innovators in senior positions / CEO commitment [199]
Innovation intent (propensity and architecture, employee constituency) [170]	

Intellectual property	
Determinants	Metrics
Patented inventions [57]	
The input of prior innovations [55]	

Planning	
Determinants	Metrics
Planned innovation [89]	Project portfolio size (the number of ongoing projects at any given time) [92]
Business planning [64] [47]	Commercial and technical fit (the degree of association between the projects commercial and the technological aspects) [92]
Innovation portfolio management [200]	
(-) Poor portfolio management [47]	
Competitive edge [163]	
Transparency in product architecture [150]	

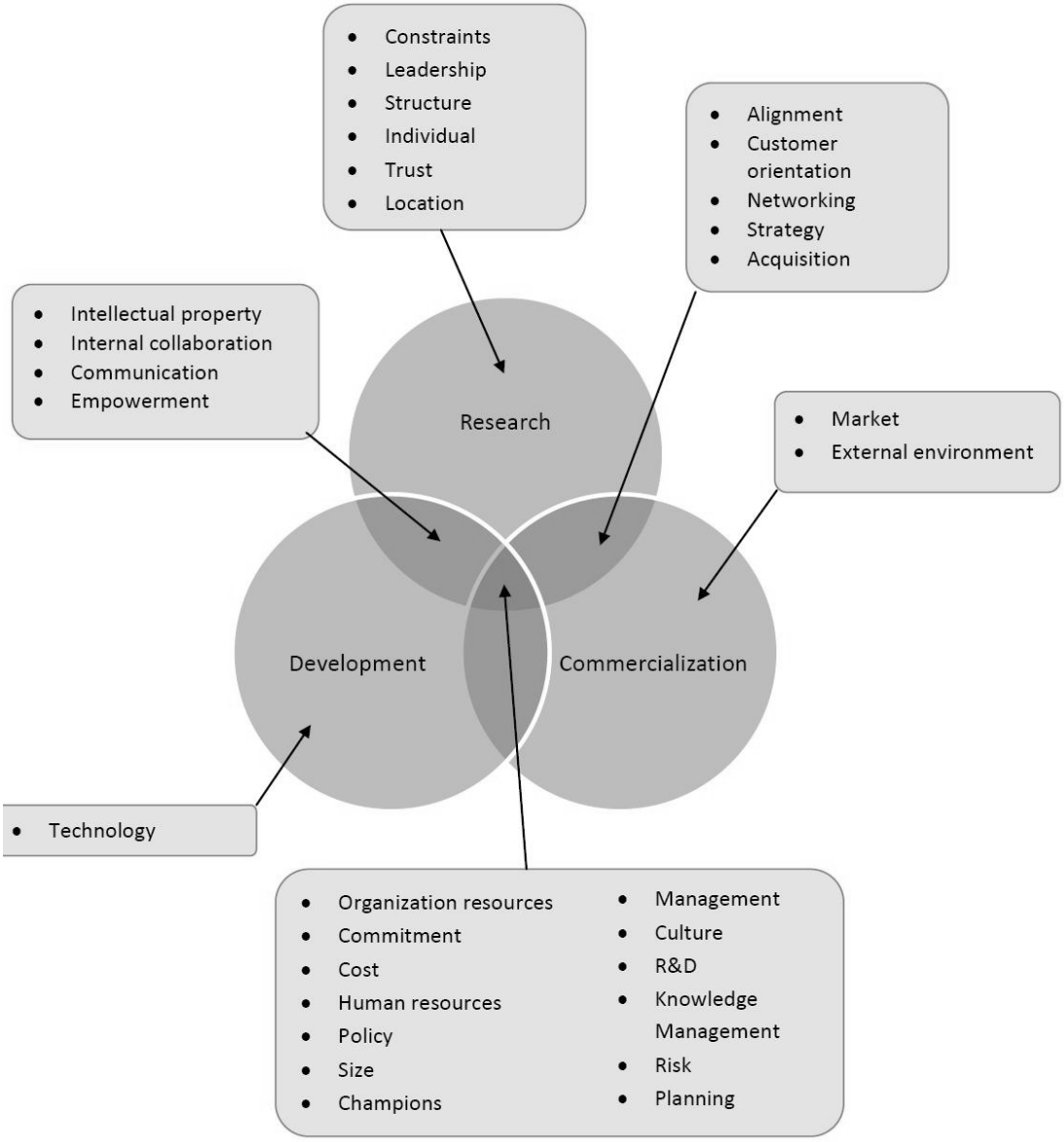
Acquisition & alliance	
Determinants	Metrics
Public procurement [201]	
Acquisition [202]	
(0/-) Mergers and acquisition [203]	
Technology acquisition [168]	
Technology access through alliances [160]	
Alliances [203]	

Size	
Determinants	Metrics
Firm size [54] [77] [149] [146] [162] [106]	Firm Size [147]
(0) Firm size [70] [119] [137]	

C.2 External Determinants

Determinants	Metrics
Population [84]	Economic structure [167]
Location cluster [204]	Human development index [169]
Technological opportunities [146]	Market competition (the degree of market competition for the project) [92]
Foreign Direct Investment (FDI) [125]	Science and technology availability (the degree to which science and technology needed for the project is readily available) [92]
International trade [125]	
(-) Location [205]	
Knowledge spill-overs make location important [206]	
A local context that encourages investment in innovation-related activity [148]	
Public R&D support [13]	
Higher education R&D investment [167]	
Extramural R&D [119]	

APPENDIX D
DETERMINANTS AND INNOVATION ACTIVITIES



APPENDIX E
METRICS FOR INNOVATION FROM SOFTWARE RELATED STUDIES

Metrics	Source
Products new to the world, developed using new or significantly improved technology	[98]
Products new to the nation, developed using new or significantly improved technology	[98]
Products new to the firm, developed using new or significantly improved technology	[98]
Activities new to the world, developed using new or significantly improved technology	[98]
Activities new to the nation, developed using new or significantly improved technology	[98]
Activities new to the firm, developed using new or significantly improved technology	[98]
Whether or not a firm had accomplished at least one major product innovation during the 3 years preceding the survey	[13]
Number of patents held	[13]
Product innovation index	[13]
Market orientation	[147]
Entrepreneurial orientation	[147]
New product performance	[147]
Timing of market entry	[147]
Product quality	[147]
Marketing synergy	[147]
Proficiency of market launch	[147]
Management involvement	[147]
Importance given to innovation in human resource management	[147]
Environmental hostility	[147]
Intensity of market competition	[147]
Firm size	[147]
R&D intensity (percent of annual sales spent on R&D)	[147]
Number of R&D personnel	[147]
Organisational innovation	[15]
Customer orientation	[3]
Competitor orientation	[3]
Inter-functional coordination	[3]
Technological orientation	[3]
Aggressiveness	[3]
Analysis	[3]
Defensiveness	[3]
Futurity	[3]
Proactiveness	[3]
Riskiness	[3]
Innovation capability	[3]
Innovation success	[3]
Teamwork Quality (TWQ)	[141]
Uniqueness of product benefits	[132]
Scope of newness	[132]
Product newness opinion as to the firm	[132]
Product newness opinion as to the market	[132]
Product new to the firm	[50]
Product new to the market in what it does	[50]
Product new to the market under technological viewpoint	[50]
Modules new to the world	[50]
Platform new to the world	[50]
Essential Patent Index (EPI)	[207]
Essential Technology Strength (ETS)	[207]

APPENDIX F
CLASSIFICATION OF METRICS WITH INNOVATION ACTIVITIES

Research	
Metrics	Source(s)
Competitor orientation	[3]
Inter-function coordination	[3]
Technical orientation	[3]
Customer orientation	[3]
Percentage of suggestion implemented	[14] [94]
Number of ideas that are moving from one stage of the process to the next	[14] [24]
Number of new product ideas, product enhancement ideas evaluation in the last year	[94]
Product planning horizon	[94]
Number of improvement suggestions per employee	[94]
Idea generation	[86]
Market orientation	[147]
Number of ideas funded	[199]
Percentage of internal ideas offered for external license	[208]

Development	
Metrics	Source(s)
Average concept-to-launch time	[14] [94]
Number of products/projects in active development	[14] [164]
Attendance at key meetings	[24]
Percentage of documentation submitted on deadlines	[24]
Percentage of projects passed on to the next stage in the process without having met all of the specified requirements	[24]
Development process efficiency (the degree to which development process is conducted efficiently)	[92]
Average product life cycle length	[94]
Average overrun	[94]
Average time of product enhancement	[94]
Average time of redesign	[94]
Manufacturing cost	[94]
Manufacturability	[94]
Testability	[94]
R&D/technology acquisition cost per new product	[94]
R&D projects that lead to new or enhanced products, process innovation, licenses, patents	[94]
Optimisation tool use	[86]
Project efficiency	[86]
Frequency of adaptation	[209]
Rapid of adaptation	[209]
Quality of adaptation	[209]
Object-Oriented Programming (OOP) Time	[210]
OOP Infusion	[210]
OOP Assimilation	[210]
Software Process Innovation (SPI) Adoption	[210]
SPI assimilation	[210]
Relational Database management system (RDB) assimilation	[210]
Computer-Aided Software Engineering tools (CASE) assimilation	[210]

Commercialization	
Metrics	Source(s)
Marketing effort (the level of effort invested in promotion or selling activities)	[92]
Market research (quality of market research effort to identify price, demand and other market characteristics and firms position in the market, market stability and user needs)	[92]
Number of new product-based business area/ventures started in the past 5 years	[94]
Market research	[86]
Market testing	[86]
Marketing and sales	[86]

General	
Metrics	Source(s)
Innovation capability (qualitative evaluation of knowledge management, market orientation, culture, innovation process, attitude towards change)	[3]
Cycle time through the entire innovation process	[24] [65]
Cycle time through specific parts of the process (e.g., prototype or pilot run)	[24] [116]
Deviation around average cycle timeshigh end to low end of the range	[24]
Deviation between initial expected financial value of the idea and the ultimate realised value	[24]
Resources expended, both per specific idea and on average	[24]
Resources expended on ideas that move through the process to a particular point but then are not ultimately commercialised	[24]
Cash payback	[24]
Managers survey	[25]
Time for each phase	[94]
Mean number of adoption overtime	[43]
Mean time of adoption overtime	[43]
Consistency of the time of innovation adoption	[43]
Success ratio at different process gates	[116]

APPENDIX G
CLASSIFICATION OF METRICS FOR EVALUATION OF INNOVATION OUTPUT AND PERFORMANCE

Product-related metrics	Source(s)
The perceived effectiveness of innovation	[6]
Patent count per time period / patent density	[6] [13] [24] [94] [59] [87] [123] [165] [169] [176] [177] [179] [211][212]
Whether or not a firm had accomplished at least one major product innovation during the 3 years preceding the survey	[13]
Product innovation index	[13]
New products or services	[14] [213]
Number of books and papers published	[24]
Intellectual property counts	[25] [214]
Patent citations	[215]
New product launches	[25] [87] [103]
Product new to the firm	[50]
Product new to the market in what it does	[50]
Product new to the market under technological viewpoint	[50]
Modules new to the world	[50]
Platform new to the world	[50]
Number of innovation	[56] [72] [60] [103]
Uniqueness of product benefits	[132]
Scope of newness	[132]
Product newness opinion as to the firm	[132]
Product newness opinion as to the market	[132]
Volume of high-technology exports (relative to the total manufactured exports)	[169]
Products new to the world, developed using new or significantly improved technology	[98]
Products new to the nation, developed using new or significantly improved technology	[98]
Products new to the firm, developed using new or significantly improved technology	[98]
Number of projects terminated last year, reviewed at a later date, offered to external parties for further development	[208]

Market-related metrics	Source(s)
Number of strategic options (i.e. newly created opportunities to significantly advance an existing business)	[14]
New market application of existing products or services	[213]

Organisation-related metrics	Source(s)
New organisational programs	[213]
New organisational structures	[213]

Process-related metrics	Source(s)
Number of new processes and significant enhancements per year	[94]
Average annual improvement in process parameters	[94]
Process innovation	[56]
Activities new to the world, developed using new or significantly improved technology	[98]
Activities new to the nation, developed using new or significantly improved technology	[98]
Activities new to the firm, developed using new or significantly improved technology	[98]
New processes (technologies)	[213]

Performance-related metrics	Source(s)
Percentage of sales that is generated by new products	[3] [14] [24] [26] [117] [147] [164]
Number of new competencies (i.e. distinctive skills and knowledge domains that spawn innovation) measured as a simple count among a threshold proportion of employees	[14]
Number of new markets entered in past year	[14]
Share of wealth, i.e., the change in the companys market value during the past year divided by the change in the total industrys market value during the same period	[14]
Organisational innovation (product of coefficient of innovativeness tendency and success of product innovation)	[15]
Brand innovation quotient	[19]
Innovation loyalty (ratio of repeat purchasers to total number of purchasers)	[19]
Return on investment or project net present value	[19] [199]
Overall revenue growth	[24]
Third-party rankings or cross-company benchmarking	[24]
Revenue from new platforms	[26]
Customer satisfaction	[94]
Product quality	[94]
Number of pages in the annual report devoted to innovation and technology	[94]
Throughput	[65]
Impact on brand	[116]
Innovation performance	[125]
Share of sales from product imitations	[103] [191]
Innovation intensities	[104]
Innovation index	[131]
Total patents filed/pending/awarded	[164]
Innovation capacity	[167]
Citations	[177]
Citation ratio	[177]
Average number of patents per capita	[179]
Share of sales from market novelties	[191]
Cost reductions due to process innovations	[191]
Long-term customer adoption	[199]
Percentage of sales of products and services came from externally licensed technologies	[208]
Percentage of net income last year came from technology licensed out to other companies	[208]
Patent-intensity (measured by successful patent applications per million dollars of total assets)	[216]
Essential Patent Index (EPI)	[207]
Essential Technology Strength ETS	[207]

APPENDIX H
CLASSIFICATION OF METRICS FOR EVALUATION OF INNOVATION INPUTS

Inputs	Metrics
Staffing, labour, people, technical personnel [14] [24] [116] [131] [214] [217]	The number of ideas, with expected payback potential for each [24]
Capital [14] [24] [116]	Science and technology availability (the degree to which science and technology needed for the project is readily available) [92]
Operating expenditures [116]	Firm technical capability (the adequacy of the firms technical capability to support the projects complexity) [92]
Time [14]	Facilities or physical resources [86]
Technology licensing [120]	Tools for support of innovation [86]
R&D [120] [144] [168]	Percentage of employees for whom innovation is a key performance goal [14]
R&D personnel [218]	R&D intensity (ratio of R&D expenditure to total assets) [94] [216]
R&D activities [167]	Human capital [211]
R&D effort [117]	The number of full-time equivalent staff for selected functions involved in the processand, most importantly, what their key people are working on) [59] [24] [86]
R&D expenditure [131] [203] [214] [216] [217]	Number of foreign companies [211]
Knowledge spill-overs [191]	The operating expense [24]
Access to complementary knowledge [191]	The capital expenditure [24]
Cost and risk-sharing in innovation projects [218]	Staffing and capital and operating expenditure [116]
Information and knowledge [135]	R&D expenditure [59] [211]
Technology transfer and networking as alternative input to R&D [137]	Total R&D head count [164]
Training [120]	R&D spending (as percent of sales) [164]
	Percentage of employees who have received training in innovation for example, instruction in estimating market potential of an idea [14]
	Number of innovation tools and methodologies available to employees [14]
	Percentage of capital that is invested in innovation activities such as submitting and reviewing ideas for new products and services and developing ideas through an innovation pipeline [14]
	Number of entrepreneurs in the company, i.e. individuals who have previously started a business, either within the company or before joining the company [14]
	Percentage of workforce time that is currently dedicated to innovation projects [14]

APPENDIX I
INNOVATION MEASUREMENT FRAMEWORKS FOUND IN LITERATURE

Source	Name of framework	Research methodology	Purpose	Means of representation	Validation
Muller et al.[14]	Guidelines for developing a customised suite of innovation metrics	Conceptual analysis	Framework for the selection of metrics	Table	No validation
Kumar et al. [92]	Monitoring framework	Survey	Assist managers in deciding whether to abandon an ongoing R&D/innovation project at various stages of R&D	Mathematical formula	No validation
Aiman-Smith et al. [64]	Value Innovation Potential Assessment Tool	Conceptual analysis	Measuring important factors leading to value innovation	Table	No validation
Capaldo et al. [93]	Innovation capabilities evaluation model	Case studies	An evaluation model for the determination of small firms innovation capabilities (based on Chiesa framework [94])	Mathematical formula	No validation
Chiesa et al. [94]	Technical audit	Experiment	Framework for auditing technical innovation management	Table (Scorecard)	Static validation
Cormican [47]	PIM Scorecard	Case studies	Assess whether the conditions necessary for innovation are in place and the degree to which best practice is used	Table (Scorecard)	No validation
Tang [134]	Inventory of organisational innovativeness	Survey	Measure organisational effectiveness in innovation	Table	No validation
Byrne et al. [100]	A lean six sigma approach	Industry report	Measure preparedness of an organisation to undertake radical innovations	Diagram	Industrial usage
Furman et al. [95]	National innovation capacity	Conceptual analysis	Measure the ability of a country to produce and commercialisation a flow of innovative technology over the long term	Graph	No validation
Nirjar [98]	Index of innovativeness	Survey	Indicates the stages of firms growth vis-vis its innovation capability	Mathematical formula	No validation
Maravelakis et al. [99]	Product Innovation Process (PIP) Score	Conceptual analysis	Assessing innovation and determining a product innovation profile	3-D graph	No validation
Wang et al. [96]	Technological innovation capability evaluation	Conceptual analysis	Method to assess the technical innovation capability of a firm	Mathematical formula	No validation
Yam et al. [97]	Audit criteria	Survey	Examine the technological capabilities of Chinese firms	Table	No validation

APPENDIX J
STUDIES FOUND IN SYSTEMATIC REVIEW RELATED TO SOFTWARE

	Title	Author(s)	Publication year	Journal
[3]	Innovative capability, innovation strategy and market orientation: An empirical analysis in Turkish software industry	G. Akman and C. Yilmaz	2008	International Journal of Innovation Management
[13]	Determinants of innovation capability in small electronics and software firms in southeast England	H. Romijn, M. Albaladejo	2002	Research Policy
[50]	Software innovativeness. A comparison between proprietary and Free/Open Source solutions offered by Italian SMEs	C. R. Lamastra	2009	R and D Management
[54]	Transformational leadership and organizational innovation: The roles of internal and external support for innovation	L. Gumuslulu and A. Ilsev	2009	Journal of Product Innovation Management
[93]	The Evaluation of Innovation Capabilities in Small Software Firms: A Methodological Approach	G. Capaldo, I. Iandoli	2003	Small Business Economics
[132]	Software innovativeness: Outcomes on project performance, knowledge enhancement, and external linkages	G. Jordan and E. Segelod	2006	R and D Management
[139]	Organizational determinants of innovation capacity in software companies	T. Koc	2007	Computers & Industrial Engineering
[141]	Teamwork Quality and the Success of Innovative Projects: A Theoretical Concept and Empirical Evidence	M. Hoegl & H. G. Gemuenden	2001	Organization Science
[89]	Determinants of success in the development of applications software	C. A. Voss	1985	Journal of Product Innovation Management
[147]	An Empirical Investigation of the Effect of Market Orientation and Entrepreneurship Orientation Alignment on Product Innovation	K. Atuahene-Gima and A. Ko	2001	Organization Science
[160]	Transformation of science and technology systems into systems of innovation in central and eastern Europe: the emerging patterns and determinants	S. Radosevic	1999	Structural Change and Economic Dynamics
[88]	Investigating the Drivers of Innovation and New Product Success: A Comparison of Strategic Orientations	A. Paladino	2007	Journal of Product Innovation Management
[162]	Explaining innovative activity in service industries: Micro data evidence for Switzerland	S. Arvanitis	2008	Economics of Innovation and New Technology
[183]	Governance structures and innovation in the Irish Software Industry	C. A. Fitzgerald, P. C. Flood, P. O'Regan, N. Ramamoorthy	2008	Journal of High Technology Management Research
[91]	The influence of creative style and climate on software development team creativity: an exploratory study	M. H. Fagan	2004	Journal of Computer Information Systems
[98]	Innovations and Evolution of Software SMEs: Exploring the Trajectories for Sustainable Growth	A. Nirjar	2008	Vision
[207]	Using Essential Patent Index and Essential Technological Strength to evaluate industrial technological innovation competitiveness	D. Z. Chen	2007	Scientometrics
[219]	KISA in innovation of New Zealand software firms	J. Williams	2006	International Journal of Services Technology and Management
[220]	Definition of innovation revisited:: an empirical study on Indian information technology industry	S. Goswami, M. Matthew	2005	International Journal of Innovation Management
[221]	Software engineering technology innovation - Turning research results into industrial success	T. R. Punter, L. Krikhaar	2009	Journal of System and Software
[222]	Assessing the management of innovation with software tools: An application of innovation Enterpriser	S. J. Conn	2009	International Journal of Technology Management
[223]	Software process innovation methodology - Multiple approach including ISO9001, maturity model and QC technique	K. Honda	1997	NEC Research and Development
[210]	The role of aggregation in the measurement of IT-related organizational innovation	Robert G. Fichman	2001	MIS Quarterly

APPENDIX K
INTERVIEW QUESTIONS

K.1 Preliminary questions

1) Name
2) Position
3) Years of experience
4) Role & responsibility
5) Company profile (R&D department, innovation profile)

K.2 General questions

K.2.1 Perception about innovation

1) What do you mean by innovation?
2) What is considered as innovation?
3) Is innovation considered a strategic objective of the company?
4) Does your organisation have a formal innovation process? What are the major phases of this process (activities in the process)?
5) What is the role of R&D in innovation?
6) What aspects of innovation are considered important and measurable?

K.2.2 Innovation measurement

1) Do you measure innovation?
2) If yes, how do you measure innovation? What metrics or measurements are used for this purpose?
3) If the answer is no, why is innovation not measured?
4) Are you satisfied with the control and visibility these metrics give you for management of innovation program?
5) What are the major issues in measuring innovation?
6) Does your organisation have a specific framework or methodology to measure innovation?
7) If yes, could you describe the major steps?
8) If no, what are the reasons and how do you perform the measurement process?
9) What measures the organisation takes to protect its Intellectual Property? (e.g. patents, non disclosure agreements, copyrights)
10) In your context, what are the most valuable inputs/pressing challenges/barrier for (measuring) innovation?
11) What metrics do you collect?

K.3 Findings review

After the initial questions we presented the major findings and the model of innovation that we have developed from the systematic literature review. We documented their comments and feedback about these results using questions like:

1) Do you think there is an aspect of innovation that is missing in this model?
2) What do you think we can add to this model to make it usable for industry?

APPENDIX L
BACKGROUND INFORMATION OF INTERVIEWEES

Interviewee ID	Experience	Firm ID	Firm size	Role & responsibilities
Interviewee A [INT_A]	>30 years of industrial experience	Firm A	Large	She has worked as R&D manager in an electrical and manufacturing firm. Currently she is product line manager for application software at a large multinational firm. Her responsibilities include supervision, management and development of the area of application software in the organization.
Interviewee B [INT_B]	>18 years of industrial experience	Firm A	Large	R&D Manager, responsible for requirements management, feasibility studies, estimations and subsequent development.
Interviewee C [INT_C]	>20 years of academic experience.	Firm B	Small	She has extensive teaching experience in areas such as strategy, innovation and business development. Currently she is heading an initiative to promote innovation through a nursery to stimulate and develop practical innovations.
Interviewee D [INT_D]	>10 years of industrial experience and >four years of academic experience	Firm C	Both SME and large firms	She has worked as industrial consultant, project manager, and executive roles for different firms. She has also led many startups and is currently involved with industrial research.
Interviewee E [INT_E]	>10 years of action research in industry	Firm D	Not applicable	She is an associate professor and is mostly involved in action research in the industry. Her interests include usability studies and human interaction and measurement thereof.
Interviewee F [INT_F]	>22 years of industrial experience	Firm E	Large	She is working as a general manager in a telecommunication firm. She is heading the group responsible for external collaboration and asset management in the company.
Interviewee G [INT_G]	>12 years of industrial experience	Firm E	Large	She is director of strategy at a prominent telecommunication firm. She has a technical background and is especially interested in how innovations affect society and human mind. Her analysis of future trends helps decide the future direction for the company.

APPENDIX M
QUESTIONNAIRE QUESTIONS

Innovation measurement in software industry

Introduction

We are masters students in software engineering at Blekinge Institute of Technology, Sweden. In our master's thesis, we are working on innovation measurement to assess the capacity and performance of software firms in terms of innovation. In this regard, we would like to get feedback from software industry practitioners on what they perceive as innovation and how they currently measure innovation.

We would like you to fill out this short survey (approx. five minutes) to give us your insight and experience about innovation measurement practices in your organization.

The demographic information acquired here will be kept confidential and will only be used for statistical purposes in this thesis project.

*** 1. Please fill out the required demographic information below:**

Position:

Job experience (in years):

Company:

Number of employees

Country:

2. Email Address (if you are interested in the results of this survey)

Definition

For question 3, 4 and 5 you may choose more than one option in the answer.

*** 3. In your opinion, innovation involves:**

- [ ] Generation or adoption of new ideas.
- [ ] Development of new products, processes, methods or techniques.
- [ ] Improvement in existing products, processes, methods or techniques.
- [ ] Introduction of products to the market, use of processes and methods in the organization.
- [ ] Other (please specify)

Innovation measurement in software industry

*** 4. In your opinion which of the following may be considered as innovation?**

- [ ] Introduction of a good or service that is new with respect to its characteristics or intended uses.
- [ ] Implementation of a new design, analysis or development method.
- [ ] Implementation of a new marketing method in product design or packaging, product placement, product promotion or pricing.
- [ ] Implementation of a new organisational method in the firm's business practices, workplace organisation or external relations.
- [ ] Other (please specify)

*** 5. To be considered as innovation it must be:**

- [ ] New to the world
- [ ] New to the industry
- [ ] New to the market
- [ ] New to the firm

Innovation measurement 1

Innovation measurement is the assessment of organizations innovation output and capacity to innovate.
For example by measuring availability of resources like funds and human capital, creative environment, policy, customer orientation and by innovation process benchmarking etc.

*** 6. Do you think innovation measurement is important for your organization?**

- ◯ Yes
- ◯ No
- ◯ I do not know.

Please describe the reason for your answer briefly.

*** 7. Does your organization have an explicit strategy on innovation?**

- ◯ Yes
- ◯ No
- ◯ I do not know

Innovation measurement in software industry

*** 8. Does your organization measure innovation?**

- ◯ Yes
- ◯ No
- ◯ I do not know

Please briefly explain the reason for your answer.

*** 9. Which of the following do you think are the main challenges for innovation measurement in your organization?**

	Strongly agree	Agree	Undecided	Disagree	Strongly Disagree
Lack of recognition of importance of innovation measurement	◯	◯	◯	◯	◯
Lack of consistent definition for innovation	◯	◯	◯	◯	◯
Lack of metrics for innovation measurement	◯	◯	◯	◯	◯
Lack of guidelines and framework for innovation measurement	◯	◯	◯	◯	◯
Cost of measurement program	◯	◯	◯	◯	◯

Any other issues (please specify)

Input to Innovation

Innovation measurement in software industry

*** 10. Which of the following innovation metrics are collected in your organization?**

- [ ] Percentage of sales spent on R&D
- [ ] Percentage of sales spent on new projects
- [ ] Percentage of employees dedicated to R&D activities
- [ ] Number of new ideas generated
- [ ] Number of ideas converted successfully to products
- [ ] Time taken in converting an idea to a product or process
- [ ] Number of new products
- [ ] Number of improvements in existing products (e.g. new or improved features, architectural changes or performance improvements etc)
- [ ] Number of intellectual property rights (e.g. patents, papers published, trademarks)
- [ ] Creative Environement (using subjective measures)
- [ ] Presence of Innovation Champions (Individuals with political skills, contacts and reputation required to secure resources and who actively and enthusiastically promote innovation progress through critical stages)
- [ ] Percentage of new product sales to total sales
- [ ] Improvement in product quality as a result of innovation
- [ ] Improvement of customer satisfaction as a result of innovation
- [ ] Other (please specify)

*** 11. Do these metrics give you enough control and visibility to successfully manage innovation program?**

- ◯ Yes
- ◯ No, please describe why

*** 12. Does your organization use any framework or methodology to measure innovation?**

- ◯ No
- ◯ Yes, please describe the major steps involved in the measurement process

Done.

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